Preventing Infant Deaths Among Aboriginal and Teenage Women In South Australia
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Final Report Part 2

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2.1.1 Alcohol Use

How many pregnant women use alcohol at harmful or hazardous levels?

Aboriginal and Torres Strait Islander women, South Australia
In an audit of pregnancy records, 5.3% (115 of 2151) Aboriginal mothers self-reported as substance users (including risky alcohol use and illicit and licit drugs, but excluding nicotine) – about three times the rate of other women (Kennare 2005).

Aboriginal and Torres Strait Islander women, Queensland
Twenty-three per cent of women (72/384) attending the Townsville Aboriginal and Islander Health Service for antenatal care reported using alcohol at harmful or hazardous levels (Panaretto 2006).

In a Brisbane study of over 8,000 pregnancies, 19% of Aboriginal women compared with 17% of other women reported drinking alcohol early in pregnancy (OR 1.3 95% CI 0.9 to 2.0, adjusted for maternal education, age and parity). The corresponding figures for consuming more than five standard drinks of alcohol in early pregnancy were 9.6% and 1.6%; OR 5.4 95% CI 3.1 to 9.4, adjusted for maternal education, age and parity (Najman 1994).

In a study from Cairns, 31% of Indigenous women consumed alcohol during pregnancy compared with 22% of non-Indigenous women (Rimmer 2006).

Australia
South Australia
In a 2003 survey at Lyell McEwin Hospital, at the first antenatal visit, 80% (70 women) reported using alcohol during pregnancy (Edwards 2008a).

In a 2005-06 survey of women attending their first antenatal visit at the Lyell McEwin or Women’s and Children’s Hospital, a much lower 12% (89 women) reported use of alcohol during pregnancy, which may be an underestimate as only a third of women responded to the questionnaire (Hotham 2008).

In an audit of 144 birth records of substance-using mothers, 8% used alcohol at risky levels (Kennare 2005).

Queensland
In a retrospective survey of antenatal case notes of 541 women in Cairns indicated that 58% had consumed alcohol before pregnancy and that this dropped to 25% during pregnancy (Rimmer 2006).

Western Australia
Rates of risky drinking are increasing in non-Indigenous Western Australian women of child-bearing age; up to 80% report drinking in the three months before pregnancy and 14% report binge drinking during pregnancy (Colvin 2007).

National
A national survey in 2006 showed that 34% of women consumed alcohol during their most recent pregnancy (Peadon 2008; Elliott 2008).

Teenagers
In the WA Aboriginal Child Health Survey, adolescent alcohol use by Aboriginal adolescents followed a similar pattern to other WA adolescents (Blair 2005).
**Fetal alcohol syndrome (FAS)**

The Australian Paediatric Surveillance Unit reported 92 confirmed new cases of FAS from 2001 to 2004, with numbers increasing over time. Prevalence of FAS detected at birth was 0.06/1000 livebirths. Most cases of FAS (94%) had high risk exposure to alcohol in utero and 78% were exposed to one or more additional drugs. Of these 92 infants with FAS, 65% were Aboriginal and Torres Islander, 51% had a sibling with FAS and 60% did not live with a biological parent (Elliott 2008).

The prevalence of FAS in Victoria has been reported as 0.01-0.03 per 1000 livebirths. Based on an audit of 109 records from the Victorian Birth Defects Registry of infants with possible FAS, no differences were seen between Aboriginal and Torres Strait Islander women and other women in Victoria (Allen 2007).

However a difference in FAS rates was seen in WA, with 2.76/1000 livebirths for Aboriginal women compared with 0.02/1000 livebirths for other women; over 100 times greater for Aboriginal women (Bower 2000). These figures are regarded as an underestimate (Elliott 2008).

In the NT, all reported cases of FAS were to Aboriginal and Torres Strait Islander women; with a birth prevalence of 0.68 to 1.87/1000 livebirths overall and 1.7 to 4.7/1000 livebirths to Aboriginal and Torres Strait Islander women (Harris 2003).

In a survey in Far North Queensland, 1.5% of Aboriginal children showed signs of fetal alcohol spectrum disorder, reaching a very high 3.6% in one of the Cape York communities (Rothstein 2007).

**International**

In the large US Pregnancy Risk Assessment Monitoring System (PRAMS), 50% of women giving birth to a live infant reported alcohol use preconception (D’Angelo 2007).

A Danish cohort study of approximately 100,000 women indicates that about one-quarter of women binge drink at least once during pregnancy, mostly before they are aware that they are pregnant. Binge drinking after recognition of pregnancy was more common among women who were not intending to become pregnant, who were multiparous unskilled workers, had been unemployed for more than a year, or had mental health problems (Strandberg-Larsen 2008c).

**Targets**

The COAG targets include developing health promotion programs targeting alcohol consumption in pregnancy, with the aim of reducing fetal alcohol syndrome rates and reducing capita alcohol consumption rates in pregnancy (www.coag.gov.au).

The US Healthy People 2010 target is for 94% of pregnant women to completely abstain from alcohol (Goler 2008).

**What are the links between alcohol use during pregnancy and infant mortality, preterm birth, small for gestational age or low birthweight?**

**Australia**

Of the 92 confirmed cases of fetal alcohol syndrome in Australia from 2001 to 2004 (65% Aboriginal and Torres Strait Islander), 36% of the infants were preterm and 65% were low birthweight (Elliott 2008).

**Queensland**

In a case-control study of mostly Aboriginal and Torres Strait Islander children with fetal alcohol syndrome in Far North Queensland, mean gestation for singleton pregnancies for 57 case mothers (those with a FAS child) was 37 weeks compared with 39 weeks for 57 control mothers (those without a FAS child); although a regression analysis linked this difference to smoking rather than alcohol use. Eighteen case mothers had preterm births compared with 5 control mothers; 3.6 times more). Low birthweights were significantly
more common among the case mothers than the control mothers, and were correlated with both alcohol and smoking. For 27 case mothers, their fetuses had intrauterine growth restriction compared with five control mothers (5.4 times more), accounting for over 50% of the pregnancy complications in case mothers (Coyne 2008).

**Western Australia**
Consumption by Aboriginal mothers in Perth of more than two standard drinks on any occasion increased the odds of a poor birth outcome (low birthweight and/or preterm birth); OR 4.2 95% CI 1.7 to 10.1. Mothers from circumstances where family members’ alcohol use caused hardship were twice as likely to have a poor birth outcome, but this did not quite reach statistical significance; OR 2.1 95% CI 0.9 to 4.6 (Eades 2008).

**International, overall population**

**High alcohol intake**
In a study of over 50,000 women giving birth in the USA from 1996 to 1999, Whitehead (2003) found significant associations between high levels of alcohol use and small for gestational age babies (OR 4.28 95% CI 1.11 to 16.61) in the last three months of pregnancy. Moderate to heavy binge drinking was also associated with small for gestational age babies (OR 2.24 95% CI 1.25 to 4.02). All results were adjusted for smoking in late pregnancy; income from public assistance; maternal age; maternal education; marital status; prepregnancy weight and maternal state of residence.

In a Danish study, consuming three or more drinks a week and two or more binge drinking episodes during the first 16 weeks of pregnancy had a hazard ratio of 2.20 (95% CI 1.73 to 2.80) for stillbirth compared with women not drinking alcohol. The hazard ratio for the same level of intake but without the binge drinking was 1.76 95% CI 1.50 to 2.06 (Strandberg-Larsen 2008b).

**Low to moderate alcohol intake**
A systematic review of low to moderate alcohol use (equivalent to one glass of wine or less a day) (Henderson 2007) showed the following:
- Stillbirth – one of five studies (56,110 women in total) found a significant increase in stillbirth with consumption of 25-60 g/week of alcohol
- Impaired growth – one of seven studies (129,439 women in total) found a significant increase (this analysis was not adjusted for confounders)
- Birthweight – one of 19 studies (175,882 women in total) found a significant increase in low birthweight (this analysis was not adjusted for confounders)
- Preterm birth – one of 16 studies (178,639 women in total) found a significant increase (not adjusted for socioeconomic status).

Small amounts of alcohol appeared to have a mildly protective effect for stillbirth, IUGR and birthweight.

**What are the links between alcohol use during pregnancy and other outcomes of interest?**

In a survey of women attending their first antenatal visit at the Lyell McEwin or Women’s and Children’s Hospital, women who used alcohol during pregnancy were significantly more likely to have had previous pregnancy losses; and these women were also less likely to have stopped alcohol use during pregnancy compared with either women in the first pregnancy or women with previous pregnancies but no losses (Hotham 2008).

**Queensland**
A prevalence of 15/1000 for ‘fetal alcohol spectrum disorders’ was noted among Aboriginal children in communities in Far North Queensland in 2001-2006 (Rothstein 2007).
In a case-control study of mostly Aboriginal and Torres Strait Islander children with fetal alcohol syndrome in Far North Queensland, case mothers had significantly more birth complications than control mothers, with preterm birth (see above) and fetal distress showing significant differences but not meconium liquor, resuscitation, twin pregnancy or chorioamnionitis. Case mothers in this study self-reported as heavy drinkers before pregnancy compared with 30% (13) control mothers. The corresponding figures for heavy alcohol use once pregnant was 69% (31) case mothers and 17% (8) control mothers. A similar pattern was seen for cigarette smoking with a large decline in smoking in control mothers once they knew they were pregnant; this decline was not seen for case mothers who were heavy drinkers (Coyne 2008).

In a study in Cairns, Queensland, 63% of the women who consumed alcohol during pregnancy smoked, compared with 39% of the women who did not consume alcohol (Rimmer 2006).

In a survey in Far North Queensland of 16,176 public births from 1992 to 2001, failure to access antenatal care was significantly associated (in multivariate analyses) with the use of alcohol (Humphrey 2004).

In the Mater University Study of Pregnancy cohort from Queensland, significant associations between maternal alcohol (and tobacco) consumption and a child’s drinking patterns in adolescence were seen. This association is likely to be due to a range of environmental factors, including familial modelling, but there is also some suggestion that fetal programming may be occurring through in utero exposure to alcohol (Alati 2008).

Although alcohol consumption at any time during pregnancy can result in harm, it is most likely to be sustained in the first weeks of pregnancy, often before a woman is aware that she is pregnant. This may lead to anxiety if the woman had been drinking at risky levels and can result in a woman deciding to terminate the pregnancy (Couto 2007).

International
A systematic review of low-moderate alcohol use (equivalent to one glass of wine or less a day) (Henderson 2007) showed the following:
- Miscarriage — five of eight studies (115,958 women in total) found a significant increase (some studies were partially adjusted or unadjusted)
- Malformations — one of six studies (57,798 women in total) found a significant increase in major malformations (unadjusted for confounders).

What are the links between alcohol use and other risk/protective factors?

It is not clear why some fetuses are affected by significant antenatal exposure to alcohol but some factors such as maternal age, health and nutritional status, fetal susceptibility and concurrent use of other psychoactive substances may play a role (Stade 2009).

Breastfeeding
In a WA longitudinal study of 551 women, assessed at six months after giving birth, those who consumed alcohol at levels of more than two standard drinks a day were almost twice as likely to stop breastfeeding compared with women drinking below these levels (Giglia 2008a).

Smoking
In a 2006 survey of Australian women, intention to smoke during a future pregnancy was associated with intention to consume alcohol; OR 5.1 95% CI 2.7 to 9.4 (Peadon 2008).

Use of other substances
Significant associations between alcohol use and use of other drugs in pregnancy have been reported for Australian teenagers (Quinlivan 2002) and UK women (Fergusson 2002).
Social and emotional wellbeing
Pregnant women who are depressed and/or suffer from anxiety are more likely to use alcohol (Tobin 2005; Edwards 2006).

What is the evidence for preventing/reducing alcohol use by pregnant women and new mothers?

The new National Health and Medical Research Council (NHMRC) guidelines on alcohol use for women who are pregnant, hoping to become pregnant or breastfeeding, state that the safest choice is not to drink alcohol (NHMRC 2009).

The national Australian clinical guidelines for the management of drug use during pregnancy (Ministerial Council on Drug Strategy 2006) contain the following consensus recommendation regarding access to treatment:

“Pregnant women identified as consuming risky levels of alcohol...should have priority access to alcohol treatment services, including comprehensive assessment and detoxification, but also including therapeutic options such as brief intervention, cognitive behavioural therapy and group sessions.”

Preventing alcohol-exposed pregnancies
In a US randomised controlled trial (RCT) in women at risk of an alcohol-exposed pregnancy, a brief motivational intervention of four counselling sessions and one contraception consultation were significantly less likely to be at risk for an alcohol-exposed pregnancy at nine months than women receiving information only (OR 1.90 95% CI 1.36 to 2.66) with each of the two components (effective contraception and reduced risky drinking) also significantly reduced (Floyd 2007).

Stopping drinking during pregnancy
In another US RCT of women who continued to drink alcohol during pregnancy, a brief intervention of 10 to 15 minute counselling sessions significantly decreased the number of women drinking compared with assessment only; OR 5.39 95% CI 1.59 to 18.25 (O’Connor 2007).

Psychological and/or educational interventions
In a Cochrane review of four RCTs, relatively brief combined psychological and educational interventions led to decreased alcohol consumption, but few other outcomes were reported (Stade 2009). (This review included O’Connor 2007 but not Floyd 2007 – both discussed above.)

Psychosocial interventions
A Cochrane review on psychosocial interventions for women enrolled in alcohol treatment during pregnancy covered contingency management, motivational interviewing, psychotherapy and behavioural therapy but no trials of these interventions have yet been completed (Lui 2008).

Home visits
Two trials of support through postnatal home visits did not show an impact on continued alcohol use; risk ratio (RR) 1.08 95% CI 0.83 to 1.41 (Doggett 2005).

Fetal Alcohol Syndrome
Early diagnosis and rearing in an appropriate environment can reduce the risks of future problems for these children such as disrupted education, unemployment, mental health disorders, substance use, and interactions with the law (Streissguth 2004).
Strategies for pregnant women to prevent or reduce their alcohol use

**Early Start, United States**
The US Early Start program places a substance abuse expert in departments of obstetrics and gynaecology with assessment and treatment appointments linked to women’s antenatal appointments. All women are screened for alcohol use by questionnaire, and by toxicology if they give informed consent; and all providers and women are educated about the effects of drugs, alcohol and cigarette use in pregnancy (Goler 2008).

In a retrospective cohort study of women who screened positive for substance use and/or at risk alcohol use, those who received no further assessment or management had worse outcomes than either the women assessed and treated, or assessed only; with significantly higher rates of low birthweight, preterm birth and intrauterine fetal death, and very high levels of placental abruption in the assessed only group. The business case analysis for Early Start shows a 30% return on investment (Goler 2008).

**What are the barriers to (or facilitators for) preventing or reducing alcohol use?**

**Barriers**
Fear of judgmental attitudes of health professionals may deter substance using women from seeking antenatal care, although a Melbourne survey found that when women do attend care and engage with a health professional these fears are usually allayed (Tobin 2005).

A postal survey of WA health professionals (excluding paediatricians) indicates that they have limited knowledge of the diagnostic features of FAS and that less than half of them ask women about their alcohol use during pregnancy (Payne 2005).

In Canada there are very few or no services for pregnant women who present for services while intoxicated (Tait 2002). Tait also notes that women often dramatically increase their substance use after apprehension of their children. This puts both a pregnant woman and her fetus at risk, since the social workers’ first priority is to the children already born and since there may be an adversarial relationship with the mother (Tait 2002).

**Ongoing projects/programs**

**ASSIST**
A study of ASSIST (the Alcohol, Smoking and Substance Involvement Screening Test) in pregnant women is currently underway at the Lyell McEwin and Women’s and Children’s Hospitals in South Australia (Hotham 2008).

**National Fetal Alcohol Syndrome surveillance**
The Australian Paediatric Surveillance Unit (APSU) is an ongoing scheme which will progressively and prospectively identify national statistics for the prevalence of fetal alcohol syndrome (Elliott 2007).

**COAG funding**
In 2006 the Commonwealth Government agreed to double the $49.3 million in funding previously provided by COAG for substance and alcohol rehabilitation and treatment services, particularly in remote areas; and the States and Territories have committed to complementary investments in services to support this initiative (www.coag.gov.au).
Pregnancy Lifescripts, Australia

This Australian primary care program advises the 5A approach (Ask, Assess, Advise, Assist, Arrange) to help pregnant women prevent alcohol-related harm. The AUDIT-C tool is recommended for screening, followed by the AUDIT tool for full assessment if necessary. The Pregnancy Lifescripts material mentions that resources specifically for Aboriginal and Torres Strait Islander women will be developed (Couto 2007).

Healthy Pregnancies, Healthy Babies

As part of research on fetal alcohol syndrome, the Victorian Aboriginal Community Controlled Health Organisation (VACCHO) has developed the Healthy Pregnancies, Healthy Babies kit for use by Aboriginal health and community workers. The kit explains the relationship between food, alcohol and other drugs during pregnancy and conveys the message that healthy pregnancies and health babies are the whole community’s responsibility (Victorian Department of Human Services 2008).

Alcohol and Pregnancy: Telethon Institute for Child Health Research

In 2006 and 2007, researchers based at the Telethon Institute developed and distributed a set of resources entitled ‘Alcohol and Pregnancy: Health Professionals Making a Difference’ to over 3500 health professionals in WA in 2007, and are currently evaluating whether the resources have changed practice in WA. A study of Aboriginal women’s knowledge, attitudes and practices regarding alcohol is also currently being undertaken in two rural and remote regions in WA and in one metropolitan area (Telethon Institute for Child Health Research 2008).

Sheway, Canada

In a deprived area of Vancouver, Canada, the Sheway program offers a single access comprehensive street-front service to pregnant and parenting women with a history of alcohol and/or drug use. Sheway adopts a harm reduction, rather than an abstinence approach and allows their clients choice and autonomy over which services they will use and which staff are involved in their care. Social support, meals, food and milk vouchers, antenatal and postnatal care are offered along with more direct drug and alcohol counselling services. In 1996, over 80% of clients self-identified as First Nation, Inuit or Metis women, with an average age of the mid-twenties. While women’s health and social problems have increased over the 9.5 years that Sheway has operated, indicators of infant health have either improved or remained stable. Over this time, 8 stillbirths out of 1127 pregnancies were recorded. There were an additional 62 miscarriages and 62 abortions. The preterm birth rates have a U-shape with a ‘low’ of about 15% in 1998 subsequently rising to over 30% in 2002. Low birthweight shows a similar but less dramatic pattern, with a low birthweight rate of nearly 20% in 2003. There were six deaths of infants among 827 live births recorded – three of these were classified as SIDS (Marshall 2005).

Cochrane review

A Cochrane review is currently underway on Pharmacologic interventions for pregnant women enrolled in alcohol treatment (Smith 2008).

Interpretation/comments

COAG has listed alcohol use in pregnancy as one of the main policy areas for ‘Closing the gap in Indigenous life outcomes in early childhood’; identifying a need to build the evidence base for effective interventions to reduce the impact of alcohol use on children and mothers (www.coag.gov.au).

Avoiding alcohol use in pregnancy has the potential to reduce low birthweight, intrauterine growth restriction, numbers of small for gestational age babies, preterm birth and perhaps stillbirths. It will also reduce numbers of infants with fetal alcohol syndrome which has been described as “the beginning of a lifelong and intergenerational pathway to physical, social and mental ill-health” (Elliott 2004).

Brief motivational interventions appear to be effective in reducing alcohol-exposed pregnancies and in reducing the number of women continuing to drink during pregnancy, although postnatal home visits specifically to support women with alcohol problems have not been shown to reduce alcohol use, and we
did not locate any programs of this nature which have been targeted to Aboriginal and Torres Strait Islander women.

These promising interventions will need to be supplemented with population and community level policies and actions, since, for example, drinking may be a cultural norm in some communities (Couto 2007).

As alcohol use in pregnancy is often linked with use of other drugs and with smoking, jointly targeting these behaviours may help.

**Further research/action required**

Current estimates of risky drinking periconceptionally and during pregnancy are probably not highly accurate, and also likely to vary considerably between different groups of women. Thus further investigation of alcohol use by women of reproductive age is needed, as better information about rates and determinants of alcohol use for particular groups of women (e.g. urban Aboriginal and Torres Strait Islander women). Peardon 2008 has called for better national routine data collection on alcohol use in pregnancy, with present methods “inadequate for monitoring trends or evaluating the effectiveness of public health interventions”.

Priority should be given to providing Aboriginal and Torres Strait Islander cultural awareness training to all maternal and child health care providers and drug and alcohol service providers (MCDS 2006).

The Aboriginal and Torres Strait Islander Peoples Complementary Action Plan to the National Drug Strategy calls for enhanced community capacity to deal with alcohol use; and for more coordinated, whole of government approaches to reduce alcohol-related harm (MCDS 2003).

The Pregnancy Lifescripts recommendation to assess alcohol use by pregnant women and women planning pregnancy will require substantial resources to implement since less than half of Australian health professionals screen for alcohol use in these women (Payne 2005). An even higher level of resourcing will be required to assess the significant number of women using alcohol at risky levels and who have an unplanned pregnancy.

Promising brief motivational interventions need to be tailored for Aboriginal and Torres Strait Islander women and teenage women populations and settings; and they then need to be piloted in specific groups of these women.
References


Alcohol Use


2.1.2 Antenatal Care

Other material relevant to antenatal care is covered under the ‘Models’ section, particularly models being used in Australia; and also ‘CenteringPregnancy’. The following concentrates on the more general aspects of antenatal care.

When and how often do pregnant women attend antenatal care?

Aboriginal and Torres Strait Islander women, South Australia
In 2007, 2.9% (17/578) of Aboriginal and Torres Strait Islander women in SA had no antenatal visits; and 55.4% (320/578) had seven or more antenatal visits. The corresponding overall figures for SA were 0.2% and 86.0% (Chan 2008).

Over the 1998 to 2005 period, there was an 18% increase in the rate of Aboriginal and Torres Strait Islander women attending at least one antenatal care session during pregnancy in SA (Australian Health Ministers Advisory Council 2008).

Aboriginal and Torres Strait Islander women, New South Wales, Queensland, South Australia, Northern Territory
In 2005, in NSW, Queensland, SA and NT, approximately 96% of Aboriginal and Torres Strait Islander mothers and 99% of non-Indigenous mothers attended at least one antenatal care session. The rates of attendance for those participating in at least one antenatal care session were similar between the groups (Australian Health Ministers Advisory Council 2008).

In a review of antenatal care, Aboriginal and Torres Strait Islander women were consistently found to initially attend later in their pregnancy, and less frequently than other groups of women (Hunt 2006).

Aboriginal and Torres Strait Islander women, New South Wales
From 1994 to 2006, the proportion of Aboriginal mothers who attended their first antenatal visit before 20 weeks gestation increased from 63% to 75%. However, this figure remained below the 88% level recorded for other mothers in 2006 (NSW Health 2008).

Aboriginal and Torres Strait Islander women, Queensland
Fifteen per cent of women (87/369) attending antenatal care at the Townsville Aboriginal and Islander Health Service reported attending four or less antenatal care visits and 9% reported being > 24 weeks gestation at their first antenatal care visit (Panaretto 2006).

In a survey in Far North Queensland, 1.4% (226 of 16,176) public births from 1992 to 2001 were to women who did not access antenatal care. For the 4750 Aboriginal and Torres Strait Islander women (29%), the corresponding percentage was 3.5% (OR 3.77 95% CI 1.63 to 8.72), a significant difference compared with all women. Women aged 18 years or less also were significantly less likely to access antenatal care (2.8% compared with 0.9% for women aged 26 years or more) (Humphrey 2004).

Aboriginal and Torres Strait Islander women, Northern Territory, Western Australia and far-west New South Wales
Information about the timing of antenatal care is available from the Audit, Best Practice in Chronic Disease (ABCD project), a national Aboriginal and Torres Strait Islander primary care quality improvement intervention. In the baseline audit of maternal health services among 18 participating services in the NT, WA and far-west NSW, 44% of all women attended their first antenatal visit at less than 12 weeks gestation. The mean estimated gestational age at first antenatal visit ranged from 13 weeks in Top End NT participating services to 20 weeks in services in far-west NSW. Despite the majority of women presenting after the first trimester, the average number of antenatal visits during the pregnancy among all women was 8 (range 5 to 10) (personal communication, Professor Ross Bailie, January 2009).
Preliminary Healthy for Life data
Of 498 Aboriginal and Torres Strait Islander women from 16 Healthy for Life sites, 41% attended their first antenatal visit before 13 weeks of pregnancy and 31% attended an antenatal visit before 20 weeks of pregnancy; with attendance rates higher in urban areas than regional or remote areas (Australian Health Ministers Advisory Council 2008).

Teenage women, Canada
In a survey of nearly 81,000 mothers in Manitoba, women aged less than 20 years had the highest rates (21%) of inadequate (no visits before 16 weeks or less than 50% of the recommended number of visits) or no antenatal care (Heaman 2008).

Recommended standards (United Kingdom)
The UK Department of Health has introduced an indicator that a full health and social care assessment of needs, risks and choices will be carried out by 12 completed weeks of pregnancy for all women (UK Department of Health 2007b).

What is the link between antenatal care visits and infant mortality, preterm birth, small for gestational age or low birthweight?

Aboriginal and Torres Strait Islander women, national
Perinatal mortality
In 2005, the perinatal mortality rate in NSW, Qld, SA and NT was much higher for Aboriginal and Torres Strait Islander mothers who attended no antenatal sessions compared with Aboriginal and Torres Strait Islander mothers who attended five or more antenatal sessions – 13% compared with 0.5% (Australian Health Ministers Advisory Council 2008).

Low birthweight
In 2005, the low birthweight rate for babies born to Aboriginal and Torres Strait Islander women in NSW, Qld, SA and NT was much higher among mothers who attended no antenatal sessions compared with mothers who attended at least one antenatal session – 39% versus 13% (Australian Health Ministers Advisory Council 2008).

In Qld, SA and NT, the combined low birthweight rate for babies born to Aboriginal and Torres Strait Islander women was higher among mothers who attended no antenatal sessions (42%) or one antenatal session (29%) compared with 13% for mothers who attended five or more antenatal sessions (Australian Health Ministers Advisory Council 2008).

Preterm birth
Patterns for preterm birth in 2005 were similar to those described above for low birthweight (Australian Health Ministers Advisory Council 2008).

South Australia (overall)
In a recent SA audit of 608 women who had a perinatal death from 2001 to 2005, 5% (n=31) had a risk factor related to access to care (lack of local resources, problems related to distance or remoteness and/or transport problems) (De Lange 2008). One hundred and four women (17.1%) presented too late for timely medical care; although most women did have sufficient numbers of antenatal visits (De Lange 2008).
Queensland (overall)
In a survey in Far North Queensland of 15,908 singleton births (about one-third being Aboriginal or Torres Strait Islander babies) from 1992 to 2001 (Humphrey 2004), failure to access antenatal care was significantly associated with:

- Perinatal mortality: OR 6.30 95% CI 3.72 to 10.69
- Preterm birth (< 34 weeks): OR 6.96 95% CI 4.96 to 9.75
- Low birthweight: OR 4.47 95% CI 3.35 to 5.98

International
A US database survey of over 22 million live births showed that inadequate antenatal care (no visits before 20 weeks or less than 50% of the recommended number of visits) was associated with increased risk of neonatal death compared with adequate antenatal care (and also with a schedule more intensive than that recommended for uncomplicated pregnancies) (Chen 2007).

In a Canadian survey of nearly 81,000 mothers, inadequate (no visits before 20 weeks or less than 50% of the recommended number of visits) or no antenatal care showed significant links with small for gestational age (SGA) (OR 1.4 95% CI 1.3 to 1.5; adjusted for maternal age and parity). Links with preterm birth and low birthweight were also significant but of a lower magnitude than for SGA. The authors of this study suggest that the apparent stronger relationship between inadequate antenatal care and SGA (than for preterm and low birthweight) may be because of the association of risk factors that are potentially modifiable through good preconception and antenatal care such as low pre-pregnancy weight, low gestational weight gain, smoking, and recreational drug use (Heaman 2008).

What are the links between antenatal visits and other outcomes?

Queensland
Univariate analysis of 15,908 singleton births in a survey in Far North Queensland showed significant associations between failure to access antenatal care and:

- Apgar score < 5 at 5 minutes: OR 4.96 95% CI 3.06 to 8.05
- Postpartum haemorrhage: OR 1.81 95% CI 1.15 to 2.85
- Blood transfusion: OR 2.37 95% CI 1.16 to 4.86

Spontaneous vaginal birth was also significantly more likely for women who did not access antenatal care; OR 1.86 95% CI 1.31 to 2.64 (Humphrey 2004).

Women’s views of antenatal care
In a review, Hunt 2006 has shown that there is much common ground in Aboriginal and Torres Strait Islander women’s experiences of care during pregnancy, including:

- Long waiting times, short consultations and lack of continuity of carer in outpatient clinics
- Limited access to interpreter services
- Understaffing
- Lack of Aboriginal and Torres Strait Islander staff and lack of Aboriginal Health Workers
- Skills of midwives not being acknowledged or used
- Problems with information exchange with community providers
- Explicitly racist attitudes and behaviours in mainstream settings.

Hunt also identifies a number of differences in programs developed specifically for care of Aboriginal and Torres Strait Islander women during their pregnancies, including:

- Services designed, staffed, operated and managed by Aboriginal women
- Flexible appointment systems
- Availability of free transport and child care
- Aboriginal Health Workers having roles in caring for women
Some services being women only on clinic days
- Providing holistic care – not just the woman’s pregnancy; and extending to care of children, family and the community
- Strong links with Aboriginal and Torres Strait Islander community members
- Having an accepted, valued and well-developed role in advocacy and policy development.

**What are the links between antenatal care and other risk/protective factors?**

In a survey in Far North Queensland of 16,176 public births from 1992 to 2001, failure to access antenatal care was significantly associated (in multivariate analyses) with the use of alcohol, low maternal age (both 18 years or less, and 19-25 years versus 26 years or more) and higher degrees of parity. A significant association was not seen for either tobacco use or recreational drug use (Humphrey 2004).

A project from Wolverhampton in the UK showed that women who book late for antenatal care tended to be single, unsupported and more socially deprived. Suggestions to promote early care include easier booking methods, drop-in clinics, home bookings for some women, increasing the profile of community midwives and improving communication through measures such as signage, maps and websites for mothers (UK Department of Health 2007b).

**Illicit drug use in pregnancy**

In a prospective cohort study from the US, the risks of preterm birth, low birthweight and small for gestational age were highest for drug-using women who did not have adequate antenatal care, with the authors noting that adherence to antenatal care may be a proxy for factors such as a more structured lifestyle (El-Mohandes 2003).

**Unintended or mistimed pregnancies**

In a US Pregnancy Risk Assessment Monitoring System survey of 9048 women, women with unintended or mistimed pregnancies were less likely to initiate antenatal care during the first trimester than women with intended pregnancies (Cheng 2009).

**What is the evidence for improving antenatal care visits in pregnant women?**

In an Australian Department of Health literature review of antenatal care programs for Aboriginal and Torres Strait Islander women, Herceg 2005 identified the following factors as being linked to improved health outcomes:

- Community-based or community controlled services
- Specific services and location for women and children
- Continuity of care and a broad spectrum of services
- Integration with other services (hospital liaison, shared care)
- Outreach activities
- Home visiting
- Welcoming and safe environment
- Flexibility in service delivery and appointment times
- Focus on communication, relationship building and development of trust
- Respect for Aboriginal and Torres Strait Islander peoples and their culture
- Respect for family involvement in health issues and child care
- Having an appropriately trained and supported workforce
- Valuing Aboriginal and Torres Strait Islander staff and female staff
- Provision of transport
- Provision of child care or playgroups.
An Australian study prospectively compared outcomes for 448 teenage women attending teenage antenatal clinics with 203 teenage women attending general hospital antenatal clinics. Thirty-three per cent of the women in the teenage clinic group and 28% in the standard clinic were Aboriginal and Torres Islander women. Nearly 50% of the women were smokers, one-fifth used alcohol and about a quarter used illicit drugs. The women attending the teen clinics were significantly less likely to have a preterm birth (12% v 26%; OR 0.40 95% CI 0.25 to 0.62) and to leave hospital on contraception. Breastfeeding initiation rates showed little difference between the two types of care. The positive influence of the teenage specific clinics on preterm birth was attributed to rigorous infection screening and social support (Quinlivan 2004c).

The Cochrane review on ‘Patterns of routine antenatal care for low-risk pregnancy’ includes the large landmark trial of the WHO model for antenatal care. The review concludes that fewer antenatal visits than the current standard at the time did not increase adverse maternal and perinatal outcomes in low-risk women, although women may be less satisfied with a reduced number of visits (Villar 2001).

In the Cochrane review of ‘Support during pregnancy for women at increased risk of low birthweight babies’, Hodnett 2003 found that giving additional antenatal support to women who were at increased risk of having a preterm or growth-restricted baby did not show reduced rates of preterm or low birthweight babies. Women may have been less anxious as well as less likely to have a caesarean, and some women were more likely to choose to terminate the pregnancy.

In a Cochrane review of midwife-led versus other models of care during the antenatal and intrapartum period, no differences were seen in overall fetal loss or neonatal death. However the review suggests that women receiving midwife-led care were significantly less likely to experience fetal loss before 24 weeks gestation and to also have other improved outcomes such as a greater likelihood of initiating breastfeeding (Hatem 2008).

In an Australian RCT, a home-based interpregnancy intervention for first-time mothers failed to show a beneficial impact on birthweights in the second birth (Lumley 2006).

A Cochrane review in progress is assessing group versus conventional antenatal care (Homer 2009).

**Strategies to encourage pregnant women to participate in programs to improve antenatal care**

*Please also refer to the ‘Models’ section for detailed coverage of strategies related to antenatal care, and also to the ‘Topics’ section (e.g. ‘Home visits’).*

In Birmingham, which has the highest number of infant deaths in England, a free pregnancy testing service was offered within local pharmacies. With the woman’s consent, the pharmacist makes a referral to the multilingual midwifery call centre, which fast tracks a referral to a midwife and also alerts women to other services such as pregnancy counselling, family planning, smoking cessation and drug and alcohol services. In September 2007, the service made 139 referrals to midwives, with 85% of referrals being before 12 weeks gestation (compared with a baseline of 39%) (UK Department of Health 2007b).

**What are the barriers to/facilitators for improving antenatal care?**

Hunt 2006 has identified the following as contributing to difficulties in communicating with Aboriginal and Torres Strait Islander women during their antenatal care:

- Cultural gaps between non-Aboriginal providers and the women
- Lack of time, particularly in consultations
- Lack of continuity of carer in hospital settings
- The complexity of some aspects of pregnancy such as screening
- Lack of background knowledge of issues such as HIV
Increasing volume of information provided to women about tests and procedures for routine pregnancy care.

These factors also reduce the opportunities for Aboriginal and Torres Strait Islander women to be involved in making decisions about their health care during pregnancy and increase power differentials between the women and providers (Hunt 2006). In fact, many Aboriginal women in remote Australian communities may have not seen a midwife or a GP until they are transferred to a hospital to give birth (Hancock 2007).

In Canada, Aboriginal women may be distrustful of service providers, including those providing antenatal care, in view of the long legacy of oppression and fear of losing custody of their baby and/or their children (Tait 2002).

Poor antenatal care among US teenage women may be due to: fear, shame, denial, failure to recognise the early signs of pregnancy, concerns about costs, confidentiality, transportation, poor motivation to attend, dissatisfaction with provider attitudes and practices, and the clinic structure, such as clinic hours or waiting times (Story 1997).

In a study in Oregon, USA, women who did not have adequate antenatal care nominated the main barriers as difficulty in paying for antenatal care, difficulty with medical insurance, ambivalence or fear about the pregnancy and transportation problems (Harvey 1993).

**Ongoing projects/programs**

**COAG, Australia**
As part of the National Partnership for closing the gap on Indigenous disadvantage, 35 Children and Family Centres are to be established across Australia in areas of high Aboriginal and Torres Strait Islander population and disadvantage, to deliver integrated services including increased access to antenatal care (www.coag.gov.au).

**Audit, Best Practice in Chronic Disease (ABCD) project, Australia**
Baseline audits of maternal health care in services participating in the ABCD project (described earlier) have been completed and are currently being fed back to services to inform systems change. Preliminary unpublished figures from the baseline audit indicate that across all services, delivery of recommended antenatal investigations varied. Just over a half of women had a documented ultrasound check between 16 to 20 weeks, or an investigation for gestational diabetes in mid-pregnancy; and less than half had a documented low vaginal swab for Group B Streptococcus late in pregnancy. Importantly, where investigations were undertaken and abnormal results detected, rates of referral and examination by a GP/obstetrician were high (personal communication, Professor Ross Bailie, January 2009).

A guideline development group is currently preparing national Australian clinical practice guidelines for antenatal care, including a section on antenatal care for Aboriginal and Torres Strait Islander women. These guidelines are being developed according to NHMRC standards for guidelines.

**Melbourne**
The recent ANEW program was designed to provide psychosocial support to women during pregnancy. Implemented at Mercy Hospital for Women in Melbourne, the program aimed to enhance the identification of women at psychosocial risk (including homelessness, violence from an intimate partner, depression, substance misuse, intellectual disability, extreme social isolation, lack of capacity to care for a baby, having experienced sexual abuse as a child, lack of social and interpersonal support, and serious mental illness) and then to offer support to these women. The program consists of intensive communication education for caregivers and the evaluation showed that communication about some sensitive issues was significantly improved, but this was confined to midwifery-led models of care (Hegarty 2007).
Interpretation/comments

The quality and nature of antenatal care can vary greatly. Hunt and Lumley showed that routine antenatal care in Australia is highly variable in some areas such as GDM screening, and is not always consistent with national policies or research evidence, for example support to stop smoking was rarely included (Hunt 2002).

The quality of antenatal care for Aboriginal and Torres Strait Islander women is also variable. The ABCD project has identified clear service deficiencies in the delivery of recommended antenatal investigations such as the morphology ultrasound at 16 to 20 weeks gestation and in screening for gestational diabetes. The project has also demonstrated that despite presenting later in pregnancy, women are attending antenatal care regularly, with the average number of antenatal visits (n=8) in accordance with the suggested minimum number of visits for pregnant women. The ABCD project indicates that there are important opportunities for risk factor intervention in pregnancy for Aboriginal and Torres Strait Islander women. Rather than focusing solely on increasing the timing and frequency of antenatal visits, there is a need to ensure that Aboriginal and Torres Strait Islander women have access to the same standard of antenatal care as other Australian women.

Attributing differences in pregnancy outcomes to differences in attendance for antenatal care is problematic because those who attend programs may be very different from those who do not attend (Hunt 2006). Some of these differences may relate to certain groups not accessing antenatal care because the services are not responsive to their needs. One example is marginalised women such as young indigenous women who use alcohol, particularly in urban settings (Humphrey 2004).

Ideally, antenatal care should be tailored to individual women’s needs and wishes (Walker 2004/2005) with women having more say in the design and management of their antenatal services (Hunt 2006).

High quality antenatal care can be a key preventative health strategy (Homer 2009).

Further research/action required

Maternity service reform, including the design and management of antenatal services for Aboriginal and Torres Strait Islander women, needs the women themselves to have more say in decision making at both individual and institutional levels (Hunt 2006). The recently announced national Maternity Services Review is canvassing issues across the spectrum of care, including antenatal services (Australian Department of Health and Ageing 2008) and key principles from the AHMAC Maternity Services Framework include choice, culturally appropriate care, and working to reduce the health inequalities faced by Aboriginal and Torres Strait Islander mothers and babies and other disadvantaged populations (Australian Health Ministers Advisory Council 2008).

Each new model of antenatal care needs to have a plan for evaluation at the design stage of the proposed model and to be resourced to adequately carry out these evaluation processes.

A valid and reliable way to measure the quality of antenatal care is urgently needed (Heaman 2008) overall and specifically for Aboriginal and Torres Strait Islander women and teenage women. This needs to encompass further understanding of the reasons why some Aboriginal and Torres Strait Islander women and teenage women present late for antenatal care.

The national Australian antenatal guidelines need to be urgently completed, and disseminated; and resources need to be provided to implement the guidelines.

Australian preconception care guidelines are also needed, with specific coverage for Aboriginal and Torres Strait Islander women and teenage women.
References


Herceg A. (2005) Improving health in Aboriginal and Torres Strait Islander mothers, Babies and Young Children - A Literature Review. *MJL - Health 4 Life*.


2.1.3 Birth Spacing

How many women have short intervals between pregnancies?

In 2006, more than a quarter of Aboriginal and Torres Strait Islander women (27%) had given birth three or more times previously, a much higher rate than for the 5.6% of all Australian women giving birth at least three times (Laws 2008). This is likely to increase the chance of Aboriginal and Torres Strait Islander women having short intervals between pregnancies. In a study of 782 Aboriginal women giving birth over a nine year period in the Kimberley region of north-west Australia, six women (8%) each gave birth to five children during these nine years (Rousham 2002).

There is a trend in many countries (particularly developing ones) for increasing intervals between births (Setty-Venugopal 2002).

After a live birth, the recommended interval before attempting the next pregnancy is at least 24 months in order to reduce the risk of adverse maternal, perinatal and infant outcomes (World Health Organization 2007).

What are the links between short intervals between pregnancies and infant mortality, preterm birth, small for gestational age or low birthweight?

International

A systematic review of 67 studies including over 11 million pregnancies (52 cohort or cross-sectional studies and 15 case-control studies) examined the links between the time that has elapsed between the woman’s last birth and the conception of the next pregnancy (interpregnancy intervals) and perinatal outcomes (Conde-Agudelo 2006). Studies were adjusted at least for maternal age and socioeconomic status.

In subsets of studies where data could be pooled, compared with interpregnancy intervals of 18 to 23 months, interpregnancy intervals shorter than six months were significantly associated with increased risks of:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm birth:</td>
<td>1.40 (1.25 to 1.58)</td>
</tr>
<tr>
<td>Low birthweight:</td>
<td>1.61 (1.39 to 1.86)</td>
</tr>
<tr>
<td>Small for gestational age:</td>
<td>1.26 (1.18 to 1.33)</td>
</tr>
</tbody>
</table>

Interpregnancy intervals of six to 17 months and longer than 59 months were also associated with a significantly greater risk for these three adverse perinatal outcomes. Although the majority of studies found associations, it is important to note that not all did.

The association with fetal and neonatal death is less clear, although results from meta-regression curves suggest that interpregnancy intervals shorter than six months and longer than 50 months are associated with increased risk (Conde-Agudelo 2006). A recent US study of 1,140 pregnant women showed that significantly more fetal deaths occurred in pregnancies with birth spacing less than two years (2.5%) compared with birth spacing of more than two years (1.1%); p<0.01 (Hatami 2008). The US Demographic and Health Surveys Program 2002 review of international studies reports that children born three to five years after a previous birth are about 1.5 times more likely to survive to age five than children born at two to three year intervals and about 2.5 times more likely to survive than children born at intervals shorter than two years (Setty-Venugopal 2002).
What links are there for short intervals between pregnancies and other outcomes of interest?

Aboriginal women
In a study of Aboriginal infants in the Kimberley region of WA, birth intervals of less than 24 months were associated with lower birthweights, with this difference being of borderline significance; p=0.04 (Rousham 2002).

International
Maternal outcomes
Another systematic review of observational studies by Conde-Agudelo et al, this time looking at the effects of birth spacing on maternal health (Conde-Agudelo 2007), found that short birth intervals were associated with increased risks of uterine rupture in women attempting a vaginal birth after previous caesarean birth and uteroplacental bleeding disorders (placental abruption and placenta praevia). The association between other adverse maternal outcomes such as death and anaemia is less clear.

Why might short intervals between pregnancies cause adverse birth outcomes?

Nutritional depletion hypothesis
Women with closely spaced births are thought to have insufficient time to replenish their nutritional reserves, with folate depletion, in particular, likely to increase the risk of fetal growth restriction (van Eijsden 2008).

Women with a previous perinatal death (a recognised risk factor for a subsequent perinatal death) are more likely to try to become pregnant again in a short time (Stephansson 2003).

Effects seen on perinatal outcomes could be secondary to subfertility (Scheepers 2006) or may be due to fewer women with closely spaced births not breastfeeding (Royce 2006).

What are the links between short intervals between pregnancies and other risk/protective factors?

Breastfeeding
Encouraging more exclusive breastfeeding for the first six months of an infant’s life will lengthen the birth interval, as well as improving outcomes for both infants (Royce 2006).

Poverty
In a US study, inequality of income was linked to less spacing between pregnancies for older mothers (26 or older) but not for younger mothers (Gold 2004).

Folate
Fetal growth restriction that is associated with short interpregnancy intervals may be connected with maternal folate depletion, indicating a possible role for postnatal (between pregnancy) folate supplementation (van Eijsden 2008).
What is the evidence for increasing intervals between pregnancies?

In a small pilot study, Dunlop 2008 assembled a cohort of 29 African-American women in the US who had previously given birth to a very low birthweight infant. They were provided with interpregnancy primary care and social support for 24 months and compared with data from a perinatal database for 58 similar women. Three women in the intervention group had one pregnancy, and two women had two pregnancies in 18 months (overall 17%); compared with 22 women having one pregnancy and seven women having two pregnancies within 18 months (overall 100%) (p = 0.02).

After participating in a US school-based support program for teen mothers that provided child care within the school, only 4 of the 65 women (6%) had subsequent childbirths within two years (Sadler 2007).

In another US RCT among African-American adolescent women, this time looking at home-based support, the intervention was effective in preventing second births within two years of an adolescent mother’s first birth (Black 2006).

What are the barriers to/facilitators for increasing intervals between pregnancies?

Facilitators
Providing extended health coverage and services to women who have experienced a poor pregnancy outcome would improve birth spacing and health status (Dunlop 2008).

Barriers
Women’s birth intervals are generally shorter than they would prefer, often because they do not have adequate access to continuity of care, family planning and a choice of methods (Setty-Venugopal 2002). However some adolescent women may have a different perspective, wishing to have their children in a shorter period (Black 2006).

The facilitators and barriers in relation to breastfeeding are outlined in the section on breastfeeding.
References


2.1.4 Breastfeeding

How many women breastfeed and for how long?

**South Australia, Aboriginal and Torres Strait Islander women (and other women)**
In a small survey, nearly 90% of rural SA women were breastfeeding at discharge from hospital – 35 women overall (88%) and 31 Aboriginal and Torres Strait Islander women (88% of all Aboriginal and Torres Strait Islander women). At the last postnatal visit, 53% of the Aboriginal women were still breastfeeding. However they were less likely to be breastfeeding at six to eight weeks compared with other rural women (Stamp 2006).

**Queensland, Aboriginal and Torres Strait Islander women**
In a Brisbane survey of 61 Aboriginal and Torres Strait Islander mothers, breastfeeding was initiated by 59% of women, with younger mothers more likely to do so. Only 12 of the infants (20%) were solely breastfeeding during the first four months (Hayman 2000).

**Victoria, Aboriginal and Torres Strait Islander women**
In a Melbourne survey of 116 Aboriginal and Torres Strait Islander mothers, 85% had planned to breastfeed and all but one of these women initiated breastfeeding. However, 9% of women stopped within the first week and 6% more stopped within the first four weeks. Only 50% of babies were still being breastfed at three months, dropping to 32% at six months. Younger women were less likely to choose to breastfeed than women over 20 years (73% versus 87%) and were also more likely to stop breastfeeding within three months. These figures are similar to the general Victorian population (Holmes 1997a).

**Western Australia, Aboriginal and Torres Strait Islander women**
A Perth survey of 425 Aboriginal and Torres Strait Islander mothers of newborn infants found that 89% of mothers were breastfeeding at hospital discharge (Binns 2004). In the Kimberley region of WA, breastfeeding rates were high, with more than 95% of infants breastfed for the first six months, and 85% at 12-18 months. The corresponding figures for preterm infants were 91% and 67% (Smith 2000).

**National Aboriginal and Torres Strait Islander figures**
In 2001, Aboriginal and Torres Strait Islander mothers aged 18-64 years were more likely than non-indigenous women to report ever having breastfed their children (85% and 75% respectively) (Trewin 2005). However figures from the most recent National Aboriginal and Torres Strait Islander Health Survey (2004-05) indicate that the higher breastfeeding rate among Aboriginal and Torres Strait Islander women may be declining, particularly in women from non-remote areas (79%) (AIHW 2008).

**South Australia, overall population**
The breastfeeding rate at one to four weeks postpartum among SA mothers is about 62%, dropping to 59% at three months (Zadoroznyj 2006b).

**Victoria, overall population**
In a survey of nearly 1000 primiparous women in Melbourne, only 26% planned to breastfeed for six months or more, with 3% of women achieving the WHO target of exclusive breastfeeding for six months. The main reason for ceasing was insufficient milk supply (Forster 2008).

**Australia, overall population**
Data from the ABS National Health Survey (2004-05) show that the average national breastfeeding initiation rate is 88% and the rate for breastfeeding at six months is 50% (Amir 2008).

**Targets and trends**
Current NHMRC recommendations are for sole breastfeeding until six months of age (NHMRC 2003).
In line with the NHMRC recommendations, the SA Breastfeeding Program Strategic and Action Plan 2007-2012 aims to increase the percentage of SA babies who are fully breastfed at every age from birth to six months and then to 12 months of age (with the addition of solids at approximately six months) (SABPSAP 2007).

The US Healthy People 2010 initiative aims for 75% of all US mothers to attempt breastfeeding, 50% to continue breastfeeding for six months after birth (25% exclusively), and 25% to continue breastfeeding for one year after birth (Healthy People 2010).

In the UK, while breastfeeding initiation has significantly increased over the past 10 years, early discontinuation rates remain unacceptably high (UNICEF 2008). Similarly, in the US, rates of initiation of exclusive breastfeeding have shown very little increase since the 1990s (Gartner 2005).

**Demographic profiles**

In a Victorian study, women at increased risk of not breastfeeding (after adjusting for breastfeeding intention and other factors) were those who were younger; did not plan to breastfeed for six months; did not attend childbirth education classes; had a higher maternal BMI; had self-reported anxiety or depression in the six months after birth; or whose baby had received artificial milk while in hospital (Forster 2006). Mothers who were unsuccessful with breastfeeding a previous child are more likely to bottlefeed a subsequent child (McIntyre 2001).

Older, married women with higher educational attainment and income are more likely to initiate and continue breastfeeding (Callen 2004). In general, women who are most disadvantaged are least likely to breastfeed and are also more likely to introduce solid foods earlier than recommended (National Institute for Health and Clinical Excellence 2008). In an Australian study, teenage women had low rates of breastfeeding (Quinlivan 2003).

In a US Pregnancy Risk Assessment Monitoring System survey of 9048 women, women with unintended pregnancies were less likely to breastfeed for eight or more weeks than women with intended pregnancies (Cheng 2009).

In a comparison of breastfeeding mothers in Perth 10 years apart, sociodemographic differences at hospital discharge were no longer apparent in the later sample in 2002-03, as breastfeeding initiation approached universality – 94% in this study (Scott 2006). The strongest predictor for leaving hospital breastfeeding, and breastfeeding exclusively, was when a woman perceived her partner to prefer breastfeeding (Scott 2006). This is consistent with a survey of 425 Aboriginal women in Perth, where breastfeeding at discharge was positively associated with perceived paternal support for breastfeeding and increased maternal age; and negatively associated with increasing parity and vaginal births. All analyses were adjusted for confounders (Binns 2004).

This is in contrast to the findings of the latest ABS National Health Survey where the gap in initiation and duration of breastfeeding has widened over time between the lowest and high sociodemographic categories. In 2004-05, the total initiation rate was 88% (81% for the lowest quintile and 91% for the highest quintile). The corresponding figures for breastfeeding at six months were 50% (37% and 66%) (Amir 2008).

The strongest predictor of breastfeeding initiation is women’s feeding intention for their infant (Donath 2003).

**Choice between bottlefeeding and breastfeeding**

In a telephone survey of 373 mothers, fathers and grandmothers in a low income area of Adelaide, the reason for preferring breastfeeding was that it was best for baby. Reasons for preferring bottlefeeding varied between groups – mothers said convenience, fathers said it was easier to leave the baby with others and grandmothers because the previous grandchild had been bottlefed (McIntyre 2001).
What are the links between breastfeeding and infant mortality?

**International**
Beginning breastfeeding within the first day after birth lowers neonatal mortality. Conversely, neonatal mortality is increased if infants were not exclusively breastfed in the neonatal period (Edmond 2006). In a US study, children who were ever breastfed had a 21% reduction in the odds of dying in the postneonatal period (OR 0.78 95% CI 0.67 to 0.93) compared with infants who were never breastfed. In the breastfed infants, longer breastfeeding was associated with lower risk of death (Chen 2004).

**SIDS**
Almost all studies, particularly the larger ones and ones that adjust for socioeconomic status, show a reduced risk of SIDS with breastfeeding (Mitchell 2007; Vennemann 2009). In a meta-analysis of seven case-control studies of high quality, any breastfeeding was associated with a reduced risk of SIDS compared with exclusive formula feeding (OR 0.64 95% CI 0.51 to 0.81) (Ip 2007). Improving breastfeeding rates will have less impact on SIDS mortality in countries where rates of breastfeeding are already high, such as New Zealand (Mitchell 1997).

What links are there for breastfeeding and other outcomes of interest?

**Outcomes in preterm and/or low birthweight infants**
The evidence that feeding mother’s own milk to preterm infants of any gestation is associated with a lower incidence of infections and necrotising enterocolitis, and improved neurodevelopmental outcomes compared with formula feeding, is strong and consistent (Edmond 2006).

Preterm infants are significantly more likely to be artificially fed than term infants. In 2003-04 data from the Longitudinal Study of Australian Children, infants born at 35-36 weeks had an adjusted odds of 0.51 (95% CI 0.34 to 0.76) and 37-39 week infants an adjusted odds of 0.80 (95% CI 0.69 to 0.93) of breastfeeding at six months, compared with infants born ≥ 40 weeks (Donath 2008a).

Why might lack of breastfeeding cause adverse birth outcomes?
The protective effect of breastfeeding on SIDS may operate through more arousals in breastfed infants than in bottlefed infants and reduced risk of infection (Mitchell 2007).

Maternal alcohol consumption may disrupt breastfeeding by inhibiting oxytocins and therefore lactation, by disrupting infant sleeping and perhaps by women who are concerned about their alcohol consumption discontinuing their breastfeeding (Giglia 2008a).

What links are there with breastfeeding and other risk factors?

**Alcohol**
In a WA longitudinal study of 551 women, assessed at six months after giving birth, those who consumed alcohol at levels of more than two standard drinks a day were almost twice as likely to stop breastfeeding as women drinking below these levels (Giglia 2008a). In Australia, there has been a slight but significant increase in the proportion of lactating women consuming alcohol (Giglia 2008b).

**Immune system**
Breastfeeding may help to strengthen the baby’s immune system, leading to protection against infections (Calder 2006).

**Maternal mental health**
It has been proposed that breastfeeding modulates inflammatory responses in mothers thus having a protective effect on maternal mental health (Kendall-Tackett 2007b).
Models of care
In a Cochrane review of midwife-led versus other models of care during the antenatal and intrapartum period, women receiving midwife-led care were significantly more likely to initiate breastfeeding (Hatem 2008).

Obesity
A systematic review shows links between breastfeeding patterns and maternal obesity (Amir 2007). Three out of four studies examining onset of lactation found a significant relationship between obesity and delayed lactogenesis. Nine of the 10 studies of breastfeeding initiation found that overweight and obese women were less likely to commence breastfeeding (but this was not a statistically significant difference in the two studies from WA).

Most of the large studies looking at duration of breastfeeding found that obese women fed for a shorter time than normal weight women, even after adjusting for possible confounding factors (Amir 2007). In addition, obese and overweight mothers stop breastfeeding earlier than normal weight mothers (Jevitt 2007).

Analysis of 2004 data for 3075 children from the Longitudinal Study of Australian Children shows that breastfeeding initiation was 95% for normal weight women, 93% for overweight women and 87% of obese women. At six months 64% of normal weight women were breastfeeding, compared with 54% of overweight, and 44% of obese women. On multivariate analysis, for women who initiated breastfeeding, the odds of overweight and obese women stopping breastfeeding within a week were 1.52 (95% CI 1.02 to 2.28) and 2.54 (95% CI 1.70 to 3.79) respectively, compared with normal weight women. For women who breastfed for at least a week, overweight women had an adjusted OR of 1.26 95% CI 1.04 to 1.53 of ceasing breastfed before six months; and for obese women the OR was 1.38 95% CI 1.10 to 1.73 compared with normal weight women (Donath 2008b).

In a study of nearly 40,000 women from the Danish National Birth Cohort early termination of any, or full, breastfeeding was associated with increased prepregnant BMI values, but gestational weight gain did not add to or modify the association. The observation that these Danish women nevertheless fed longer than American women with similar BMIs was attributed to social support such as 24 week maternity leave and universal breastfeeding support available in Denmark (Baker 2007).

There is some suggestion that maternal obesity affects the development of the mammary glands before and during pregnancy as well as early in the postpartum period (Rasmussen 2007).

Furthermore, caesarean section is more common in obese women, and caesarean section itself is associated with no breastfeeding or breastfeeding for a shorter duration (Rasmussen 2007).

Smoking
The observation that women who smoke are less likely to breastfeed is largely due to a lower motivation to breastfeed rather than a physiological effect of smoking on the woman’s milk supply (Donath 2004).

Evidence of effects of breastfeeding and of methods of breastfeeding
In a Cochrane review of observational studies, babies who were exclusively breastfed for six months experienced less infectious morbidity compared with three to four months of mixed breastfeeding (Kramer 2002). Exclusive breastfeeding for six months is also recommended for term low birthweight infants, as long as they are given iron supplementation (Edmond 2006).
Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

Maternal weight loss after birth
A Cochrane review shows that dieting and exercise together, and diet alone, are more effective than usual care at helping breastfeeding (and other) women to lose weight after childbirth, with no likely adverse impact on infant growth (Amorim 2007).

Value for money
Even when health benefits of peer and professional breastfeeding education programs are conservatively estimated, these interventions are likely to be cost effective – and extremely so if benefits later in life are included (National Institute for Health and Clinical Excellence 2008).

Mastitis
Mastitis or inflammation of the breast can be infective or noninfective, and this relatively common condition can interfere with milk supply and difficulties in caring for the baby. A Cochrane review has found that there is not enough evidence that antibiotics are effective in treating mastitis (Jahanfar 2009).

Strategies and programs to encourage new mothers to breastfeed

Education
A systematic review has shown that for every three to five women attending an antenatal breastfeeding education program, one additional woman will initiate and continue breastfeeding for up to three months who otherwise would not have breastfed (Guise 2003). Education programs need to involve personal contact, as written materials on their own are not effective (Guise 2003).

A Cochrane review of 11 RCTs found that breastfeeding education (either antenatal or postnatal or both) significantly improved initiation rates compared with routine care in low income women in the US (Dyson 2005). Midwives and other health workers need to ensure that a mother can demonstrate how to position and attach the baby to the breast and know how to tell that the baby is feeding well, before leaving hospital (National Institute for Health and Clinical Excellence 2008).

Support
A Cochrane review of 34 RCTs showed that all forms of extra support for mothers (for example WHO/UNICEF programs – see below) increased the duration of exclusive breastfeeding; and that lay and professional support together significantly extended the duration of any breastfeeding (Britton 2007). Another Cochrane review has shown lay health worker programs to be promising in promoting breastfeeding (Lewin 2005).

In a small study of the SA Mothercarer program run from the Lyell McEwin Health Service, 50% of the women receiving practical home support through the program were breastfeeding at three months, compared with 39% of women who were not in the program (Zadoroznyj 2006b).

Partner support has been shown in RCTs to increase breastfeeding initiation (Wolfberg 2004) and increase the prevalence of exclusive breastfeeding (Pisacane 2005).

The UK National Institute of Health and Clinical Evidence (NICE) recommends that local, easily accessible breastfeeding peer support be provided to pregnant women and new mothers, particularly those who are least likely to start and continue to breastfeed. Peer supporters should be part of a multidisciplinary team, they should undergo accredited training, and contact with new mothers should be made within 48 hours of transfer home from hospital (National Institute for Health and Clinical Excellence 2008).

In a French RCT, an early routine postnatal visit to a primary care doctor (paediatrician or GP) resulted in significantly more women breastfeeding exclusively at four weeks (84% v 72%); with these women significantly less likely to report breastfeeding difficulties compared with women receiving standard care (Labarere 2005).
Another recent RCT from Denmark has shown that support (in the form of home visits by trained health workers in the first five weeks following birth and which focus on both psychosocial and practical aspects of breastfeeding) may prolong the duration of exclusive breastfeeding (Kronborg 2007).

**Education and support**
In a concurrent nonrandomised comparison of two groups of low income women in the US, a combination of antenatal education and home based postpartum support doubled the odds of the women starting breastfeeding; and also of continuing to breastfeed for six months, compared with the control group (Gill 2007).

**SA Breastfeeding Program; Strategic and Action Plan (SABPSAP 2007)**
The performance measures of this plan are to increase the hospital discharge rate of fully breastfed babies from the current (2007) rate of 83\% to greater than 90\% by 2012; and to increase the number of babies being fully breastfed at six months by 10 percentage points from 18\% to 28\% by 2012.

**Baby Friendly Hospital, and Health, Initiatives (BFHI)**
In a before and after study of over 4000 women in Taiwan, the WHO ‘Ten Steps to Successful Breastfeeding’ have been shown to increase overall and exclusive breastfeeding (Gau 2004), although additional support is likely to be needed after discharge from hospital (Vic. DEECD 2007). Eleven SA hospitals have BFHI accreditation and throughout Australia, 59 hospitals are accredited out of approximately 500 (www.bfhi.org.au [accessed 24 October 2008] and Best Start 2007).

In a Swiss comparison of over 3000 births, babies born in UNICEF Baby Friendly Hospital Initiative hospitals had higher rates of exclusive breastfeeding and longer breastfeeding duration than did babies born elsewhere; particularly in hospitals with a high compliance with the guidelines (Merten 2005). In this study, Merten and colleagues found that full rooming in, first suckling within one hour, breastfeeding on demand and pacifier use were associated with positive effects on breastfeeding duration (Merten 2005).

**Maternal coping strategies**
Two Australian qualitative studies of breastfeeding indicate that the following coping strategies may help new mothers increase their breastfeeding duration: increasing breastfeeding, trying to stay relaxed, using positive self-talk, challenging unhelpful beliefs, problem solving, goal setting and the practice of mindfulness (O’Brien 2009).

**Maternal involvement**
When mothers participate in the care and feeding of their low birthweight infant, breastfeeding rates improve and earlier discharge from hospital is more common (Edmond 2006).

**Skin-to-skin contact**
A Cochrane review has found that skin-to-skin contact for mothers and their healthy newborn infants immediately after birth is associated with more mothers breastfeeding, and breastfeeding for longer (Moore 2007). In another Cochrane review, kangaroo mother care (skin-to-skin contact between a mother and her newborn, frequent and exclusive or nearly exclusive breastfeeding and early discharge from hospital) increased exclusive breastfeeding rates at discharge for low birthweight babies (Conde-Agudelo 2003). A later report of a preterm sample from one of the trials included in the kangaroo mother care Cochrane review indicates more exclusive breastfeeding and increased breastfeeding (up to six months) compared with controls (Hake-Brooks 2008).

**Environment**
In a Cochrane review, home-like settings were associated with increased breastfeeding duration and initiation compared with conventional institutional settings (Hodnett 2005).
Expressed milk
All breastfeeding mothers should be shown how to hand-express breast milk and should be advised on how best to store expressed milk (National Institute for Health and Clinical Excellence 2008).

Weight loss for obese and overweight women
Preventing excess weight gain during pregnancy needs to start from the first antenatal visit, with obese women counselled to have a diet of nutritious foods with sufficient protein and iron and to avoid ‘empty’ foods such as soft drink and confectionery (Jevitt 2007).

Other strategies for obese and overweight women
Physiologic birth support, avoiding surgical birth where possible, and limiting separation of mothers and babies are likely to contribute to greater breastfeeding success in obese women; and massage or pumping may soften and extend the obese nipple in order to help the baby latch on (Jevitt 2007).

What are the barriers to/facilitators for improving breastfeeding?

In Aboriginal mothers
In focus groups of Aboriginal mothers in Melbourne, some women felt embarrassment about breastfeeding. These women’s mothers may have lacked breastfeeding experience as artificial feeding was promoted in the period when they were new mothers, particularly on missions. This means that the present generation of mothers were used to being given milk powder when they were babies. On the other hand, the cost of formula is an incentive to breastfeed (Holmes 1997b).

Passing on knowledge of healthy infant feeding practices has been disrupted in many Aboriginal communities due to factors such as forcible removal of Aboriginal children from their families (Holmes 1997b).

Lack of support for breastfeeding
In a telephone survey of 373 mothers, fathers and grandmothers in a low income area of Adelaide, there was little support for breastfeeding compared with bottlefeeding. Some important barriers were maternal discomfort with breastfeeding, support required for breastfeeding, father’s involvement with feeding, the convenience of bottlefeeding, a mother’s previous experience of breastfeeding and breastfeeding in public (McIntyre 2001).

Beliefs of the infant’s grandmother(s) can also influence breastfeeding practices, sometimes in ways that do not protect breastfeeding (Grassley 2008).

Many women who stop breastfeeding (e.g. the 90% of UK women who stopped in the first two weeks) would have liked to continue longer, suggesting that more support could have been provided (National Institute for Health and Clinical Excellence 2008).

Feeding in public
In a survey of nearly 1000 primiparous women in Melbourne, women’s views were mostly negative, ranging from feeling shy about it, to being a traumatic experience. The lack of role modelling (growing up without seeing women breastfeeding in public) is likely to be a factor in women choosing not to do so (Forster 2008). McIntyre 2001 observed that as the level of privacy decreases, so too does the level of comfort.

Working conditions and workplaces
Analysis of 3697 infants from the Longitudinal Study of Australian Children shows that significantly fewer women in full or part-time employment were breastfeeding beyond six months (Cooklin 2008). Aboriginal organisations are likely to expect mothers to bring their babies to work for the first six months, but this probably would not be the case in other workplaces (Holmes 1997b). Paid maternity leave would assist women to continue breastfeeding (Amir 2008), especially among low-income women with returning to work early being the norm in some cases (Renfrew 2007).
Partner attitudes
In focus groups (including one of male partners alone), comments from both men and women suggested some men’s ambivalence about breastfeeding (Holmes 1997b). In WA, paternal support was also identified as a facilitator for breastfeeding among Aboriginal families, with women more likely to initiate breastfeeding when they had partner support to do (Binns 2004; Scott 2006).

Information and education
Hospital antenatal classes may not be a comfortable experience for Aboriginal women and they also prefer direct advice from health workers rather than written information (Holmes 1997b).

Information provided by health professionals, literature, media and product labelling is not always consistent or evidence-based (National Institute for Health and Clinical Excellence 2008).

Sore nipples
This is one of the most common reasons for ceasing breastfeeding (reported in up to 50% of women in some studies) (Kendall-Tackett 2007b). This is often due to poor positioning, which can be rectified by appropriate support and education (Holmes 1997b).

Obesity
The reasons for obese women being less likely to breastfeed may be biological but may be more closely connected with psychological, behavioural and/or cultural issues (Amir 2007). There is evidence that clinicians do not manage obese women differently to normal weight women in relation to breastfeeding, despite lower rates and durations of breastfeeding in obese women (Rasmussen 2006) and despite greater breastfeeding difficulties, obese mothers were less likely to seek support for breastfeeding in the first three months postpartum (Mok 2008). Breastfeeding women need to be advised that losing weight by eating healthily and exercising regularly will not affect the quantity or quality of their milk (National Institute for Health and Clinical Excellence 2008).

Biomedical factors
In a Perth study, women who had undergone a caesarean or whose infant had been admitted to the special care nursery were significantly less likely to be exclusively breastfeeding at hospital discharge (Scott 2006).

Commercial promotion of infant formula
NICE advises maternity care workers to avoid promoting infant formula by using product samples or advertising (National Institute for Health and Clinical Excellence 2008).

Kangaroo care (skin-to-skin contact between a mother and her newborn, frequent and exclusive or nearly exclusive breastfeeding and early discharge from hospital)
Barriers to implementation of kangaroo care programs include infant safety concerns, lack of time, insufficient guidance and lack of knowledge about benefits of kangaroo care. Kangaroo mother care (or continuous kangaroo care) is rare in developed countries because incubator space and formula are readily available. Other obstacles, particularly for preterms, include coexisting maternal illness, distance from the postpartum ward to the NICU, difficulty in accessing milk expression equipment, and an infant who is too weak to feed from the breast (Hake-Brooks 2008).

Ongoing projects/programs
South Australia
The goal of the SA Breastfeeding Strategic and Action Plan (SABSAP) 2007-2012 is to increase the percentage of South Australian babies who are fully breastfed at every age from birth to six months and then to 12 months (with the addition of appropriate solids at approximately six months). Aboriginal and Torres Strait Islander women living in urban areas have been identified as a priority group for breastfeeding interventions.
The SABSAP details a series of strategies around health promotion action areas that support breastfeeding, based on the key action areas of the Ottawa Charter for Health Promotion. These include:

- Increasing Baby Friendly Hospital accreditation in SA birthing hospitals and community services by utilising a capacity building model that provides incentives, networking opportunities, and useful written resources to support organisational change and partnerships;
- Promoting and providing access by hospitals, health services, health professionals and educational institutions to the Baby Friendly e-learning breastfeeding education programs;
- Commissioning a literature review that informs the development of postnatal strategies to support the continuation of breastfeeding;
- Advocating for health and community services, including CYWHS’s Child and Family Health Division (CFH) and the Australian Breastfeeding Association (ABA), to increase access to culturally appropriate postnatal breastfeeding support from women from culturally and linguistically diverse backgrounds, specifically Aboriginal and Torres Strait Islander women and women from low socioeconomic groups;
- In partnership with relevant groups, develop an indicator of access to postnatal breastfeeding support which will measure and report change;
- Implementing a social marketing campaign to encourage women to breastfeed for longer and to increase the acceptance of breastfeeding among the general community;
- Undertaking research and consultation to develop appropriate social marketing strategies with women on low incomes, Aboriginal and Torres Strait Islander women in urban areas and younger women;
- Recruiting suitable ambassadors to promote breastfeeding as the cultural norm;
- Working in partnership with a range of education providers to link appropriate breastfeeding information with existing curricula;
- Investigating access issues to breastfeeding services for low income urbanised Aboriginal and Torres Strait Islander women and younger women;
- Working with the Australian Breastfeeding Association (ABA) to increase the number of workplace organisations with ABA Breastfeeding Friendly Workplace Policies and Breastfeeding Welcome Here;
- Building the capacity of the regional Australian Better Health Initiative (ABHI) Healthy Weight Coordinators to support the implementation of the SABPSAP across health regions through workforce development measures.

In NSW, the effect of trained nurse support on rates of exclusive breastfeeding and ongoing breastfeeding is being evaluated in an RCT (ANZCTR12608000361303, www.anzctr.org.au/trial_view.aspx?ID=82905).

Australia

The Federal Government is providing $2.5 million to expand the Australian Breastfeeding Association’s helpline to a national toll-free 24 hour service, which is expected to operating nationally by December 2008 (Roxon 2008).

The Australian Parliamentary Best Start report (Best Start 2007) recommendations include:

- Funding research into the long-term health benefits of breastfeeding for the mother and infant; and evaluation of strategies to increase the rates of exclusive breastfeeding to six months;
- Funding research into best practice in programs that encourage breastfeeding;
- Funding a national education campaign;
- Commissioning a study into the economic benefits of breastfeeding;
- Expanding the Breastfeeding-Friendly Workplace Accreditation Program;
- Funding the Australian College of Midwives to run the Baby Friendly Hospital Initiative in Australia;
- Department of Health and Ageing to provide leadership in monitoring, surveillance and evaluation of breastfeeding rates and practices in Aboriginal and Torres Strait Islander populations in both remote and other areas;
- Promoting breastfeeding within Aboriginal and Torres Strait Islander communities as a major preventative health measure.
Victoria
The Breastfeeding Education and Support Service (BESS) at the Royal Women’s Hospital in Melbourne helps mothers and infants with breastfeeding problems, such as attachment difficulties, nipple damage, low milk supply and painful feeding (Chin 2008).

New South Wales
In 1983, the Thallikool project had the original aim of training Aboriginal and Torres Strait Islander women to become breastfeeding specialists and to help prepare them for employment. Later stages of the project involved producing videos and other resources. The resource kit developed for Aboriginal health workers was widely distributed and regarded as effective and culturally appropriate (Victorian Department of Human Services 2004).

United Kingdom
Part of the UK Healthy Start program encourages health professionals to support parents in initiating and maintaining breastfeeding (National Institute for Health and Clinical Excellence 2008).

From March 2009, assessments for Baby Friendly accreditation will use the recently revised and evidence-based UNICEF UK Seven Point Plan for Sustaining Breastfeeding in the Community (UNICEF 2008):
1. Have a written breastfeeding policy that is routinely communicated to all health-care staff
2. Train all staff in the skills necessary to implement the breastfeeding policy
3. Inform all pregnant women about the benefits and management of breastfeeding
4. Support mothers to initiate and maintain breastfeeding
5. Encourage exclusive and continued breastfeeding, and appropriately timed introduction of complementary foods
6. Provide a welcoming atmosphere for breastfeeding families
7. Promote cooperation between health-care staff, breastfeeding support groups and local community.

Protocols for Cochrane reviews in preparation include:
- Antenatal breastfeeding education for increasing breastfeeding duration (Lumbiganon 2007)
- Separate care for new mother and infant versus rooming-in for increasing the duration of breastfeeding (Sharifah 2007)
- Interventions for preventing mastitis after childbirth (Crepinsek 2008)
- Early additional food and fluids for healthy breastfed fullterm infants (Remmington 2007)
- Pacifier use versus no pacifier use in breastfeeding term infants for increasing duration of breastfeeding (Sharifah 2008).

Interpretation/comments
In a survey of primiparous women in Melbourne, many women expressed both positive and negative attitudes towards breastfeeding, indicating the complexity of issues that need to be considered in programs designed to encourage and support women to breastfeed (Forster 2008).

Further research/action required
Research is needed on how best to encourage and support women to breastfeed exclusively during the first six months and on how to ensure women breastfeed for a longer time (National Institute for Health and Clinical Excellence 2008).

Urban Aboriginal and Torres Strait Islander women, in particular, require more intensive breastfeeding support and services, such as those provided by lactation consultants.
We urgently need qualitative studies to help understand the infant feeding decisions and behaviour of obese women (Amir 2007).

Increasing the rate of breastfeeding in Australia requires a combination of full implementation of the WHO BFHI strategies, health professional training, personal education of mothers by health professionals and broad based community support (Vic. DEECD 2007).

Interventions aimed at helping overweight and obese women to breastfeed successfully need to be evaluated in RCTs (Amir 2007).

As maternal intention to breastfeed is strongly linked to breastfeeding initiation, interventions are needed to see if maternal intentions can be altered (Donath 2003).

Renfrew 2007 outlines the following topics as priorities for breastfeeding research in the UK:
- impacts of health and welfare policies;
- mass media promotion and social marketing;
- interventions targeting subgroups of disadvantaged women;
- ‘insufficient milk’ syndrome;
- painful feeding;
- specific baby and maternal problems;
- education and training of health professionals;
- ways of changing practice, including psychological models investigating why staff do not follow best practice;
- the impact that large scale changes in delivery of health care and changes in policy may have on breastfeeding.
References


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UNICEF. (Revised September 2008) The Seven Point Plan for Sustaining Breastfeeding in the Community. WHO and UNICEF.


2.1.5 Diabetes

Definitions (from Templeton 2008):

- **Gestational diabetes mellitus (GDM):** Glucose intolerance that has its onset or is first diagnosed during pregnancy.
- **Type 1 diabetes mellitus:** A form of diabetes marked by a complete lack of insulin production and needing insulin replacement for survival. This form of diabetes mostly arises in childhood or in young adults, though it can occur at any age.
- **Type 2 diabetes mellitus:** The most common form of diabetes, which is marked by reduced or less effective insulin. Management may be by diet, exercise and weight loss; sometimes with the addition of oral glucose lowering drugs or insulin.
- **Glucose intolerance:** Slower metabolism of glucose due to insulin deficiency or insulin resistance.
- **Insulin:** A hormone produced in the pancreas that helps glucose to enter body cells for energy metabolism.
- **Insulin resistance:** The inability of cells to respond to insulin, resulting in higher levels of glucose in the blood.

How many pregnant women or women of reproductive age are affected by diabetes?

**Aboriginal and Torres Strait Islander women (or populations), Northern Territory**

In the NT in 1995, 1.0% of Aboriginal women had diabetes prior to pregnancy and another 5.6% developed gestational diabetes. These findings are fairly similar to the Strong Women Strong Babies Strong Culture Program, where 2.0% of the mothers had pre-existing diabetes and 7.7% had gestational diabetes in 1994/96 (Mackerras 1998; Mackerras 2001). Corresponding figures for non-Indigenous women in the NT were 0.3% and 3.6% respectively (Mackerras 1998).

A 1993-95 survey of Torres Strait Islander women, and Aboriginal women from central Australia, showed the following frequencies for metabolic syndrome features (Schutte 2005):

<table>
<thead>
<tr>
<th>Metabolic Syndrome</th>
<th>Torres Strait Islander women n=183</th>
<th>Aboriginal women from central Australia n=379</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin resistance and/or hyperglycaemia plus two other factors such high BMI</td>
<td>34.4%</td>
<td>27.7%</td>
</tr>
<tr>
<td>Age &lt; 30</td>
<td>12.5%</td>
<td>17.3%</td>
</tr>
</tbody>
</table>

**Queensland/Northern Territory**

In an audit of 1367 Aboriginal and Torres Strait Islander adults from Far North Queensland and NT, glycaemic control was poor overall (mean HbA1c level 8.9%). Despite higher levels than for non-Indigenous people with diabetes (reported from Australian diabetes centres), these individuals were much less likely to have been prescribed insulin (alone or combined with oral treatment) even though they had much higher HbA1c levels. They were also much less likely to self-monitor their glucose levels than non-Indigenous diabetics (McDermott 2004).
Queensland
In the Well Persons’ Health Check survey of remote Indigenous communities in northern Queensland, 10.3% of Aboriginal and Torres Strait Islander women of reproductive age self-reported diabetes compared with general population figure of 2.4% from the 2000 AusDiab survey (McCulloch 2003). Further detail is shown in the table below:

<table>
<thead>
<tr>
<th>Age</th>
<th>Aboriginal women</th>
<th>Aboriginal and Islander women</th>
<th>Islander women</th>
<th>AusDiab women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>%</td>
<td>n/N</td>
<td>%</td>
</tr>
<tr>
<td>15-24</td>
<td>2/206</td>
<td>0.9</td>
<td>0/33</td>
<td>0</td>
</tr>
<tr>
<td>25-34</td>
<td>11/214</td>
<td>5.1</td>
<td>1/25</td>
<td>4</td>
</tr>
<tr>
<td>35-44</td>
<td>37/184</td>
<td>20.1</td>
<td>2/21</td>
<td>9.5</td>
</tr>
<tr>
<td>45-54</td>
<td>24/118</td>
<td>20.3</td>
<td>4/8</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>74/722</td>
<td>10.3%</td>
<td>7/87</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

Western Australia
In a desert population in the Kimberley region, 49% of the adult Aboriginal population was diabetic (Gracey 2006).

Australia
In 2005-06, the age-adjusted incidence rate of GDM among Aboriginal and Torres Strait Islander women was 1.5 times that of other Australian women (4.8% and 4.6% respectively as unadjusted percentages). The risk was higher for ATSI women across all age groups, but particularly so for those aged 30-44 years. However Aboriginal and Torres Strait Islander women aged 15-29 years accounted for 51% of GDM cases in 2005-06, compared with 30% among other Australian women in this age group, indicating a need to target younger Aboriginal and Torres Strait Islander women for GDM screening and lifestyle modification programs (Templeton 2008). This differential was also reflected in a nearly fourfold higher national GP encounter rate for gestational diabetes by Aboriginal and Torres Strait Islander women compared with other women (Australian Health Ministers’ Advisory Council 2008).

In 2005-06 in Australia, more than 12,700 babies were born to mothers with GDM (4.6% of hospital confinements), an increase of 22% over six years. It was not clear if this increase was also happening among Aboriginal and Torres Strait Islander women (Templeton 2008).

South Australia, all women
In SA the 2006 overall rate of gestational diabetes was 4.5%; and 0.59% of SA women giving birth had pre-existing diabetes mellitus (Laws 2008). In 2007, the corresponding figures were similar – 4.9% and 0.6% respectively (Chan 2008).

New Zealand
Over a 12 year period in Auckland, 82,025 infants were born to Maori and non-Maori women without established diabetes or gestational diabetes (GDM). Of the women with diabetes:

- 160 infants (2%) were born to women with type 1 diabetes;
- 434 (5%) infants were born to women with type 2 diabetes (256 pre-existing (3%) and 178 (2%) newly diagnosed during pregnancy);
- 932 (11%) infants were born to women with GDM (Cundy 2000).

First Nations, Canada
In a population of pregnant Cree women in Canada, about 15% were classed as having gestational diabetes mellitus (Gray-Donald 2000).
South Australia, overall
In 2007, 0.6% of women overall who gave birth had pre-existing diabetes (Chan 2008).

Trends
In line with increasing obesity and an increase in maternal age, the incidence of GDM is also increasing (Ferrara 2007). Diabetes and risk factors for future diabetes were common in a survey of urban Aboriginal and Torres Strait Islander people from Darwin, indicating a high and increasing disease burden (O’Dea 2008).

Around 17% of Australian women with GDM develop type 2 diabetes within 10 years, and up to 50% within 30 years (Lee 2007). The Diabetes Prevention Program showed that women with a history of GDM had a 71% higher rate of diabetes than women without a history of GDM (Ratner 2008).

What are the links between diabetes and infant mortality, preterm birth, small for gestational age or low birthweight?

New Zealand
In a large New Zealand study of Maori and non-Maori women, the perinatal mortality for women with pre-existing and newly presenting type 2 diabetes was 46.1 per 1000 (being particularly high for newly presenting women at 56.1 per 1000). These rates were significantly higher than for:

- women with GDM, excluding newly presenting type 2, (8.5 per 1000)
- women with type 1 diabetes and non-diabetic women (both 12.5 per 1000).

The excess perinatal mortality in type 2 diabetes compared with the other groups was mostly from late fetal death (seven-fold increase) followed by intermediate fetal death and early neonatal death (each a 2.5 fold increase) (Cundy 2000).

In a 20 year extension of this cohort (1986-2005) of New Zealand women with type 1 or type 2 diabetes, there were 42 perinatal deaths out of a total of 1216 fetuses, which is a perinatal mortality rate of 34 per 1000. These 42 deaths comprised 8 elective terminations, 12 intermediate fetal deaths, 11 late fetal deaths (18 stillbirths overall) and 11 early neonatal deaths. Just over half of the 1200 women were of Maori descent. The perinatal mortality rate for each group was:

<table>
<thead>
<tr>
<th>Diabetes Type</th>
<th>Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 diabetes (known)</td>
<td>9 (27 per 1000)</td>
</tr>
<tr>
<td>Type 2 diabetes (known)</td>
<td>19 (34 per 1000)</td>
</tr>
<tr>
<td>Type 2 diabetes (newly recognised)</td>
<td>13 (41 per 1000)</td>
</tr>
<tr>
<td>Other diabetes;</td>
<td>1 (200 per 1000)</td>
</tr>
<tr>
<td>Overall:</td>
<td>42 (34 per 1000)</td>
</tr>
</tbody>
</table>

In this study, more than 75% of pregnancy losses in type 1 diabetes were due to congenital anomalies or prematurity, whereas in type 2 diabetes, more than 75% of losses were due to stillbirth, chorioamnionitis or birth asphyxia. In the later decade, the pregnancy loss for women with type 2 diabetes fell from 49 per 1000 to 28 per 1000. This fall may have been due to better recognition of type 2 diabetes before pregnancy and a drop in the rate of women smoking during pregnancy (Cundy 2007).

Diabetes during pregnancy has shown an increased rate of preterm birth – threefold in a group of Canadian women (Kramer 1992) and fourfold in Australian Aboriginal women (Sayers 1997).

A systematic review of observational studies showed that in pregnant women with type 1 or type 2 diabetes, poor glycaemic control was associated with increased perinatal mortality; OR 3.03 95% CI 1.87 to 4.92 (Inkster 2006).
In a Canadian cohort study of over 150,000 women published after the cutoff date for the Inkster review (Yang 2006), the 516 infants born to mothers with diabetes had significantly higher odds of:

- being stillborn (OR 2.45 95% CI 1.02 to 5.89); 9.75% v 4.0%
- perinatal mortality (OR 3.01 95% CI 1.55 to 5.84); 17.4% v 5.9% (but no longer significant when adjusted for major congenital abnormality, preterm birth and pre-existing hypertension)
- infant mortality (OR 8.89 95% CI 5.15 to 15.32); 15.5% v 2.8%.

Fretts 2005 estimated that in women being treated for their diabetes by diet or by insulin, the stillbirth rate is 6-35/1000 (about double the rate for nondiabetic pregnant women).

**What links are there for diabetes and other outcomes of interest?**

Women with GDM are at higher risk of high blood pressure and pre-eclampsia, preterm labour and caesarean birth (Templeton 2008).

Overweight or obese women are more likely to develop GDM (Templeton 2008) with a systematic review of international studies indicating a fourfold increase in gestational diabetes with maternal BMI of 30 or more (Smith 2008).

In a US study of 3,000 women with GDM, Gonzalez-Quintero 2007 found that women with uncontrolled blood glucose had a significantly higher rate of a composite of adverse birth and neonatal outcomes (33% v 24%). The elements of the composite were one or more of the following: macrosomia, large-for-gestational-age, hypoglycaemia, jaundice or stillbirth.

There is a positive correlation between hyperglycaemia during embryogenesis and risk for congenital malformations among infants of diabetic mothers. Diabetic women with good glycaemic control, however, have a similar rate of birth defects to the general population. In a case control study from the US, cardiac and noncardiac defects were associated with women with pre-existing diabetes; women with GDM generally only showed an association with birth defects if they had a prepregnancy BMI > 25 (Correa 2008).

In the Inkster 2006 systematic review of observational studies in pregnant women type 1 or type 2 diabetes, poor glycaemic control was associated with an increased risk of miscarriage; and also for congenital malformations, where a ‘dose-response’ relationship was seen with HbA1c levels.

**What are the links between diabetes and other risk/protective factors?**

The Well Persons’ Health Check survey of remote Indigenous communities in northern Queensland examined lifestyle behaviours of people with and without diabetes. After adjustment, no significant differences were seen between people self-reporting as having diabetes or not having diabetes (men and women aged 15 to 75+) in regard to consuming adequate amounts of fruit, undertaking adequate exercise and consuming alcohol at hazardous or harmful levels. However people self-reported to have diabetes were less likely to drink any alcohol than those who reported that they did not have diabetes (McCulloch 2003).

Around eight in 10 (83%) of Aboriginal adults with diabetes/high glucose levels were overweight or obese in 2004-05 (ABS 2008).

**What is the evidence for preventing or treating diabetes in pregnant women and new mothers?**

**Preventing diabetes; Aiming for glycaemic control pre-conception**

Compared with an earlier cohort, 35 pregnant women with pre-existing type 1 diabetes in NSW had significantly higher rates of planned pregnancies (defined as attending a clinic prepregnancy with the
specific aim of optimising glycaemic control before conception). This change over time was not seen for women with pre-existing type 2 diabetes. Planning was associated with lower glucose levels, greater gestational age at birth and lower caesarean rates (Gunton 2002). In an earlier systematic review of observational studies in women with mostly type 1 diabetes, the rate of major congenital anomalies was lower among women receiving preconception care (emphasising good glycaemic control) compared with those who did not; 2.1% v 6.5%; RR 0.36 95% CI 0.22 to 0.59 (Ray 2001).

**Women with impaired glucose tolerance**
In a subgroup analysis of the Diabetes Prevention Program, both intensive lifestyle interventions and metformin were effective in delaying or preventing diabetes in women with impaired glucose tolerance and a history of GDM (Ratner 2008).

**Treating diabetes in pregnancy**
A Cochrane review has concluded that there is insufficient evidence to recommend, or advise against, diabetic pregnant women enrolling in exercise programs (Ceyssens 2006).

A Cochrane review of continuous subcutaneous insulin infusion versus multiple daily injections of insulin for pregnant women with diabetes did not show significant differences in outcomes (Farrar 2007).

**Treating gestational diabetes**
In an Australasian randomised trial of managing women with ‘mild’ gestational diabetes (screening, dietary counselling and insulin treatment if required) compared with standard care, a composite outcome (death, shoulder dystocia, bone fracture and nerve palsy) showed a significant reduction for the managed group. A significant reduction in the pre-eclampsia rate was also seen in the managed group (Crowther 2005).

The New Zealand and Australian Metformin in Gestational Diabetes (MIG) randomised trial has recently shown that the babies of mothers treated with metformin were not different from the babies of mothers treated with insulin alone, either at birth or at 6-8 weeks of age, paving the way for oral antidiabetic drugs to be used instead of insulin for women with gestational diabetes (Rowan 2008).

While a low glycaemic index diet was seen to be beneficial for some mother and child outcomes, overall results from a Cochrane review of dietary advice in pregnancy for preventing gestational diabetes mellitus were not conclusive enough to suggest that pregnant women should adopt this type of diet (Tieu 2008).

**Strategies to engage pregnant women and new mothers in preventing diabetes**
Among a population of pregnant Cree women in Canada, an intervention of counselling, physical activity and nutrition advice did not have a noticeable impact on preventing gestational diabetes or on reducing the high rate of infant macrosomia (Gray-Donald 2000).

In the Looma Healthy Lifestyle program in the Kimberley region of Western Australia, while no reduction in diabetes was seen, there was a suggestion that insulin sensitivity may have improved; and self-reported dietary habits and physical activity levels improved in the general community (Rowley 2000).

**What are the barriers/facilitators for preventing or treating diabetes?**

**Access**
Low rates of self-monitoring and insulin use in Aboriginal and Torres Strait Islander communities could be due, in part, to “clinical inertia” through doctors overestimating the care they actually provide, lack of time and lack of appropriate training. Poor socioeconomic conditions are also likely to contribute, through lack of availability and affordability of glucose monitors, and good food (such as fruit and vegetables in remote communities) as well as low levels of physical exercise (McDermott 2004).
Post GDM screening

Despite a high chance of developing type 2 diabetes after a diagnosis of GDM, just over half (57%, 400/707 women) returned for screening (4-6 weeks postpartum) in a Diabetes in Pregnancy Program in Texas, US. Those who failed to return for screening were more likely to have higher glucose levels at diagnosis, weighed more before pregnancy, were more likely to have a history of GDM and to require medication and insulin to treat their GDM than women who did return for screening (Hunt 2008).

Ongoing projects/programs

The Audit and Best Practice for Chronic Disease Extension (ABCDE) Project is a continuous quality improvement (CQI) project being conducted in 40-50 Aboriginal and Torres Strait Islander community health centres from the NT, WA, NSW and Queensland, with prevention and management of diabetes being one of the components (Bailie 2008). Although this is an ongoing project, the impact of the CQI intervention on preventing and managing chronic illness has been previously reported. Findings indicated that the CQI approach was highly acceptable in Aboriginal and Torres Strait Islander primary care setting. To date it has been associated with significant improvements in systems and processes of care such as improved frequency of HbA1c testing as well as blood pressure and cholesterol assessment; and improvements in some intermediate health outcomes such as improved HbA1c values (Bailie 2007).

Preventing and managing diabetes in pregnancy is an active topic of research in Australia, with a number of Australian trials completed but not yet published, and trials commenced but not yet completed:

- A randomised trial of a multidisciplinary teamcare approach involving obstetric, dietary and clinical psychological input in obese pregnant women to reduce the incidence of gestational diabetes (Fighting obesity from conception) has finished but it is not yet published; the chief investigator is Julie Quinlivan, Melbourne – ACTRN012605000709640, http://www.anzctr.org.au/trial_view.aspx?ID=821;
- A randomised controlled trial using exercise to reduce gestational diabetes and other adverse maternal and neonatal outcomes in obese pregnant women – the pilot study (BAMBINO) has finished but is not yet published; the chief investigator is Katie Foxcroft, Brisbane (ACTRN012606000271505, http://www.anzctr.org.au/trial_view.aspx?ID=1413);
- Effect of different diets on gestational diabetes – can a low glycemic index (GI) diet during pregnancy reduce prevalence of large for gestation age (LGA) amongst gravidas with gestational diabetes (GDM)?; this trial is not yet recruiting – the chief investigator is Jennie Brand-Miller, Sydney (ACTRN12608000218392, http://www.anzctr.org.au/trial_view.aspx?ID=82779);
- Preventing excess weight gain and gestational diabetes in overweight and obese pregnancies is not yet recruiting – the chief investigator is Helena Teede, Melbourne (ACTRN12608000233325, http://www.anzctr.org.au/trial_view.aspx?ID=82798);
- Dietary and lifestyle advice for women with borderline gestational glucose intolerance (IDEAL) has recently started recruiting – the chief investigator is Caroline Crowther, Adelaide (ACTRN012607000174482, http://www.anzctr.org.au/trial_view.aspx?ID=81643);
- The efficacy and feasibility of progressive strength training in the management of glucose control in women with gestational diabetes has finished but is not yet published (ACTRN012605000378628, http://www.anzctr.org.au/trial_view.aspx?ID=436) – the chief investigator is Jonathan Shaw, Melbourne;
- The feasibility and efficacy of an individualised approach to increase physical activity among women with previous gestational diabetes mellitus is not yet recruiting; (ACTRN12608000280303, http://www.anzctr.org.au/trial_view.aspx?ID=82865) – the chief investigator is David McIntyre, Queensland;
- Diabetes and antenatal milk expressing (DAME) is not yet recruiting – the chief investigator is Kerri McEgan, Melbourne.
There are also a number of relevant Cochrane reviews in preparation:

- Alternative strategies for diagnosing gestational diabetes mellitus to improve maternal and infant health (Farrar 2008);
- Different techniques of blood glucose monitoring in women with gestational diabetes for improving maternal and infant health (Pelaez-Crisologo 2009);
- Oral antidiabetic agents for women with pre-existing diabetes mellitus/impaired glucose tolerance or previous gestational diabetes mellitus (Tieu 2009);
- Preconception care for women with pre-existing diabetes (Tieu 2009);
- Screening for gestational diabetes mellitus for improving maternal and infant health (Tieu 2008).

**Further research/action required**

It is important to find ways to ensure that women with pre-existing diabetes access preconception care, including control of glucose levels before conception.

There is a need to target younger Aboriginal and Torres Strait Islander women for GDM screening and lifestyle modification programs (Templeton 2008); and an overall need to increase access to GDM screening for Aboriginal and Torres Strait Islander women of all ages. There is a particular need to investigate the influence of nutrition and diet on diabetes in pregnant women.

Links between diabetes, obesity and hypertension in pregnant women are not completely clear and further research into these links as is elucidating pathways in order to determine what sorts of preventive and management strategies, and their timing, will be most effective.
References


2.1.6 Family Violence

Definition
The Australian Medical Association has defined domestic violence as:

“An abuse of power. It is the domination, coercion, intimidation and victimisation of one person by another by physical, sexual or emotional means within intimate relationships.”

We will use the wider term ‘family violence’ here, which encapsulates the AMA definition within it.

How many pregnant women are exposed to family violence?

Aboriginal and Torres Strait Islander women, Queensland
Sixteen per cent (69 of 387 women) attending the Townsville Aboriginal and Islander Health Service for antenatal care reported being exposed to domestic violence (Panaretto 2006).

Aboriginal and Torres Strait Islander adults and children, New South Wales
NSW hospitalisation data show that Aboriginal and Torres Strait Islander people were more than four times as likely to die as a result of interpersonal violence; and more than five times as likely to be hospitalised for interpersonal violence (Clapham 2006).

Aboriginal and Torres Strait Islander men and women, Australia
Indigenous people are involved (as both victims and offenders) in just under a quarter of intimate partner homicides in Australia (Mouzos 2003).

South Australia, general population
In a survey of women attending their first antenatal visit at the Lyell McEwin Hospital, 5.6% of women had been victims of violence since becoming pregnant (Edwards 2008a). This rate is comparable with the 5.8% reported for Australia by Webster 1994, but is higher than the 1.5% reported by Matthey 2004 for southwest Sydney.

Western Australia, general population
During 1990-2004 in WA, there were nearly 37,000 hospital admissions due to interpersonal violence, with over nearly one third of these due to a subsequent episode of interpersonal violence. In this survey, Aboriginal and Torres Strait Islander people were more likely to be readmitted than non-Indigenous people, with 74% of these readmissions (n=8545) involving Aboriginal and Torres Strait Islander people, the majority of them (65%) being female. Despite representing only 3-4% of the WA population, Aboriginal and Torres Strait Islander victims of interpersonal violence accounted for nearly half of all hospitalisations (Meleuners 2008).

Australia, general population
Three per cent of women in the community report partner violence in the previous 12 months, with the rate reported in primary care being 8%. Women appear to be particularly vulnerable in their early childbearing years (Taft 2006). This is borne out in a survey of pregnant women in Melbourne, with 13% reporting some form of partner abuse in the past 12 months (Hegarty 2007).

Intimate partner violence is a major public health problem with a similar prevalence to chronic diseases such as diabetes and asthma. In Australia it is the leading contributor to death, disability and illness for women aged 15 to 44 years (Hegarty 2008a).
New Zealand, general population
Over a third of women in a New Zealand survey reported that they had ever experienced intimate partner violence - physical or sexual (Fanslow 2008a) with 6% of urban women and 9% of rural women experiencing violence during pregnancy (Fanslow 2008b).

Hong Kong
In a survey of 3,245 pregnant women attending antenatal clinics, 9% reported abuse (physical and/or sexual or psychological) by an intimate partner in the past year (Tiwari 2008).

United States of America
In a study of 312 Native American women in Oklahoma, over half (59%) reported experiencing physical or sexual intimate partner violence in their lifetime. Among women who had been pregnant in the previous year, 9% (13/140) reported that their partner physically or sexually assaulted or hurt them during their pregnancy (Malcoe 2004).

In a population-based sample of 118,579 women, approximately 1 in 17 (5.8%) of women giving birth to liveborn infants reported physical domestic violence, either during pregnancy or in the year prior to pregnancy (Silverman 2006).

International
Lifetime prevalence of physical or sexual partner violence or both was reported to vary from 15% to 71% in a WHO study (Garcia-Moreno 2006).

What are the links between family violence and infant mortality, preterm birth, small for gestational age or low birthweight?

In a cross-sectional study in the US of 791 women and their 2388 pregnancies, Coker 2004 found significant associations between domestic violence (after adjustment for age at pregnancy, race, health insurance, marital and smoking status) and:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perinatal death:</td>
<td>2.1</td>
<td>1.3 to 3.4</td>
</tr>
<tr>
<td>Preterm birth:</td>
<td>1.7</td>
<td>1.1 to 2.6</td>
</tr>
<tr>
<td>Low birthweight:</td>
<td>2.0</td>
<td>1.4 to 3.1</td>
</tr>
<tr>
<td>Preterm and low birthweight:</td>
<td>2.4</td>
<td>1.5 to 4.0</td>
</tr>
</tbody>
</table>

Many of these associations showed a ‘dose response’ effect, increasing with increasing levels of domestic violence.

In a survey of women from the Australian Longitudinal Study on Women’s Health, significant associations were seen between partner violence and preterm birth (Taft 2007).

In a review of 20 studies examining associations between domestic violence and adverse birth outcomes, Coker 2004 found that there were inconsistent findings, perhaps due to small sample sizes. Six of these studies found an association with low birthweight, three with preterm birth and with intrauterine growth retardation in one study.

A later survey of 16,041 pregnant women in the US found physical abuse to be associated with an increased risk of neonatal death (1.5% v 0.2%, p = 0.004); and verbal abuse to be associated with low birthweight (7.6% v 5.1%, p= 0.002) compared with women who reported no abuse during pregnancy. However the worst outcomes were found for the 0.6% of women who declined to be interviewed (Yost 2005).
What are the links between family violence and other outcomes of interest?

Alcohol and substance use
Alcohol and substance use are common contributing factors to violence in Aboriginal and Torres Strait Islander communities (Productivity Commission 2007). Alcohol is involved in many homicides of Aboriginal and Torres Strait Islander people, with the victims often being intimate partners (Mouzos 2003).

In a New Zealand study of 2391 women, those who had experienced violence during pregnancy consumed alcohol more than women who had not experienced violence, but this was not statistically significant – 31% vs 20% (Fanslow 2008b).

Depression (and other mental health issues)
Violence (either by or towards the pregnant woman) was the strongest predictor of antenatal depression in a survey of South Australian women and may be under recognised (Edwards 2008a).

People with mental illness were more likely to be readmitted to hospital for interpersonal violence in WA (Meuleners 2008).

In a Hong Kong survey of pregnant women, those subjected to psychological abuse only, had a higher risk of postnatal depression compared with women who were not abused and had significantly poorer mental health-related quality of life (the latter finding also applied to women reporting physical abuse). It was not clear if any of the women had depression before the current pregnancy (Tiwari 2008).

Physical and sexual intimate partner violence against women has been estimated to account for nearly 500,000 hospital emergency department visits and one million visits to doctors annually (Malcoe 2004).

Breastfeeding
In a review of the US Pregnancy Risk Assessment Monitoring System (PRAMS), an association was seen between domestic physical violence around pregnancy and not starting to breastfeed, and with ceasing to breastfeed by four weeks postpartum. This association disappeared when adjusted for demographics and smoking (Silverman 2006).

Birth outcomes
In a Hong Kong survey of pregnant women, no differences between the nonabused and abused groups were seen for length of gestation, birthweight, Apgar scores, mode of birth and admission to NICU (Tiwari 2008). However, presence of family violence is a strong predictor of child abuse (Productivity Commission 2007).

Miscarriage and termination
In a New Zealand survey, women who had ever experienced domestic violence were significantly more likely to report ever having a miscarriage (OR 1.41 95% CI 1.10 to 1.81) and to report that they had ever had an abortion (OR 2.49 95% CI 1.81 to 3.42); both figures controlled for confounding (Fanslow 2008a).

Infection
Adolescent girls who experienced partner abuse were significantly more likely to have been diagnosed with a sexually transmitted disease (Teitelman 2008).

Social and economic factors
Women who were in debt, required financial assistance, whose pregnancy was unplanned and who had in-law conflict were more likely to experience intimate partner violence in the past year in a Hong Kong survey of pregnant women (Tiwari 2008). This is consistent with a UK study showing that women in households with an income less than 10,000 pounds are 3.5 times more at risk of domestic violence than those in households with an annual income over 20,000 pounds; and that unemployed women are more vulnerable
to domestic violence (Walby & Allen 2004). In a WA study of interpersonal violence, people with more affluent backgrounds tended to have a lower risk of being readmitted to hospital due to interpersonal violence than people in the most disadvantaged group (Meuleners 2008).

Malcoe 2004 reports a sevenfold disparity in the rate of intimate partner violence experienced by women in the lowest, compared with the highest, income groups in the US.

**Smoking**

In a New Zealand study of 2391 women, those who had experienced violence during pregnancy were significantly more likely to smoke tobacco during pregnancy (Fanslow 2008b).

**Unintended pregnancy**

A number of studies described in a recent review of intimate partner violence suggest a link with unintended pregnancy (Sarkar 2008). Women experiencing violence and abuse can be subject to coercive and unprotected sex, leading to additional unplanned and, perhaps, unwanted pregnancies (Bacchus 2001). For example in a New Zealand study of 2391 women, those who had experienced violence in pregnancy were less likely to report that their last pregnancy had been wanted (28% vs 55%) and less likely to report that their partner wanted the pregnancy (40% vs 57%) than women who had not experienced violence (Fanslow 2008b).

A systematic review of 51 studies shows clear links between women’s sexual health and physical violence. In particular, physical violence is associated with increased risks of unwanted pregnancy and induced abortions; and also with sexual risk-taking behaviours such as inconsistent condom use and partner not being monogamous (Coker 2007).

**Costs**

A UK study has estimated that health care costs incurred as a result of physical injuries and mental health impairment from family violence amounts to nearly 1.4 billion pounds or 3% of NHS expenditure (Walby 2004).

**Why might family violence cause adverse birth outcomes?**

Pathways to poor birth outcomes include blunt physical or sexual trauma to the mother, maternal infections or more indirectly through elevated physical and psychological stress, isolation and inadequate access to antenatal care, substance use, inadequate maternal nutrition and exacerbation of hypertension and depression (Coker 2004).

Depression, hostility and sleep disturbance are common sequelae of violence against women and may be linked to illness through impacts on the immune system (Kendall-Tackett 2007a).

**What are the links between family violence and other risk/protective factors?**

Cripps 2008 outlines two categories of factors that are linked with Aboriginal and Torres Strait Islander family violence in Australia:

- **Group 1:** Colonisation policies and practices; dispossession and cultural dislocation; dislocation of families through removal;
- **Group 2:** Marginalisation as a minority; direct and indirect racism; unemployment; welfare dependency; past history of abuse; poverty; destructive coping behaviours; addictions; health and mental issues; low self-esteem and a sense of powerlessness.

For example, of the 24% of Aboriginal and Torres Strait Islander people who reported being victims of violence in a 2002 ABS survey, 38% had been removed from their natural families compared with 23% who were not removed.
Group 2 factors on their own or in combination were also linked to violence in this survey (Al-Yaman 2006), with victims reporting higher rates of:

- Disability (29% compared with 22% among those without a disability);
- Living in low income households (27% compared with 19% among those in high income groups);
- Unemployment (38% compared with 21% among the employed).

Aboriginal and Torres Strait Islander children are particularly vulnerable to injury, but little is known about the nature of these injuries. Some of the risk factors for children are likely to be living in an overcrowded environment, economic deprivation, high stress levels and recurring domestic violence (Clapham 2006).

Eisenstat 1999 outlines the risk factors for domestic violence to be:

- women less than 40 years of age
- past history of child abuse or having a child who is currently being abused
- recent separation or divorce
- socially isolated
- having an accompanying partner who is overattentive
- presenting frequently
- delay in seeking treatment or noncompliant.

In a cross-sectional study, Coker 2004 found the following to be correlated with domestic violence:

- being younger
- earlier age at first sexual intercourse
- being single, divorced or separated
- having education less than high school
- on Medicaid
- being unemployed
- being a smoker
- having an STI before or during pregnancy.

**What is the evidence for providing help to pregnant women and new mothers exposed to family violence?**

Mainstream responses to violence in Aboriginal and Torres Strait Islander families such as women’s refuges, criminal justice responses and ‘therapeutic’ programs have mostly been culturally inappropriate and ineffective (Cripps 2008).

Positive interactions with medical professions are often highlighted by women as important in helping them to recover from the effects of domestic violence (Hegarty 2000). Such interactions need to validate the experience of abuse, affirm that violence is unacceptable, and express support (Hegarty 2008a).

**Screening v case finding**

There is still vigorous debate about the methods of identification — either screening (consistent use of a validated set of short questions to detect partner violence in all of an asymptomatic population in order to prevent further violence, illness and death) or case finding (using the opportunity of the clinical encounter to check for partner violence and associated health problems in symptomatic people in order to prevent further violence, illness and death). Recent international consensus guidelines recommend that GPs should routinely ask all pregnant and adolescent women about partner violence (Victorian Govt Dept Justice 2006), as does the American College of Obstetricians and Gynecologists (ACOG 2006). If screening is not universal, Hegarty 2008a suggests that clinicians should adopt a low threshold for raising the topic of family violence, especially when underlying psychosocial problems are suspected.
Hegarty 2000 also suggests that opportunistic screening in practice settings, such as antenatal clinics, is worthwhile, and that different questions will be needed to elicit experiences of domestic violence for different groups of women e.g. Aboriginal and Torres Strait Islander women.

**Counselling and outreach**

A US cluster RCT randomised abused pregnant women to either a brief intervention (given a card with agency telephone numbers and information); counselling (unlimited access to a female counsellor with expertise in domestic violence); or outreach (access to counsellor plus a trained ‘mentor mother’). One quarter of the women were teenagers. Physical violence scores were significantly lower for women who received counselling and mentoring compared with counselling alone; but not significantly lower than those women who received only a referral card and brochure. However all three groups of women increased their use of services, indicating a role for initial assessment of domestic violence during pregnancy (McFarlane 2000).

**Cueing/prompting for health professionals**

A recent US RCT included 37 women who reported experience of violence a year before pregnancy or during pregnancy during a risk assessment. Seventeen of the 20 women allocated to providers who were prompted to discuss violence (through a cueing sheet attached to the woman’s medical record), reported having such a discussion, compared with four of the 17 women in the control group (Calderon 2008).

**Microfinancing**

In a cluster RCT in rural South Africa, a microfinancing and education intervention halved the risk of physical or sexual intimate partner violence in the previous year (Kim 2007).

**Cognitive behaviour therapy for male partners**

A Cochrane review of six trials (all from the US) did not demonstrate any differences on continued physical violence on women from their male partners who underwent cognitive behavioural therapy compared with those who did not (Smedslund 2007).

**Strategies to engage pregnant women and new mothers in preventing and addressing family violence**

**Hollow Water Community Holistic Circle Healing, Canada**

This small Anishabe community had been characterised by high levels of violence, with incarceration providing little deterrent to reoffending. The cycle of abuse has been interrupted by the healing circles process which may take three to five years. A victimiser needs to plead guilty and fully cooperate to be accepted into the program; otherwise they will be left to go through the courts system. In a series of circles, abusers are asked to share what they have done, to tell their immediate family what they have done, and then their extended family, with a sentencing circle to tell the community what steps they have taken on their healing journey. In a formal evaluation, recidivism rates were very low – two out of 107 individuals. However critics such as La Rocque maintain that the healing circles promote leniency for the offender and are detrimental to the victim. In addition the program is not consistent with traditional punishments for sexual abuse which were very severe, and may allow asymmetrical and dysfunctional power relations to be reinforced. Nonetheless elements of the program may achieve rehabilitation and healing for offenders, consistent with the concept of Healing Lodges being established in conjunction with Corrections Canada (in Cripps 2008).

**Australia (mainstream)**

Each State and Territory has confidential telephone services for people experiencing domestic violence.

The National Helpline Associated with the Violence Against Women Australia Says NO campaign will continue in its present form while the Government considers the effectiveness of the model in conjunction
with the National Plan to Reduce Violence Against Women and their Children. While the plan is still being finalised, the Government has announced immediate key deliverables (Office of Women 2008), including:

- White Ribbon Day education activities in rural and regional communities to promote culture change around violence against women
- Respectful relationship resources for all Australian high schools
- Tougher and nationally consistent laws and best practice
- Funding to boost the Australian Institute of Criminology’s National Homicide Monitoring Program to investigate domestic violence-related homicides to inform future interventions
- Research into international and best practice models for working with perpetrators of violence, to make them confront their violence and its impact on their partners and children.

In 2006, an Early Intervention and Prevention Program (EIPP) was developed by the Attorney-General’s Department. EIPP funds programs in rural and remote Aboriginal and Torres Strait Islander communities that prevent the occurrence of family violence and sexual abuse, by changing the behaviours and attitudes of individuals and the community (record 145; Australian Domestic & Family Violence Clearinghouse).

**What are the barriers to/facilitators for reducing family violence?**

Aboriginal and Torres Strait Islander people can be reluctant to report injuries – for childhood injuries this can be due to fear of investigation from government departments (Clapham 2006).

Witnessing or experiencing violence from an early age can set up a cycle of abuse, with these children more likely to demonstrate future desensitisation towards violence and to be predisposed towards violence in future relationships (Productivity Commission 2007).

Reasons for not disclosing abuse to clinicians include fear, denial and disbelief, emotional bonds to their partner, commitment to marriage, hope for change, staying for the sake of the children, ‘normalisation’ of violence, social isolation, depression, stress, and feeling that they will not be believed or that services will not be able to help (Hegarty 2000). Lifetime disclosure rates range from 18% to 37% (Hegarty 2008).

Antenatal care providers are often reluctant to screen for and counsel about violence; some reasons being discomfort with the topic, fear of offending the woman, and a sense of powerlessness (Sugg 1992 in Calderon 2008). In a survey of Belgian gynaecologists, only 8% regularly questioned women about intimate partner violence (Roelens 2006).

Women have indicated that they would prefer health care providers to play an active role once they have disclosed intimate partner violence (Dienemann 2005).

**Ongoing projects/programs**

In 2005, the Australian Government announced a $75.7 million commitment for the Women’s Safety Agenda, including promotional campaigns, development and evaluation of programs, funding of resource centres and training for practice nurses in regional and rural areas (www.ofw.facs.gov.au/womens_safety_agenda [accessed 4 November 2008]).

The Australian Domestic and Family Violence Clearinghouse provides information about domestic and family violence matters and practice in Australia (www.austdvclearinghouse.unsw.edu.au).

The Victorian Indigenous Family Violence Strategy supports developments to address family violence in Aboriginal and Torres Strait Islander communities. This has included establishing 10 regional action groups, supported by 10 Indigenous family violence support workers. The Indigenous Family Violence Community Initiatives Fund provides grants to Aboriginal organisations and community groups to support implementation of local projects that aim to reduce family violence, such as workshops, trivia nights, family
and children’s days, men’s forums, youth camps and elders’ events. Government agencies and the Indigenous Family Violence Partnership Forum are currently finalising the Indigenous Family Violence Ten Year Plan (Victorian Department of Human Services 2008).

A cluster RCT called MOSAIC (Mothers’ Advocates in the Community) is underway in Victoria. GP clinics or Maternal and Child Health Nurse Teams are randomised to offer pregnant women or recent mothers at risk of partner violence either weekly visit, outing or phone call support from a mentor mother; or the standard care from GPs and nurses trained in identifying and referring such women (ACTRN01260700010493, http://www.anzctr.org.au/trial_view.aspx?id=81704).

In another Victorian cluster RCT, a multifaceted general practice intervention will be tested to see if it can increase the safety, mental health and quality of life of abused women. The weave project (Women’s Evaluation of Abuse and Violence Care in General Practice) will offer GP or nurse counselling sessions to women who are afraid of their partner or ex-partner. The trial will use a recently developed management tool for health professionals called PREMIS (Hegarty 2008b).

As part of the Northern Territory Intervention, 20 safe houses for women and men’s cooling places have been established in NT Aboriginal and Torres Strait Islander communities (reported by ABC News 31 December 2009).

The Peek A Boo Club in Melbourne works with infants affected by family violence, to enhance the attachments of infants and mothers (Bunston 2008).

Cochrane reviews
The following Cochrane reviews are in preparation:

- Screening women for intimate partner violence in health care settings (Taft 2008);
- Advocacy interventions to reduce or eliminate violence and promote the physical and psychosocial well-being of women who experience intimate partner abuse (Ramsay 2005).

Further research/action required

In his 2007 annual report, Social Justice Commissioner, Tom Calma, has called for the immediate funding and establishment of a clearinghouse on Indigenous family violence and abuse initiatives to share stories of success and of challenges, building capacity rather than “reinventing the wheel every time a new policy or program is announced” (Cripps 2008).

Hegarty 2008a lists the following as areas of future research:

- Do system-level interventions in health care settings improve the response of health services to survivors of partner violence or improve health outcomes for women?
- Do psychological and advocacy interventions after disclosure of partner violence in health care settings (whether this is the result of screening, routine enquiry or selective inquiry) reduce violence and improve quality of life and mental health?
- What do women want from health care or healthcare related interventions after disclosure of partner violence?
- What is the natural course of partner violence?
- What is the long term prognosis for survivors of partner violence after identification in health care settings?
References


2.1.7 Home Visits

What is the evidence for home visits to pregnant women and new mothers?

**Australia**
**Armstrong 1999**
In a Queensland RCT, 181 vulnerable women in the immediate postpartum period were assigned either to a structured program of nurse home visiting or to standard community child health services. At six weeks, women receiving the home visits program had “significant reductions in postnatal screening scores as well as improvements in their experience of the parental role and improvement in the ability to maintain their own identity. Maternal-infant interactions were more likely to be positive with significantly higher (better) scores in aspects of the home environment related to optimal development in children, particularly maternal-infant secure attachment. Intervention group mothers were significantly more satisfied with the community health service.”

**Quinlivan 2003 (teenagers)**
In an RCT of 139 young pregnant women attending three Australian antenatal clinics, women in the home visits group (six visits over six months) had significantly fewer adverse neonatal events compared with the standard care group. In the home visits group, one neonatal death and one non-voluntary foster care for the baby was reported; the corresponding figures for the standard care group were two neonatal deaths, one non-accidental injury to the baby and six cases of non-voluntary foster care for the baby. About 25% of the teenagers in this trial were Aboriginal and Torres Strait Islander women.

**New Zealand Early Start**
In the RCT of this home visiting program, participation was associated with small to moderate benefits in child health, parenting, and child abuse (Fergusson 2005). However benefits were not seen for maternal health (including depression, smoking, use of alcohol and other substances) and measures of stress and family functioning (Fergusson 2006).

**United Kingdom**
**Oakley 1990**
In an RCT of midwife home visits (minimum three antenatal visits plus telephone contacts and pager access) for socially disadvantaged women, there was a small birthweight increase in the visited group compared with the standard antenatal care group, but no differences were seen for numbers of low birthweight babies. More women in the standard care group were admitted to hospital during their pregnancy; and visited mothers and their babies were healthier than those in the standard care group (Oakley 1990).

**Home Start (Barnes 2006)**
Home Start is a voluntary organisation offering in-home support to families with young children in the UK. Some studies have shown beneficial effects of the program although a quasi-experimental study did not find significant differences between Home Start and those families receiving standard local services (Barnes 2006).

**Sure Start (Melhuish 2008; Belsky 2006)**
The Sure Start program initially showed some benefits for the less disadvantaged parents and some disbenefits for the most disadvantaged parents. After some program adjustments designed to reach the most vulnerable, positive benefits were seen on the life chances of young children living in deprived areas.

**United States of America**
**Brooten 2001 RCT**
In an RCT where half the antenatal care was provided in women’s homes by nurse specialists, the reduction on infant mortality in the home visit group nearly reached statistical significance (2/94 v 9/98; RR 4.32 95%
CI 0.96 to 19.46) with preterm birth significantly lower. No difference was seen in rates of low birthweight. The infant mortality reductions were attributed to earlier detection and intervention of problems during pregnancy (Brooten 2001).

**Early Head Start (United States of America)**
This program combines home visiting and centre-based programs, as well as offering each model separately. It is discussed below under ‘Ongoing programs’ and also in the ‘Models’ section of the report.

**Early Intervention Program (EIP) for Adolescent Mothers** (Koniak-Griffin 2003; Koniak-Griffin 2002; Koniak-Griffin 2000; Koniak-Griffin 1999; Lesser 2000; Olds 2007a)
This nurse home visiting program involves visiting first-time adolescent mothers in mid pregnancy (20 weeks) and continues through to the infant’s first birthday. The RCT found that infants spent fewer days in hospital and had fewer hospitalisations for injuries, but at 12 months there were no significant program effects on mother-child interaction, subsequent pregnancies, maternal depression or substance use. However at 24 months EIP mothers used marijuana less than the women receiving standard care. Olds 2007a notes that the rates in both the intervention and control groups were similar to the Nurse Family Partnership results (see below) and believes that the failure to find effects here may be due to low power from a small sample size.

**Every Child Succeeds** (Donovan 2007)
Every Child Succeeds is a community-based home visiting program for low income first-time mothers and their children in Cincinnati; it uses two national models, Nurse Family Partnership (NFP) and Healthy Families America (HFA). For NFP, women are enrolled in pregnancy, or before their child reaches three months for HFA. In a retrospective study, 4995 infants whose families did not receive home visiting were 2.5 times more likely to die in infancy compared with 1665 infants whose families received home visiting. Adequacy of antenatal care and infant death were significantly associated but antenatal care is likely to be a proxy for some other factor, as some women only started receiving home visits postnatally. No effects on preterm birth were seen.

**Healthy Families/Healthy Start** ([www.healthystartassoc.org](http://www.healthystartassoc.org))

- **Bugental 2002 RCT**
  This RCT compared a home visiting program enhanced with a cognitive component, standard home visits and a control group. It found some significant benefits of the enhanced program (e.g. better parenting) in the subgroup of high-risk infants compared with either the standard home visit or the control groups (Bugental 2002). According to Olds 2007a, the results of this small trial are promising and need to be replicated.

- **Duggan 2007 RCT**
  In a RCT involving six Healthy Families Alaska programs, no effects of the program were seen on either parental risks or infant outcomes (Duggan 2007; Duggan 2005; Gessner 2008; Olds 2007a).

- **Duggan 2004 RCT**
  A similar RCT of Healthy Start in Hawaii also failed to show effects of the program, although high attrition and poor implementation may have played a part in this (Duggan 2004; Olds 2007a).

- **USA (DuMont 2008; DuMont 2006)**
  In this RCT of Healthy Families in New York, significantly fewer low birthweight babies in the intervention group compared with the control group were reported in DuMont 2006 (in Olds 2007a), but the robustness of this finding has been questioned by Olds. In the 2008 report of the trial, fewer episodes of serious child abuse by mothers were noted (DuMont 2008).

- **Landsverk 2002 RCT (in Olds 2007a)**
  Although the program was well implemented in this trial of Healthy Families in San Diego, and there was over 80% retention of participants in the trial, effects were small and generally not sustained (Olds 2007a).

- **Omaha Healthy Start** (Cramer 2007)
  In 2003, there were no infant deaths for participating families (0/157 compared with 2/79 for 2002). The corresponding figures for low birthweight babies were 15/157 in 2003 and 12/79 in
2002. A 31% cost saving in average hospital expenditure compared with nonparticipants was reported (Cramer 2007).

**Norbreck 1996**
In this RCT of 114 low-income pregnant African American women in California with low levels of social support, fortnightly home visits from nurses resulted in significantly fewer low birthweight babies in the social support group.

**Nurse Family Partnership (US)** (Olds 2007a; Olds 2007b; Olds 2004a; Olds 2004b; Olds 2002; Olds 2000)
Often referred to as the Olds model, the Nurse Family Partnership (NFP) has been evaluated in the US in three RCTs – in Elmira (New York), Memphis and Denver.

A number of other trials are underway or being planned:
- An intervention to increase participant retention and the number of completed visits in a 30 site cluster RCT;
- An intervention to increase nurses’ skills in managing intimate partner violence;
- Improving nurses’ management of parents’ mental illness;
- Nurses’ skills in competent care-giving;
- Involving fathers in their children’s and partners’ lives.

Home visiting programs based in the Olds model are being replicated nationally across the US and are being introduced to other countries such the UK (Family Nurse Partnership) and Australia (Nurse Family Partnership).

The program targets first-time low-income mothers, with home visits provided during pregnancy and the first two years of their children’s lives.

The RCTs of Elmira and Memphis found that the program was successful in reducing child injuries and ingestions, reducing smoking in pregnancy (Elmira only), reduced hypertension in pregnancy (Memphis only); fewer subsequent pregnancies, greater work force participation, reduced use of public assistance and food stamps.

In the Memphis trial there was a trend towards fewer infant deaths from birth through age 9, with 10/498 deaths in the control group and 1/222 deaths in the nurse-visited group (OR 0.22 95% CI 0.03 to 1.74). Six of the deaths in the control group (due to extreme prematurity, SIDS (3), intestinal infection, multiple congenital abnormalities) and the single death in the nurse-visited group (due to chromosomal abnormalities) occurred in the first year of life. The later four deaths were due to chronic respiratory disease and 3 deaths from injury (homicide, 2 accidents). No program effects were seen for low birthweight or preterm birth in the Memphis trial.

In Elmira, there were beneficial long term effects on the number of arrests, convictions, emergent substance use and promiscuous sexual activity of children of low-income, unmarried nurse-visited mothers.

**Domestic violence**
The Elmira program had no impact on domestic violence – in households with domestic violence, program effects reduced child abuse and neglect.

**Cost analysis**
No net savings were seen for women who were married and of higher social class, but in low-income unmarried women, savings to government and society exceeded the cost of the program by a factor of 4 over the life of the child (Karoly 1998). A later analysis of all three RCTs estimated that for every family served by nurses, society experiences a $17,000 return on investment (Aos 2004).
Denver RCT
In the first phase of the trial (from pregnancy to child aged two years), paraprofessional home visitors produced small beneficial effects – these effects were about half the size of effect with nurse visitors and were rarely clinically or statistically significant. Nurses produced effects consistent with previous trials of the program, including beneficial effects on women’s use of tobacco during pregnancy, maternal life course (fertility and workforce participation) and emotional, language and cognitive development of infants born to mothers with low levels of psychological resources (limited intellectual functioning, mental health and sense of control over life circumstances).

Compared with the control group at two years follow-up (when children were aged from two to four years), nurse-visited women reported:

- greater intervals between the births of their first and second children (24.51 months v 20.39);
- less domestic violence (6.9% v 13.6%);
- less frequent enrolment of their children in preschool, Head Start or licensed day care.

There were no statistically significant effects of nurse visits on the number of subsequent pregnancies, women’s educational achievement, employment, mental health, mastery, use of marijuana or alcohol, use of welfare, behaviour problems attributable to substance use, marriage, or living with a partner or father of the child. There were no statistically significant nurse effects on sensitive-responsive mother-child interaction, children’s emotional regulation or externalising behaviour problems.

Paraprofessional visits resulted in more mother-child interaction but no other significant differences were seen (typically about half the size than for nurse visits when any differences were seen).

UCLA Family Development Project
This RCT of a relationship-based home visiting program and parent-infant support group for first-time parents at risk for poor parenting found some improvements in parenting and in children’s behaviour but not on child development outcomes (Heinicke 2001).

Children First, United States of America
Children First (CI) is a program for first-time mothers (Carabin 2005), based on the Olds’ nurse home visitation program. It was implemented statewide in Oklahoma in mid-1997. All 239,466 Oklahoma birth certificates between 1997 and 2002 were included; ending up with 8598 CI mothers and 55,737 nonCI mothers (any first-time mother). The program targets pregnant women < 28 weeks gestation, who had previously given birth to a liveborn infant and who had little financial or social support. The home visitors focus on five domains of functioning: personal health, environmental health, maternal role, life-course development and family and friends’ support.

Among single mothers without pregnancy risk factors (chronic hypertension, pregnancy-induced hypertension, anaemia, cardiac disease, renal disease, genital herpes, diabetes, haemoglobinopathy, uterine bleeding, eclampsia or prior pregnancy loss (fetal death or stillbirth)), risks were lower for CI mothers:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Adjusted OR</th>
<th>95% BCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm birth</td>
<td>0.89</td>
<td>0.79 to 1.00</td>
</tr>
<tr>
<td>Very preterm</td>
<td>0.71</td>
<td>0.50 to 0.98</td>
</tr>
<tr>
<td>LBW</td>
<td>0.86</td>
<td>0.75 to 0.98</td>
</tr>
<tr>
<td>Very LBW</td>
<td>0.77</td>
<td>0.56 to 1.02</td>
</tr>
<tr>
<td>Infant mortality</td>
<td>0.36</td>
<td>0.17 to 0.63</td>
</tr>
</tbody>
</table>

*Bayesian Credible Interval (BCI)*

These risk reductions were not observed among married mothers. In both single and married mothers, the presence of pregnancy risk factors reduced the impact of CI on lowering the risk of LBW and PT births. At baseline, CI mothers were more disadvantaged than non-CI mothers.
Participation in Women’s Children’s and Infants’ Program (WIC) considerably reduced the risk of adverse pregnancy outcomes and infant mortality (and was a confounder of the effectiveness of CI). This may indicate that participation in WIC indirectly reflects better antenatal care and/or that the nutritional supplements improve birth outcomes.

**RCT of home visiting intervention for American Indian adolescent mothers (Barlow 2006)**

This small RCT used an intervention modelled on ‘Healthy Families America’ (12 research based principles to ensure quality of home-visiting interventions for at-risk families) for teen mothers from Navajo and Apache reservations in New Mexico and Arizona. At six months, knowledge was significantly better in the intervention group, but no significant difference was seen for skills, involvement or other outcomes (Barlow 2006).

**Programs**

**South Australian universal home visiting scheme (Zadoroznyi 2006a)**

In 2004, almost all babies (98.5%) born in the past 12 months had received a visit from a child health nurse. The scheme employs about 120 nurses and costs $4 million per year. During these visits (at one to four weeks after birth) the nurses conduct an infant health check, weigh and measure the infant, answer any questions from parents and enrol the child for subsequent clinic visits at six months, 18 months and two to three years of age. The nurses also identify families ‘at risk’ who would benefit from further followup visits. They use the Pathways to Parenting Questionnaire to assess:

- adequacy of social support for the family
- adequacy of housing
- parenting abilities and relationship with infant
- smoking, income and financial management
- parents’ intellectual capacity and mental health
- interpersonal violence
- substance abuse
- experience of childhood abuse of caregiver
- child protection issues with previous children.

A summary is also made of support systems already in place.

Only 0.02 to 0.04 per cent of all families visited (680 families in 2004-05) receive sustained followup (young mothers and Aboriginal and Torres Strait Islander families are disproportionately represented). The sustained follow-up program is currently being evaluated (see ‘Healthy Babies, Bright Futures’ below).

While some staff have expressed concern about features of the tool (e.g. ethical and privacy concerns), clients have not generally been so concerned (Nossar 2005). With home visiting nurses making up to 25 visits a week, only limited support can be offered, and matters like establishing breastfeeding are not easily dealt within the scheme.

**Mothercarer program, South Australia (Zadoroznyi 2006a and b; Klaer in SA Department of Health 2006)**

This home care worker program (based on the Dutch model) at Lyell McEwin Health Service works in tandem with the already existing domiciliary care program provided by visiting midwives. The Mothercarer service is available for six hours a day for up to six days following discharge from hospital and provides a range of domestic and/or social support services as required. On discharge from hospital 90% of women chose to have daily visits from a midwife but only 30% accepted the Mothercarer service. Women who self-select into the program are the least socially, culturally and materially resourced, as well as having lower education levels. These groups of women are also more likely to be discharged early from hospital. The program has had a lower than expected uptake, perhaps due to its portrayal as being for women without any support rather than as a complement to existing postnatal support mechanisms.
Mothercarer users were very satisfied with the program. There has been a small increase in breastfeeding since the start of the program and the program is thought to have the potential to reduce the incidence of postnatal depression.

The project aims not only to help new mothers and their families, but is also intended to create jobs and provide training in life skills for women in the northern suburbs. Training takes the form of a six-month Certificate in Community Services/Children’s Services provided through the University of South Australia. Women aged 18-25 were targeted for these traineeships, which led to some concerns for the clients, particularly that such young women were seen to lack experience. On the other hand, trainees’ life skills and self-esteem were enhanced and as of 2006, seven women had gained permanent positions with the program.

**New South Wales**

The Gudaga Service in NSW has a home visiting component - see ‘Gudaga’ under the Models section of the report.

**Early Head Start, United States of America (Love 2005; Gray 2007)** - also see ‘Early Head Start’ in Models section

Early Head Start is a federally funded program targeting children aged 0-3 from low income homes. (The Head Start Program is aimed at pre-school children from the age of four years, and has been operating since 1965.)

Early Head Start was established in 1994 as an extension to Head Start, in response to the growing body of evidence about the critical nature of the period from birth to three for later development. Currently it provides services for pregnant women and children in 63,000 low income families, about 3% of the eligible families.

Services include early education (at home or at a centre); home visits; parent education and health services, both antenatal and postnatal; case management and home support. Both Head Start and Early Head Start are widely considered to be successful, with Early Head Start having significant positive impacts on key developmental indicators and on parents.

**Minding the baby, United States of America (in Olds 2007a)**

A home visiting intervention integrating advanced practice nursing and mental health care for at-risk first-time parents is being developed in New Haven, Connecticut. This program has been based on the Nurse Family Partnership, with the addition of an intensive mother-infant relationship focus.

**What are the barriers to/facilitators for home visits?**

**Facilitators**

Paraprofessional visitors may share many social characteristics with the families they serve (Olds 2004) because this may increase visitors’ ability to empathise with their clients, who, in turn are more likely to trust those similar to them (Heins 1987).

**Barriers**

Some parents may not want visitors in their home – one reason may be fear of drug abuse or other illegal activity being detected (Olds 2007a).

Other parents may feel uncomfortable about home visits. In a NSW survey, 33% of parents with an Aboriginal child who had never had a home visit said that they would be uncomfortable compared with 22% of other parents. Other characteristics associated with home visits being unacceptable were younger mothers, males with lower education, smoking households and people speaking a language other than English at home. Regarding access, the characteristics of parents who received a home visit compared with those who did not also differed – younger women, parents with younger children, or only speaking English
at home were significantly more likely to have a home visit. No significant differences were seen for education, employment, area of residence, home smoking or whether the infant was of Aboriginal or Torres Strait Islander descent (Wen 2007).

Overseas programs may be seen as cultural imports (Ferraro 2008).

Some of the home visiting programs aim to improve economic conditions for women, but this depends on jobs being available (Ferraro 2008).

There are very substantial workforce issues:
- If nurses are to provide the home visits, there may be difficulties in recruiting and training them (Ferraro 2008).
- High staff turnover (particularly due to low wages) has been a feature of the HFA program in the US and this turnover has been associated with families dropping out of the program (Gomby 2007).

**Ongoing projects/programs**

**Healthy Babies, Bright Futures, South Australia**
The South Australian Family Home Visiting Program (the sustained follow-up component of the universal home visiting scheme) is currently being evaluated (Children, Youth and Women’s Health Service 2008; ACTRN1260800275369, http://www.anzctr.org.au/trial_view.aspx?ID=82810). In the ‘Healthy Babies, Bright Futures’ evaluation, participating mothers and infants receive 34 planned home visits delivered by specially trained nurses, commencing when the infants are aged two to three months and finishing when they are two years.

SA Children, Youth and Women’s Health Services is adopting and adapting the Olds model of family home visiting for families of Aboriginal and Torres Strait Islander children, using both nurses and cultural consultants (Sivak 2008).

**Miller Early Childhood Sustained Home Visiting (MECSH), New South Wales**
An RCT of a sustained home visiting program in NSW has recently finished recruiting but the results have not yet been published. The program commenced antenatally and continued until the child reached two years, and the trial recruited 208 at-risk mothers from a disadvantaged community (Kemp 2008).

**In-Home Support, Victoria (Victorian Department of Education & Early Childhood Development 2007a; and 2007b)**
The Victorian In-Home Support program aims to improve the health, development, learning and wellbeing of Aboriginal children aged 0-3 years and strengthen, support and improve parenting capacity for Aboriginal parents that is respectful of their cultural identity. All parents are able to participate in group and community activities that promote knowledge about health, wellbeing, safety and childhood development. Families identified as requiring more intensive parenting support are provided with individual support from an In-Home support worker.

Initially four Koori Maternity Service sites (Mildura Aboriginal Cooperative, Rumbalara Aboriginal Cooperative, Gippsland and East Gippsland Aboriginal Cooperative) and the Victorian Aboriginal Health Service have implemented the In-Home Support program, with Wathaurong implementing Koori Maternity Services and In-Home Support concurrently.

**Nurse Family Partnership, Australia (Ferraro 2008)**
A program, based on the US Nurse Family Partnership Program, will be implemented in 2009, starting mostly in regional and urban areas. Nearly 2000 Aboriginal and Torres Strait Islander families will be visited regularly at home by trained nurses, starting during pregnancy and continuing until a child’s second birthday.
Family Nurse Partnership, United Kingdom (UK Department of Health 2009; 2007b, and UK Department of Health media release 17 March 2008; www.everychildmatters.gov.uk/parents/healthledsupport)

Thirty sites across the UK are piloting the US Olds model of home visits with teenage mothers. This will be expanded to 70 sites by 2011. The program aims to improve pregnancy outcomes by engaging women in good health practices; by improving child health, development, future readiness and achievement by helping parents to provide responsible and competent care; and to improve parents’ economic self-sufficiency by helping them develop a vision for their own future, plan for future pregnancies, continue their education and find work.

For example, in Derby (UK), intensive home visiting is being provided to 100 of the most vulnerable first-time mothers under the age of 20 from the 14th week of pregnancy until the child is two years old. After seven months, 90% of the families offered the Family Nurse Partnership have entered the program. While it is too early to assess long-term outcomes:
- The project is well accepted by teenage parents with very few drop-outs so far;
- The number of parents stopping smoking in pregnancy has increased;
- The self-esteem of young parents on the program has increased;
- Young fathers and other family members have become involved in the program;
- Participants are willing to develop a long-term therapeutic relationship with the family nurse and to learn about and try breastfeeding;
- Participants are willing to learn about development of babies.

A randomised trial of the Family Nurse Partnership program is being conducted to determine the impact on children and families in England (UK Department of Health 2009).

Cradling Our Future Through Family Strengthening Study, United States of America

This RCT of in-home prevention of substance use risks for native teen families is currently recruiting at-risk teen mothers living in four Native American reservation communities. It will determine whether an in-home paraprofessional-delivered family strengthening curriculum ‘Family Spirit’ is effective at increasing parental competence, improving maternal and childhood outcomes (NIDA, NCT00373750).

Interpretation/comments

Home visiting needs to be regarded as a general service strategy, not a specific intervention – effectiveness is determined by what actually happens when home visitors are in the home (Gomby 2007).

Olds 2007a also highlights the importance of program design, such as selecting the right target population, intervening at vulnerable points of development, and providing services that from the participants’ perspectives are likely to reduce that vulnerability. Such programs are more likely to engage parents, produce reliable reductions in dysfunctional care and produce effects on child outcomes. The authors of Olds 2007a maintain that “The success of parenting programs will depend upon the degree to which parents’ concerns and motivations are integrated into the program design and effective clinical methods for behavioural change are employed by the staff.”

Lu et al 2005 contend that it may be premature to conclude that psychosocial interventions are not effective in preventing low birthweight, as the interventions tested may not have been appropriately designed.

Most programs have been established to address maternal-infant attachment. As our focus in the report is primarily effects on infant mortality, only part of the picture about the effects of home visits can be presented here.
Further research/action required

Family characteristics
We need to know more about the characteristics of families who do not take up the offer of home visits and their reasons for doing so, in order to make home visiting programs more acceptable and responsive.

Systematic reviews of home visits
Some aspects of home visits for particular groups (such as women with an alcohol or drug problem) are covered by Cochrane reviews but the main Cochrane reviews on home visiting have been withdrawn; and the Olds 2007a review does not purport to be a systematic review. There is an urgent need to produce a series of systematic review of home visits, perhaps covering short term and long-term outcomes separately.

More intensive models of home visiting
There is a need to test more intensive models such as the Bugental type interventions (Bugental 2002) with additional components.

Ongoing evaluation of the Nurse Family Partnership and other home visiting models in Australia
We need ongoing evaluation (formative and summative) of models introduced into the Australian setting and particularly for Aboriginal and Torres Strait Islander families, as the performance of many of the models in Australia is not yet known. This needs to address workforce issues, including the roles of Aboriginal Health Workers.
References


Landsverk 2002 (cited in Olds 2007a)


2.1.8 Hypertension in Pregnancy

Definitions/scope (Hofmeyr 2008):

Hypertensive disorders in pregnancy can be classified as:

- **Gestational hypertension**: Hypertension detected for the first time during the second half of pregnancy (after 20 weeks gestation) in the absence of proteinuria (which resolves within three months of birth).

- **Pre-eclampsia/eclampsia**: Hypertension detected for the first time during the second half of pregnancy (after 20 weeks gestation); eclampsia is the occurrence of seizures in a woman with pre-eclampsia.

- **Chronic hypertension**: Hypertension known to be present before pregnancy, or detected before 20 weeks gestation.

- **Pre-eclampsia superimposed on chronic hypertension**: Women with chronic hypertension may develop pre-eclampsia.

How many women are affected by hypertension in pregnancy?

**Aboriginal women, Western Australia**
In the Bibbulung Gnarneep cohort, 4% of Aboriginal women had high blood pressure during pregnancy (Eades 2008).

**Aboriginal and Torres Strait Islander women, central Australia**
In a central Australian survey, 18% of Torres Strait Islander women and 17% of Aboriginal women had high blood pressure. The corresponding figures for women under 30 years were 4% and 6% (Schutte 2005).

**Aboriginal and Torres Strait Islander women of reproductive age, national**
Percentages of Aboriginal and Torres Strait Islander women of reproductive age in Australia from 2004-05 with self-reported high blood pressure/hypertension were 1% for women aged 15-24; 5% for women aged 25-34 and 11% for women aged 35-44. Each of these was significantly higher than for the corresponding age groups for non-Indigenous women (Australian Health Ministers Advisory Council 2008).

**Overall population, South Australia**
In a review of 70,386 singleton pregnancies in SA from 1998-2001, 639 (0.9%) of the mothers had chronic (pre-existing) hypertension, 5356 (7.6%) had gestational hypertension or pre-eclampsia and 448 (0.6%) had pre-eclampsia superimposed on chronic hypertension (Heard 2004).

In 2006, 1.0% of SA women who gave birth had chronic hypertension and 7.2% had pregnancy-induced hypertension (Laws 2008). At 7.0%, the figures for pregnancy hypertension in 2007 (Chan 2008) were similar to the previous year.

**International**
Between 5- 7% of healthy nulliparous women develop pre-eclampsia (Sibai 1997).

In a Swedish record linkage study of nearly 900,000 women, 0.55% of women had chronic hypertension (Zetterstrom 2008).
What are the links between hypertension in pregnancy and infant mortality, preterm birth, small for gestational age or low birthweight?

Perinatal mortality
The perinatal mortality rate for hypertensive women in SA from 1998-2001 was 6.4/1000 (41/6443) compared with 6.9/1000 for normotensive women. This represents a substantial improvement from 1991 to 1997 where the perinatal mortality rate for hypertensive women was 10.1/1000, a significantly worse rate than for normotensive women giving birth in this period (Heard 2004).

Fretts 2005 estimates the following stillbirth rates for hypertensive disorders in pregnancy in a pooled international analysis:

<table>
<thead>
<tr>
<th>Hypertension Type</th>
<th>Stillbirth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic hypertension</td>
<td>6-25/1000</td>
</tr>
<tr>
<td>Mild hypertension</td>
<td>9-51/1000</td>
</tr>
<tr>
<td>Severe hypertension</td>
<td>12-29/1000</td>
</tr>
</tbody>
</table>

In Norway the risk of stillbirth in women with pre-eclampsia has decreased over time from 4.2 fold higher to 1.3 fold, compared with women without pre-eclampsia. A two fold risk of neonatal mortality has remained stable over several decades (Basso 2006).

In a Swedish record linkage study of nearly 900,000 women, compared with normotensive women, women with chronic hypertension had a significantly higher risk of fetal death (OR 2.04 95% CI 1.48 to 2.82) and neonatal death (OR 2.51 95% CI 1.69 to 3.74); after adjusting for age, parity, smoking and BMI. There was a tendency to higher mortality if the mother was older, smoked or had a high BMI, with a strong association between intrauterine death and obesity (Zetterstrom 2008).

Preterm birth, low birthweight and small for gestational age
In the study from SA, babies of women in all hypertensive groups had significantly higher risks for preterm birth and low birthweight than normotensive women, although the risk was not as high in the pre-existing hypertension group as it was for the gestational hypertension/pre-eclampsia or the superimposed pre-eclampsia groups. There was a higher risk of SGA with these latter two groups but not for pre-existing hypertension (Heard 2004; Vreeburg 2004). In this study, rates of preterm birth and SGA in hypertensive Aboriginal women were 2 to 2.5 times than in hypertensive Caucasian women (Vreeburg 2004).

In the WA Bibbulung Gnarneep cohort, the 4% of Aboriginal women who had high blood pressure during pregnancy were significantly more likely to have had either a preterm or a low birthweight baby; OR 1.8 95% 2.3 to 30.9 (Eades 2008).

What links are there for hypertension in pregnancy and other outcomes of interest?
In the SA study, the risk of emergency caesarean section was significantly higher in all three hypertensive groups than for normotensive women, with the risk of elective caesarean section only higher in the pre-existing hypertension and superimposed pre-eclampsia groups. Babies of women in all hypertensive groups had a higher requirement for more intensive nursery care, with only the gestational hypertension/pre-eclampsia and superimposed pre-eclampsia groups having a higher risk of low Apgar scores and hospitalisation beyond the neonatal period (Heard 2004).
Why might hypertension in pregnancy cause adverse birth outcomes?

Hypertensive disorders in pregnancy are thought to be caused by inadequate blood supply to the placenta, which may result in inadequate blood flow to many of the mother’s organs (Hofmeyr 2008). Death of placental tissue due to blood clots within the placenta may also be involved. In fact pre-eclampsia and eclampsia, and intrauterine growth restriction and placental abruption, are all thought to be related to abnormalities in development and formation of the placenta (Redman 2009). Some authors have suggested that infection may play a role in hypertensive disease in pregnancy (Mathew 2007).

What are the links between hypertension in pregnancy and risk/protective factors?

Diabetes
In a SA study of over 70,000 births, both gestational diabetes and pre-existing diabetes were strongly associated with all types of hypertension in pregnancy (Jacobs 2003).

Obesity
In a systematic review of over one million women, the risk of pre-eclampsia rose with increasing BMI after adjustment for other clinical and metabolic factors (O’Brien 2003). Another systematic review found a link between maternal obesity (BMI 30 or more) any hypertensive disorders; OR 2.79 95% CI 2.59 to 3.00 (Smith 2008).

Smoking
Reduced rates of pre-eclampsia have been observed in women who smoked during pregnancy (Cnattingius 2002; Jacobs 2003) although Zetterstrom 2008 has noted an increased rate with smoking.

What is the evidence for preventing or treating hypertension in pregnancy?

Prevention
Cochrane reviews indicate that antenatal calcium supplementation can almost halve the risk of pre-eclampsia (Hofmeyr 2006), with a smaller, but still significant, 17% reduction seen for antiplatelet agents (Duley 2007).

Cochrane reviews of rest (Meher 2005), exercise (Meher 2006a), garlic (Meher 2006b), dietary salt (Duley 2005, Duley 1999), nitric oxide (Meher 2007), diuretics (Churchill 2007), progesterone (Meher 2006c) or antioxidants (Rumbold 2008) have not shown reduced risk for pre-eclampsia, although marine oil shows a suggestion of promise (Makrides 2006).

Treatment
Mild to moderate hypertension
It is not clear if antihypertensive drug treatment for mild to moderate hypertension during pregnancy is worthwhile (Abalos 2007; Magee 2003).

Severe hypertension
In women with pre-eclampsia, a Cochrane review has shown a halving of the risk of developing eclampsia with magnesium together with a possible reduction in maternal mortality, although no differences were seen for stillbirth and neonatal death (Duley 2003a).

For women with eclampsia, magnesium is the most effective treatment (Duley 2003b; Duley 2003c; Duley 2000).

There is not enough evidence to recommend bed rest for severe hypertension (Meher 2005).
Ongoing projects/programs

The CHIPS trial: Control of Hypertension In Pregnancy Study
An international multicentre RCT is about to start recruiting in several countries, including Australia. The CHIPS trial will determine if pregnant women with non-severe, non-proteinuric maternal hypertension at 14-33 weeks, compared with 'less tight' control (target diastolic blood pressure (dBP) of 100 mmHg) versus 'tight' control (target dBP of 85 mmHg) have increased or decreased likelihood of pregnancy loss (ISRCTN71416914).

The following Cochrane review is currently being prepared:
- Antibiotics for preventing hypertensive diseases in pregnancy (Mathew 2007).

Further research/action required

Carroli 2001 has outlined a number of research questions for hypertensive disorders in pregnancy such as aetiology and determinants, detection, blood pressure thresholds for treatment, and evaluating drug and non-drug interventions for prevention and treatment of hypertension.

Further research is needed to try to elucidate the links between hypertension and other elements of the metabolic syndrome (such as diabetes and obesity); and to use this knowledge to test methods of reducing hypertension and allied problems in pregnancy.
References


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2.1.9 Infection in Women, Mothers and Babies

Overview
Unacceptably high rates of bacterial sexually transmitted infections (STIs) are still being detected among some Aboriginal and Torres Strait Islander communities, and this has been the case for more than a decade. The rates are particularly high for young people (National Centre in HIV Epidemiology and Clinical Research 2007). Rates of women with at least one STI were up to 20% (36% in women under 20). In SA gonorrhoea and syphilis occur predominantly in Aboriginal and Torres Strait Islander women from remote and rural areas; with the incidence for both increasing in the Aboriginal and Torres Strait Islander population across Australia.

How many pregnant women have infections which might impact on infant outcomes?

Australia
Sexually transmitted infections and blood borne viruses

In an analysis of the South Australian pregnancy outcome data 1995-99, the proportion of Aboriginal women with a STI recorded on their pregnancy outcome data form as a ‘medical condition in pregnancy’ was 1% (Westenberg 2002).

In a cohort of 456 pregnant women attending Townsville Aboriginal and Islander Health Services for shared antenatal care, 403 were screened for chlamydia, gonorrhoea and trichomonas; and 432 were screened for syphilis. A total of 92 cases with at least one STI (20.2%, 95% CI 16.5 to 23.9) were detected; 36.4% (95% CI 27.3 to 45.5) in women aged 20 years and under. The overall prevalence of chlamydia was 14.4%, gonorrhoea 6.1%, trichomoniasis 7.2% and infectious syphilis 2.5%. There was one acute hepatitis B infection, four had carrier status for hepatitis C and no HIV cases were detected (Panaretto 2006a).

In a cohort of 71 Aboriginal women attending services in Mildura, maternal syphilis was found in 28% (How 1994).

A study of 180 pregnant Aboriginal women in the Central Sydney Area reported that 3.2% were Hepatitis B antigen positive and 11.8% had Group B Streptococcus detected on antenatal screening (De Costa 1996).

In the Northern Territory, an audit of the medical records of 342 Aboriginal women aged between 20 and 45 years in one large remote community revealed a high prevalence of STIs including trichomoniasis (46%), gonorrhoea (27%), chlamydia (30%), syphilis (41%) and bacterial vaginosis (9%). One-third (32%) of women had suspected pelvic inflammatory disease (Kildea 2000).

Chlamydia
- In SA in 2006, there were 192 notifications for chlamydia from Aboriginal and Torres Strait Islander women; 10% of all female notifications (SA STD Services 2007).
- 578, or 30%, of female notifications in SA for chlamydia were from women under 20 in 2006 (SA STD Services 2007).
- In NT, SA, VIC and WA, diagnosis of chlamydia in the Aboriginal and Torres Strait Islander population showed a 61% increase (compared with a 93% increase in the non-Indigenous population).
- Rates of diagnosis among Aboriginal and Torres Strait Islander people in major cities in SA, VIC and WA were almost four times that of non-Indigenous people; among Aboriginal and Torres Strait Islander people in remote areas of NT, SA, Vic and WA, the rate was almost 13 times that of non-Indigenous people.
- Rates of diagnosis almost doubled in SA in 2006 (increase of 47% in NT, 56% in Vic, 73% in WA); compared with increases in the non-Indigenous rate of 73% in SA, 43% in NT and doubling in Vic and WA.
In both Aboriginal and Torres Strait Islander and non-Indigenous populations, the age groups 13-19 and 20-29 accounted for almost 80% of all cases; however this may reflect higher rates of testing in these age groups in both populations.

The rate of diagnosis of chlamydia in the Aboriginal and Torres Strait Islander population in the 13-19 and 20-29 groups was 9-11 times and 5-6 times respectively greater than in the non-Indigenous population in 2002-06 (National Centre in HIV Epidemiology and Clinical Research 2007).

Gonorrhoea
South Australia

- Of the 194 female gonorrhoea notifications in SA in 2006, 173 were from Aboriginal women; 131 were from Nganampa Health Services and another 26 were from rural Aboriginal health services; 65 (34%) of female notifications overall were from women under 20 in 2006 (SA STD Services 2007).
- In SA the rate of diagnosis increased more than 2.5 fold in 2006 – from 378/100,000 in 2002 to 1357/100,000 of the Aboriginal and Torres Strait Islander population – which is the highest rate of increase (but not the highest rate, which was seen in Victoria) (National Centre in HIV Epidemiology and Clinical Research 2007).

Australia

- The Australian population rate of diagnosis of gonorrhoea increased by 29% from 32.8/100,000 in 2002 to 42.2/100,000 in 2006, with an increase of 48% in the Aboriginal and Torres Strait Islander population overall (National Centre in HIV Epidemiology and Clinical Research 2007).
- The rate of diagnosis of gonorrhoea in the Aboriginal and Torres Strait Islander population was 41 times the rate in the non-Indigenous population in 2002 and was more than 46 times in 2006.
- In 2006, a substantially higher percentage of cases among the Aboriginal and Torres Strait Islander population were aged less than 30 years at gonorrhoea diagnosis (77%) compared with the non-Indigenous population (49%).
- In the Aboriginal and Torres Strait Islander population, the rate of diagnosis in the 13-19 year age group increased from 2,200 in 2002 and 3,037 in 2006, a 38% increase whereas in the non-Indigenous population the rate increased by 5% from 27.2 in 2002 to 28.6 in 2006.
- Among the Aboriginal and Torres Strait Islander population, the main form of transmission is heterosexual transmission, whereas it is predominantly male homosexual transmission in the non-Indigenous population.
- In 2006 the rate of diagnosis among Aboriginal and Torres Strait Islander women aged 13-19 was more than 100 times higher than among non-Indigenous women.
- The rate of diagnosis of gonorrhoea in the Aboriginal and Torres Strait Islander population in 2006 was substantially higher among outer regional, remote and very remote areas of NT, Qld, SA, VIC and WA, compared with major cities or inner regional areas of those states/territories (however this may be inflated by increased screening in remote areas).

Syphilis
South Australia

- Of the seven female notifications for syphilis in SA in 2006, five were from Aboriginal women (SA STD Services 2007).
- Five of these seven notifications were from Nganampa Health Service (SA STD Services 2007).
- Of the seven female notifications for syphilis in SA in 2006, five (71%) were from women under 20 (SA STD Services 2007).

Australia

- In 1995 and 1996 there was a peak of infectious syphilis in NSW with Aboriginal and Torres Strait Islander people accounting for 64% (85 cases) and 69% (50 cases) of all cases, respectively.
- In 2004-06, the rate of diagnosis increased from 37 to 51 per 100,000 in the Aboriginal and Torres Strait Islander population whereas in the non-Indigenous population, the rate of diagnosis remained stable at three per 100,000 population.
In 2006, 73% of diagnoses in the Aboriginal and Torres Strait Islander population occurred in those aged less than 30 years whereas only 22% of diagnoses in the non-Indigenous population were among those aged 30 years or less.

- The mode of transmission is mostly heterosexual in the Aboriginal and Torres Strait Islander population and predominantly male homosexual transmission in the non-Indigenous population.
- The rate of diagnosis in Aboriginal and Torres Strait Islander population in remote and very remote areas of NSW, NT, QLD, SA, Vic, WA was 156 and 81 times that in the non-Indigenous population in those areas.
- The rate of diagnosis amongst Aboriginal and Torres Strait Islander people in the NT increased five fold but remained relatively stable elsewhere (National Centre in HIV Epidemiology and Clinical Research 2007).

**Donovanosis**

- Donovanosis diagnoses continue to decline annually with only four cases reported in 2006 Australia-wide (all within Aboriginal and Torres Strait Islander communities).
- The National Donovanosis Eradication Project was implemented from 2001-04, employing strategies such as targeted surveillance, high quality education and support of primary health care workers.
- There have been no diagnoses in SA for past five years (also NSW, TAS, Vic) (National Centre in HIV Epidemiology and Clinical Research 2007).

**Human Immunodeficiency Virus (HIV)**

- Of the 44 individuals diagnosed with HIV in SA in 2007, only one (2%) was reported from an Aboriginal person, who was male (SA STD Services, 2007).
- Of the 73 HIV infections reported in SA females from 1985 to 2006, six (8%) were from women under 20 – one of these being diagnosed in 2006 (SA STD Services 2007).
- Within the Aboriginal and Torres Strait Islander community the annual number of new HIV diagnoses has remained stable or even declined for the past five years, in contrast to increases seen in the non-Indigenous population (National Centre in HIV Epidemiology and Clinical Research 2007).
- The number of new diagnoses increased in Australia by 31% between 2000 and 2006, with similar rates for Aboriginal and Torres Strait Islander and non-Indigenous populations, (with a decline in both from 1997 to 2001); a similar pattern was observed for AIDS.
- Among Aboriginal and Torres Strait Islander people, the percentage of HIV infections attributed to injecting drug use increased from 5% in 1992-98 to 18% in 2002-06 (remaining constant at 3% in the non-Indigenous population) (National Centre in HIV Epidemiology and Clinical Research 2007).

**Hepatitis C virus (HCV)**

- In SA in 2006, 35 (15%) of the 235 new diagnoses of HCV in females were reported from Aboriginal and Torres Strait Islander women (SA STD Services 2007).
- Of the 235 women diagnosed in SA with HCV in 2006, 13 (6%) were in women under 20 (SA STD Services 2007).
- The rate of newly diagnosed HCV in the Aboriginal and Torres Strait Islander population increased from 122 in 2002 to 163 in 2006 whereas the rate remained stable in the non-Indigenous population at around 52 per 100,000 population. (The rate declined in the 13-19 age group but increased in the 20-29 age group for Aboriginal and Torres Strait Islander people.)
- Among people seen at needle and syringe programs, HCV prevalence was high, increasing in the Aboriginal and Torres Strait Islander population by 13% from 62% in 2002 to 70% in 2006; and in the non-Indigenous population, increased by around 7% from 56% in 2002 to 60% in 2006.
- The difference between diagnosis rates was greatest for SA where it was between five and 10 times higher in the Aboriginal and Torres Strait Islander population than in the non-Indigenous population (National Centre in HIV Epidemiology and Clinical Research 2007).
Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

Hepatitis B virus (HBV)

- In SA, four (4%) of the 112 women newly diagnosed with HBV were Aboriginal and Torres Strait Islander women.
- The rate of diagnosis of newly acquired HBV in the Aboriginal and Torres Strait Islander population more than doubled over the past five years from three per 100,000 in 2002 to seven per 100,000 population in 2006, whereas the rate declined in the non-Indigenous population from two in 2002 to one in 100,000 in 2006.
- The rate of new diagnoses is relatively stable in 13-19 age group, but more than doubled in the 20-29 age group.
- There is a continuing need for vaccination programs to provide protection for adults who may have missed neonatal or school-based HBV vaccination.
- In SA overall, newly acquired diagnoses of HBV amongst Aboriginal and Torres Strait Islander people have increased to seven per 100,000 in 2006 (from 0 in 2004 and 2005) (National Centre in HIV Epidemiology and Clinical Research 2007).

International HIV

- The proportion of Canada’s total HIV/AIDS cases contracted by Aboriginal people has risen sharply – from 1.0% in 1990 to 7.2% in 2001 (Adelson 2005).

Teenage women

- In the United States, approximately three million teens become infected with an STI each year and females aged 15-19 years have the highest rate of STIs compared to other age and gender groups (Berman 1999; Meade 2005).
- Across seven independent US samples, 10-51% of mothering teens reported a history of STIs prior to their index pregnancy, with a weighted mean of 23.8% (95% CI 21.6% to 26.0%) (Meade 2005).
- Across six US studies that used biological measures to diagnose STIs, 19-39% of pregnant teens tested positive for chlamydia, trichomoniasis, and/or gonorrhoea (weighted mean 28.8% 95% CI 26.2% to 31.4%) and 8-19% became infected or reinfected during pregnancy (Meade 2005).
- In two US studies of postpartum STIs, 14-39% of teen mothers were diagnosed with an STI within six to 10 months following birth (Meade 2005).

Urinary tract infection (UTI)

- In SA, between 1995-1999, the proportion of pregnant Aboriginal and Torres Strait Islander teenagers with a recorded UTI on their perinatal data form was 10.7%; and 6.9% among pregnant Aboriginal and Torres Strait Islander women aged 20 years or more (Westenberg 2002).
- The overall rate of urinary tract infections for women giving birth in SA in 2007 was 2.3% (447/19,471) (Chan 2008).
- In an audit of medical records of pregnant Aboriginal and Torres Strait Islander women attending 10 rural and remote primary health services in the NT (2002-03) the proportion of women with a confirmed UTI at first antenatal visit was 16% (95% CI 10%, 21%), and 23% (95% CI 18%, 28%) had at least one UTI during the pregnancy (Bookallil 2005). These findings are similar to those reported among pregnant Aboriginal and Torres Strait Islander women attending services in Townsville (2000-03), where 24% had a UTI and 4% had persistent bacteriuria in the pregnancy (Panaretto 2006a).
- A study of pregnant women living in the Central Sydney Area reported a 4.8% prevalence of UTIs among Aboriginal and Torres Strait Islander women, who were twice as likely to have a UTI in pregnancy than non-Aboriginal women in the same area (RR 2.45 95% CI 1.27 to 4.30) (De Costa 1996).
- In South Australia, a report on all registered Aboriginal and Torres Strait Islander births in 1981 and 1982 reported an 8% overall prevalence of UTI compared with 2.8% among all SA births in that time period (Hart 1985).
Rubella

- The incidence of rubella and congenital rubella syndrome is low, however Aboriginal and Torres Strait Islander women have been identified as a population group vulnerable to rubella.
- A study of Aboriginal women birthing at the Royal Darwin Hospital in 1999 demonstrated that fewer than 75% of Aboriginal women from rural and remote communities had adequate levels of rubella immunity (Hunt 2004).

How many infants develop infections which are life threatening?

Fatal infections

A study of infant mortality in Western Australia (1980-2001) found that the main causes of infant death for Aboriginal and Torres Strait Islander infants were sudden infant death syndrome (SIDS) and infection, which are largely preventable, in contrast to birth defects and prematurity in non-Aboriginal infants (Freemantle 2006). The mortality rate for deaths caused by infections was 5·9 per 1000 livebirths for Aboriginal infants, compared with 0·7 per 1000 livebirths for non-Indigenous infants (RR 8·5, 95% CI 7·1 to 10·2), and the risk of death from infection was significantly higher among Aboriginal infants living in remote areas. The main causes of deaths from infection were respiratory infection followed by chorioamnionitis (infection in the placental membranes).

In this study, while infant mortality rates improved overall for both Aboriginal and non-Indigenous children, the study found increasing disparities in mortality rates for all major causes of death, including infection; this is due to the non-Indigenous rate improving faster than that for Aboriginal children (Freemantle 2006).

Early onset group B streptococcal sepsis

Early onset group B streptococcal sepsis (EOGBS) is more than three times as common in Aboriginal and Torres Strait Islander babies delivered in hospital than in non-Aboriginal babies (Australasian Study Group for Neonatal Infections 1995), but a steady fall in EOGBS infections has been observed in recent years. Among Aboriginal and Torres Strait Islander babies, the incidence of EOGBS fell significantly from 5.2 per 1000 live births (95% CI 1.8 to 8.6) in 1991 to 1993 and 5.1 (95% CI 3.0 to 7.2) in 1993 to 1995 to 1.8 (95% CI 1.1 to 2.5) in 1995 to 1997 (P < 0.05) (Isaacs 1999). Similar falls have been observed among non-Indigenous babies, a fall that has been attributed to antenatal screening and increasing use of intrapartum antibiotics.

Diarrhoea

Infectious diarrhoea has been a major cause of death in Aboriginal infants and children but now rarely results in death; for example, no deaths of Aboriginal infants or children were recorded from 1990 to 2000 inclusive in WA hospitals (Gracey 2003).

Vaccine preventable infectious diseases 2003-2006 (Menzies 2008)

- **Haemophilus influenzae type b (Hib):** Vaccination has dramatically reduced the incidence of Hib among Aboriginal and Torres Strait Islander children, however the incidence of Hib remains nearly nine times higher among Indigenous children than non-Indigenous children, with the greatest difference occurring in children aged 0-4 years (Indigenous notifications 4.3 per 100,000 vs. non-Indigenous notifications 0.4 per 100,000).

- **Hepatitis A:** In the 0-4 age group, the incidence of Hepatitis A is 24 times higher among Aboriginal and Torres Strait Islander infants compared with non-Indigenous infants (Indigenous notifications 33.9 per 100,000 vs. non-Indigenous notifications 1.4 per 100,000).

- **Hepatitis B:** As a result of vaccination programs, rates of acute Hepatitis B infection are low in Aboriginal and Torres Strait Islander and non-Indigenous children (Aboriginal and Torres Strait Islander notifications 0.6 per 100,000 vs. non-Indigenous notifications 0.3 per 100,000).

- **Influenza and pneumonia:** Rates of influenza and pneumonia are significantly higher among Aboriginal and Torres Strait Islander people than non-Indigenous people, most notably in children less than five years of age (Indigenous hospitalisation rate 2,830 per 100,000 vs. non-Indigenous hospitalization rate 813 per 100,000) and older people.
Measles: As a result of universal immunisation, measles notifications and hospitalisations are at record lows in Australia, including among Aboriginal and Torres Strait Islander children (notification rate 0.6 per 100,000).

Meningococcal disease: In the age group 0-4 years, the rate of meningococcal disease in Aboriginal and Torres Strait Islander children is almost five times the rate for non-Indigenous children (Indigenous notification rate: 44.9 per 100,000 vs. 9.2 per 100,000).

Pertussis: Pertussis notifications are high across all age groups in Australia, however pertussis disproportionately affects Aboriginal and Torres Strait Islander children in the 0-4 age group (Indigenous notification rate: 64.6 per 100,000 vs. non-Indigenous notification rate 41.7 per 100,000).

Pneumococcal disease: Rates of invasive pneumococcal disease are higher among Aboriginal and Torres Strait Islanders than other Australians across all age groups. In the age-group 0-4 years the notification rate is 65.2 per 100,000 compared with 35.8 per 100,000 in non-Indigenous children of the same age group.

Vaccine coverage
By the age of 24 months, vaccine coverage is similar among Aboriginal and Torres Strait Islander children and non-Aboriginal children for universally funded vaccines. However, delayed vaccination is more common among Aboriginal children, who are less likely to be fully vaccinated at 12 months of age.

In the Northern Territory health checks, 16% of children (1409) were due for immunisations (AIHW 2008).

What is the link between infection and infant mortality preterm birth, small for gestational age or low birthweight?

In a study of Aboriginal and Torres Strait Islander women in northern Queensland, an increased proportion of low birthweight births and perinatal deaths were significantly associated with STI and infectious syphilis during the pregnancy. The proportion of low birthweight was 11.1% overall; and 18.1% for women with STI, 36.4% for women with infectious syphilis. The overall perinatal mortality rate was 2.4%; and 5.9% for women with STI, 18.2% for women with infectious syphilis. The proportion of preterm birth was 8.7% overall; 10.6% among women with an STI and 18.7% among women with infectious syphilis (Panaretto 2006a).

In this study, the subgroup at greatest risk of preterm birth was women with a previous preterm birth and infection in the current pregnancy. There were no significant differences in perinatal outcome between the groups with and without chlamydia, gonorrhoea and trichomoniasis. The association of grouped STI with low birthweight and perinatal mortality was largely due to the presence of infectious syphilis. On controlling for confounders with multivariate analysis, syphilis does not persist as an independent predictor of poor pregnancy outcome, which may be due to the size of the data set and lack of power, or syphilis being a marker for other risk factors such as young maternal age or alcohol use (Panaretto 2006a).

In a retrospective case-control study of Aboriginal women in Western Australia, Aboriginal women who gave birth to a low birthweight baby (≤ 2250 g) had a significantly higher rate of genital or urinary tract infections during pregnancy, or both, than Aboriginal women who have given birth to a baby weighing ≥ 3000g or more (68% compared with 44% respectively), and a significantly higher number of infections. Trichomonas, bacterial vaginosis with any of the Gardnerella vaginalis, bacteroides species or anaerobic streptococci; and Group B Streptococcus were significantly more common in the genital tract of women giving birth to low birth weight infants. Similarly, Escherichia coli was significantly more common among cultured urine samples of these women. After controlling for confounding factors, the odds ratio for low birth weight when genitourinary tract infection was present at delivery was 3.99 (95% CI 2.28 to 6.99). Smoking in pregnancy was not controlled for in the analyses, however, there was no significant difference in the proportion of women smokers between the two groups (Schultz 1991).
Amongst a cohort of 71 Aboriginal women attending services in Mildura, the odds ratio for preterm birth associated with syphilis in pregnancy was 21.5 (95% CI 2.26 to 205) and the relative risk of stillbirth in the presence of syphilis was 4 (95% CI 2.56-6.25) (How 1994).

In addition to genital and urinary tract infections, oral infection occurring in periodontal disease has been associated with preterm birth and low birthweight. A meta-analysis of observational studies of the association between periodontal disease and preterm birth and/or lowbirth weight reported an overall odds ratio of 2.83 (95% CI: 1.95-4.10, P < 0.0001), although there were concerns about the quality of many of the included studies (Vergnes 2007).

What are the population attributable risks (PAR) of maternal infection for infant mortality, preterm birth, small for gestational age or low birthweight?

In a study of Aboriginal women in Western Australia, the PAR of low birthweight to genitourinary tract infection in the Aboriginal population was calculated to be 32.1% (95% CI 16.8% to 48.6%) (Schultz 1991). When threatened spontaneous abortion and premature rupture of the membranes were excluded as risk factors from the multivariate analyses, the PAR of low birthweight to genitourinary tract infection in the Aboriginal population was 37.7% (95% CI 22.4% to 53.4%).

In the 2006 South Australian Pregnancy Outcomes Report the proportion of LBW babies recorded for Aboriginal and Torres Strait Islander women was 14.3%; the proportion of preterm birth was 15.9% and the perinatal mortality rate was 14.3 per 1000 births (Chan 2007). Using these population figures and the infection rates among Aboriginal and Torres Strait Islander women in Townsville, the calculated PAR for LBW associated with infection in SA was 34.2%. The PAR of preterm birth to infection was 48.2%.

These figures are similar to the PARs calculated for smoking and poor perinatal outcomes in SA Aboriginal and Torres Strait Islander women, which have been estimated at 35% for low birthweight; 48% for SGA (59% for births to Aboriginal and Torres Strait Islander teenagers), and 20% for preterm birth (Chan 2001).

What links are there for maternal infection and other outcomes?

Other perinatal outcomes
In addition to increased risks of preterm birth, low birthweight and perinatal mortality, pregnant women with STIs have higher rates of ectopic pregnancy, spontaneous abortion, and stillbirth compared with women without STDs (Watts 1999). Other genital tract infections that are not sexually transmitted are also implicated in poor perinatal outcomes. For example, in an Australian study of 428 stillbirths, the incidence of chorioamnionitis was 36.9%, with higher incidence in stillbirths occurring in early or late gestation (Lahra 2007).

There is inconsistent evidence about the relationship between infection and pre-eclampsia. One systematic review found that any infection in pregnancy (bacterial or viral) was associated with a two fold higher risk of pre-eclampsia (Rustveld 2008). However, another review concluded that the risk of pre-eclampsia was increased among pregnant women with a urinary tract infection or periodontal disease, but not for other infections such as chlamydia or HIV (Conde-Agudelo 2008).

Long term outcomes
There are well-established long-term sequelae of preterm birth and low birthweight, including neurological and respiratory impairment as well as risk of chronic disease in later life. However, a follow up study of preterm infants exposed to acute inflammation in utero found no additional and direct effect of inflammation on risk of adverse childhood outcomes beyond that conferred by preterm delivery (Andrews 2008).
Why might maternal infection cause adverse birth outcomes?

Maternal infections, including some STIs, can be transmitted perinatally from mother to infant, leading to life-threatening congenital infections and complications (Meade 2005). Maternal infections can also cause systemic inflammation, and the release of inflammatory factors which can cross the placenta and cause direct damage to the developing fetus.

Bacterial infections within the uterus can occur between maternal tissues and the fetal membranes, or within the fetal membranes, placenta, amniotic fluid, fetus or umbilical cord (Goldenberg 2000).

In preterm birth, most bacterial infections in the uterus are associated with organisms that have passed through the cervix from the vagina. Bacterial invasion results in an inflammatory response; this stimulates prostaglandin synthesis and thus uterine contractions and the release of metalloproteases which attack the chorioamniotic membranes leading to rupture (Goldenberg 2000). Bacterial organisms commonly associated with preterm labour include Gardnerella vaginalis, Mycoplasma hominis, Ureaplasma urealyticum and bacteroides species, all of which are indicative of bacterial vaginosis. However, other genital infections such as asymptomatic bacteriuria, gonorrhoea, chlamydia and trichomonas vaginalis, as well as oral infections occurring in periodontal disease, have also been associated with preterm birth and premature rupture of membranes.

In the case of stillbirth associated with infection, this may occur from:
- maternal systemic infection and death resulting from inflammation with or without direct fetal infection or maternal infection causing placental insufficiency;
- fetal damage due to infection early in the pregnancy causing congenital anomalies (e.g. rubella); or
- multiple factors where infection and/or inflammation result in preterm birth (e.g. chorioamnionitis), IUGR and perinatal mortality (Rawlinson 2008).

Both bacterial and viral infections have been associated with stillbirth including infections such as Group B Streptococcus, syphilis, toxoplasmosis, chorioamnionitis, listeria, parvovirus and cytomegalovirus.

What are the links between maternal infection and other risk/protective factors?

Amongst Aboriginal and Torres Strait Islander women in north Queensland, predictors for STI in pregnancy were young age (less than 20 years), harmful/hazardous alcohol use and unwanted pregnancy, as well as domestic violence, adjusted for parity, BMI and history of stillbirth (Panaretto 2006a). There was no association with place of residence, education status, number of antenatal care visits, timing of antenatal care or other complications of pregnancy.

In Western Australian, early cessation of breastfeeding (i.e. less than three months) has been identified as a risk factor for recurring chest infection and hospitalisations for these infections among Aboriginal children (Oddy 2008).

There are associations between infection and drug use – in a study of pregnant Australian teenagers, overall infection rates were high, with over half the teens having at least one infection during the antenatal period. The survey also found significantly higher infectious morbidity for chlamydia and endocervical pathogens in multidrug users, compared with non drug users in pregnancy (Quinlivan 2002).

Teenage women are thought to be at heightened risk of STIs due to the immature anatomical development of their cervix, and pregnant teens are at greater risk due to cervical changes occurring in pregnancy (Watts 1999). A review of predominantly American studies assessing sexual risk behaviour in pregnant and mothering teenagers found that sexual risk factors were derived from multiple areas related to: individual factors (e.g. attitudes, frequent intercourse, inconsistent contraception), inter-personal and social relationships (e.g. peer norms), as well as family (e.g. not residing with family) and community factors (e.g. 
poverty) (Meade 2005). The review concluded that teen pregnancy was a strong marker for future sexual risk behaviour and adverse outcomes.

Other research undertaken in the US demonstrated an association between stressful exposures in pregnancy and bacterial vaginosis, and concluded that at least some of the ethnic differences in the incidence of bacterial vaginosis (where there is a high disease burden among black women) can be explained by variation in exposure to chronic stress (Culhane 2002). Poor nutrition has also been associated with bacterial vaginosis, with a significantly increased risk of bacterial vaginosis demonstrated among women with high energy intake, particularly high fat intake, after adjusting for confounding factors (Neggers 2007).

What is the evidence for preventing/reducing maternal infection in women of reproductive age?

Population-based programs to prevent and treat sexually transmitted infections
Sustained reductions in the prevalence of some sexually transmitted infections from previously very high rates have been demonstrated in programs conducted in remote Aboriginal and Torres Strait Islander communities in the Northern Territory (Su 2007) and northern South Australia (Huang 2008). The key elements of these programs include the employment of a dedicated sexual health program coordinator located within primary health care services, community-based steering committees providing program direction and advice, a focus on increasing opportunistic testing as well as annual population-wide sexual health screening, gender-specific staffing and facilities and community education activities.

Preventing and treating infection in pregnancy
There is a large body of literature assessing interventions to prevent or treat infection in pregnancy, which is summarised below:

- There is clear evidence for the routine use of antibiotics for women with preterm prelabour rupture of membranes; a Cochrane review concluded that among these women treatment is associated with a delay in delivery and reduced poor neonatal infectious, respiratory and development outcomes (Kenyon 2003).
- A Cochrane review assessing antibiotic treatment in pregnant women with asymptomatic bacteriuria (urinary tract infection) detected on antenatal screening, concluded that treatment is effective in clearing asymptomatic bacteriuria, and associated with a reduction in pyelonephritis and low birthweight babies (Smaill 2007).
- A Cochrane review assessing the effectiveness of antibiotic treatment for bacterial vaginosis in pregnancy found that treatment can eliminate bacterial vaginosis, however treatment did not reduce the risk of preterm birth (McDonald 2007). Treatment prior to 20 weeks pregnant may prevent preterm birth, but this needs to be confirmed in further large trials.
- A Cochrane review based on one large study (4155 women) concluded that general infection screening and treatment programs in pregnant women may reduce preterm birth and preterm low birthweights (Swadpanich 2008).
- A Cochrane review assessing the effectiveness of probiotics for preventing preterm birth concluded that there is evidence for reduced genital infections in pregnancy with the use of probiotics, however there is insufficient evidence to assess the impact on preterm birth and related complications (Othman 2007).
- A Cochrane review assessing the effectiveness of antibiotics given to women with ureaplasma in the vagina concluded that there is insufficient evidence to determine whether giving antibiotics will prevent preterm birth (Raynes-Greenow 2004).
- There is inconsistent evidence about the use of prophylactic antibiotics in pregnancy. One systematic review concluded that giving antibiotics in pregnancy to women at risk of preterm birth does not reduce the risk of having a subsequent preterm birth (Simcox 2007). However, a Cochrane review concluded that antibiotics given in the second or third trimester reduced the risk of prelabour rupture of membranes amongst unselected women, and among women at high risk of...
preterm birth (i.e. a previous preterm birth), reduced the risk of low birthweight and postpartum endometritis (Thinkhamrop 2002).

- There is inconsistent evidence about the treatment of trichomoniasis in pregnancy – a Cochrane review concluded that metronidazole is an effective treatment of trichomoniasis infection during pregnancy, but may increase the risk of preterm and low birthweight babies (Gulmezoglu 2002).
- A systematic review using Cochrane methodology found a significant reduction in preterm birth with periodontal therapy during pregnancy compared with postnatal therapy (Thomas 2008), although a large trial of a similar comparison, recently published as an abstract, did not find a difference in preterm birth between women having treatment during pregnancy compared with women having treatment after birth (Offenbacher 2008).

**Preventing infection in pregnant teenagers**

A review of interventions targeting sexual risk behaviours among pregnant or mothering teenagers found a distinct lack of interventions aimed at reducing risk in this population (Meade 2005). Only one intervention was designed to reduce HIV and STI risk behaviour, the remaining eight identified studies focused on reducing repeat pregnancy. In the one study assessing a STI and HIV prevention program, at 12 month follow-up participants in the program had greater condom use intentions, but there was no difference seen in the frequency of unprotected sex between control participants.

**What is the evidence for preventing/reducing infant infection which is life threatening?**

There has been a continued decline in the rates of many vaccine preventable diseases associated with universal vaccination programs as well as programs targeted to high-risk population groups including Aboriginal and Torres Strait Islander people (Menzies 2008). Similarly, since the introduction of rubella immunisation, the incidence of rubella infection among women of reproductive age in South Australia has fallen dramatically (Cheffins 1998).

**Strategies/programs to encourage pregnancy women to participate in programs to prevent/reduce maternal and neonatal infection**

Having a dedicated sexual health program coordinator has been identified as a key element of successful population-based sexual health programs in remote Aboriginal and Torres Strait Islander communities in the Northern Territory and northern South Australia (Su 2008; Huang 2008). In addition, the development of self-administered testing with tampons as a screening method for STIs has proved to be a reliable and acceptable form of screening among Aboriginal women in remote communities and has increased access to diagnostic services (Tabrizi 2007).

Preventing or reducing maternal and infant infections will require strategies that improve access to quality antenatal care, and facilitate early initiation of care, so that women can participate in routine infection screening in pregnancy and access timely treatment. Improving access is possible, as evidenced by programs such as the Townsville Mums and Babies program, a community-based and focused care program which demonstrated that by the end of 2005, approximately 90% of all women attending for antenatal care were screened for sexually transmitted disease and had serological tests for hepatitis B and syphilis (Panaretto 2007).
What are the barriers to/facilitators for preventing or reducing infection?

Barriers are likely to be both cultural and health service-related. In many communities “women’s business is women’s business and men’s business is men’s business”; this is likely to hold for the city as well as country and for young people (Kelly 2007). In order to deliver culturally appropriate sexual health care this may require services to employ separate men’s and women’s Aboriginal sexual health workers, and in some instances have physically separate facilities, which increases workforce requirements and resources. For some services, prioritising sexual health is hampered by the competing demands associated with the management of acute health problems.

Including sexual health in the core training of all Aboriginal and Torres Strait Islander health workers is an important step towards addressing this issue. Furthermore, including STI screening, particularly bacterial STI screening in routine care protocols such as those within antenatal care and chronic disease management, will help to reduce stigma, and increase access to diagnostic services.

Ongoing or recent projects/programs

In 2004, the SNAKE Condoms project was piloted by the Victorian Aboriginal Community Controlled Health Organisation (VACCHO), Marie Stopes Australia (MSA) and the Mildura Aboriginal Health Service. The project promotes culturally appropriate condoms at a subsidised price, using social marketing approaches delivered by peer educators that aim to positively affect sexual behaviour (http://www.mariestopes.org.au/cms/snake-condoms.html). Based on the success of the pilot, the project has been expanded nationally and sales of snake condoms continue to grow from 10,017 in 2006 to 96,300 in 2008.

The ‘Telling It Like It Is’ programme is sexual health peer education initiative developed by MSA, VACCHO and Family Planning Victoria, that aims to provide culturally appropriate sexual health peer education for Victorian Aboriginal youth given by Aboriginal teenage parents. The program is ongoing with toolkits developed for health workers and peer educators about the program distributed nationally to Aboriginal and Torres Strait Islander communities.

The Mooditj program is a culturally specific program for Aboriginal youth 1-14 years of age which has been developed by Family Planning WA, after consultation with members of over 200 regional and rural Indigenous communities. Mooditj integrates issues of sexual health with physical, mental and emotional wellbeing, and promotes knowledge and personal resilience skills by providing an environment where young people can feel comfortable talking about sexual health. More than 300 Mooditj ‘leaders’ have been trained to facilitate the program, which has been implemented in Aboriginal communities in WA, NT, SA and NSW. The Mooditj program won the 2006 Healthway Excellence in Health Promotion Award (AMA 2008).

The Queensland Aboriginal and Islander Health Council has recently launched a new sexual health manual to combat high rates of STIs, titled ‘Early Detection and Treatment of Sexually Transmissible Infections and Blood Borne Diseases: a Manual for Improving Access to Early Detection and Treatment Programs for Aboriginal and Torres Strait Islander people in Queensland’ (Gwalwa-Gai newsletter – www.crcah.org.au [accessed 23 January 2009]).

The Indigenous Peer Education Project (IPEP) was developed and implemented by Sexual Health and Family Planning ACT with funds provided through the National Indigenous Sexual Health Strategy 2002-04, with the main aim of developing peer sexual health mentors (Mikhailovich 2005) – see section 2.5 for further details.
‘Healthy Homes’ has been identified as one of the Council of Australian Governments (COAG) building blocks for ‘Closing the gap’ with strategies and funding planned to improve housing for Aboriginal and Torres Strait Islander people, which will reduce overcrowding and enable good hygiene practices (www.coag.gov.au).

A multisite randomised controlled trial is currently evaluating the effectiveness of group antenatal care to reduce human immunodeficiency virus (HIV) risk behaviour and sexually transmitted diseases among pregnant women aged 14-25 in the United States. A secondary analysis assessing the impact of group care on perinatal outcomes has shown a reduced rate of preterm birth among women receiving group care (Ickovics 2007).

**Interpretation/comments**

In many Aboriginal and Torres Strait Islander communities with a high prevalence of STI there is likely to be early sexual debut (National Centre in HIV Epidemiology and Clinical Research 2007). Although this has not been rigorously assessed, this suggests that many of the cases of STIs in young people result from sexual contact among similar aged peers. Social network theories identify the immediate social network as a key determinant of sexual health risk, particularly when there is high partner concurrency, indicating that STI management programs need to consider broader contextual factors such as peer norms, in addition to individual risk factors. This may be a useful approach for STI programs within Aboriginal and Torres Strait Islander communities. For example, the link between STI and hazardous and harmful alcohol use identified among Aboriginal people in Townsville was largely related binge drinking among younger community members (Panaretto 2006a).

**Further research/action required**

**Actions**

- Inclusion of sexually transmitted infection protocols in all antenatal guidelines;
- Improved implementation of immunisation programs in infancy and for school-age girls and boys, to ensure timely initiation of vaccines;
- Ongoing catch-up vaccination programs to provide protection for adults who may have missed neonatal and school based hepatitis B vaccination;
- Strategies to support mothers to continue breast-feeding;
- Strategies to increase access to sexual health services for adolescents and young adults.

**Priorities for research**

- The development of interventions to reduce sexually transmitted infection that: (a) focus on adolescents and young adults; and (b) move beyond individual risk factors and consider the broader contextual factors;
- Interventions to improve perinatal outcomes once infection is detected, given the inconsistent evidence about antibiotics and preterm birth and other perinatal outcomes;
- Research investigating why the incidence of vaccine preventable diseases is still higher in Aboriginal and Torres Strait Islander children;
- Investigation of why the transmission of blood borne viruses via intravenous drug use is increasing among Aboriginal and Torres Strait Islander people;
- Investigating the reasons for the dramatic increase in rates of gonorrhoea in South Australia.
References


Preventing infant deaths among Aboriginal and teenage women in South Australia


2.1.10 Nutrition

How many pregnant women have nutritional problems which might impact on infant outcomes?

Aboriginal and Torres Strait Islander women, babies and children

- 28% of low birthweight and 15% of intrauterine growth restriction could be attributed to continuing poor nutrition of Aboriginal and Torres Strait Islander women in the Darwin region; and 15% of mothers were classified as undernourished immediately after the birth of their baby (Sayers 1997).
- Poor nutrition may be having an influence well before childbearing years – in the Northern Territory, 14% of children under five were underweight compared with the expected 2.3% population distribution (Li 2007) and at 11 years of age, 10% of Aboriginal and Torres Strait Islander children in the Darwin region were underweight with a marked urban-rural differential (2% versus 13%) (Mackerras 2003).
- A group of Aboriginal and Torres Strait Islander women in Far North Queensland were shorter and lighter, with lower BMI than a group of non-Indigenous women (Humphrey 2001).
- Anaemia rates of 26% to 34% have been reported in Northern Territory and Queensland Aboriginal and Torres Strait Islander women (Sayers 1997; Panaretto 2006b) suggesting that nutrition may be compromised in these women.
- Rates of neural tube defects have remained high in Aboriginal babies in Western Australia, with the Indigenous rates (2.56/1000 in the period with both promotion of supplements and voluntary food fortification) twice those in non-Indigenous infants, suggesting that the mainstream promotional strategies have had no effect in the Aboriginal population (Bower 2004a; Bower 2006).
- In a report covering the period 1998-2005, Aboriginal and Torres Strait Islander women had more than twice the risk of experiencing a birth affected with a neural tube defect (9.1 per 100,000 women giving birth versus 4.4). For both groups, just over half of births were live births, with Aboriginal and Torres Strait Islander babies having twice the risk of neonatal death compared with non-Indigenous babies (Abeywardana 2008).
- The only paper identified as recording dietary intake in an urban Aboriginal and Torres Strait Islander population (88% were females with a mean age of 44 years) showed a higher intake of protein and cholesterol than the median Australian intake, and lower intakes of vitamin A, vitamin C, niacin, potassium, magnesium, iron and fibre. Many individuals had vitamin A, thiamine, riboflavin, folate, vitamin C, magnesium, calcium, phosphorus, iron and zinc deficiencies (Longstreet 2008).

South Australia, overall population

In 2007, 5.4% of pregnant women were anaemic in their current pregnancy (Chan 2008).

Western Australia, overall population

In WA, the prevalence of neural tube defects (including terminations) has fallen from approximately 2/1000 prior to 1995-99 to 1.4/1000 in 2000-04 after the introduction of national supplementation guidelines and voluntary fortification of some foods (Bower 2006).

First Nations, Canada

Nutrient intake in pregnant Cree women was adequate for most nutrients, although some food sources were high energy and low nutrient. Dietary folate was low and cholesterol level high, reflecting low intakes of fruit and vegetables and the abundance of eggs in the diet (Gray-Donald 2000).

Teenagers

- Adolescent girls commonly have inadequate intakes of certain vitamins (folate, vitamins A, E and B6), minerals (calcium, iron and zinc), and fibre, as well as excessive intakes of total fat, saturated fat, sodium and cholesterol (Story 1997).
It is unclear whether the diets of low-income adolescents are nutritionally poorer than those of higher-income adolescents, with several studies (though not all) showing poorer nutritional status in low-income adolescent women (Story 1997).

Young, still-growing pregnant adolescents have greater energy and nutrient needs than do more mature pregnant women (Scholl 1995b).

Inadequate weight gain by adolescent gravidas early in pregnancy (< 4.3 kg by 24 weeks gestation) has been associated with an increased risk of SGA infants, which was not diminished by later adequate or compensatory gains (Hediger 1989).

**Targets**
The proposed national nutritional risk scheme proposed by COAG aims to reduce the incidence and prevalence of undernutrition; and to reduce low birthweight levels to those of non-Indigenous people.

Another COAG health status targets is for more than 90% of Aboriginal and Torres Strait Islander families able to access a standard healthy food basket (or supply) for a cost of less than 25% of their available income by 2018 (Close the Gap 2008).

**How many infants have nutritional problems which are life-threatening?**

**Australia – Aboriginal and Torres Strait Islander infants**
The proportion of Aboriginal and Torres Strait Islander infants from central Australia who fail to thrive has been estimated to be 2-3% of infants aged 0-6 months and 20% of infants aged 6-12 months (Balmer 1997).

In the Northern Territory Child Health Checks, 15% of children were found to have anaemia (AIHW 2008).

**International**
Under-nutrition and child mortality have a strong link (Caulfield 2004). Some of this is due to micronutrient deficiencies, mostly vitamin A and zinc (Bhutta 2008).

**What is the link between maternal/neonatal nutrition and infant mortality, preterm birth, small for gestational age or low birthweight?**

**Low pre-pregnancy weight, low maternal weight gain, and inadequate dietary intake**

- In Darwin, infants born to Aboriginal and Torres Strait Islander mothers with a BMI of less than 18.5 had five times the odds of having low birthweight babies and more than double the odds of intrauterine growth restriction (Sayers 1997).
- The babies from a group of Aboriginal and Torres Strait Islander women in Far North Queensland were on average almost 450 g smaller than their non-Aboriginal counterparts and slightly shorter (Humphrey 2001).
- Low maternal weight gain and low pre-pregnancy weight (along with smoking) account for nearly two-thirds of growth retardation in infants (Shiono 1995).
- In a meta-analysis of approximately 11,000 births, there was an inverse relationship between amount of maternal weight gained during pregnancy and higher rates of low birthweight and intrauterine growth restriction (Kelly 1996).
- Low weight gain in the second trimester is associated with approximately double the risk of intrauterine growth restriction and low weight gain in the third trimester with a slightly lesser risk, while low weight gain in the first trimester was not influential (Strauss 1999).
- In a US cohort study of 20,465 nondiabetic term singleton births, a weight gain of less than 7 kg (compared with a normal weight gain of 11.5 to 16 kg) during pregnancy, was associated with significantly higher rates of small for gestational age babies (adjusted OR 2.26 95% CI 1.76 to 2.90) (Stotland 2006a).
Nutritional deficiencies

- Lack of nutrients or oxygen during pregnancy may result in small size and disproportion at birth (Mackerras 1998).
- Young women entering antenatal care with iron-deficiency anaemia had a threefold increase in the risk of having an LBW infant and more than a twofold increase in the risk of preterm birth (Scholl 1995a).
- Low micronutrient intakes of zinc and folate may be associated with an increased risk of LBW and preterm birth in adolescents (Scholl 1995b).
- Iodine deficiency during pregnancy can cause abortion, stillbirth, congenital anomalies, and increased perinatal and infant mortality (National Health and Medical Research Council 2006).

Dietary habits

Women who consumed meals/snacks less frequently had a higher risk of delivering preterm (adjusted OR 1.30 95% CI 0.96 to 1.76) and premature rupture of the membrane (adjusted OR 1.87 95% CI 1.02 to 3.43); n=220 – adjusted for pregravid BMI, total energy intake during the second trimester and prenatal supplement use (Siega-Riz 2001).

International Folate

More than one-half of pregnancies affected by neural tube defects probably end in medical termination or fetal/infant death, while the surviving infants will be born with significant disability and other serious health problems (Meyer 2004).

Food security

In a US case control study of nearly 2000 women, food insecurity was associated with increased risk of birth defects such as spina bifida and anencephaly (Carmichael 2007).

What links are there for nutritional problems and other outcomes?

- Vitamin A in large doses can produce spontaneous abortion and fetal malformations (Abrams 1993).
- Increased risk of maternal complications, including premature rupture of the membranes, infection and anaemia has been reported for underweight women (< 90% of ideal weight-for-height) (Story 1997).
- A systematic review of 48 studies shows that people who were light at birth generally have an adverse profile of later glucose and insulin metabolism (Newsome 2003).

Why might nutritional problems cause adverse birth outcomes?

Under-nutrition during early pregnancy restricts fetal growth so that the baby is small, yet has normal body proportions. In contrast, under-nutrition in late pregnancy alters the body proportions of the fetus and the relative sizes of internal organs (National Health and Medical Research Council 2000).

Teenage women who give birth to normal weight babies show a third trimester dip in skin fold thickness following the second trimester rise, which may correspond to a mobilisation of stored energy for the final, rapid phase of fetal growth. This dip is not seen when mothers of lower birth weight babies are examined, presumably because those mothers did not experience a mobilisation of energy (Rees 1997).

Food insecurity may increase the risk of birth defects, since it is an indicator of increased stress or compromised nutrition, both of which are implicated in birth defect aetiologies (Carmichael 2007).
**Nutritional depletion hypothesis**

Women with closely spaced births are thought to have insufficient time to replenish their nutritional reserves, with folate depletion, in particular, likely to increase the risk of fetal growth restriction (van Eijsden 2008).

**What are the links between nutrition and other risk/protective factors?**

**Folate**

In a WA case-control study, preconceptional knowledge of the link between folate and neural tube defects and taking folic acid supplements periconceptually were both less common among women who were younger, less well educated, single, public patients, who smoked, who were having their first pregnancy and who had not planned their pregnancy (Bower 2004b; Bower 2005; Bower 2006).

The North Carolina Birth Defects Monitoring Program found that the prevalence of spina bifida has decreased very little among women less than 25 years of age, with less than a high school education, and on Medicaid (Meyer 2002).

**Breastfeeding**

Counselling about breastfeeding has been shown to reduce child mortality in undernourished populations (Bhutta 2008) – *see also ‘Breastfeeding’ topic.*

**Infection**

Increased dietary fat intake is associated with increased risk of bacterial vaginosis in women, whereas increased intake of folate, vitamin A and calcium may decrease the risk of severe bacterial vaginosis (Neggers 2007).

**Iron depletion**

Teenagers, along with women with several pregnancies in a short period or a multiple pregnancy, are at high risk of iron depletion (National Health and Medical Research Council 2003).

**Unintended or mistimed pregnancies**

In a US Pregnancy Risk Assessment Monitoring System survey of 9048 women, those with unintended or mistimed pregnancies were more likely to consume less than the recommended amount of preconception folic acid than women with intended pregnancies (Cheng 2009).

**What is the evidence for preventing/reducing nutritional problems in pregnant women, and/or women of reproductive age or in infants?**

**Diet in general**

- Australian dietary guidelines recommend that pregnant women should increase their daily intake to five to six serves of vegetables/legumes, four serves of fruit and four to six serves of cereal (National Health and Medical Research Council 2003). (In particular this will increase folate intake – see below.) UK dietary guidelines for pregnant women guidelines add one portion of oily fish a week to the Australian recommendations (National Institute for Health and Clinical Excellence 2008).
- During breastfeeding, women should increase their daily intake to seven serves of vegetables/legumes, five serves of fruit and five to seven serves of cereal (National Health and Medical Research Council 2003).
- WHO has estimated that up to 2.7 million lives could be saved each year if fruit and vegetable consumption was sufficiently increased (WHO 2006b).
- Cost-utility analyses of nutrition interventions such as the Mediterranean diet, ‘2 Fruit and 5 Vegetables’ compare favourably to drug interventions and physical activity interventions (Dalziel 2007).
Nutrition education in pregnancy
A meta-evaluation of the literature on nutrition education in pregnancy (Boyd 1993) included five studies with a quasi-experimental or experimental design. All five showed positive results in improving either weight gain or birth outcomes, although all studies had had some methodological shortcomings.

In a meta-evaluation with less stringent inclusion criteria, Bronner 1995 also showed positive results in 16 studies (six with pregnant adolescents). The studies in adolescents were of comprehensive programs so it was not possible to elucidate the specific role of nutrition among the overall interventions.

Maternal supplementation
Energy and protein
Balanced energy and protein supplements during pregnancy can reduce the risk of an SGA baby by 32% (RR 0.68 95% CI 0.56 to 0.84) and stillbirth by 45% (RR 0.55 95% CI 0.31 to 0.97) (Kramer 2003).

Calcium
Although the NHMRC 2003 dietary guidelines do not support additional dietary intake of calcium during pre-pregnancy, pregnancy and breastfeeding, the Cochrane review of calcium supplementation during pregnancy showed a significantly reduced rate of pre-eclampsia (a common precursor to preterm birth), particularly for women at high risk for hypertensive disorders of pregnancy and those with low baseline calcium intake, as well as reduced maternal mortality and/or serious maternal morbidity (Hofmeyr 2006). A recent RCT of calcium supplementation in teenage mothers showed that supplementation with dairy products increased maternal folate and vitamin D levels and their babies had higher birthweights compared with supplementation with calcium-fortified orange juice or controls (Chan 2006).

Folate
A Cochrane review provides strong evidence that folate supplementation prior to conception and during the first trimester significantly reduces incidence of neural tube defects (Lumley 2001). NICE recommends that women take a folic acid rich diet (fortified cereals, yeast extract, peas, beans, orange juice) as well as taking folate supplements (National Institute for Health and Clinical Excellence 2008).

Iodine
A systematic review shows that iodine supplementation for pregnant mothers reduced deaths during infancy and childhood by 29% (RR 0.71 95% CI 0.56 to 0.90). However, iodine deficiency is now rare due to interventions such as salt iodisation (Bhutta 2008). There are no published data on the effect of maternal iodine supplementation on long term maternal and child outcomes (Zimmerman 2004).

Iron
In a Cochrane review of 40 trials with 12,706 women, there was insufficient evidence that routine iron supplementation results in significant risks or benefits to maternal and fetal health (Pena-Rosas 2006).

Multiple micronutrient supplementation
A systematic review shows multiple micronutrient supplements in pregnancy can reduce the risk of low birthweight by 16% (RR 0.84 95% CI 0.74 to 0.95) (Bhutta 2008).

Vitamin A
For maternal supplementation with vitamin A, childhood mortality was reduced in children aged 6-59 months by 24% (RR 0.76 95% CI 0.69 to 0.84) (Bhutta 2008).

Zinc
In a Cochrane review of zinc supplementation in pregnancy, a 14% relative reduction in preterm birth was seen compared with placebo (RR 0.86 95% CI 0.76 to 0.98), but no corresponding effect was seen on low birthweight (Mahomed 2007).
Infant supplementation

Vitamin A

- There is some emerging evidence that a single dose (or two) in the first few days of an infant’s life may have a survival advantage for some infants e.g. infants in developing countries (Abrams 2008; Klemm 2008). Pooling of four studies in south Asia has shown a 21% reduction in mortality in babies younger than 6 months with neonatal vitamin A supplementation; RR 0.79 95% CI 0.65 to 0.96 (Bhutta 2008).
- In a Cochrane review of supplementing very low birthweight infants with vitamin A, death or oxygen requirement at one month were significantly reduced (Darlow 2007).
- Fortification of food with vitamin A showed a 30% reduction in mortality of children aged 6 to 49 months (Muhilal 1988).

Zinc

A pooled estimate from a meta-analysis of zinc supplementation in prepubertal children indicated a 9% reduction in mortality (RR 0.91 95% CI 0.82 to 0.99) (Bhutta 2008).

Delayed cord clamping

Term infants

A Cochrane review shows that delayed cord clamping in term infants may improve iron status, which is of clinical value where access to good nutrition is poor. However, delaying clamping may increase the risk of jaundice requiring phototherapy (McDonald 2008a).

Strategies/programs to encourage pregnant women and new mothers to participate in programs to prevent/reduce nutritional problems

General nutrition programs in Aboriginal populations

- The Australian ‘Strong Women, Strong Babies, Strong Culture Program’ encouraged pregnant Aboriginal women to improve their nutrition e.g. through greater use of bush foods. Despite an early improvement in low birthweight (Mackerras 2001), there were no significant differences for mean birthweight or number of low birthweight babies over the 1988-2001 period, (d’Espaignet 2003) – see ‘Models’ section for a fuller description and discussion.
- Looma Healthy Lifestyle included a community based nutrition intervention conducted with the Minjilang community in northwest WA which increased consumption of fruit and vegetables, wholemeal bread, fruit juice, diet drinks and sandwiches and discouraged high fat take-away foods, sweet drinks and sugar (Rowley 2000).
- Growth monitoring plays a central role in NT Aboriginal and Torres Strait Islander child health programs through the NT Government’s Growth, Assessment and Action Program (GAA). However a review of evidence for interventions to prevent growth faltering found no clear evidence of benefit associated with growth monitoring alone, highlighting the need for monitoring to be incorporated into a broader primary health care program that includes assessment of other major risks to child health (McDonald 2008b).
- A recent unpublished study in a remote community showed that modifying the current turnover of key selected foods and food groups available through the community food outlets, in line with Australian standards, resulted in a diet that met or exceeded the minimum required nutrient density for all nutrients except for potassium (Brimblecombe 2007).
- Dietary intake of Aboriginal and Torres Strait Islander people improved over time as a result of the lifestyle intervention program ‘the Walkabout Together Program (WAT)’ in Townsville, Queensland (Longstreet 2008).
- ‘Approaches to Failure to Thrive’ was a child nutrition project established in the Ngaanyatjarra Pitjantjatjara Yankunytjatjara (NPY) communities of central Australia by the NPY Women’s Council. About a quarter of mothers with young children attended workshops on good nutrition, with some subsequent improvement in children’s weight and an increased demand for fruit and vegetables from the community food stores (Balmer 1997).
Among a population of pregnant Cree women in Canada, after an intervention of counselling, physical activity and nutrition advice, the only dietary changes were a reduction in caffeine during pregnancy and increase in postpartum folate consumption (Gray-Donald 2000).

The US Women’s Infants and Children’s Program (WIC) which was created in 1972, targets low-income pregnant women, postpartum women and children up to the age of five at nutritional risk, and combines nutritional education with vouchers for certain nutritious foods. Evaluations have varied, but the majority of studies have shown that women enrolled in WIC have lower rates of low birthweight (1-3% lower) than women of similar socioeconomic status not participating in WIC (Rush 1988, Devaney 1992, USDA 1995).

The WIC Special Supplemental Food Program in the US has shown that redeemable food vouchers can increase fruit and vegetable consumption (Herman 2008).

Through its Food Mail program, the Government of Canadian Government subsidises the cost of transporting nutritious foods to remote, isolated communities, but even with this subsidy many foods are still expensive (Doran 2004).

Teenagers
In the US, seven strategies have been proposed to improve the nutritional health of pregnant adolescents (Story 1997):

1. Increasing access and utilisation of antenatal care
2. Redirecting the content of antenatal care
3. Determining whether WIC meets the needs of pregnant teenagers
4. Understanding determinants of eating and weight gain
5. Identifying and addressing barriers to behaviour change
6. Developing and evaluating developmentally and culturally appropriate nutrition education intervention programs
7. Reducing risk with population-wide approaches for improving the health of all adolescent females.

While preconception care should be standard for all women, it may not be the most effective approach for reaching adolescents (who tend to have unintended pregnancies and have the lowest rates of health care utilisation of any age group). A more effective approach may be primary prevention strategies aimed at improving the nutritional health of all adolescent females, such as school based programs (Story 1997).

Antenatal nutritional risk assessment
Antenatal nutritional risk assessment investigates pre-pregnant weight and weight gain patterns; conducts a diet history with evaluation of adequacy; identifies barriers to adequate intake; and identifies any unusual dietary patterns (Story 1997). The most useful screening tool is amount of weight gained at 16-20 or 24-28 weeks gestation (National Health and Medical Research Council 2000).

Folate

In 1996, voluntary fortification of certain foods was approved in Australia, up to 100ug of folic acid per serve (Lawrence 1999). However, in WA, health promotion and voluntary fortification have had no effect on the rate of neural tube defects in Aboriginal infants (Bower 2004a; Bower 2006).

Mandatory fortification of a staple food with folate is currently being considered as a priority in New Zealand and Australia (Bower 2006). This has proved effective in other countries (Hertrampf 2003; Honein 2001). Mandatory fortification of bread flour will be introduced into Australia in September 2009 (Abeywardana 2008).

NICE recommends that manufacturers of products (such as pregnancy tests, sanitary products, contraceptives and ovulation predictor kits) include information about the importance of folic acid supplements before and during pregnancy (National Institute for Health and Clinical Excellence 2008).
COAG Close the Gap
Recent COAG recommendations relating to nutrition (Close the Gap 2008) include:

- developing a national ‘nutritional risk’ scheme for at-risk Aboriginal and Torres Strait Islander mothers, infants and children. Eligibility for this scheme will include a low household income, pregnancy, postpartum or breastfeeding, or a child under the age of five years, in the presence of nutritional risk assessed by a health professional (this may include inadequate diet, abnormal weight gain during pregnancy, history of high-risk pregnancy, child growth problems such as stunting, underweight, or anaemia; or homelessness), with $50 m budgeted over four years. Nutritionists will be partnered with Aboriginal and Torres Strait Islander health/nutrition workers to support the maternal and child health nurse home visiting teams;
- developing, costing, funding and implementing a national nutrition plan which will focus on affordability and accessibility of healthy food choices;
- implementing nutrition interventions for at-risk communities – recognising the link between poverty and poor quality diets;
- ensuring community stores commit to healthy nutrition goals and targets as well as financial goals and targets.

What are the barriers to/facilitators for improving nutrition?

Cost of food
- In Aboriginal communities, the proportion of family income required to purchase a healthy basket of food is two to three times as much as those living in main centres. In an adaptation of the 2006 NT data, a basket of food for a family of six for a fortnight ranged from $500 to over $800 (PMSEIC 2008). Aboriginal and Torres Strait Islander people living in remote communities are doubly disadvantaged – they pay more for food while having the lowest incomes of any population group.
- In addition healthy food is more expensive than less healthy options such as takeaway foods and soft drinks (Webb 2007). This differential seems to be widening in Australia, with the price of core foods such as bread rising in price significantly more than cakes and biscuits, and the price of milk rising more than soft drinks (Burns 2008).
- In the UK, over a third of people from low income groups worry about running out of food before receiving money to buy more; and report that they cannot afford to eat balanced meals (National Institute for Health and Clinical Excellence 2008).

Access
Knowledge about nutrition is generally high among Aboriginal and Torres Strait Islander women, indicating a need for better access to good food.

Lack of messages
GPs rarely ask pregnant women about their diet (Pregnancy Lifescripts – see below).

Type of messages
- Young women may be more responsive to messages about changes in stored energy during their pregnancies, rather than to messages about weight gain (Rees 1997).
- Adolescent behaviours such as restrictive dieting, unsafe weight-loss practices, skipping meals (especially breakfast), snacking on low-nutrient foods or high-fat foods, excessive consumption of fast foods, unbalanced diets and substance use can increase the risk of inadequate nutrition (Story 1997).
- Chomitz 1995 has identified the following barriers to changing eating behaviour in pregnant adolescents:
  - Psychosocial – lack of support from family and friends; social isolation; denial or failure to accept the pregnancy; emotional stress or depression.
Systemic barriers – poverty; lack of food; lack of transportation; negative or uninformed attitudes of health care providers; inadequate refrigeration/cooking facilities; lack of access to health care.

Biological barriers – physical changes of pregnancy: increased nutrient requirements; discomforts of pregnancy (nausea, vomiting).

Individual barriers – lack of nutrition knowledge/misinformation; low value on the importance of nutrition; fear of weight gain; lack of behaviour change skills; substance use.

Ongoing projects/programs

National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan 2000 to 2010
NATSINSAP is a nationally agreed framework to improve Aboriginal and Torres Strait Islander health through better nutrition. It is separate from, but aligned to, Eat Well Australia. At the 2008 National Nutrition Networks Conference, a number of recommendations were made, including the following relating to mothers and children:

*Pregnant women, breastfeeding mothers, babies and children have access to enough available and affordable nutritious food*

- Implement the provision of nutritious food to supplement at risk Aboriginal and Torres Strait Islander mothers, babies and children according to local need through existing programs (e.g. Maternal and Child Health and new nurse led home visiting programs).
- National breakfast/lunch initiatives are funded based on local need and community involvement e.g. women’s centres, childcare, preschools, schools.
- Creation and ongoing support of dedicated Aboriginal and Torres Strait Islander nutrition positions prioritising early life, linked with pre-existing and new programs such as nurse home-visiting programs.

Remote Indigenous Stores and Takeaways Project (RIST)
In mid 2005 the SA Department of Health became a partner in RIST, a national three year project which aims to develop, trial and promote uptake of guidelines to improve the quality of food in remote Aboriginal and Torres Strait Islander communities (Verity 2006). One of the RIST projects has been to develop a mechanism for monitoring the nutritional quality of food available through stores in remote Indigenous communities, building on work such as examinations of store turnovers which found that store managers can influence the nature of food supplies in remote Aboriginal communities (Lee 1995). A monitoring tool has been developed and piloted in six stores across Australia and it is intended to build on this work to determine a set of national key performance indicators to evaluate food and nutrition related policy for Indigenous Australians (Brimblecombe 2008).

Mai Wiru
The Mai Wiru (‘healthy food’) regional stores policy is addressing issues of food security, food access (including affordability) and food availability (including range and quality) on the Anangu Pitjantjatjara Yankunytjatjara Lands (Mai Wiru 2005).

Go For Your Life
Part of this Victoria-wide program focuses on developing culturally relevant programs for healthy eating and physical activity in the Aboriginal community, with particular attention given to poor nutrition during pregnancy and childhood. Wautharong Aboriginal Cooperative is currently running a Being Active and Eating Well pilot project (Victorian Department of Human Services 2008).

Food security
The Dieticians Association of Australia (DAA) and the Public Health Association of Australia (PHAA) are currently drafting a statement on food security for Aboriginal and Torres Strait Islander people (DAA/PHAA 2008) that resolves to:
1. Advocate to government and non-government agencies for the comprehensive implementation of the National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan.
2. Advocate for continuing support for existing programs, such as Remote Indigenous Stores and Takeaways Project and Outback Stores, and new initiatives to improve food supply in remote areas, such as those recommended in FoodNorth.
3. Advocate for the continuation of existing programs and to commence new initiatives to enhance the knowledge and skills of public health practitioners, dieticians and nutritionists around nutrition and health issues of Aboriginal and Torres Strait Islander peoples.
4. Support initiatives for the employment and trainings of Aboriginal and Torres Strait Islander Health Workers (ATSIHWs) to strengthen the food and nutrition skills, and knowledge of Aboriginal and Torres Strait Islander peoples.
5. Encourage cooperation across the sectors of health, education, housing, employment and training at all levels of government, with significant input from Aboriginal and Torres Strait Islander people to develop and implement food and nutrition policies, including those related to taxation and subsidies.
6. Encourage cooperation across government agencies, non-government organisations and the private industry, with significant input from Aboriginal and Torres Strait Islander peoples.
7. Pursue collaborative relationships with peak Aboriginal and Torres Strait Islander health agencies to advocate for improvements in food security in all geographical areas of Australia.

**Pregnancy Lifescripts (Australia)** (Couto 2007)

- GPs and practice nurses give simple, evidence-based advice on nutrition (and other lifestyle factors such as smoking and alcohol).
- This consists of a written script, ongoing review and referral to help women eat well during pre-pregnancy, pregnancy and breastfeeding.
- Pregnancy Lifescripts for nutrition uses the 5As model:
  1. Ask – check nutrition status at each visit.
  2. Assess – nutrition assessment tool; identify those who would benefit from a full dietary assessment and nutrition counselling (in particular pregnant and lactating teenagers, women with a multiple pregnancy and women with a subsequent pregnancy in a relatively short period); assess barriers to healthy eating; identify current folate supplementation.
  4. Assist – jointly set realistic goals, individualise, and provide written information.
  5. Arrange – refer to a dietician when indicated; recruit support.
- Pregnancy Lifescripts uses Medicare item number 16500 for routine antenatal attendances, and 16400 for care provided by rural and remote communities by midwives, nurses, enrolled nurses and Aboriginal Health Workers on behalf of doctors.

**Lifescripts (Adaptation for Aboriginal and Torres Strait Islander people)**
The Australian Department of Health and Ageing has engaged the Mount Isa Centre for Rural and Remote Health (James Cook University) to adapt the Lifescripts resources for Aboriginal and Torres Strait Islander people – due for completion in 2008 (www.health.gov.au/lifescripts).

**United Kingdom Healthy Start**
In 2006 the Healthy Start program replaced the UK Welfare Food Scheme. One of the changes was to give low income pregnant women, pregnant teenage women, and those with young children, vouchers for a wider range of foods over and above milk or infant formula. Vouchers may be more effective if they were able to be used in community initiatives such as food cooperatives. The Healthy Start program also provides free vitamin supplements (folic acid with vitamins C and D) specially formulated for pregnant women and free vitamin drops (vitamins A, C and D) for young children. Health and lifestyle advice about diet during pregnancy, breastfeeding and the importance of fresh fruit, vegetables and vitamins is also part of the Healthy Start program (National Institute for Health and Clinical Excellence 2008).
Cochrane reviews in progress

- Calcium supplementation (other than for preventing or treating hypertension) for improving pregnancy and infant outcomes (Buppasiri 2008);
- Folate supplementation in pregnancy (Haider 2008);
- Vitamin A supplementation for the prevention of morbidity and mortality in infants six months of age or less – this review is looking at both maternal and infant supplementation (Gogia 2008).

Interpretation/comments

Most evidence relating to nutrition for Aboriginal and Torres Strait Islander people is from remote areas where stores are the major food source – almost nothing is known about nutrition of Aboriginal and Torres Strait Islander people living in other settings. For example high sugar and fat consumption may be an issue in regional and urban areas too.

Further research/action required

The dietary intake study from Longstreet 2008 indicates that the diet of urban Aboriginal and Torres Strait Islander people may be harmful to their future health, but we do not know if this applies to urban Aboriginal and Torres Strait Islander women who are pregnant. In addition this urban setting was in a regional area and may not be totally applicable to a city setting. Dietary recall surveys in Aboriginal and Torres Strait Islander women who are pregnant and/or of reproductive age are urgently needed. Such studies would inform the design of future nutrition programs for these women.

We need additional information about the effect of poor oral health on women’s ability to maintain a nutritious and balanced diet.

There is a lack of population or intervention studies on how to improve the nutritional status and dietary intake of young children, pregnant and breastfeeding women (National Institute for Health and Clinical Excellence 2008).

Interventions targeted to, and applicable to, low-income families may be more effective than generic interventions (National Institute for Health and Clinical Excellence 2008).

Further research is needed on the cost-effectiveness of maternal and child nutrition interventions, including balancing the cost of primary prevention of nutrition-related ill health against the costs of detecting and treating disease (both short and long term) (National Institute for Health and Clinical Excellence 2008).

Future research in nutrition education in pregnancy needs formative assessment to guide intervention development, and needs to clearly define and describe program content so that programs can be replicated (Boyd 1993).

According to Hinkle 1997, successful nutrition and health promotion programs for adolescents: involve youth in program planning and implementation; integrate cultural, linguistic and social factors into the program; address the multiple influence that impact on eating behaviours; respect personal integrity and build upon empowerment; employ credible and respectful individuals to deliver the program; focus on skill and capacity building; and make it fun.
References


DAA/PHAA. (2008) Joint Statement on Food security for Aboriginal and Torres Strait Islander People for approval by the Boards of the Dietitians Association of Australia (DAA) and the Public Health Association of Australia (PHAA). DRAFT.


PMSEIC. (2008) PMSEIC Working Group on Aboriginal and Torres Strait Islander health focusing on maternal, fetal and post-natal health. Prime Minister’s Science, Engineering and Innovation Council (PMSEIC).


2.1.11 Obesity

How many women of reproductive age are obese?

Aboriginal and Torres Strait Islander women, South Australia

In 2007, the 248 Aboriginal and Torres Strait Islander women attending antenatal care before 20 weeks gestation in SA had the following BMI distributions (Chan/Kennare personal communication January 2009):

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>Percentage</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (BMI &lt; 18.5)</td>
<td>3.6%</td>
<td>(n=9)</td>
</tr>
<tr>
<td>Normal weight (BMI 18.5 to 24.9)</td>
<td>27.0%</td>
<td>(n=67)</td>
</tr>
<tr>
<td>Overweight (BMI 25.0 to 29.9)</td>
<td>17.7%</td>
<td>(n=44)</td>
</tr>
<tr>
<td>Obese (BMI 30 to 34.9)</td>
<td>13.7%</td>
<td>(n=34)</td>
</tr>
<tr>
<td>Severely obese (BMI 35.0 to 39.9)</td>
<td>5.2%</td>
<td>(n=13)</td>
</tr>
<tr>
<td>Morbidly obese (BMI 40 or more)</td>
<td>4.4%</td>
<td>(n=11)</td>
</tr>
<tr>
<td>Unknown</td>
<td>28.2%</td>
<td>(n=70)</td>
</tr>
</tbody>
</table>

Aboriginal and Torres Strait Islander women, Australia

Obesity (BMI ≥ 30)

According to the 2004-05 National Aboriginal and Torres Strait Islander Health Survey, there were approximately twice as many Indigenous women who were obese, compared with non-Indigenous women (AIHW 2008; ABS 2008). Age breakdowns for women of reproductive age being obese (ABS 2008) were:

- 18-24 years, nearly 20% (versus 8% for non-Indigenous women);
- 25-34 years, 35% (versus 15%);
- 35-44 years, nearly 40% (versus 18%);
- 45-54 years, just over 40% (versus 20%).

Overweight (BMI 25 to <30)

In addition about 25% of Aboriginal and Torres Strait Islander women of reproductive age were overweight, a similar proportion to non-Indigenous women.

About one in six Aboriginal and Torres Strait Islander women’s BMIs were not recorded, so these figures may be underestimates of the prevalence of obesity and overweight (ABS 2008).

Obese/overweight

In a Queensland survey of 252 pregnant Aboriginal and Torres Strait Islander women of normal weight or higher, 48% of women were overweight or obese (Callaway 2006).

In northern WA, 45% of Aboriginal women of child-bearing or child-rearing age were obese (BMI > 30) and 14.3% of females up to 18 years were overweight or obese (Gracey 2006).

Body fat distribution is significantly different for Aboriginal and Torres Strait Islander people compared with non-Indigenous people in Australia. Aboriginal and Torres Strait Islander people are more likely to have central fat deposition which leads to increased risk of chronic diseases such as type 2 diabetes and heart disease (ABS 2008). Losing ‘waist’ may be as important as losing weight. Wood 2006 suggests that pregnant women with a high waist to hip ratio should reduce their intake of refined carbohydrates by adopting a low glycaemic index diet.

In a 1993-95 survey of 183 Torres Strait Islander women and 379 Aboriginal women from central Australia (Schutte 2005), body composition measurements (BMI and waist-hip ratio (WHR)) were:

<table>
<thead>
<tr>
<th>Body composition (%)</th>
<th>Torres Strait Islander women</th>
<th>Aboriginal women</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI &gt; 30 and/or WHR &gt; 0.85 (age &lt; 30)</td>
<td>76.0% (60.0%)</td>
<td>59.4% (54.9%)</td>
</tr>
</tbody>
</table>
**Overall, South Australia**

Of the more than 20,000 women giving birth in South Australia in 2007, 25.9% were overweight (BMI 25.0 to 29.9); 13.8% were obese (BMI 30.0 to 34.9); 6.3% were severely obese (BMI 35.0 to 39.9) and 4.0% were morbidly obese (BMI 40 or more). This analysis is adjusted for data missing from 28% of the women (Chan 2008).

In an unadjusted analysis of these 2007 data, the comparative percentages for Aboriginal and Torres Strait Islander women (n=248) and non-Indigenous women (n=11444) were (Chan/Kennare personal communication January 2009):

<table>
<thead>
<tr>
<th></th>
<th>Aboriginal and Torres Strait Islander women (n=248)</th>
<th>Non-Indigenous women (n=11444)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (BMI &lt; 18.5)</td>
<td>3.6%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Normal weight (BMI 18.5 to 24.9)</td>
<td>27.0%</td>
<td>33.5%</td>
</tr>
<tr>
<td>Overweight (BMI 25.0 to 29.9)</td>
<td>17.7%</td>
<td>18.6%</td>
</tr>
<tr>
<td>Obese (BMI 30 to 34.9)</td>
<td>13.7%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Severely obese (BMI 35.0 to 39.9)</td>
<td>5.2%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Morbidly obese (BMI 40 or more)</td>
<td>4.4%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Unknown</td>
<td>28.2%</td>
<td>28.1%</td>
</tr>
</tbody>
</table>

In summary, there were similar numbers of overweight Aboriginal and Torres Strait Islander and non-Indigenous mothers, with a higher proportion of obese, severely obese and morbidly obese Aboriginal and Torres Strait Islander women.

**Overall, Australia**

In an obstetric population of 14,230 women from Brisbane, 34% were overweight, obese or morbidly obese (Callaway 2006). Pregnant women are now heavier and older than before (Ramachenderan 2008).

**First Nations women, Canada**

In a survey of 603 Cree women in their first pregnancy living in James Bay, Quebec (singleton, fullterm pregnancies), 27.9% were overweight (BMI 25-29.9) and 49.1% were obese (BMI ≥ 30) (Brennand 2005).

**Teen mothers, USA**

In a small US study, both overweight and obesity showed significant increases postpartum and 18% of their children were overweight at three years of age. The authors speculate that the stresses and deprivations of teen pregnancy and motherhood may be having adverse effects on their weight – and their children’s weight (Lemay 2008).

**Weight gain during pregnancy**

**First Nations women, Canada**

In the survey of 603 Cree women in their first pregnancy living in James Bay, Quebec (singleton, fullterm pregnancies), nearly half the women gained excessive weight in pregnancy (Brennand 2005).

**International**

A US study of excessive weight gain during pregnancy (more than 18 kg) found that excess gain rose steadily from 18.6% to 24.2% between 1990 and 2000 (Rhodes 2003).

Obese women tend to gain the least weight during pregnancy and normal weight or overweight women tend to gain the most (Walling 2006). Cedergren 2006 found that approximately 30% of average and overweight women had high gestational weight gain, whereas only approximately 20% of obese women had high gestational weight gain. Excessive weight gain during pregnancy is associated with long-term BMI increases (Amorim 2007).
What is the link between obesity in pregnancy and infant mortality, preterm birth, small for gestational age or low birthweight?

**Australia**
Neonates born to 248 morbidly obese women from Brisbane were significantly more likely to be born prematurely (before 34 weeks gestation) compared with neonates born to 6443 normal weight women: adjusted OR 2.13 95% CI 1.13 to 4.01 (Callaway 2006). Results were adjusted for maternal age, parity, educational status, smoking status and ethnicity.

Other results were not significant for:
- preterm < 34 weeks for overweight and obese women
- preterm < 37 weeks for overweight, obese and morbidly obese women
- stillbirth for overweight, obese and morbidly obese women.

**International**

**Stillbirth**
Pooling of international studies shows a significant association between stillbirth and being overweight (OR 1.47 95% CI 1.08 to 1.94; 7 studies) and obese (OR 2.07 95% CI 1.59 to 2.74; 8 studies) (Chu 2007).

Fretts 2005 has estimated the rate of stillbirth for women with a prepregnancy BMI of 25-29.9 to be 12-15/1000 and 13-18/1000 for women with a prepregnancy BMI > 30 (two to three times higher than for non-obese women).

**Perinatal mortality**
In a Finnish study of over 25,000 births, Raatikainen 2006 found an association between perinatal mortality and maternal BMI 26 to 70 (OR 1.74 95% CI 1.20 to 2.52).

**Neonatal mortality**
In a large Danish birth cohort of over 85,000 babies, neonatal mortality was increased in infants of mothers who were overweight (BMI 25 to 29) or obese (BMI 30 or more) compared with normal weight mothers (adjusted hazard ratios 1.7 95% CI 1.2 to 2.5; and 1.6 95% CI 1.0 to 2.4 respectively) (Nohr 2007a).

**Preterm subgroup**
For the 3,934 preterm infants (136 deaths) in this study, neonatal mortality in infants born after preterm prelabour rupture of membranes was significantly increased if they were born to an overweight (over three-fold increase) or obese (nearly six fold increase) mother; adjusted hazard ratios 3.5 95% CI 1.4 to 8.7 and 5.7 95% CI 2.2 to 14.8 respectively. No associations were seen between high BMI and neonatal mortality in infants born after spontaneous preterm birth without preterm PROM or in infants born after induced preterm birth (Nohr 2007a).

**Preterm birth**
In pooling four studies, Smith 2008 did not find an association between obesity in pregnancy and preterm birth (OR 1.04 95% CI 0.98 to 1.11). A study not included in the Smith review followed nearly 25,000 births in the UK. It found a link between preterm birth, and both obesity (OR 1.2 95% CI 1.0 to 1.4) and morbid obesity (OR 2.1 95% 1.4 to 3.1). This link was not seen for mothers who were overweight (but not obese) (Bhattacharya 2007).

**Low birthweight**
Significant associations have not been seen between having a low birthweight baby and being overweight or obese in pregnancy (Bhattacharya 2007; Raatikainen 2006).
Weight gain during pregnancy

In a Swedish case-control study of 649 women with stillbirths and 690 control women (both groups nulliparous), an association was not seen between high maternal weight gain during pregnancy and stillbirth (Stephansson 2001).

Multivariate analyses of a retrospective cohort study of 20,465 non-diabetic, term singleton births (Stotland 2006a) showed that gestational weight gain of more than 18 kg, compared with weight gain of between 11.5 to 16.0 kg, was associated with more SGA babies (AOR 0.50 95% CI 0.42 to 0.60). These analyses were adjusted for maternal race/ethnicity, prepregnancy BMI, maternal age, parity, gestational hypertension, smoking, date and mode of birth, length of first and second stages of labour, gestational age at birth.

Based on the results of a large Swedish population-based cohort study, Cedergren 2007 states that the following weight gains during pregnancy are associated with better fetal outcomes, such as fewer SGA babies:

<table>
<thead>
<tr>
<th>BMI</th>
<th>Weight Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI &lt; 20</td>
<td>4 to 10 kg</td>
</tr>
<tr>
<td>BMI 20 to 24.9</td>
<td>2 to 10 kg</td>
</tr>
<tr>
<td>BMI 25 to 29.9</td>
<td>&lt; 9 kg</td>
</tr>
<tr>
<td>BMI 30 or more</td>
<td>&lt; 6 kg</td>
</tr>
</tbody>
</table>

What other links are there for maternal obesity and other outcomes?

Obesity in pregnancy

In a Brisbane study (Callaway 2006), significant associations between overweight and obese pregnant women were seen for:

- Length of stay > 5 days
- Caesarean section
- Birth defects (obese and morbidly obese only)
- Neonatal hypoglycaemia (obese and morbidly obese only)
- Jaundice (morbidly obese only)
- Admission to neonatal intensive care.

Smith 2008 has pooled six international studies (including Callaway 2006) which examine the associations between obesity in pregnancy and pregnancy complications, finding significant associations for macrosomia (OR 2.37 95% CI 2.26 to 2.48) and caesarean section (OR 2.10 95% CI 2.01 to 2.19).

Significant associations between maternal obesity and increased risk of caesarean and instrumental births, haemorrhage, infection, longer duration of hospital stay and increased neonatal intensive care requirement were also seen in another systematic review (Heslehurst 2008).

Moderate and morbid obesity has also shown significant associations with increased risk of postpartum haemorrhage, genital and urinary tract infections, and wound infection (Sebire 2001).

Weight gain during pregnancy

Weight gain during pregnancy is considered to be the most important determinant of postpartum weight retention (Althuizen 2006).
Multivariate analyses of a retrospective cohort study of 20,465 non-diabetic, term singleton births (Stotland 2006a) showed that gestational weight gain of more than 18 kg, compared with weight gain between 11.5 to 16.0 kg, was associated with the following adverse neonatal outcomes:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>AOR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assisted ventilation</td>
<td>1.52 1.16 to 2.00</td>
</tr>
<tr>
<td>LGA</td>
<td>2.28 2.00 to 2.62</td>
</tr>
<tr>
<td>Seizure</td>
<td>6.19 1.32 to 28.96</td>
</tr>
<tr>
<td>Hypoglycaemia</td>
<td>1.67 1.13 to 2.46</td>
</tr>
<tr>
<td>Polycythaemia</td>
<td>1.59 1.13 to 2.22</td>
</tr>
<tr>
<td>Meconium aspiration syndrome</td>
<td>1.86 1.13 to 3.05</td>
</tr>
</tbody>
</table>

but not with birth trauma, 5 minute Apgar score, NICU or SCN admission, neonatal infection, RDS or tachypnea, or extended hospital stay.

These analyses were adjusted for maternal race/ethnicity, prepregnancy BMI, maternal age, parity, gestational hypertension, smoking, date and mode of birth, length of first and second stages of labour, gestational age at birth, and birthweight (the latter not for SGA and LGA).

A cohort of 45,245 singleton births in California (Hedderson 2006) found similar neonatal results:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>OR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macrosomia</td>
<td>3.05 2.19 to 4.26</td>
</tr>
<tr>
<td>Hypoglycaemia</td>
<td>1.38 1.01 to 1.89</td>
</tr>
<tr>
<td>Hyperbilirubinaemia</td>
<td>1.43 1.06 to 1.93</td>
</tr>
</tbody>
</table>

In a prospective cohort study of 245,526 singleton term pregnancies in Sweden, Cedergren 2006 grouped women into five BMI categories and three gestational weight gain categories:

- Obese women with low weight gain (< 8 kg) had a decreased risk (compared with an 8 to 16 kg weight gain) for:
  - Pre-eclampsia: Adjusted OR 0.52 0.42 to 0.62
  - Caesarean section: Adjusted OR 0.81 0.73 to 0.90
  - Instrumental birth: Adjusted OR 0.75 0.63 to 0.88
  - LGA: Adjusted OR 0.66 0.59 to 0.75

- There was a two fold increased risk for pre-eclampsia and LGA among average and overweight women with excess weight gain (> 16 kg)
- Excess weight gain increased the risk for caesarean section in all maternal BMI classes

In a retrospective study of 815 nondiabetic women, Kabali 2007 showed that compared with mothers who had a normal prepregnancy BMI and pregnancy weight gain, odds of macrosomia were significantly elevated only in overweight women with excess weight gain (AOR 2.6 1.2 to 5.4). An elevation was not seen among normal weight mothers with excess gain, or overweight mothers with normal or low gain.

**Prolonged gestation**

Since higher BMI is associated with prolonged gestation at term, Stotland 2007 have suggested that achieving optimal BMI before conception may reduce the risk of postterm pregnancy and its associated complications.

**Weight gain before pregnancy**

There is some evidence to indicate that weight gain in the five years before pregnancy may increase the risk of gestational diabetes mellitus (Hedderson 2008).
Overweight and obese teenage mothers

In a US study, inner-city overweight and obese teenage pregnant women were more likely than normal weight teens to have a caesarean and to have gestational diabetes. However they were less likely to have spontaneous preterm births (Haeri 2009).

**Why might maternal obesity cause adverse birth outcomes?**

As yet it is unclear why maternal obesity is linked with adverse birth outcomes, although the increased risk of pre-eclampsia, diabetes and gestational diabetes in obese women have demonstrated links with poorer neonatal outcomes.

Maternal obesity can be regarded as a state of low-grade inflammation (Ramachenderan 2008).

Obese pregnant women are more likely to snore than nonobese pregnant women; with snoring related to more episodes of oxygen desaturation, hypertension in pregnancy and fetal growth restriction (Frett 2005).

Inflammation or infection related to obesity may be part of the causal pathway to neonatal death (Nohr 2007b).

Malformations that increase the risk of stillbirth may be missed in obese women as quality of the ultrasounds can affected by layers of subcutaneous fat (Devlieger 2007).

Thinner women may be more able to detect decreased fetal movements than obese women, resulting in higher stillbirth rates in obese women (Fretts 2005).

**What are the links between obesity and other risk/protective factors?**

In a survey of pregnant women in Brisbane, increasing BMI was associated with increasing maternal age, parity, smoking, a lower education level and being of Aboriginal and Torres Strait Islander or minority ethnic group descent (Callaway 2006).

Aboriginal and Torres Strait Islander women from non-remote areas who were overweight or obese had a similar lifestyle risk factor profile as women of normal weight, except for having lower rates of smoking and long-term risky drinking (ABS 2008).

The low cost of energy-dense foods is a partial explanation of a link between poverty and obesity (Drewnowski 2004).

**Breastfeeding**

A systematic review shows links between breastfeeding patterns and maternal obesity. Three out of four studies examining onset of lactation found a significant relationship between obesity and delayed lactogenesis. Most of the large studies looking at duration of breastfeeding found that obese women fed for a shorter time than normal weight women, even after adjusting for possible confounding factors (Amir 2007).

There is some suggestion that maternal obesity affects the development of the mammary glands before and during pregnancy as well as early in the postpartum period (Rasmussen 2007).

**Diabetes**

Around eight in 10 (83%) of Aboriginal adults with diabetes/high glucose levels were overweight/obese in 2004-05 (ABS 2008).
Pooling of five studies (including the Brisbane study of Callaway 2006) showed a significant link between gestational diabetes and obesity; OR 3.87 95% CI 3.50 to 4.09 (Smith 2008).

**Hypertension in pregnancy**

Pooling of five studies (including the Brisbane study of Callaway 2006) showed a significant link between hypertensive disorders and obesity; OR 2.79 95% CI 2.59 to 3.00 (Smith 2008).

In a systematic review of over one million women, the risk of pre-eclampsia rose with increasing BMI after adjustment for other clinical and metabolic factors (O’Brien 2003). A Swedish study found a strong association between intrauterine death and obesity in women with chronic hypertension (Zetterstrom 2008).

**What is the evidence for preventing/reducing obesity in women of reproductive age?**

**During pregnancy**

A randomised trial found that a behavioural intervention was not successful in reducing weight in overweight pregnant women but was effective in reducing excessive weight gain in normal weight women (Polley 2002). However in a preliminary report of a randomised trial, intensive dietary and life counselling did appear to reduce weight gain in pregnancy (Asbee 2008).

Gray-McDonald 2000 did not found that an intervention of counselling, exercise and nutrition advice was effective among Cree women in Canada in regard to weight gain (compared with a preceding control period).

In a BMI monitoring and education intervention, Olson 2004 reported a reduced risk of excessive gestational weight gain in a low-income subgroup of women only.

In a Cochrane review, restricting protein or energy in obese pregnant women was not shown to improve pregnancy outcomes, although women in the dietary restriction group had significantly lower weight gain per week (mean difference 255 g/week) compared with standard care (Kramer 2003).

An Australian RCT has found that routine weight measurement was effective in reducing excessive gestational weight gain in women who were overweight prior to pregnancy (Jeffries 2009).

**After childbirth**

A Cochrane review of six trials shows that dieting and exercise together, and diet alone, are more effective than usual care at helping women to lose weight after childbirth, with dieting plus exercise having the added advantage of improving cardio-respiratory fitness of mothers (Amorim 2007). Women who retain a considerable amount of weight after birth have a higher risk of doing so in subsequent pregnancies (Linne 2003); and those women who do not lose pregnancy weight by six months postpartum are more likely to be obese in the longer term (Rooney 2002).

**Preventing obesity in young women**

A small Swedish RCT ‘Health Hunters’ evaluated a one year tailored diet and exercise intervention in women aged 18 to 28 years with at least one severely obese parent. It found that the 14 women in the intervention group had a significantly greater drop in BMI than the 16 women in the control group (Eiben 2006).

**Adolescents**

In a RCT of male and female adolescents aged 13 to 18 years and of normal or above normal weight, providing noncaloric beverages through home delivery decreased consumption of sugar-sweetened beverages by 82%. BMI was not significantly different overall between the noncaloric and control group.
However, in the > 30 BMI subgroup, the noncaloric group had significantly greater weight loss than the control group (Ebbeling 2006).

**Strategies/programs to encourage pregnant women to participate in programs to prevent/reduce obesity**

In a community promotion, detection and care program for Aboriginal people in one Kimberly community, 49% of the participants had lost weight after several months, probably through increased physical activity and improved food stores (Gracey 2006). Additional information about food stores is included in the ‘Nutrition’ topic.

Another community-based lifestyle program in the Kimberley region ‘Looma Healthy Lifestyle’ has shown diet and exercise improvements at the individual level (for those at high risk for metabolic disorders) and at the community level, related to community management and store management. However sustained weight loss or changes in diabetes and obesity prevalence were not seen and younger community members were less likely to participate (Rowley 2000).

**What are the barriers to/facilitators for preventing/reducing obesity before, during or after pregnancy?**

A small survey of obese Swedish women who had attended an antenatal weight program showed that the women viewed the program positively and most were satisfied with their weight gain although less than half the women achieved the target of a maximum weight gain of 6.9 kg (Claesson 2008a). Aqua aerobics classes were particularly liked by the women. The authors conclude that successful programs need women to set their own goals that require extensive support and continuous feedback and reinforcement (Claesson 2008b).

Women also want interactions with professionals to be at the level of a health mentor rather than being ‘nagged’ to adopt or cease particular lifestyle activities (Ebbeling 2007).

**Ongoing projects/programs**

A lifestyle modification program has recently been introduced into a metropolitan Aboriginal Health Service in Canberra and is already operating in three communities in the far north of WA (Gracey 2006).

**Pregnancy Lifescrpts, Australia**

This Australian primary care program advises the 5A approach (Ask, Assess, Advise, Assist, Arrange) to help pregnant women avoid obesity. The Pregnancy Lifescrpts material mentions that resources specifically for Aboriginal and Torres Strait Islander women will be developed (Couto 2007).

Limiting weight gain in overweight and obese women during pregnancy to improve health outcomes is the topic of a large international randomised trial led by Jodie Dodd from the University of Adelaide (http://www.anzctr.org.au/trial_view.aspx?ID=81642).

Another Australian trial ‘Preventing excess weight gain and gestational diabetes in overweight and obese pregnancies’ (led by Helena Teede in Melbourne: http://www.anzctr.org.au/trial_view.aspx?ID=82798) is about to start recruiting.

Two other Australian randomised trials are addressing preventing childhood obesity:

- The Healthy Beginnings trials is evaluating the impact of home visits on preventing early onset of childhood obesity in disadvantaged areas of Sydney (Wen 2007);
• The INFANT trial is assessing the effect of an early childhood obesity prevention intervention for first-time parents who attend maternal and child health centres in Victoria (Campbell 2008).

Several Australian randomised trials have recently finished recruitment, but not yet published their results:


The New Life(style) RCT in the Netherlands aims to coach women expecting their first child to maintain a healthy weight during pregnancy (Althuizen 2006).

A National Institute of Health study of home visits, telephone counselling and group classes compared with Women, Infants and Children’s programs to reduce obesity in postpartum women has not yet published its results (Ebbeling 2007; Peterson 2002).

Another US trial assessing ways to enhance weight loss in postpartum women has also been completed but not yet published (Ostbye 2008).

The following Cochrane review is in progress:

- Interventions for preventing excessive weight gain during pregnancy (Muktabhant 2008).

Interpretation/comments

High gestational weight gain is independently associated with adverse neonatal outcomes and is not simply a marker for obesity (Stotland 2006a).

Although lifestyle interventions may be able to help pregnant and postpartum women lose weight, the low participation, and high attrition rates in trials indicate that expecting and new mothers may need special consideration to help them overcome barriers of lack of time and of physical and emotional energy (Kuhlmann 2008).

Further research/action required

The findings that normal weight women both gain more weight than obese women during pregnancy (Walling 2006) and that they seem to be more responsive to behavioural interventions which lead to weight loss (Polley 2002) indicate that normal weight women may be an effective target group for preventive strategies.

As teenage women often have many of the risk factors for obesity, programs to address weight, diet and exercise should be a priority for these women (Lemay 2008).
Preventing infant deaths among Aboriginal and teenage women in South Australia

References


2.1.12 Poverty/Socio-economic status

How many women (or people in general) are affected by poverty?

**Aboriginal and Torres Strait Islander people, South Australia**

The 2006 Social Health Atlas of Australia (Glover 2006) reports a stable but high level of social inequality for Aboriginal and Torres Strait Islander people compared with the overall population (metropolitan risk ratio 8.24 and country risk ratio 13.40).

**Indigenous and non-Indigenous women, New South Wales**

In an analysis of infants born to local mothers in an outer Sydney hospital, 47% of the Aboriginal and Torres Strait Islander infants (42/90) were from the lowest socio-economic (SES) quintile, compared with 20% of the non-Indigenous infants (321/1616) (Titmuss 2008).

**Aboriginal and Torres Strait Islander people, Australia**

In 2006, 42% of Aboriginal and Torres Strait Islander children lived in jobless families, three times higher than for non-Indigenous children (AIHW in AMA 2008).

**Teenage women, New South Wales**

In this study, 24% of the Indigenous women in the lowest SES quintile were under 20 years, compared with 10% of Indigenous women in the other quintiles combined; and 11% of non-Indigenous women in the lowest SES quintile (Titmuss 2008).

What are the links between poverty and infant mortality, preterm birth, small for gestational age or low birthweight?

**South Australia**

The most disadvantaged 20% of SA’s population have an infant mortality rate 63% higher than the most well off group (Glover 2006). The 2006 Social Health Atlas of Australia (Glover 2006) reports a decreasing level of health inequality for infant deaths in the country; a stable level of health inequality for low birthweight babies from the country; and an increasing level of health inequality for low birthweight babies in Adelaide.

From 2001-04, the likelihood of infant mortality in Adelaide was nearly doubled in the lowest SES quintile compared with the highest quintile. For low birthweight in 2001-04 the pattern was different for Aboriginal and Torres Strait Islander women than for non-Indigenous women, with low birthweight rates elevated in the second lowest (25%) and the highest SES quintiles, with a similar rate of 6% across all SES quintiles for non-Indigenous women (Glover 2008).

**Aboriginal and Torres Strait Islander and non-Indigenous infants, New South Wales and Victoria**

**Low birthweight**

In an analysis of infants born to local mothers in an outer Sydney hospital, low birthweight for Indigenous infants in the lowest SES quintile was much higher than for Indigenous infants in the other SES quintiles combined (16.7% versus 6.3%). The low birthweight rate of 6.3% for the other SES quintiles was comparable to the non-Indigenous lowest quintile rate of 7.2% (Titmuss 2008).

A review of over 300,000 births in Victoria from 1982 to 1986 showed a significant link between low birthweight and the two lowest SES deciles. However this association was not apparent for non-smoking women (Bell 1992).
International
A review of Nordic countries found a link between stillbirth and perinatal mortality and social differences, with most of the 35 studies showing relative risks of between 1.4 and 1.9 for the groups with greatest deprivation (Jorgensen 2008). An earlier review of studies from Nordic countries found that “the higher people are located in the social hierarchy, whether measured by social group, educational level, or income, the lower the infant mortality rate.” This effect was more pronounced for postneonatal mortality than neonatal mortality, probably reflecting the influence of lifestyle factors in the postneonatal period (Arntzen 2004).

In a large Swedish survey of nearly 400,000 women, maternal social class, as an adult and also as a child, were both independently associated with low birthweight and neonatal mortality in their infants (Gisselman 2006).

In the UK, the local authority areas with the worst health and deprivation indicators have higher than average infant mortality rates; and the gap between the lowest SES group and the population as a whole is widening (UK Department of Health 2007a, b). This source also reports a socioeconomic gradient in the UK for all causes of neonatal mortality and all but one cause of postneonatal deaths. In 2004-06, the infant mortality rate for England and Wales was 17% higher in the most deprived group (routine and manual) than for the total population (UK Department of Health 2007b).

A similar pattern is evident for the US, with vital records data showing an increase in relative socioeconomic disparities over time; in 1985-89 infants in the most deprived group had 36% and 57% higher risks of neonatal and postneonatal mortality, respectively, than infants in the least deprived group. The corresponding relative risks increased to 43% and 96% in 1995-2000, with maternal education becoming an increasingly important predictor of infant survival. When adjusted for maternal childhood class, maternal age and parity, most of the lower SES groups had significantly increased low birthweight, neonatal and postneonatal mortality than the highest SES group, with women in the lowest SES group having about 1.5 times the risk of having a low birthweight baby; or a neonatal or postneonatal death (Singh 2007).

Manual maternal childhood class was consistently associated with low birthweight and neonatal mortality (about a 10-20% increased risk) and for postneonatal mortality when adult social class was not in the model. Thus maternal social disadvantage may occur as early as the mother’s childhood, and which is not always compensated for by moving to a higher SES group as an adult (Gisselman 2006).

Preterm birth
A study of nearly 635,000 births in Missouri has shown a link between preterm birth and women residing in socioeconomically deprived areas. The adjusted odds ratio of having a preterm birth (< 35 weeks) was 1.18 95% CI 1.03 to 1.35, compared with women living in the least disadvantaged areas (DeFranco 2008).
The following table (adapted from Kramer 2000) shows the interactions between low socioeconomic status and potential mediators for preterm birth and IUGR:

<table>
<thead>
<tr>
<th>Potential mediator</th>
<th>More common ↑ or less common ↓ with low SES</th>
<th>PTB/IUGR</th>
<th>Likely overall impact on PTB or IUGR in developed countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short stature</td>
<td>↑</td>
<td>IUGR</td>
<td>likely to be important</td>
</tr>
<tr>
<td>Low prepregnancy BMI</td>
<td>↓</td>
<td>IUGR</td>
<td>low</td>
</tr>
<tr>
<td>Low gestational weight gain</td>
<td>↑</td>
<td>IUGR</td>
<td>likely to be important</td>
</tr>
<tr>
<td>Low micronutrient intake</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>unknown</td>
</tr>
<tr>
<td>Cigarette smoking</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>high</td>
</tr>
<tr>
<td>Cocaine use</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>low</td>
</tr>
<tr>
<td>Marijuana use</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>modest</td>
</tr>
<tr>
<td>Narcotic use</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>low</td>
</tr>
<tr>
<td>High alcohol consumption</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>modest</td>
</tr>
<tr>
<td>High caffeine consumption</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>modest</td>
</tr>
<tr>
<td>Prolonged standing/strenuous work</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>low</td>
</tr>
<tr>
<td>Vigorous leisure time exercise</td>
<td>↓</td>
<td>PTB/IUGR</td>
<td>low</td>
</tr>
<tr>
<td>Inadequate antenatal care</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>low</td>
</tr>
<tr>
<td>Bacterial vaginosis</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>may be important</td>
</tr>
<tr>
<td>Multiple birth</td>
<td>↓</td>
<td>PTB/IUGR</td>
<td>low</td>
</tr>
<tr>
<td>Stressful life events</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>likely to be important</td>
</tr>
<tr>
<td>Chronic stressors</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>likely to be important</td>
</tr>
<tr>
<td>Unwanted pregnancy</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>likely to be important</td>
</tr>
<tr>
<td>Depression</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>likely to be important</td>
</tr>
<tr>
<td>Physical abuse</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>likely to be important</td>
</tr>
<tr>
<td>Low levels of social support</td>
<td>↑</td>
<td>PTB/IUGR</td>
<td>likely to be important</td>
</tr>
</tbody>
</table>

What links are there for poverty and other outcomes of interest?

In an analysis of Aboriginal and Torres Strait Islander infants born to local mothers in an outer Sydney hospital, residing in the most socioeconomically disadvantaged quintile was associated with much higher rates than other Aboriginal and Torres Strait Islander infants for most birth outcomes and risk factors (mean birthweight; admission to special care nursery or neonatal intensive care unit; mother less than 20 years; and mother smoked).

Furthermore, outcomes for Aboriginal and Torres Strait Islander infants not in the lowest SES quintile were generally comparable with non-Indigenous infants from the lowest SES quintile. The exceptions were that the proportion of single mothers was higher in the Aboriginal and Torres Strait Islander group (46% versus 33%) and smoking was lower in the Aboriginal and Torres Strait Islander group (31% versus 44%) (Titmuss 2008).

Antenatal care attendance
In a study of births in Oregon, US, 70% of mothers who had inadequate antenatal care said that they experienced difficulty in paying for antenatal care and 55% of these mothers said that they had difficulties with health insurance (Harvey 1993).

Birth spacing
In a US study, inequality of income was linked to less spacing between pregnancies for older mothers (26 years or older) but not for younger mothers (Gold 2004).

Breastfeeding
According to one group, almost all studies, particularly the larger ones and ones that adjust for socioeconomic status, show a reduced risk of SIDS with breastfeeding (Mitchell 2007). However Moon 2007 maintains that adjustment for socioeconomic status makes the protective effect of breastfeeding disappear in some studies.
Infection
In a large UK survey, 21.4% of 4,987 spontaneous very preterm singleton births had recorded evidence of maternal or fetal infection. Rates of infection increased significantly with increasing deprivation; 27.3% in the most deprived quintile and 21.4% in the least deprived quintile (Smith 2007).

Violence
In a WA study of interpersonal violence, people with more affluent backgrounds tended to have a lower risk of being readmitted to hospital due to interpersonal violence than people in the most disadvantaged group (Meuleners 2008).

Women who were in debt, required financial assistance, whose pregnancy was unplanned and who had in-law conflict were more likely to experience intimate partner violence in the past year in a Hong Kong survey of pregnant women (Tiwari 2008). This is consistent with a UK study showing that women in households with an income less than 10,000 pounds are 3.5 times more at risk of domestic violence than those in households with an annual income over 20,000 pounds; and that unemployed women are more vulnerable to domestic violence (Walby & Allen 2004 in Humphreys 2007). In a WA study of interpersonal violence, people with more affluent backgrounds tended to have a lower risk of being readmitted to hospital due to interpersonal violence than people in the most disadvantaged group (Meuleners 2008). Malcoe 2004 reports a seven fold disparity in the rate of intimate partner violence experienced by women in the lowest, compared with the highest, income groups in the US.

What are the links between poverty and other risk/protective factors?

Education is strongly related to childhood social class, which will later be a determining or limiting factor in educational success (Gisselman 2006).

Social class in early life is associated not only with disadvantageous health outcomes later, but also with social class later in life (Gisselman 2006).

Evidence is increasing for the association between poorer health outcomes and social position being a result of accumulated hazardous exposures over a life course (Arntzen 2004; Stanley 2008).

In an Australian longitudinal study, at 14 years of age, children of teenage mothers (compared with older mothers) in Queensland were more likely to have disturbed psychological behaviour, poorer school performance, poorer reading ability, were more likely to have been in contact with the criminal justice system and were more likely to smoke regularly and to consume alcohol, but no association was seen with general health outcomes for the 14 year-old children. However subgroups of teenage mothers with depression and/or from low socioeconomic backgrounds had offspring with poorer health outcomes as well as poorer psychological, cognitive and behavioural outcomes. Most of the overall associations were largely explained by socioeconomic factors, maternal depression, family structure and maternal smoking, and although this study had moderate losses to followup, excluding these probably underestimates the strength of their findings (Shaw 2006).

What is the evidence for preventing poverty for pregnant women and new mothers?

Social policy
In a review of 18 wealthy nations, Lundberg 2008 found an association between generosity of family policies (ones which support dual-earner families) and lower infant mortality. In this study, Australia is described as having a market-oriented family policy model with less generosity, and, along with New Zealand and the USA, has among the highest infant mortality of the wealthy countries. This association is ascribed to fewer opportunities for parental leave which can disrupt breastfeeding and care of the child (Lundberg 2008).
Conditional cash transfers
A recent systematic review of 10 studies from low and middle income countries found that directly transferring money to households conditional on at least one requirement related to health, found that such conditional cash transfer programs are effective in increasing the use of preventive services and sometimes in improving health status. Conditions for transfer of cash included school attendance, attending preventive health examinations, or parental attendance at health workshops (Lagarde 2007). One of the studies (from Colombia) found an improvement in the nutritional status of newborns and infants, attributed to improved nutrition of mothers during their pregnancy (Attanasio 2005). Most studies were in settings with relatively adequate health infrastructures and the authors comment that expanding health system capacity may need to be done before introducing conditional cash transfer systems (Lagarde 2007).

A later RCT from Mexico (Fernald 2008) has shown an independent effect from the cash transfer component of a conditional cash transfer program on child health outcomes, which may have been due to increased purchasing power or better care and support of children from the improved wellbeing of family members, or both (Shibuya 2008).

Microfinancing
In a cluster RCT in rural South Africa, a microfinancing and education intervention halved the risk of physical or sexual intimate partner violence in the previous year (Kim 2007).

Strategies to engage pregnant women and new mothers in preventing poverty
Sure Start, United Kingdom
The UK Sure Start Local Programmes were set up to improve the health and wellbeing of young children living in disadvantaged neighbourhoods by providing services such as outreach and home visits; parental and family support; play, learning and childcare support; primary and community health care; and support for children and parents with special needs. Initial evaluation and a later evaluation have shown some positive results on aspects of child and family development but have failed to show a difference in other outcomes such as physical health and maternal wellbeing (Melhuish 2008; Belsky 2006).

Healthy Start, United States of America
Early findings from the US Healthy Start program indicate that providing health coverage and removing financial barriers to low-income women may not be sufficient to improve access to care or birth outcomes (Haas 1993).

What are the barriers to/facilitators for/improving SES?
Organisational and personal factors, as well as financial ones, can be significant barriers to antenatal care attendance. These include transportation problems, not knowing where to access care, having a poor understanding of or attaching a low value to care, ambivalence or fear about the pregnancy, and high levels of stress. The authors of this study conclude that “poverty may be the overriding factor preventing access to care; obstacles appear to be deeply rooted in the experience of being poor, disadvantaged and vulnerable” (Harvey 1993).

Workforce/Employment
According to Professor Ian Anderson, “one of the simplest but most powerful effects of increasing the numbers of indigenous people trained as health workers is that there will be more indigenous people with jobs, many of them the kind of long term, well paid jobs that lead to permanent escape from poverty” (Cheng 2007).
Education and employment
Education research from NSW has shown that completing years 10 and 11 will increase an Aboriginal person’s chance of employment by 40% (Cheng 2007).

Ongoing projects/programs

Baby Bonus payment in Australia
In NSW, after the introduction of the baby bonus payment in 2004 birth rates have increased, especially among teenagers and women having a third or subsequent birth (Lain 2009). Amendments to the baby bonus have been suggested to provide incentives for women and service providers. This could take the form of a small increase in the payment for those who attend antenatal care early, which is likely to be of particular benefit to Aboriginal and Torres Strait Islander women who tend to present later in pregnancy for antenatal care than do non-indigenous women (de Costa 2009).

Health Inequalities Infant Mortality Public Service Agreement Target (UK)
Reducing health inequalities has been made one of the top six NHS priorities and the UK has recently set the following target for reducing infant mortality (UK Department of Health 2007a, b):

“Starting with children under one year, by 2010 to reduce by at least 10% the gap in mortality between the routine and manual group and the population as a whole.”

Modelling done for this report suggests that:
- if obesity in the most deprived group was to fall by 23% to the levels of obesity in the population as a whole, this would reduce the gap by 2.8%;
- reducing smoking in pregnancy from 23% to 15% in the most deprived group would reduce the gap by 2%;
- reducing sudden unexpected deaths in infancy in the most deprived group by persuading 1 in 10 women in this group to avoid sharing a bed with their baby or placing the baby prone for sleep would reduce the gap by 1.4%;
- achieving the teenage pregnancy target would reduce the gap by 1%.

Other suggested strategies were:
- meeting the child poverty target to halve the number of children in low-income households by increasing incomes in the most deprived group by an average of 18%;
- reducing housing overcrowding in the most deprived group;
- promoting early antenatal booking among disadvantaged groups;
- optimising preconception care;
- providing access to culturally sensitive healthcare;
- reducing maternal and infant infections;
- improving maternal education attainment.

Microfinancing
A microfinancing initiative (small scale loans, financial literacy training and support, micro-enterprise development and asset building) has been established in the western suburbs of Adelaide. Initial participation has been slow and the program is yet to be fully evaluated (Dinnison in Towards a Fairer Society 2006).

Social determinants
A group led by Michael Marmot is being set up to translate the Commission on Social Determinants of Health principles and recommendations into concrete policies for the UK and similarly the WHO is advocating for the Commission’s findings to be translated into country-specific policies (Editorial, Lancet 2008).
Evidence for interventions to reduce infant mortality
The National Perinatal Epidemiology Unit has been commissioned to develop a series of systematic reviews of the research evidence to identify and promote the key interventions that are most likely to contribute to the UK target of reducing infant mortality by 10% by 2010 (see above); and in the longer term to improving maternal and child health and achieving a sustainable reduction in health inequalities (UK Department of Health 2007b).

Child nutrition
Investments in child nutrition are being promoted as a strategy for economic development (Victora 2008).

Interpretation/comments
While it is clear that poverty is both a cause and an outcome of poor human development (Victora 2008), some maintain that it is not clear if the benefits generally shown from improved education and income will follow in the Aboriginal and Torres Strait Islander circumstance (Walker 2008).

Factors such as maternal sociodemographic factors including SES, younger age, smoking status and single parent status are more likely to explain differences in birth outcomes between Aboriginal and Torres Strait Islander women and non-Indigenous women rather than Indigenous status itself (Titmuss 2008).

Further research/action required
Multifocused interventions tackling social, economic and behavioural factors are likely to be the most effective way to improve birth outcomes for Indigenous infants (Titmuss 2008).

A SA record linkage study of SES and birth outcomes (subgrouped by Aboriginal and Torres Strait Islander mothers and teen mothers) is likely to reveal which populations may benefit most.

Research into whether any residual socio-economic disparities remain after controlling for factors whose mediating roles are known or strongly suspected could uncover possible new pathways for preterm birth and IUGR (Kramer 2000).
References


Walby & Allen 2004 cited in Humphreys 2007

2.1.13 Social and Emotional Wellbeing

How many pregnant women and new mothers have impaired social and emotional wellbeing (such as depression and stress)?

Aboriginal and Torres Strait Islander women, Queensland
Research conducted at three sites in Queensland showed that psychosocial risk factors identified in ATSI women were consistent with those in the wider community (beyondblue 2008). A version of the Edinburgh Depression Scale modified for women attending the Townsville Aboriginal and Islander Health Service identified 27.7% of women to be at risk compared with 16.7% for the standard version, suggesting that the standard version may underestimate numbers of Aboriginal and Torres Strait Islander women at risk of depression (Campbell 2008).

Australia (overall population)
The prevalence of postnatal depression in Australia is estimated to be around 14% (Campbell 2008). A recent beyondblue survey of more than 40,000 women reported a 19.6% rate of depression as detected by scoring 10 or more on the EPDS (Buist 2006).

In a beyondblue survey of 43 health services across Australia, 12,361 postnatal women (just over half those contacted) completed questionnaires between six and eight weeks after childbirth as part of a depression screening program. This survey included Townsville Aboriginal and Islander Health Service, Palm Island, Yapatjarra and Child Health, and Mt Isa in Queensland. Over one in six women (15.5%) had a postnatal Edinburgh Postnatal Depression Score (EPDN) > 9 and 7.5% had an EPDS > 12 (the latter indicating probable major depression), with significant variation in rates between states (Buist 2008a).

A survey of nearly 2000 women attending Victorian perinatal health services showed that antenatal depression was more common in urban than in rural areas (8.5% versus 3.4%; p=0.006), with postnatal depression rates being similar. For urban mothers, their antenatal depression score was the best predictor of postnatal depression; and for rural mothers, SES and psychiatric history also had a significant influence (Bilszta 2008).

South Australia (overall population)
In a 2003 survey of 421 women attending their first antenatal visit at the Lyell McEwin Hospital (which is located in a socioeconomically deprived area) 88% of women reported at least one psychosocial risk factor. The incidence of depression (10 or more on EPDS) was 29.7%. Over a third had been abused as children (35.6%); 34.9% had suffered recent major life stresses; 24.5% had thoughts of self-harm, 8% admitted to recently hitting or hurting someone in anger and 5.6% had been victims of violence since becoming pregnant (Edwards 2008a). A follow-up study indicates that while antenatal screening was useful for identifying problems during the antenatal period, it was not useful as a predictor of postnatal depression (Edwards 2008b).

In a beyondblue Australia-wide survey, SA had the equal highest rate of elevated EPDS scores, with 10.2% scoring > 12 on the EPDS; and 19.6% scoring > 9. The two states with longstanding perinatal screening and early intervention programs had the lowest rates (Buist 2008a).

New South Wales
In a similar survey to Edwards 2008a, 52% of women from southwest Sydney reported at least one psychosocial risk factor (Matthey 2004).

Victoria
In a Melbourne survey of 325 new mothers (six weeks to six months postpartum) 19-25% of women were possibly depressed and 13% had symptoms of anxiety (7% of women were both anxious and depressed) (Miller 2006).
New Zealand
In the 1376 mothers who were part of the Pacific Islands Families Study, 16.4% were assessed postnatally as probably experiencing depression. Rates varied from 7.6% for Samoans to 30.9% for Tongans; and risk factors apart from ethnicity included stress due to insufficient money for food, and unhappiness in the relationship (Abbott 2006).

International
A systematic review of 28 studies of depression in pregnancy and postpartum (with diagnostic confirmation) found that as many as 18% of women were depressed during pregnancy (with around 13% with major depression). Nineteen percent of new mothers may be depressed in the first three months after birth, with 7% of these mothers having major depression (Gavin 2005).

In a large Israeli population-based study of 181,479 births, 0.3% (607) of women reported psychiatric illness – depressive and anxiety orders (39%); schizophrenia (11%) and other psychiatric illness (50%) (Schneid-Kofman 2008).

In a Danish prospective study, 5973 women out of a total of 19,282 pregnancies (31%) reported a high level of stress at 30 weeks gestation (score of 12 or more on the 12-item General Health Questionnaire) (Wisborg 2008).

About 13% of mothers experience postpartum depression, usually within the first 12 weeks after birth – much of it undetected (McQueen 2008).

In the large US Pregnancy Risk Assessment Monitoring System (PRAMS), 18.5% of women giving birth to a live infant reported experiencing at least four stressors before pregnancy; and 15.7% of women reported having symptoms of depression between pregnancies (D’Angelo 2007).

A Portuguese study reported that both antenatal and postnatal depression is more common in teenage mothers than in adult mothers (Figueiredo 2007).

Teen mothers
Adolescent mothers experience higher rates of postpartum depression – about half of teen mothers report mental health problems (Cox 2008).

Early motherhood is also associated with poorer mental health of these women in their middle age, even after controlling for factors such as SES (Henretta 2008).

The 65 teen mothers in a small US cohort study had experienced a mean of over 13 negative life events in the past 12 months (Sadler 2007).

What is the link between social and emotional wellbeing in pregnancy and infant mortality, preterm birth, small for gestational age or low birthweight?

Stillbirth
In a prospective study of 19,282 pregnancies from 1989 to 1998 in Denmark, a link between stress and stillbirth was seen (Wisborg 2008). Compared with women showing an intermediate level of psychological stress during pregnancy, women with a high level of stress (score of 12 or more on the 12-item General Health Questionnaire) had an 80% increased risk of stillbirth (RR 1.8 95% CI 1.1 to 3.2). Adjustment for maternal age, parity, maternal pre-pregnancy BMI, smoking habits, alcohol and caffeine intake during pregnancy, education and cohabitation failed to change the result. The results remained essentially unchanged after exclusion of preterm births. Exclusion of women with complications during pregnancy such as diabetes, hypertension, vaginal bleeding, immunisation and imminent preterm birth also failed to
change the results; and the effect of missing data may mean that the association with stillbirth has been underestimated.

**Perinatal mortality**
In a large Israeli population-based study of 181,479 births, psychiatric conditions were shown to be independent risk factors for perinatal mortality (adjusted OR 2.4 95% CI 1.5 to 3.7) (Schneid-Kofman 2008).

**Preterm birth**
In a large Danish survey of 1.35 million births, death or serious illness of close relatives during a mother’s pregnancy was significantly associated with preterm birth (Khasan 2009).

**Low birthweight**
In a large UK study of nearly 11,000 women, there was no significant association between high maternal depression scores and low birthweight, after adjustment for factors such as maternal smoking (Evans 2007).

**Small for gestational age**
In a New Zealand case-control study a significant association was seen between perceived stress and SGA births (Pryor 2003).

**What other links are there for social and emotional wellbeing and other outcomes?**

A national survey of Aboriginal and Torres Strait Islander people showed that those who had experienced abuse or violent crime, drug or alcohol related problems had the highest levels of psychological distress (Productivity Commission 2007).

In a prospective Danish study, pregnant women with a high level of stress (score of 12 or more on the 12-item General Health Questionnaire) were significantly more likely to be smokers, to have a high coffee intake during pregnancy and to be older than those with a low level of psychological stress (Wisborg 2008). Other studies have found a link between antenatal depression and smoking, as well as showing that pregnant women who are depressed are less likely to attend antenatal care and education, more likely to use alcohol and other substances and to neglect their diet and self-care (Edwards 2006).

**Violence**
Violence (either by or towards the pregnant woman) was the strongest predictor of antenatal depression in a South Australian survey and may be under-recognised (Edwards 2008a).

**SES**
A finding of lower (better) EPDS scores for private hospital clients versus public hospital clients supports a link with higher socioeconomic and educational status (Buist 2008a).

People with a background of lower SES are more likely to encounter more difficulties during childhood and this seems to be combined with a worse ability to handle these difficulties in adulthood (Kristenson 2004; Stanley 2008).

**Maternal death**
Maternal psychiatric illness is one of the leading causes of maternal death (pregnancy until the end of the first year postpartum). Nineteen of the 26 women who died in Australia in the period 1994 to 2002 had a previous or current psychiatric disorder and just under half of these women (9/19) were in contact with mental health services. At least three of 26 maternal deaths in Australia from 1994 to 2002 occurred in Aboriginal and Torres Strait Islander women. Young women were also at risk, with 27% (7/26) of maternal deaths being in women under 25 years (Austin 2007).
Unintended or mistimed pregnancies
In a US Pregnancy Risk Assessment Monitoring System survey of 9048 women, those with unintended or mistimed pregnancies were more likely to report postpartum depression than women with intended pregnancies (Cheng 2009).

Why might impaired social and emotional wellbeing cause adverse birth outcomes?
Two possible pathways may be from elevated cortisol levels which increase corticotrophin releasing hormone leading to triggering of birth; and activation of proinflammatory cytokines, and prostaglandin E2 which plays a major role in uterine contractions (Dayan 2006).

What is the evidence for preventing/reducing impaired social and emotional wellbeing in women of reproductive age?

Depression

What is effective for treating antenatal depression?
A Cochrane review of psychosocial and psychological treatments for antenatal depression included one trial of 38 women with major depression. The women randomised to interpersonal psychotherapy or parenting education programs showed some reduction in depressive symptoms (Dennis 2007a).

What can prevent postnatal depression?
A Cochrane review of antidepressant drugs for preventing postnatal depression included two trials of women with previous postnatal depression randomised to antidepressants or placebo immediately postpartum, but the trials were too small to show clear findings (Howard 2005). A Cochrane review of 15 RCTs was unable to detect differences between psychosocial and psychological interventions to prevent postnatal depression compared with usual care, although intensive, professionally based postpartum support showed some promise (Dennis 2004). Two subsequent trials have shown beneficial effects from interventions to prevent postnatal depression. In a cluster RCT in the UK, women with a high Edinburgh postnatal depression score at six weeks who were visited by specially trained health visitors were significantly less likely than women in the usual group to have a high score (≥ 12) at six months: 34% (93/271) v 46% (67/147); OR 0.62 95% CI 0.40 to 0.97. The health visitors were trained to develop skills in assessing women, in detecting postnatal depressive symptoms and in providing psychological informed interventions based on person centred or cognitive behaviour principles (Morrell 2009). A Canadian trial assessed telephone peer support (provided by mothers who had experienced and recovered from postnatal depression) to women identified as being at high risk of postnatal depression. At 12 weeks, 14% (40/297) of women in the telephone support group and 25% (78/315) in the control group had an Edinburgh postnatal depression score > 12: OR 0.47 95% CI 0.31 to 0.72 (Dennis 2009).

What is effective for treating postnatal depression?

Psychosocial and psychological interventions
A Cochrane review of 10 RCTs indicates that both psychosocial interventions (such as peer support and non-directive counselling) and psychological (such as cognitive behaviour therapy and interpersonal psychotherapy) are effective in reducing the symptoms of postnatal depression (Dennis 2007b). A later RCT from Chile compared a multicomponent intervention (psychoeducation, support and pharmacotherapy if needed) with standard care. The authors found that the intervention improved EPDS scores and reduced antidepressant use in the 230 low-income women in this trial (Rojas 2007).

In a Dutch RCT, 85 mothers being treated for depression received either 8-10 home visits by psychologists, social psychiatrists or trained health educators; or three telephone calls over a six month period. The home
visited mothers showed improvements for some outcomes such as attachment security and socioemotional competence. Children in this study are currently being followed to school-age and another study will evaluate a similar intervention in mothers with other mental illnesses (van Doesum 2008).

**Drugs and hormones for postnatal depression**

A Cochrane review of antidepressant treatment for postnatal depression was able to include only a single trial, with no conclusions possible about the effects of antidepressants on postnatal depression (Hoffbrand 2001). Another Cochrane review was unable to show benefit from oestrogens and progestins, with some suggestion that synthetic progestogens may even be harmful (Dennis 2008).

**Stress**

In a South African RCT, 86 pregnant white women without known medical risk for having a low birthweight or preterm baby but who screened positively for stress on the Social Readjustment Rating Scale were randomised at about 20 weeks gestation to client centred counselling from a social worker (individualised to address the sources or causes of the woman’s stress) versus standard care, with no significant differences seen between groups for numbers of low birthweight babies (Rothberg 1991).

**Strategies/programs to encourage pregnant women to participate in programs to improve social and emotional wellbeing**

The Top End Division of General Practice is now employing Aboriginal Mental Health Workers (AMHWs) in eight remote communities (Nagel 2005). AMHWs have also been employed in the inpatient unit of Royal Darwin Hospital since 1997, coinciding with improvements in Aboriginal mental health (Nagel 2006).

Recommendations to improve perinatal detection of mental health problems in Australian women include (Austin 2007):

- Women with a history of significant mental health problems should be offered a mental health assessment antenatally and be counselled about pharmacological and other treatments during pregnancy
- Psychosocial screening, with ongoing health monitoring and clear referral pathways (where appropriate), should be made available to all women in the maternity setting
- Continuing professional development programs for GPs, midwives, child and family health nurses, and other community health practitioners should include education about perinatal morbidity and mortality from mental illness up to a year after birth
- Members of the mental health profession should engage in developing a standard instrument for investigating maternal deaths from psychiatric illness
- A culture of audit should be developed among mental health professionals regarding maternal deaths.

The UK NICE antenatal and postnatal health guidelines identify the following implementation priorities (National Institute for Health and Clinical Excellence 2007):

- Women should be asked at first contact (antenatal and postnatal) with health services about her mental health history;
- Health professionals should ask the Whooley questions (“During the past month, have you often been bothered by feeling down, depressed or hopeless?; During the past month, have you often been bothered by having little interest or pleasure in doing things?”) with a third question (“Is this something you feel that you need or want help with?”) if the answer to either of the first two questions is yes;
- If antidepressants are being considered for pregnant or breastfeeding women, prescribers need to take into account that the safety of these drugs is not well understood although tricyclic depressants such as amitriptyline, imipramine and nortriptyline, and the selective serotonin fluoxetine may be safer than other antidepressants;
- Self-help strategies, nondirective counselling at home and brief cognitive behavioural therapy or interpersonal psychotherapy should be considered for women who develop mild or moderate depression during pregnancy or postnatally;
- Clinical networks for perinatal mental health services should be established.

**What are the barriers to/facilitators for improving social and emotional wellbeing?**

**Access**
The beyondblue National Action Plan has identified the biggest gaps in perinatal mental services to be the lack of services and available workforce in remote and rural settings and Aboriginal and Torres Strait Islander communities (beyondblue 2008).

In a qualitative interview study, rural practitioners in Queensland expressed the view that there are significant problems with inter-service communication and liaison between different parts of mental health service delivery, with too few psychiatrists and psychologists and inadequate staffing to cater for referrals. The challenge of managing co-occurring mental health and substance use was specifically mentioned (Bambling 2007). Projects involving rural access to Allied Psychological Services projects are, however, beginning to show positive impacts on rural peoples’ mental health (3% of clients are Aboriginal and Torres Strait Islander people). These services are funded through the Better Outcomes in Mental Health Care program (Morley 2007).

**Appropriateness of resources**
A number of internet resources such as ‘moodgym’ (moodgym.anu.edu.au), ‘blue pages’ (bluepages.anu.edu.au) and the community training package Mental Health First Aid (beyondblue.org.au) have been developed in Australia, but may not be readily accessible to vulnerable groups such as remote Aboriginal and Torres Strait Islander people, and may not be culturally appropriate in their present form (Nagel 2005).

**Early postnatal care**
Across Victorian public maternity units, there is no systematic approach to determine whether new mothers have particular psychosocial needs postnatally (Yelland 2007).

**Failing to seek help**
The many reasons that women do not seek help for perinatal psychological problems include predominant anxiety masking underlying depression, a mistaken belief that postnatal depression is linked to not wanting the baby, the stigma of being seen as a bad mother and the stigma of depression (Buist 2008b).

**Workforce**
There is a serious lack of Aboriginal Mental Health Workers (Nagel 2005).

**Ongoing projects/programs**

**Australia**
Some relevant Australian initiatives include:
- beyondblue has been funded to develop an Aboriginal and Torres Strait Islander Perinatal Mental Health Plan in consultation with ATSI groups and individuals (beyondblue 2008);
- Respectful and sensitive engagement of Aboriginal and Torres Strait Islander peoples will be an ongoing priority of the overall Perinatal Mental Health Action Plan (beyondblue 2008).
- AIMhi (Australian Integrated Mental Health Initiative) has developed a mental health audit as part of the Audit of Best Practice in Chronic Disease Extension (ABCDE) trial (Nagel 2005);
- The NT Australian Integrated Mental Health Initiative (AIMhi) is a five year project (2003-08) targeting remote Indigenous people through use of cross-cultural care-planning packages (Nagel 2005);
The Australian Government is implementing an $85 million plan for perinatal depression; beyond blue is developing Australian perinatal mental health guidelines, as part of this national initiative; Better Outcomes in Mental Health Care, supporting GPs (Morley 2007); Commonwealth-funded Specialist Outreach services complementing the outreach of the Top End Mental Health Services; Australian Integrated Mental Health Initiative (2003); NT Government Building Healthier Communities (2004).

Council of Australian Governments (COAG)
COAG has recommended that all Aboriginal and Torres Strait Islander women have access to culturally appropriate maternal and infant mental health services, through supporting the development and resourcing of maternal/infant mental health services alongside antenatal services across all communities. COAG has also recommended that all Aboriginal and Torres Strait Islander women have access to mental health screening perinatally within five years. This will require the cultural adaptation of the Edinburgh postnatal depression scale and other culturally relevant instruments (Close the Gap 2008).

ANEW, Melbourne
The ANEW program was designed to provide psychosocial support to women during pregnancy. Implemented at Mercy Hospital for Women in Melbourne, the program aimed to enhance the identification of women at psychosocial risk (including homelessness, violence from an intimate partner, depression, substance misuse, intellectual disability, extreme social isolation, lack of capacity to care for a baby, having experienced sexual abuse as a child, lack of social and interpersonal support, and serious mental illness) and then to offer support to these women. The program consists of intensive communication education for caregivers and the evaluation showed that communication about some sensitive issues was significantly improved, but this was confined to midwifery-led models of care (Hegarty 2007).

The Victorian Aboriginal Health Service, in partnership with the Nexus Dual Diagnosis Service, is building capacity to recognise and respond to co-existing mental illness and alcohol and drug problems experienced by Aboriginal people (Victorian Department of Human Services 2008).

International
In Canada, the Aboriginal Healing Foundation was created in 1998, with five years allotted to establish programs and five years to monitor and evaluate them. Nearly 300,000 people (on and off reserve) are estimated to be experiencing the intergenerational effects of removal from family and culture. According to the authors of the Aboriginal Healing Foundation Report, an average of 10 years is required for a community to reach out; to dismantle denial; to create safety; and engage people in therapeutic healing – which consists of traditional and Western therapies and combinations of both (www.ahf.ca [accessed 29 January 2009]).

A RCT ‘Living in harmony’ of cognitive behaviour therapy in American Indian adolescents during and after pregnancy has recently been completed but is not yet published (the chief investigator is Dr. Ginsberg and the trial registry number is NCT00183547 Ginsberg 2008).

Anxiety
A Cochrane review on Mind-body interventions during pregnancy for preventing for treating women’s anxiety is in preparation (Marc 2009).
Further research/action required

Research is required to validate mainstream psychosocial assessment tools in remote Aboriginal and Torres Strait Islander communities (beyondblue 2008).

More Aboriginal Mental Health Workers need to be trained, with an option to specialise in maternal mental health, and to be available to be employed by antenatal and postnatal family care services.

The ANEW program for identifying pregnant women who are at psychosocial risk and then supporting these women effectively needs to be tested in a more rigorous design such as a randomised trial and in other settings (Hegarty 2007). The need for the role of social support to be further researched, and for differences between rural and urban women to be investigated, has also been highlighted by other Australian researchers (Bilszta 2008).

Recommendations for future research from the UK NICE guidelines for Antenatal and postnatal mental health include the following (National Institute for Health and Clinical Excellences 2007):

- RCT of decision aids for helping pregnant and breastfeeding women make decisions about their care, particularly regarding the use of psychotropic drugs;
- RCT of brief psychoeducational intervention for women with chronic subthreshold symptoms of depression and anxiety;
- Validation of the Whooley questions (“During the past month, have you often been bothered by feeling down, depressed or hopeless?; During the past month, have you often been bothered by having little interest or pleasure in doing things?”) in women in the first postnatal year, when asked by midwives and health visitors.
Preventing infant deaths among Aboriginal and teenage women in South Australia

References


2.1.14 Sudden Infant Death Syndrome (SIDS) and Sudden Unexpected Deaths in Infancy (SUDI)

Definitions:

**SIDS**

* Sudden and unexpected deaths in infants under one year of age, with onset of the fatal episode apparently occurring during sleep, that remain unexplained after a thorough investigation, including a complete autopsy and review of the circumstances of death and clinical history are classified as sudden infant death syndrome (SIDS) (Krous 2004).

**SUDI**

This newer broader term includes SIDS, accidental asphyxiation and undetermined cause (Maternal, Perinatal and Infant Mortality Committee 2008).

How common is SIDS?

SIDS remains the leading cause of death among infants between one month and one year of age in the developed world (Hauck 2008) even after the striking decrease (of 50% to 90%) in SIDS after the risk-reduction campaigns that started in the early 1990s (Moon 2007). The highest national rates of SIDS are now in New Zealand and the US (0.80 and 0.54 per 1000 live births, respectively). In 2005, the Australian SIDS rate was 0.32 per 1000 live births, representing an 82% drop from 1990 (Hauck 2008).

Around 90% of SIDS deaths happen in the first six months of life, peaking between two and four months of age. Boys are more likely to die than girls, showing a 60:40 ratio (Moon 2007).

Aboriginal and Torres Strait Islander women

**South Australia**

From 2002-06, the rate of SIDS for Aboriginal and Torres Strait Islander babies in SA was 1.8 times that for non-Indigenous infants, a non-significant difference between the groups. The respective rates were 0.3 and 0.2 per 1000 live births (Australian Health Ministers Advisory Committee 2008).

From 1993 to 1996, the rate of SIDS for Aboriginal infants born in SA was 4.6 per 1000 livebirths (7/1526), seven times the rate of non-Indigenous infants (0.65 per 1000; 43/73732) (Beal 2000).

**Western Australia**

In the 1980s, the Aboriginal SIDS rate was three to four times that of non-Indigenous infants (Alessandri 1996). The differential for SIDS deaths and deaths from unascertainable causes (SIDSplus) increased to eightfold in 1998-2001, due to a drop in the non-Aboriginal population but no corresponding decrease among Aboriginal infants. Between 1980 and 2001, deaths attributed to SIDSplus accounted for 31% of Aboriginal and 21% of non-Aboriginal infant deaths (Freemantle 2006).

**Queensland**

Figures from north Queensland (1990-98) show a rate of SIDS for Indigenous infants that is three times that for non-Indigenous infants; 1.9 versus 0.66 per 1000 live births (Panaretto 2002a).

**Northern Territory**

Nearly three-quarters of Aboriginal and Torres Strait Islander children (73% – 483) under one year of age who were provided with health checks in the Northern Territory in 2007-08 were judged to be at risk of SIDS, due to bed-sharing (AIHW 2008); while 35% (229) were at risk due to soft sleeping surfaces and loose bedding (AIHW 2008).
Overall, South Australia
In 2007, there were 11 sudden unexpected deaths in infancy – none of these were attributed to the stricter definition of SIDS. There were two accidental asphyxiations and nine deaths with an undetermined cause. Some risk factors associated with the deaths were:
- Unsafe bedding (seven deaths)
- Smoking among close family members (seven deaths)
- Not breastfed at the time of death (five deaths)
- Prone position (four deaths)
- Co-sleeping (four deaths)
- Maternal depression (four deaths)
- Teenage mother (four deaths)
- Heavy alcohol consumption by family members (three deaths).

About 10 such unexpected deaths occur each year, with no reduction seen over the 1998 to 2007 period (Maternal, Perinatal and Infant Mortality Committee 2008).

Teens
From 1988 to 1997 the rate of SIDS in teenage mothers was 3.4 per 1000 live births, over three times the overall SIDS rate for the period (Beal 2000).

1994-98
In a study of 114 consecutive cases of unexpected infant death in SA from 1994 to 1998, 19 deaths were due to natural causes, 21 to accidents, and five to homicides. Factors associated with some of the other deaths were nonlethal inflicted injuries (7), unusual sleeping positions (5), failure to thrive (4), sibling deaths attributed to SIDS (3), 1 chest-neck skin petechiae, 1 death while being nursed, 1 moderate-marked gastric aspiration, 1 toxicologic finding of non-prescribed drugs, and 1 recent maternal psychosis (Mitchell 2000).

Overall, Australia
From 2002 to 2006, there were 133 deaths classified as SIDS in Queensland, Western Australia, South Australia and the Northern Territory – 39 (29%) of these were deaths of Aboriginal and Torres Strait Islander infants. Over these three states and one territory, Aboriginal and Torres Strait Islander infants died from SIDS at over five times the rate of non-Indigenous infants, with rates dropping over time to a similar degree in both groups. Eleven per cent of Aboriginal and Torres Strait Islander infant deaths Australia-wide were classified as SIDS (Australian Health Ministers Advisory Council 2008).

American Indians, United States of America
SIDS is the leading cause of postneonatal mortality among American Indian peoples (Iyasu 2002).

International, Teens
In an analysis of the entire US birth cohort for 1996-97, 36% of postneonatal deaths in infants born healthy to mothers aged 15 years and younger were attributed to SIDS (Phipps 2002).

What are the links between SIDS and risk/protective factors?

Maternal smoking
More than 60 studies have shown an association between maternal smoking and SIDS, with an even larger effect apparent since the 1990s reductions in SIDS. Together, these studies show a significant association between SIDS and smoking: RR 3.93 95% CI 3.78 to 4.08 (Mitchell 2006a). In the UK, the prevalence of maternal smoking during pregnancy has risen among SIDS mothers at the same time as the rate among expectant mothers in the general population has fallen (Fleming 2007).
Environmental tobacco smoke
The risk of SIDS is much less when members of the household other than the mother are smokers, suggesting that the main risk originates from in utero effects (Mitchell 2006a). However it is an additional risk for SIDS, which increases with the number of smokers in the household or the number of daily hours the infant is exposed to tobacco smoke. Furthermore, most mothers who smoke during pregnancy continue to smoke after their child is born (Fleming 2007).

Prone and side sleeping
Although campaigns in many countries have dramatically reduced the numbers placed on their front or side to sleep, the now low prevalence of these sleeping positions is still significantly associated with higher rates of SIDS (Mitchell 1997). In a small Queensland survey of 30 Aboriginal and Torres Strait Islander women and 30 non-Indigenous women, 37% of the Aboriginal and Torres Strait Islander infants were reported to sleep prone compared with 17% of non-Indigenous infants (Panaretto 2002b).

Preterm
SIDS mortality is significantly higher (up to four times) in preterm babies compared with term babies. Although risk factors such as prone sleeping, not being breastfed, maternal smoking, and bedsharing are similar for both preterm and term infants, preterm infants are often placed prone in intensive care for respiratory reasons (but should be placed supine as soon as is medically safe) (Thompson 2006; Moon 2007).

Low birthweight
In a SA study examining births from 1988-97, infants with a birthweight less than 2 kg were significantly more likely to die from SIDS – over four times the overall rate of SIDS for singletons and over six times for twins (Beal 2000).

SGA/LGA
While small for gestational age infants (particularly at higher gestational ages) are at slightly higher risk of for SIDS/SUDI, the risks of SGA for other causes of death were much higher. In utero growth acceleration leading to large for gestational age babies appears protective for SIDS/SUDI, independent of maternal diabetes and pregnancy weight gain (Malloy 2007).

In a case control study of all Aboriginal infants born in WA from 1980 to 1990 inclusive and classified as dying from SIDS, and compared with liveborn Aboriginal infants, being small for gestational age was significantly associated with SIDS (OR 3.36 95% CI 1.83 to 6.17). [SGA was defined as below the population tenth percentile using charts constructed for the Aboriginal population in WA.] The study authors posit that small malnourished infants may not be at increased risk of SIDS in contrast to ‘normally’ or pathologically small infants (Alessandri 1996).

Bed sharing/co-sleeping
There is a significant association between increased risk of SIDS and bed sharing, particularly with mothers who smoke; and also with sleeping with older siblings (Mitchell 2007). While not all studies have shown these interactions (Lahr 2005), the combination of habitual parental smoking and infants co-sleeping seems particularly dangerous, with a 10-fold increase in risk (Fleming 2007).

Increased risk for SIDS is also seen for sleeping on a sofa, either with an adult or alone (Mitchell 2007).

A survey in north Queensland found that co-sleeping was significantly more common in Indigenous infants compared with non-Indigenous infants; 74% (14/19) versus 39% (7/18) (Panaretto 2002a).
Bedroom sharing
On the other hand, sharing the parental bedroom (but not the parental bed) may reduce the risk of SIDS, but it is not clear why this should be so (Mitchell 2007).

Overcrowding
Overcrowded housing appears to have an impact on SIDS, although the mechanisms are unknown (UK Department of Health 2007b).

Bedding
Soft sleeping surfaces, pillows (especially adult pillows) and some duvets are thought to increase the risk of SIDS (Mitchell 2007).

Head covering
Head covering may be part of a chain of events for some SIDS deaths. Pooling of studies conducted after the SIDS campaigns in the 1990s showed that about 20% of SIDS victims were found with their head covered, compared with 3% of control infants after a reference sleep (adjusted OR 16.9 95% CI 12.6 to 22.7) (Blair 2008).

Alcohol
In a small study comparing SIDS cases and matched living controls in Northern Plains Indians in the USA, Iyasu 2002 found a link between SIDS and maternal alcohol use during the periconceptional period (OR 6.2 95% CI 1.6 to 23.3) and first trimester binge drinking (OR 8.2 95% CI 1.9 to 35.3 – adjusted for maternal and paternal education levels, home telephone, number of antenatal visits, layers of clothing and any postnatal visits).

Postnatal home visits
On the other hand in this study (Iyasu 2002), postnatal home visits from a nurse were highly associated with fewer cases of SIDS (OR 0.2 95% CI 0.1 to 0.8 – adjusted for the same factors as above with the addition of alcohol use and omission of postnatal visits).

Recurrence of SIDS in siblings
Siblings are increased risk for SIDS. This may be due to unrecognised metabolic or genetic disorders, and while homicide needs to be considered, a sudden infant death in a subsequent sibling is six times more likely to be SIDS than homicide (Moon 2007).

Illness/infection
Illness and infection seem only to be a risk factor for SIDS when the infant is sleeping prone (Mitchell 2007). In a UK case review of autopsies performed on 546 infants who died unexpectedly, a high rate of Staphylococcus aureus and E. coli suggests a link with otherwise unexplained causes of death (Weber 2008).

Immunisations
There have been claims of both an increased and decreased risk of SIDS with immunisation (the latter likely due to socioeconomic factors), but there does not seem to be a causal link with immunisation (Mitchell 2007).

Breastfeeding
According to Mitchell 2007, almost all studies, particularly the larger ones and ones that adjust for socioeconomic status, show a reduced risk of SIDS with breastfeeding. Although Moon 2007 has maintained that adjustment for socioeconomic status makes the protective effect of breastfeeding disappear in some studies, a recent large German case-control study which controlled for smoking and SES indicates that breastfeeding halves the risk of SIDS at all ages throughout infancy (Vennemann 2009).
**Pacifier use**

Pacifier use has been shown to be associated with a reduced risk of SIDS in two recent systematic reviews (Hauck 2005; Mitchell 2006).

**Child care settings**

About 20% of SIDS deaths occur when the infant is being cared for by a non-parental caregiver and a large proportion of these deaths occur during the first week of child care. Factors contributing could include stress and sleep disruption during the transition to child care (Moon 2007).

**SES**

A case control study of SIDS deaths in Aboriginal infants in WA found significant associations with young maternal age and high parity, which are both related to socioeconomic factors (Alessandri 1996).

A South Australian study found that a significant number of families in which infants die unexpectedly have “chaotic lifestyles with poor living circumstances” (Mitchell 2000). Another study from SA found that, of the fathers living with the family where an infant had died from SIDS, 45% were unemployed compared with a state unemployment figure of 10% for fathers at the same time period – 1991-96 (Beal 2000).

In a New Zealand study, four risk factors (prone, not breastfed, smoking, bedsharing) accounted for the majority of sudden infant deaths (89% for Maori and 79% for non-Maori) from 1987 to 1990. Higher rates of smoking and bedsharing were the major contributors to the overall fourfold higher rate of SIDS for Maori infants (Mitchell 1993).

In addition to some of the factors mentioned above, in a New Zealand study, Mitchell 1997 also found associations between increased risk of SIDS and unmarried mothers, leaving school at a younger age, young mother, greater number of previous pregnancies, late attendance for antenatal care, male infant, and Maori ethnicity.

**SUDI and SIDS**

In a German study of 455 sudden unexpected infant deaths in the first year of life, 51 (11.2%) could be explained – mostly due to respiratory or generalised infections. The remaining 404 deaths were classed as SIDS. This study excluded cases of non-accidental injury (an additional 5.8%). Risk factors for explained SUDI and SIDS were remarkably similar except for prone sleeping position and not being breastfed, which are significant for SIDS only. Socioeconomic disadvantage and smoking are risk factors for both SIDS and explained SUDI (Vennemann 2007).

**What are the population-attributable risk (PAR) of SIDS for individual outcomes?**

Hauck 2008 has estimated that between 27 to 47% of current SIDS deaths in the US could be prevented by placing infants supine to sleep. Even after the US Back to Sleep campaign, 13% of infants are still being placed prone to sleep.

Avoiding head covering (see below) might reduce SIDS deaths by more than a quarter (Blair 2008).

Mitchell 1997 has estimated that addressing bed sharing among mothers who smoke could reduce SIDS by at least one-third; and in a later paper (Mitchell 2006a) proposed that a third of SIDS deaths could possibly be prevented if in-utero smoke exposure was eliminated.
What might the causes of SIDS be?

SIDS is more likely to be a consequence of a wide range of infant and environmental interactions rather than due to one particular cause. The triple risk hypothesis proposes that three factors all need to be present: a vulnerable infant, a critical period of development in homeostatic control and an external stressor such as being placed prone for sleep. Immature cardiorespiratory autonomic control and failing to arouse from sleep may be then be the final pathway to SIDS (Moon 2007).

Prone sleeping
During prone sleep, an infant is at risk for rebreathing oxygen-poor air trapped in an air pocket created by soft bedding (Esposito 2007). The prone position also increases nasopharyngeal colonisation by bacteria (Highet 2008).

Side sleeping
The side sleeping position is relatively unstable, probably resulting in some infants turning to the prone position (Mitchell 2007).

Bed sharing
Postulated mechanisms include airway obstruction, thermal stress, head covering, and hypoxia due to rebreathing of expired gases (Mitchell 2007).

Head covering
Suggested causal mechanisms include mechanical occlusion of the airways, rebreathing of expired air (both of which could lead to hypoxia or hypercapnoea) and thermal stress (leading to generalised or localised hyperthermia) (Blair 2008).

Smoking
Antenatal smoke exposure can have adverse effects on the baby’s lungs and heart and may also lead to decreased arousal to stimuli such as hypoxia and decreased spontaneous arousal from sleep (Moon 2007). A genetic predisposition in Aboriginal and Torres Strait Islander people may interact with tobacco smoke to increase inflammatory responses (interleukin (IL)-6), which may in turn, increase deaths from SUDI (Moscovis 2006).

Infections
Infection and inflammatory responses may trigger physiologic events leading to SIDS. Many SIDS cases are likely to result from colonisation of bacteria such as Staphylococcus aureus and E. coli; death may result without displaying pathology associated with invasive infection (Highet 2008). Preterm babies lack the normal flora in their throats and stomachs and so may be less able to prevent colonisation by bacteria which produce toxins (Highet 2008). Viral infections such as respiratory infections are likely to be also implicated in SIDS, perhaps by making sublethal doses of bacterial toxins lethal (Highet 2008). In addition nicotine may increase the lethal effects of bacterial toxins (Highet 2008).

Thermal
Although excessive clothing and bedding, warmer rooms, reduced ventilation and infections are all associated with SIDS deaths (Blair 2008), these thermal factors seem to be more important when babies were sleeping prone, so less emphasis may now be able to be placed on room heating and excess clothing and bedding (Mitchell 2007).
Breastfeeding
The protective effect of breastfeeding on SIDS may operate through antibodies to staphylococcal toxins being present in breastmilk (Highet 2008) thereby reducing infection; and by more arousals in breastfed than in bottlefed infants (Mitchell 2007). It has also been suggested that breastfed infants arouse more readily than do formula-fed infants and also that formula-fed infants may have less docosahexaenoic acid in their brains, a fatty acid associated with neurodevelopment and more mature infant sleep patterns (Moon 2007).

Pacifier use
Using a pacifier at sleep time might induce a lower threshold for arousal, perhaps leading to increased responsiveness to a life-threatening challenge such as obstructive apnoea, cardiac arrhythmia or external conditions leading to hypoxia and asphyxia. Other explanations may be an improved ability to breathe through the mouth if the nasal airway becomes obstructed or that pacifiers favourably influence sleep position (Moon 2007).

Genetic predisposition and environment interaction
Some infants may be less able to sense and physiologically react to dropping levels of oxygen (e.g. air pocket from sleeping prone) through a combination of genetic predisposition and compensatory mechanisms which are not yet fully developed. Other infants would arouse and react to restore homeostasis (Esposito 2007).

What is the evidence for preventing SIDS?

‘Back to Sleep’
In New Zealand, the proportion of infants sleeping on their back is estimated to have increased from about one-quarter to nearly three-quarters during 1992 to 2005, which may have accounted for 39-48% decrease in SIDS mortality over this period (Mitchell 2007). This represents just over half the decrease in SIDS seen until 2005 (Hauck 2008).

Advice from health professionals
Parents are more likely to place their infant to sleep in a supine position if this has been recommended by a health professional, ideally when the baby is in the newborn nursery. This is particularly for infants admitted to the NICU where they may have kept in the prone position (Esposito 2007). Only 52% of neonatal nurses routinely provide instructions consistent with promoting supine sleep at home (Aris 2006).

Strategies to prevent SIDS
The Safe Sleeping (SIDS prevention) in Indigenous communities project in WA aims to significantly increase awareness of the risks associated with SIDS. One of the tools used is a Safe Sleeping training manual developed for use by Aboriginal Health Workers (in AMA 2008).

SIDS and Kids (NT) has produced a multimedia kit ‘Taking care of your baby’ (www.sidsandkids.org).

Head covering – see above

Feet to Foot campaign in the UK – Mitchell 2007 maintains that although this should reduce the chance of head covering, large cots may also be wide, allowing the infant to twist sideways under the blankets.
What are the barriers to/facilitators for preventing SIDS?

There is little evidence that interventions targeted at reducing maternal smoking in disadvantaged groups has succeeded – according to Fleming 2007 this will require fundamentally changing the availability of tobacco.

Recommendations to offer a pacifier at sleep time and to discourage bedsharing have met with some opposition from breastfeeding advocates as they fear that these will reduce breastfeeding frequency and duration (Moon 2007).

Ongoing projects/programs

Several initiatives to standardise classifications of SUDI/SIDS and to develop surveillance systems with data on modifiable risk factors are underway (Shapiro-Mendoza 2006).

Further research/action required

The accurate diagnosis needed to formulate preventative strategies and to assist in the counselling of parents has not always been possible in small scattered Indigenous communities such as those in north Queensland. Guidelines for death-scene investigations, as well as access to specialist pathologists for conducting autopsies, are urgently needed (Panaretto 2002a).

In order to interpret national trends over time, it is important to know which definitions of SIDS are being used. For example it is not clear whether the lower 1.8 differential between Aboriginal and Torres Strait Islander infant deaths from SIDS in SA (compared with the national fivefold finding) as cited in The Framework (Australian Health Ministers Advisory Committee 2008) is due to definitional differences or a much lower rate in SA; or a combination of the two.
References


2.1.15 Smoking

How many pregnant women smoke?

South Australia

Aboriginal and Torres Strait Islander women (Chan 2008b; 2007)
- In 2007, 59% of pregnant Aboriginal and Torres Strait Islander women were smokers (at first antenatal visit) compared with 15% of other women – or four times the rate of other women. In 2008 there was a slight drop in the rate of smoking in pregnancy by Aboriginal and Torres Strait Islander women (down to 52%).
- In 2007, the proportion of women who quit before the first visit was slightly higher among Aboriginal and Torres Strait Islander women (4.8% compared with 4.2%).
- In 2006, smoking rates were high among all age groups of Aboriginal women varying from 45% among teenage women to 67% among those aged 40-44 years.
- In 2008, a slightly greater proportion of Aboriginal and Torres Strait Islander women under 20 years smoked compared with Aboriginal and Torres Strait Islander women across all age groups – 56% and 52% respectively. (This is in contrast to non-Indigenous women where teenage pregnant women were significantly more likely to be smokers than older pregnant women – 39% versus 16%.)
- In the second half of pregnancy, 48% of Aboriginal and Torres Strait Islander women smoked, compared with 15% of non-Indigenous women.
- 3% of Aboriginal and Torres Strait Islander women smoked more than 20 cigarettes a day in the second half of pregnancy.
- 3% of Aboriginal and Torres Strait Islander women managed to quit smoking before their first antenatal visit compared with 5% in non-Indigenous women (Chan 2001).

Australia

Aboriginal and Torres Strait Islander women
- In 2006, Aboriginal and Torres Strait Islander women smoked during pregnancy at around three times the rate of non-Indigenous mothers – 52% v 16% (Laws 2008). These rates have remained stable for the past three years.
- In 2006, Aboriginal or Torres Strait Islander mothers accounted for 13.9% of all mothers who smoked during pregnancy (Laws 2008).
- In Queensland, the rate of smoking among Aboriginal mothers was 54%, almost triple the rate of 19% among non-Indigenous mothers (Wills 2008).
- More than a third of the Aboriginal population who ever smoked commenced before the age of 14 years (Chan 2001).
- In the NT Child Health Checks, 75% of children (6,760) lived in a household with a smoker (AIHW 2008).

Teenage women (or young women)
- In 2006, 42% of teenage mothers in Australia smoked; this represents 11.6% of all mothers who smoked during pregnancy (Laws 2008).
- In 2001-04, over half of Aboriginal and Torres Strait Islander teenage women (53%) smoked during pregnancy, compared with 41% of other teenage mothers (Chan 2008a).
- Australian teenagers smoking more than 10 cigarettes a day had babies with lower birthweights than those who smoked up to 10 cigarettes a day (Chan 2008a).
- In a NSW survey, 9% of the pregnant women smokers started smoking before the age of 13 years and 83% started during their teenage years (Mohsin 2007).
- Pregnant women aged 15-24 years were significantly more likely to be smokers (32%) than older pregnant women (Hotham 2008).
- One in 15 Australian teenage smokers stopped smoking during pregnancy, significantly lower than the one in 12 older mothers who quit during pregnancy (Chan 2008a).
Non-Indigenous or overall population

- In a NSW survey, among pregnant smokers with a partner, 67% had a partner who also smoked (Mohsin 2007).

International

Non-Indigenous or overall population

- Two-thirds of women will resume smoking after birth (Dolan-Mullen 2004);
- Smoking rates reduced from 24% in the first pregnancy to 21% in the second pregnancy (Cnattingius 1999);
- While most pregnant women say that they want to quit, 18-27% quit on their own before being registered for antenatal care (Cnattingius 1992; Fingerhut 1990). Compared with women who smoke at registration to antenatal care, women who stop smoking prior to registration generally started smoking at a later age, are less likely to be heavy smokers and are less likely to have a smoking partner (Cnattingius 1990).

Targets

The COAG health status targets for smoking include a 4% annual reduction in smoking for pregnant Aboriginal and Torres Strait Islander women, reducing to the national average for Australia by 2020 (Close the Gap 2008).

What is the link between smoking in pregnancy and infant mortality, preterm birth, small for gestational age or low birthweight?

South Australia, overall population

In a study of nearly 35,000 mothers, women who smoked (compared with non-smoking women) had an elevated risk of:

<table>
<thead>
<tr>
<th></th>
<th>Preterm birth</th>
<th>SGA</th>
<th>LBW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Indigenous</td>
<td>RR 1.64 95% CI 1.51 to 1.80</td>
<td>RR 2.28 95% CI 2.14 to 2.43</td>
<td>RR 2.52 95% CI 2.29 to 2.76</td>
</tr>
<tr>
<td>Indigenous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teen smokers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=686)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All these outcomes showed a dose-response relationship with amount of smoking (Chan 2001).

The breakdown for Aboriginal and Torres Strait Islander (ATSI), non-Indigenous and teen women compared with non-smokers in their matching categories was:

<table>
<thead>
<tr>
<th></th>
<th>ATSI smokers (n=392)</th>
<th>Non-Indigenous teen smokers (n=686)</th>
<th>ATSI teen smokers (n=94)</th>
<th>Non-Indigenous smokers (n=7230)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm birth</td>
<td>RR 1.47 95% CI 1.03 to 2.09</td>
<td>RR 1.17 95% CI 0.83 to 1.63</td>
<td>RR 1.29 95% CI 0.59 to 2.82</td>
<td>RR 1.59 95% CI 1.45 to 1.74</td>
</tr>
<tr>
<td>Low birthweight</td>
<td>RR 2.03 95% CI 1.37 to 2.98</td>
<td>RR 1.72 95% CI 1.09 to 2.46</td>
<td>RR 1.57 95% CI 0.74 to 3.32</td>
<td>RR 2.43 95% CI 2.21 to 2.68</td>
</tr>
<tr>
<td>SGA</td>
<td>RR 2.76 95% CI 4.01 to 4.01</td>
<td>RR 1.61 95% CI 1.27 to 2.05</td>
<td>RR 3.60 95% CI 1.56 to 8.29</td>
<td>RR 2.23 95% CI 2.09 to 2.39</td>
</tr>
</tbody>
</table>

Among births to Aboriginal and Torres Strait Islander women compared with non-Indigenous births, there were significantly higher incidences for women who smoked during pregnancy of:

- Preterm birth – 17.1% v 8.3%
- Low birthweight – 18.1% v 8.7%
- SGA – 24.0% v 16.5
Queensland, overall population

In an analysis of nearly 80,000 births from the Queensland Perinatal Data Collection, adjusted preterm birth and full-term low birthweight rates were significantly higher for all smoking compared with non-smoking mothers (Wills 2008). The relative risks for Aboriginal and Torres Strait Islander women and non-Indigenous women who smoked during pregnancy (compared with the respective non-smoking groups) were:

<table>
<thead>
<tr>
<th></th>
<th>ATSI smokers</th>
<th>Non-Indigenous smokers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preterm birth</strong></td>
<td>RR 1.37 95% CI 1.18 to 1.55</td>
<td>RR 1.28 95% CI 1.19 to 1.37</td>
</tr>
<tr>
<td><strong>Low birthweight</strong></td>
<td>RR 4.91 95% CI 3.80 to 6.03</td>
<td>RR 3.38 95% CI 2.95 to 3.81</td>
</tr>
</tbody>
</table>

(Adjusted for maternal age, parity, remoteness, socioeconomic status, number of antenatal visits, type of antenatal care, pregnancy complications and medical conditions)

Thus smoking shows a more pronounced effect on growth (over a threefold risk of growth restriction) than on preterm birth (Wills 2008).

National Perinatal mortality

In 2005, the perinatal mortality rate for babies born to Aboriginal and Torres Strait Islander women who smoked was similar to the rate of babies born to Aboriginal and Torres Strait Islander women who did not smoke — around 18 per 1,000 livebirths. The corresponding figures for non-Indigenous women were 12 and 8 deaths per 1000 livebirths respectively (Australian Health Ministers’ Advisory Council 2008).

Preterm birth

In 2005, 15% of babies born to Aboriginal and Torres Strait Islander women who smoked were preterm compared with 11% of babies born to Aboriginal and Torres Strait Islander women who did not smoke. The corresponding figures for non-Indigenous women were 10% and 7% (Australian Health Ministers’ Advisory Council 2008).

Low birthweight

In 2005, 16% of babies born to Aboriginal and Torres Strait Islander women who smoked were low birthweight compared with 9% of Aboriginal and Torres Strait Islander women who did not smoke. The corresponding figures for non-Indigenous women were 10% and 5% (Australian Health Ministers’ Advisory Council 2008).

Rest of Australia

South Australia, overall population

In a survey of women attending their first antenatal visit at the Lyell McEwin or Women’s and Children’s Hospital, women who smoked during pregnancy were significantly more likely to have had previous pregnancy losses (Hotham 2008).

Western Australia

Stillbirth and infant mortality were significantly higher in mothers who smoked, with the greatest difference being in the post-neonatal mortality rate which was fivefold higher in smoking mothers (WA Health 2007).

The prevalence of smoking was 28.0% in mothers experiencing a stillbirth or infant death compared with 19% in the general population of mothers. The prevalence of smoking was 23% in mothers experiencing a stillbirth and 39% of those mothers experiencing an infant death (WA Health 2007).
**International New Zealand**

- An estimated 33 Māori children and three Pacific children die each year from SIDS as a result of exposure to smoking by adults (New Zealand Ministry of Health 1999).

**Sweden**

- Maternal smoking during both the first and second pregnancies involves a significant increased risk of stillbirth (OR 1.35 95% CI 1.15 to 1.58) while women who only smoked during the first pregnancy did not have an increased risk of stillbirth in the second pregnancy (OR 1.02 95% CI 0.79 to 1.30) compared with non-smoking mothers (Hogberg 2007).

- Smoking is causally associated with fetal growth restriction and probably also with placental abruption, which are two main causes of stillbirth (Hogberg 2007).

In an international review of recent studies (post sleeping position campaigns), there was a significant association between SIDS and smoking: RR 3.93 95% CI 3.78 to 4.08 (Mitchell 2006).

For children of lone mothers aged 25-34 living in low income households, who had not graduated from high school, who received no prenatal care, and who smoked heavily during pregnancy, the estimated probability of these children having been SGA at birth is 26%. For children born to mothers with the same characteristics except that they did not smoke during pregnancy, the estimated probability of SGA falls to 11% (Millar 1998).

**Effect of environmental tobacco smoke**

A recent systematic review has looked at the effect on birth outcomes of non-smoking mothers exposed to environmental tobacco smoke (ETS). The investigators found that ETS was associated with a significantly increased risk of low birthweight: OR 1.32 95% 1.07 to 1.63, but there was no clear effect on preterm birth or SGA (Leonardi-Bee 2008).

**What are the population-attributable risks (PAR) of maternal smoking for infant mortality, preterm birth, small for gestational age or low birthweight?**

**South Australia**

**Aboriginal women (Chan 2001)**

Among Aboriginal and Torres Strait Islander (versus non-Aboriginal) births, population attributable risks of maternal smoking were significantly higher for:

- SGA (48% v 21%); and 59% for births to Aboriginal and Torres Strait Islander teenagers;
- LBW (35% v 23%);
- preterm birth (20% v 11%).

**What links are there for smoking during pregnancy and other outcomes?**

**Aboriginal and Torres Strait Islander women and SES**

In an analysis of mothers giving birth in an outer Sydney hospital, the rate of smoking during pregnancy was 67% of Indigenous women from the lowest SES quintile, 31% for Indigenous women from the other SES quintiles combined and 44% for non-Indigenous women from the lowest SES quintile (Titmuss 2008).

**Aboriginal and Torres Strait Islander people, SES and other social factors**

SES was also an important factor in an analysis of social determinants of smoking from the 2002 Aboriginal and Torres Islander Social Survey. Increasing household income was associated with increasing likelihood of being a non-smoker; being arrested in the past five years was associated with being a smoker, as was being removed from a person’s natural family (Thomas 2008).
Teenage women
- In a NSW survey, for pregnant teenagers, higher rates of smoking than for other pregnant women was associated with being single (OR 3.44 95% CI 1.96 to 6.05); having less formal education (OR 2.10 95% CI 1.35 to 3.26); and being unemployed (Mohsin 2007).
- Among teenage smokers, binge drinking and low age at first intercourse are more common than among non-smokers (Sutherland 1998).

General
- In a NSW survey, those who were more aware of the risks of smoking during pregnancy were less likely to smoke than others (OR 0.81 95% CI 0.65 to 0.99) and those who had least knowledge on potential harms of smoking were more likely to smoke (OR 1.73 95% 1.39 to 2.16); and women who reported inability to control their stress were more likely to smoke than others (Mohsin 2007).
- Smoking is more common in women with lower levels of education (Mohsin 2007; Cnattingius 2002; US Surgeon-General 2001, Cavelaars 2000, Stephansson 2001; Millar 1998) and overweight women (Stephansson 2001).
- Based on 453,801 singleton births from the Swedish Medical Birth Register, smoking reduced pre-eclampsia, increased placental abruption (dose dependent), had a negligible effect on caesarean and no effect on GDM (Cnattingius 2002).
- In a prospective Dutch study of 10,000 women, maternal smoking was inversely associated with infants' head circumference, abdominal circumference and femur length (with a ‘dose’ response) (Jaddoe 2007).
- In a Perth study, the smoking rate of Aboriginal mothers declined with length of breastfeeding, but not significantly so (Gilchrist 2004).

Why might smoking cause adverse birth outcomes?

Sidestream smoke (the primary component of environmental tobacco smoke) may be more harmful than the mainstream smoke which is inhaled during maternal smoking (Leonardi-Bee 2008). This is because environmental tobacco smoke contains greater concentrations of toxins which affect fetal growth through low birthweight through decreased fetal supplies of nutrients and oxygen (Jaddoe 2007) and through mechanisms not yet identified (Leonardi-Bee 2008).

What are the links between smoking in pregnancy and other risk/protective factors?

Periodontitis
In the Australian National Survey of Oral Health 2004-06 of over 3000 people, former and current smokers had significantly higher levels of periodontitis than those who had never smoked. The population-attributable fraction of smoking for moderate or severe periodontitis was 32% (Do 2008). This link between smoking and periodontitis is important as stronger evidence is emerging about the role of periodontal disease in pregnant women in increasing adverse birth outcomes (Thomas 2008).

Unintended pregnancies
In a US Pregnancy Risk Assessment Monitoring System survey of 9048 women, women with unintended or mistimed pregnancies were more likely to smoke before and after pregnancy than women with intended pregnancies (Cheng 2009).
What is the evidence for stopping/preventing smoking in women of reproductive age?

**Smoking during pregnancy** (Lumley 2004)
This Cochrane review of interventions to stop women smoking during pregnancy showed a significant reduction in smoking (RR 0.94 95% CI 0.93 to 0.95; 48 trials). This represents an absolute difference of six fewer women in 100 women continuing to smoke in pregnancy if they were exposed to a smoking cessation intervention than if not.

There was a significant reduction in low birthweight (RR 0.81 95% CI 0.70 to 0.94) and preterm (RR 0.84 95% CI 0.72 to 0.98). There were no statistically significant differences in very low birthweight, stillbirths, perinatal or neonatal mortality but these analyses had very limited power.

One intervention strategy, rewards plus social support (reported in two trials), resulted in a significantly greater smoking reduction than other strategies. Five trials of smoking relapse prevention showed no statistically significant reduction in relapse.

**Postpartum care**
A systematic review of three trials of postpartum advice and counselling to prevent smoking relapse (with over 3000 women), or stopping or reducing smoking, showed no statistically significant impact of these interventions (Levitt 2007).

**School-based programs**
In a New Zealand study, school-based tobacco policies were found to be unrelated to the prevalence of tobacco used among students, tobacco purchasing behaviour and knowledge of the negative health effects of tobacco (Darling 2006).

Although most primary schools in New Zealand offer some form of smoke-free education, there was a lack of rigorous program evaluation, with links to harm reduction not demonstrated (Walker 2007).

This lack of compelling evidence for behavioural interventions in the school environment is echoed in a Cochrane review of school-based programs for preventing smoking (Thomas 2006).

**Environmental tobacco smoke**
In a Cochrane review about ways to reduce exposure to environmental tobacco smoke, intensive counselling provided in clinical setting was shown to be effective (Priest 2008).

**Pharmacological interventions - Nicotine replacement therapy**
Nicotine replacement therapy (NRT) has not been commonly used in Australia to help pregnant women stop smoking because of concerns about adverse effects and harm to the baby. Current Australian guidelines for drug use in pregnancy do allow for use of intermittent nicotine replacement therapy if a pregnant woman is unable to quit after trying psychosocial interventions (Ministerial Council 2006). A study of self-selected smokers from Aboriginal communities in the NT concluded that free nicotine patches might benefit a small number of Aboriginal and Torres Strait Islander smokers (Ivers 2003).

The overall evidence for NRT in general populations is strong – a Cochrane review shows that NRT increases the rate of quitting by 50% to 70% regardless of setting (Stead 2008). An RCT ‘Baby steps’ not yet included in this Cochrane review showed NRT and cognitive behaviour therapy to be more effective in helping pregnant women to stop smoking than cognitive behaviour therapy alone, although this did not persist postnatally. The trial was stopped early because of an excess of adverse events in the NRT arm, such as preterm birth. Since there were more women in the NRT arm with a history of preterm birth, it is more likely that the additional preterm births were due to the higher risk profile of women in the NRT arm rather
than exposure to NRT (Pollak 2007). A cohort study from Denmark of nearly 90,000 pregnancies did not show an increase in stillbirth with the use of nicotine replacement therapy (Strandberg-Larsen 2008a).

An RCT among Aboriginal and Torres Strait Islander women in Queensland has included NRT as one of the options for women who have otherwise been unable to stop smoking when pregnant but results of the study are not yet published (Gilligan 2008).

Clinical practice guidelines in antenatal care
In Queensland, implementation of clinical practice guidelines used to help women stop smoking in pregnancy showed an increase in evidence-based practice in antenatal care with some suggestion of a reduction in smoking (Flenady 2008).

Web and mobile phone messaging
A New Zealand RCT showed mobile phone messaging to be effective in the short-term (six weeks) quitting smoking, for both Maori (n=355) and non-Maori (n=1350) people. Participants were mostly young (median age 22) and 58.5% were female – 74% for Maori (Bramley 2005).

An RCT ‘Happy Ending’ in a general population (50% were women) in Norway showed greater abstinence from smoking with frequent emails, web and mobile text contacts than a control group receiving a self-help booklet (Brendryen 2008).

Strategies/programs to encourage pregnant women to participate in smoking cessation programs

South Australia
A smoke-free pregnancy project was funded by Drug and Alcohol Services SA and project managed by Quit SA in four SA metropolitan public birthing hospitals from 2004 to 2006.

A study of ASSIST (the Alcohol, Smoking and Substance Involvement Screening Test) in pregnant women is currently underway at the Lyell McEwin and Women’s and Children’s Hospitals in South Australia (Hotham 2008).

National/rest of Australia
Brief smoking cessation advice is part of the ‘Mums and Babies’ program in Townsville which shows a reduction in infant mortality (Panaretto 2007).

New Zealand
New Zealand has a five-year plan (2004-09) for tobacco control “Clearing the smoke” (NZ Ministry of Health, 2004). The Ministry of Health is considering the following actions to prevent or reduce harm from smoking in pregnancy:

- Expanding current smoking cessation support programs for pregnant women (including programs for Māori women)
- Increasing tobacco taxation
- Funding a mass media campaign (with culturally appropriate media)
- Warning on cigarette packets
- Review benefits and costs of financial incentives from employers to encourage employees to quit
- Review health education resources for pregnant women (considering appropriateness for Māori)

New Zealand is also running a smoking cessation program called Smokechange.
The Smoking Cessation Treatment and Research Programme provides brief advice training to all staff who come into contact with pregnant women and parents of young children. Following referral, the woman is assisted to develop a quit plan and a quit date is established. Weekly support sessions are organised for 12 weeks with nicotine replacement therapy provided. Women are supported through home visits during their pregnancy and also given intensive postnatal support to help prevent relapse after giving birth. The program was informed by social marketing which indicated a previous lack of enthusiasm and empathy from healthcare workers. The rate of women smoking during pregnancy has dropped from 38% to 23% since the introduction of the program (UK Department of Health 2007b).

**What are the barriers to/facilitators for preventing or reducing smoking?**

**Attitudes of Aboriginal and Torres Strait Islander women**
Given the social and economic pressures faced by Aboriginal and Torres Strait Islander women, stopping smoking, even in pregnancy, is not always a priority (Wood 2008).

**Participation in programs**
In a NSW survey of pregnant women, only 5.5% of current smokers reported that they had ever enrolled in a quit smoking program and just over a quarter recalled that they had received any advice to stop smoking during pregnancy (Mohsin 2007).

**Attitude of pregnant smokers to nicotine replacement therapy, and to smoking**
In a study of 64 low SES pregnant smokers in Sydney, 63% indicated that they were very likely to use NRT if provided free of charge at the antenatal clinic and 87% felt that NRT should be offered to pregnant smokers. In this survey, 53% of women did not recall receiving advice or assistance regarding smoking while pregnant. Almost all women (92%) said that they were worried about the effects their smoking had on the baby, yet less than half (48%) intended to quit in the next three months (Bedford 2008).

A Canadian study showed that while Aboriginal smokers showed that while they were keen to stop smoking, they were less willing to use nicotine patches than non-Aboriginal smokers. Awareness of a subsidy for free provision of patches was associated with increased willingness to use drug therapy (Wardman 2007).

**Low quit rates**
In a Queensland survey of pregnant women who smoked, only 7% of non-Indigenous women and 3% of Aboriginal women were able to quit by 20 weeks gestation (Wills 2008).

**Staff role models**
Many health service staff smoke and this may influence the smoking behaviour and attitudes of their clients. Nurses who smoke are less willing to counsel and encourage others to quit. In a NSW health service quit program for staff, a third of the 75 staff who had accessed free nicotine replacement therapy had quit smoking at three months. Most of the staff who had not quit at this attempt were considering another quit attempt (Wallace 2008).
Ongoing projects/programs

South Australia

As part of South Australia’s Strategic Plan 2007:

- The SA Pregnancy Record will be used to identify and address smoking in pregnant women by developing a smoking assessment tool in consultation with Quit SA (by 2008)
- Professional education programs for antenatal health care providers (accommodating the Quit SA principles) will be developed in consultation with the SA GP Obstetric Shared Care Program/SA Divisions of General Practice (outline by January 2009)
- All participants (approximately 94% of the SA Birth cohort) who are visited following the birth of a child at the Universal Contact visit will be provided with an assessment of smoking risk and support for cessation and risk reduction
- All Family Home Visiting participants will be provided with an assessment of smoking risk and support for cessation and risk reduction
- Healthy for Life Commonwealth Government initiatives to enhance the capacity for Aboriginal primary health care services to improve child and maternal health relating to smoking will be supported
- A range of strategies targeting specific Aboriginal groups and aimed at reducing tobacco use and exposure to passive smoking; and smoking cessation will be implemented
- Smokecheck training of Aboriginal Health workers across SA and brief intervention counselling will be provided.

Outcomes will be monitored by measuring the percentage of women who smoke during pregnancy and the percentage of low birthweight babies born to women who quit smoking in pregnancy.

The Quit SA SmokeFree Pregnancy Program aims to expand to all antenatal and postnatal services across SA (www.quit.sa.org.au/aspx/smoke_free_pregnancy_project.aspx) [accessed 16 July 2008], including a focus on Aboriginal women (Owen 2007).

Drug and Alcohol Services South Australia currently funds an Aboriginal Project Officer based within Country Health SA, Port Augusta, to support Aboriginal Health Workers and communities to reduce smoking prevalence amongst Aboriginal people in rural and remote areas of northern and far western South Australia. The project is funded for four years, at $130,000 per year.

National/elsewhere in Australia

- The National Advisory Group on Smoking and Pregnancy has been provided with $4.3 million to fund a national program from July 2005 to July 2008.
- The National Smoke-Free Pregnancy Project provides brief interventions for pregnant smokers who attend participating public birthing services.
- As part of the Victorian Aboriginal Services Plan, antenatal smoking and cessation programs will be trialled and evaluated by Aboriginal Community Controlled Organisations. Aboriginal organisations will also be supported to implement smoking cessation programs for health workers (Victorian Department of Human Services 2008).
- One of the HITnet multimedia productions is an animation titled ‘Granny, Why Don’t You Smoke?”. HITnet uses interactive technology to expand options for Indigenous health promotion, through YouTube and through initiatives such as touchscreen kiosks to be located across Australia (www.hitnet.com.au/health.html) [accessed 31 December 2008].
- A RCT of smoking cessation strategies in Aboriginal and Torres Strait Islander women in Queensland is currently underway (Gilligan 2008).
- Another RCT of smoking cessation support strategies in Aboriginal Health Services is underway in WA – entitled the BOABS (Be our Ally Beat Smoking) study (ANZCTR 12608000604303, http://www.anzctr.org.au/trial_view.aspx?ID=83369)
In 2008, the Federal Government announced an initial $14.5 million to be used to develop an evidence-based Indigenous tobacco control strategy (Galyna Angin 2008).

The Centre for Excellence in Indigenous Tobacco Control has developed resources such as the Talkin’ Up Good Air kit and Deadly Dan, Smoke-Free Man (Galyna Angin 2008).

**New Zealand**
The impact of the 2003 smoke-free law on smoking on school premises in New Zealand has not yet been fully evaluated (Wilson 2007).

**United Kingdom**
A Yorkshire program is promoting smoke-free homes through three options in what is seen as a friendly, nonjudgmental approach (UK Department of Health 2007a):
- Gold promise: smoke-free home
- Silver promise: smoking limited to one room in the house and never in the presence of children
- Bronze promise: never smoke in the presence of children.

The National Institute of Health and Clinical Excellence is preparing Guidelines on how to stop smoking in pregnancy and following childbirth (National Institute for Health and Clinical Excellence 2009).

**Ongoing RCTs**
- In the US, MiQuit is testing an individually tailored smoking cessation self-help leaflet plus 12 weeks of individualised mobile phone text messaging smoking cessation support (ISRCTN11301171).
- The Smoking, Nicotine and Pregnancy (SNAP) trial is underway in the UK (Coleman 2007).
- In the US and the UK, an RCT of physical activity during pregnancy to help smoking cessation is underway (Ussher 2008).

**Interpretation/comments**
Pregnancy presents an opportunity for a woman who smokes as this is the time that she is more likely to quit smoking than any other time in her life. However giving up is not likely to be easy, with multiple attempts likely to be needed.

The relapse rate after birth is high, so ideally women could be offered help to stop smoking before they start having their babies – or even to be persuaded not to begin smoking. For many young women, there are many factors in their lives that make this a difficult challenge. For instance, smoking is seen a means of coping with stress. Alternative strategies for coping with stress are needed, which is a particular consideration for Aboriginal and Torres Strait Islander women and teenage women (Roche 1997; Wood 2008).

**Further research/action required**

**Antenatal care programs and specific smoking in pregnancy programs**
The progress of general and specific programs in achieving reductions in smoking in pregnant women and women of reproductive age needs to be monitored, audited and disseminated.

**Barriers**
Some very useful knowledge about Aboriginal and Torres Strait Islander women’s attitudes to smoking has recently been published. This needs to be continued and translated into strategies for supporting women who are considering stopping or reducing their smoking, and also strategies for health workers to have access to smoking cessation support.
Role of guidelines and implementation
There is some indication that implementation of antenatal guidelines may have an impact on maternal smoking behaviour and so these efforts should be further developed and tested.

Prepregnancy and interpregnancy smoking cessation
Although likely to be a difficult area to address, there is a need to find ways to help women stop smoking before they become pregnant, between pregnancies – and ideally to help stop young women starting to smoke at all.

Nicotine replacement therapy
There is some indication that nicotine replacement therapy may be acceptable to pregnant Aboriginal and Torres Strait Islander women wishing to stop smoking. This needs to be further explored as does the risk profile of NRT for pregnant women and their babies.

Emails and mobile phone texting
Interventions using communication technologies such as the internet and mobile phone texting may be useful in reducing smoking and should be tested in groups of pregnant women and women of reproductive age with access to these technologies.

Environmental tobacco smoke
Given the impact of environmental tobacco smoke on low birthweight, ways of reducing exposure need to be implemented and evaluated.
References


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2.1.16 Social and Family Support

This topic is strongly linked to the ‘Home Visits’ topic, although not all social and family support is home-based. Relevant material can also be found in the sections on ‘Models’ and ‘Community Resilience’.

What sorts of social and family support might assist women before, during and after birth; and how many women have low levels of social support?

Aboriginal and Torres Strait Islander women
Northern Territory
The majority of Aboriginal and Torres Strait Islander women living in remote communities in the Northern Territory travel to regional centres and birth alone. The issues of language, different styles of communication and the concept of shame (being forced to act in disharmony with your cultural or social beliefs) may all contribute to making a maternity hospital stay difficult or uncomfortable for Aboriginal and Torres Strait Islander women.

In a NT study of maternity experiences, most women had moral and economic support and most used the phone to communicate with their families; but some felt lonely, bored or afraid, which was made worse by lack of communication and perceived negative attitudes from staff. Watson and colleagues highlight the importance of advice from mothers and grandmothers about cultural conventions, correct diet and taboo eating practices, and responsibilities for caring for the baby. In the Northern Territory, the Patients Assistance Scheme pays for flights to regional centres and accommodation and meal costs, and an official escort for those 15 years or younger (Watson 2002a, Watson 2002b, Watson 2002c).

International
United States of America
Over a third (114/319) adult low-income pregnant African American women were identified as lacking support from their mothers or male partners (Norbeck 1996).

What are the links between social and family support and infant mortality, preterm birth, small for gestational age or low birthweight?

International
In a Swedish prospective cohort study of 826 nulliparous women with a singleton live birth (Dejin-Karlsson 2000) SGA was associated with the following measures of social support and networks (unadjusted analyses):

<table>
<thead>
<tr>
<th>Measure</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low social stability</td>
<td>2.0 (1.1 to 3.5)</td>
</tr>
<tr>
<td>Low social participation</td>
<td>2.2 (1.2 to 3.8)</td>
</tr>
<tr>
<td>Low emotional support</td>
<td>1.7 (1.0 to 3.0)</td>
</tr>
</tbody>
</table>

No significant association with SGA was seen for instrumental support, support from the child’s father, support from the mother’s mother, job support and control of daily life. In analyses adjusted for demographic, education and lifestyle factors, SGA was no longer associated with low social stability, but the association with low social participation remained significant. Other shifts after adjustment for these factors were that SGA became significantly associated with low instrumental support (access to advice and information) and lost significance for low emotional support. The results did not change when biomedical risk factors (such as hypertension, urinary tract infection, bleeding and/or preterm contractions during current pregnancy) were added to the model. The effect of an inadequate social network and weak social support on intrauterine growth may be greater among women who are already subjected to some sort of social deprivation (such as immigrant women and women with little education).
In a UK study of over 16,000 mother-infant pairs, mothers without a companion at birth (5% of births) were significantly more likely to have a preterm birth and a low birthweight baby (Essex 2008).

In a New Zealand case control study there was a significant association between social support and SGA births (after adjustment for ethnicity) (Pryor 2003).

What is the evidence for providing social and family support for pregnant women and new mothers?

Perinatal mortality
In a RCT conducted in Manchester, UK, of 1227 women (< 20 weeks gestation) at increased risk of giving birth to a low birthweight baby, there were six stillbirths in the family support from the lay workers group and one in the standard care group; and the corresponding figures for neonatal deaths were one and three deaths (Spencer 1989).

Preterm birth
In the Spencer 1989 RCT, no differences were seen for preterm birth < 37 weeks for women provided with family support from lay workers compared with standard care (OR 1.1 95% CI 0.7 to 1.6).

Small for gestational age
In the Spencer 1989 RCT, no differences were seen for SGA (< 10th centile) for women provided with family support from lay workers compared with standard care (OR 1.0 95% CI 0.7 to 1.5).

Low birthweight
In the Spencer 1989 RCT, no differences were seen for low birthweight (< 2500 g) for women provided with family support from lay workers compared with standard care (OR 1.0 95% CI 0.7 to 1.6).

Birth spacing
In a small pilot study, 29 African-American women in the US who had previously given birth to a very low birthweight infant, were provided with interpregnancy primary care, and social support for 24 months from a Resource Mother (a trained layperson). They had significantly fewer pregnancies within 18 months compared with data from a perinatal database for 58 similar women (Dunlop 2007).

Ongoing projects/programs

Baffour 2006 describes an ongoing model of family health advocacy and social support for African-American pregnant women and mothers of children under two years in Gadsden County, USA. Evaluation of this program is not yet published.
References


2.1.17 Substance Use

How many pregnant women use drugs (other than alcohol and tobacco)?

Aboriginal and Torres Strait Islander women, South Australia
In an audit of nearly 90,000 pregnancy records, 5.3% (115 of 2151) Aboriginal mothers self-reported as substance users (illicit and licit, excluding nicotine but including risky alcohol use) – about three times the rate of non-Indigenous women in an adjusted analysis (Kennare 2005).

Aboriginal women, Western Australia
In a Perth survey, pregnant women using amphetamines were more likely than the general WA population to be Aboriginal women (p=0.001), but this was not the case for opiate use (Ludlow 2004).

Aboriginal and Torres Strait Islander people, Northern Territory
In some remote communities, particularly where access to alcohol has been restricted, cannabis use is high, with 70% of young males and 20% of young females being current users (Lee 2009).

Aboriginal and Torres Strait Islander women, New South Wales
Eighteen per cent of babies born to substance-using women at the RPAH in Sydney were babies of Aboriginal and Torres Strait Islander women (Teasdale 2008).

South Australia, overall population
In a survey of women attending their first antenatal visit at the Lyell McEwin or Women’s and Children’s Hospital, 4.5% (34 women) reported using cannabis during pregnancy (Hotham 2008). In this survey respondents reported low levels of use during pregnancy of amphetamines, hallucinogens, ‘non-medical’ use of benzodiazepines, ‘non-medical’ use of opioids; and no respondents reported using cocaine during pregnancy. In a 2003 survey at the Lyell McEwin Hospital, 5.4% (19 women) reported using drugs (other than alcohol or tobacco) during pregnancy, likely to be an underestimate as one in five women did not answer this question (Edwards 2008a).

Pregnant women aged 15-24 years were significantly more likely to use cannabis (8%) compared with older pregnant women (Hotham 2008).

An earlier study found that 0.8% of pregnant women (707 out of 89,080) self-reported substance use in their birth record in South Australia during 1998-2002. This includes use of illicit substances and licit substances (other than nicotine) such as alcohol, paint or petrol. In an audit of 144 birth records, marijuana was used by 39% of substance users, methadone by 30% and amphetamines by 15%, with polydrug use reported by 19% of these women. No women reported cocaine use (Kennare 2005).

New South Wales, overall population
In an audit of mothers and their babies in Lismore from 1995-99, 0.7% (49) births were to women using substances: 23 methadone users; 14 methadone and intravenous heroin users; 11 heroin user; one amphetamines user. Two of the 49 women identified as being Aboriginal (Richardson 2001).

More than 5% of high-risk newborn infants (310/6120) admitted to intensive care units in NSW and ACT had mothers who had used drugs of dependence (illicit drug or otherwise) during their pregnancy. This rose to 6.8% in the subset of infants of 22 to 26 weeks gestation. Substance-using mothers were likely to be younger and Indigenous than non-substance-using mothers. Nearly 43% of women were opioid users and 79% used non-opioids with some women using both classes. Most opiate users (86%) were enrolled in methadone programs. Just over 40% of women solely used marijuana (Abdel-Latif 2007).
Western Australia, overall population
In a Perth survey, 0.76% of the 11,954 births during the period were documented as being to opiate-using mothers and 0.42% to amphetamine-using mothers (Ludlow 2004). These women were younger than the general population.

Australia, teens
In a prospective cohort study of 456 pregnant teenagers attending antenatal care at three Australian obstetric hospitals, 20.4% (96) women used marijuana throughout their pregnancy. Thirty-one women were multidrug users, taking solvents, amphetamines, heroin, ecstasy and or LSD. Half the non-users admitted to being ex-users of illicit drugs but had ceased when pregnant. Of the 138 Indigenous teenage women in the survey, most (76%) did not use drugs during their pregnancy, with 18% using marijuana only and 6% using marijuana and other drugs (Quinlivan 2002).

Australia, overall population
The prevalence of substance use is increasing in Australia (Kelly 2000 in Ludlow 2004).

According to figures from 2004 National Drug Strategy, 2.3% of Australian females aged between 20 and 29 had recently used cocaine (Riddell 2008).

International
An estimated 5.5% of the 4 million women who gave birth in the US in 1992 used illegal drugs (mostly marijuana and cocaine) while they were pregnant (Matthias 1992). In this survey, while pregnant women decreased substance use during pregnancy, they did not discontinue altogether.

In a later US prospective cohort study, 12% of 6673 mothers were recorded as illicit drug users immediately postpartum (El-Mohandes 2003).

In the US, postpartum drug use (drug use among parenting women) is over twice the rate of drug use during pregnancy (Ondersma 2007).

Estimated prevalence of opiate use among pregnant women ranges from 1% to 2% to as much as 21% (Brown 1998).

Cannabis
In a prospective UK study of over 12,000 pregnant women, 5% reported smoking cannabis before and/or during pregnancy. During pregnancy this dropped to 2-3% and the level of daily use was less than 1% (Fergusson 2002).

What are the links between drug use and infant mortality, preterm birth, small for gestational age or low birthweight?

Aboriginal and Torres Strait Islander women, New South Wales
In a survey in Lismore, of the 49 babies born to women using heroin, methadone or amphetamines, two were stillbirths. One neonate with congenital abnormalities died at day 10. Twelve babies (26%) were preterm (< 37 weeks) and 12 babies also had birthweights less than the 10th percentile (Richardson 2001).
South Australia, overall population

Kennare 2005 found significant links between self-reported maternal substance use and preterm birth, as well as small for gestational age, stillbirth and neonatal death in 723 babies (707 live born), compared with babies of non-users:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>AOR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm birth</td>
<td>2.63 2.21 to 3.13*</td>
</tr>
<tr>
<td>Small-for-gestational age</td>
<td>1.79 1.49 to 2.13**</td>
</tr>
<tr>
<td>Stillbirth</td>
<td>2.54 1.52 to 4.26***</td>
</tr>
<tr>
<td>Neonatal death</td>
<td>2.92 1.41 to 6.04****</td>
</tr>
</tbody>
</table>

* Adjusted for age, smoking, baby’s sex, mother’s psychiatric condition
** Adjusted for age, smoking
*** Adjusted for age, race, smoking and mother’s psychiatric condition
**** Adjusted for age, race, smoking and mother’s psychiatric condition

New South Wales and Australian Capital Territory, overall population

Infants admitted to NICUs who were exposed to antenatal substance use were significantly more likely to have a lower gestational age and a lower mean birthweight than infants not so exposed. No significant differences were seen for SGA and death (Abdel-Latif 2007).

Western Australia, overall population

In a Perth survey, opiate-using mothers were more likely to have a preterm birth < 37 weeks and a birthweight less than 2500 g (both p=0.0001) compared with all births for WA in the same period, although the birthweight difference was no longer significant when adjusted for gestational age and fetal sex (Ludlow 2004). There was a similar pattern for amphetamine-using mothers, with the corresponding figures being p=0.001 for preterm birth and p=0.001 for low birthweight (Ludlow 2004).

In this survey, the rate for both preterm birth and LBW was 20.6% for opiate-using mothers. The corresponding rates for amphetamine-using mothers were 26% and 20% (Ludlow 2004).

Australia, teens

Quinlivan 2002 found no difference in preterm birth rates between non-drug using pregnant teenagers and those using marijuana or marijuana plus other drugs, although the preterm rate (over 16%) was high for all groups.

International

Highly significant associations between illicit drug use and preterm birth; low birth weight and small for gestational age were reported in a prospective cohort study from the US. The risks were highest for drug-using women who did not have adequate antenatal care, although the authors of this study note that adherence to antenatal care may be a proxy for factors such as a more structured lifestyle (El-Mohanandes 2003).

Heroin

There is a significant increase in neonatal complications with heroin use in pregnancy – an increase in neonatal mortality and 74-fold increase in sudden infant death syndrome (Dattel 1990). However all of the opioids including methadone can lead to infant death (Minozzi 2008).

In a UK study, 30% (16 women) using methadone had a preterm birth and the corresponding figure for heroin users was 23% (11 women) (Fajemirokun-Odudeyi 2006). There were two neonatal deaths (2%) – one in the methadone group and one in the heroin group.
Cannabis
In a systematic review of 10 studies (adjusted for cigarette smoking) (English 1997), any cannabis use during pregnancy (mostly self-reported) was not associated with increased low birthweight (OR 1.09 95% CI 0.94 to 1.27); although use four or more times a week was associated with a small decrease in birthweight (mean difference 131 g 95% CI 52 to 209). This is consistent with a later UK study of over 12,000 pregnant women where adjusted analysis did not show a relationship between cannabis use and preterm birth or low birthweight, although women who use cannabis at least once a week before and throughout pregnancy may have lighter babies (Fergusson 2002).

Cocaine
In a systematic review of five studies, adjusted for cigarette smoking, any cocaine use during pregnancy was associated with a higher risk of low birthweight (RR 1.77 95% CI 1.15 to 2.17) and a decrease in birthweight (MD 112 g 95% CI 62 to 161 g) which was even more pronounced with heavier use: RR 4.42 95% CI 2.24 to 8.71 (Hulse 1997).

What links are there for drug use in pregnancy and other outcomes of interest?
In an audit of pregnancy records in South Australia, Kennare 2005 found significant links between self-reported maternal substance use and length of nursery care, hospital stay and congenital abnormalities in 723 babies (707 live born), compared with babies of non-users. Substance users were significantly more likely to have placental abruption, and antepartum haemorrhage from other causes, but this was not the case for pregnancy hypertension, gestational diabetes, retained placenta, cord prolapse or caesarean birth. In a Perth survey, 38.0% and 36.0% of babies of opiate and amphetamine-using mothers respectively required neonatal resuscitation. The corresponding figures were 2.1% and 38.0% for Apgar score < 7 at 5 minutes; and 45.0% and 32.0% for admission to the special care nursery. All these outcomes were significantly different than the general population of WA mothers and babies, except for the need for neonatal resuscitation for babies of amphetamine-using women (Ludlow 2004).

In another Perth study of the experiences of 20 illicit drug-using mothers, only one had accessed services to address their own physical and/or emotional health needs after childbirth (Dowdell 2009). In a prospective cohort study of 456 Australian pregnant teenagers, no significant differences were seen between non-drug users, marijuana users and multidrug users for antenatal problems such as anaemia, preterm rupture of membranes, antepartum haemorrhage, and gestational hypertension. Significantly more women in the marijuana and multidrug using groups had threatened preterm labour (but did not experience preterm birth as noted above). Modes of birth were comparable between all three groups, as were maternal postnatal problems (including complications of prematurity, jaundice, fever, weight loss and drug withdrawal). The rate was over 50% in all groups for both maternal and infant problems. Infant outcomes such as birthweight, length, head circumference and Apgar scores were not significantly different between groups after adjusting for gestational and other unspecified antenatal factors (Quinlivan 2002).

Antenatal care
While the risk of preterm birth and low birth weight increased with inadequacy of antenatal care in a US study involving illicit drug using mothers, only total lack of antenatal care increased the risk of SGA (El-Mohandes 2003).

Breastfeeding
In an audit in Lismore, NSW of 47 babies born to women using heroin, methadone or amphetamines, only 40% were breastfeeding at hospital discharge, compared with a NSW average of 78% (Richardson 2001). This is in contrast to an Australian cohort study where non-drug using teenagers had similar rates for...
Why might drug use in pregnancy cause adverse birth outcomes?

Cocaine may impair oxygen transfer and nutrient delivery from mother to fetus via uterine vasoconstriction, it may act at the cellular level to reduce amino acid uptake by placental villous tissue, it increases fetal tachycardia which in turn may lead to increased fetal activity (Hulse 1997).

Opiates and amphetamines may have both vasospastic and vasoconstrictive effects leading to IUGR, preterm birth and low Apgar scores (Ludlow 2004).

What are the links between drug use in pregnancy and other risk/protective factors?

In a study of cannabis use in remote Indigenous NT communities, users (male and female) were less likely than non-users to participate in education and training, and more likely to report symptoms of depression, and to have been imprisoned. When cannabis supplies were scarce, community violence increased. Up to 10% of these communities’ total income and between 31% and 62% of a user’s median weekly income was spent on cannabis (Lee 2009).

A survey of South Australian birth records in 1998-2002 indicated links between substance use and smoking, mothers having a psychiatric condition, being single, being of lower socio-economic status, being Aboriginal and Torres Strait Islanders and living in the metropolitan area. For example, the percentage of substance users who also smoked during pregnancy was 86.0% compared with 22.3% of non-users; corresponding figures for women with psychiatric conditions were 10.3% and 1.4% (Kennare 2005).

Women, in particular, experience comorbidity between substance use and psychiatric disorders (Rayburn 2004) which is of the order of 56% to 73% in drug dependent pregnant women (Jones 2008). A study in Lismore restricted to 49 women using heroin, methadone or amphetamines in pregnancy reported that 15 (31%) had a history of various mental health disorders including psychosis (3), schizophrenia (2), bipolar disorder (3), depression (6) and attempted suicide (1) (Richardson 2001).

Data from Melbourne also show a link between substance use and mental health, with 61% of women presenting for pregnancy care having a diagnosed mental illness in addition to their existing substance use disorder (Tobin 2005).

In an audit in Lismore, NSW, all 49 women who used heroin, methadone or amphetamines were smokers and 30% of them smoked more than 20 cigarettes a day. Over half the women (55%) had irregular antenatal visits and 41 (89%) were hepatitis C positive (Richardson 2001).

In Quinlivan’s Australian survey of 456 pregnant teenagers, 74% of marijuana users and 90% of multidrug users were smokers, compared with 40% smokers in the non-drug users. The corresponding figures for alcohol use were 39% and 52% compared with 13% of non-drug users; all comparisons were statistically significant (Quinlivan 2002). This survey also found significantly higher infectious morbidity for chlamydia and endocervical pathogens in multidrug users, compared with non-drug users in pregnancy. A number of coexisting psychosocial morbidities and social problems were also found to be significantly more common in the drug using pregnant women (such as social isolation, homelessness, domestic violence, and DSM IV psychiatric morbidity). This was especially so for the multidrug using women (Quinlivan 2002).

In a UK survey of over 12,000 pregnant women, smoking cannabis before and/or during pregnancy was associated with younger age, lower parity, better education and being more likely to use alcohol, cigarettes, coffee, tea and hard drugs (Fergusson 2002).
It is very difficult to separate out the effect of substance use on pregnancy outcomes from the effect of other maternal lifestyle and psychosocial factors associated with substance use (Kennare 2005) as evidenced by the characteristics of women attending the Sheway Service for substance using pregnant women and parents (Marshall 2005). In 2003, of the women using Sheway services:

- 76% were current users of drugs or alcohol;
- 23% had experienced family violence;
- 15% had a mental illness;
- 30% had had a previous child die, or a child removed;
- 60% had inadequate housing;
- 70% had inadequate income; and
- 38% had hepatitis B and/or C, or HIV.

**What is the evidence for preventing drug use or treating drug dependency in for pregnant women and new mothers?**

**Medication**

A Cochrane review of maintenance treatments for opioid-dependent pregnant women found only three small trials, showing few differences between methadone and buprenorphine (Minozzi 2008). Methadone maintenance treatment is sometimes limited in pregnant opiate-addicted women in order to reduce the risk of neonatal abstinence syndrome in their babies. However a retrospective review of high dose and low dose methadone treatment during pregnancy showed no increased risk of neonatal abstinence syndrome and fewer positive screens for illicit drugs at birth (McCarthy 2005). Compared with 35 opiate-addicted women who started methadone treatment in the second or third trimester of pregnancy, 22 women who conceived and remained on methadone for the whole pregnancy had significantly fewer positive screens for opiates at birth without increased risk of neonatal abstinence syndrome in their babies (McCarthy 2008).

Most attempts to taper or reduce methadone doses will fail, although a Cochrane review has shown that slow tapering can reduce withdrawal severity. Nevertheless most people (from a general, not a pregnant, population) relapsed to heroin use (Amato 2005).

Maintenance treatments for opiate-dependent pregnant women are often combined with care packages, with women receiving additional prenatal care (Minozzi 2008).

At present methadone remains the only recommended mainline treatment for opiate dependency during pregnancy in Australia. Pregnant women need more methadone than nonpregnant women, with the optimal dose being one that prevents onset of withdrawal, reduces or eliminates drug cravings and blocks euphoric effects (Oei 2007).

As virtually all antiaddiction medications are thought to pass into breast milk, breastfeeding is usually not recommended (Rayburn 2004). However there is some evidence that breastfeeding can help prevent neonatal abstinence syndrome and that the benefits of breastfeeding generally outweigh the risks (Oei 2007).

Currently there is no clearly effective medication for treatment of cocaine, amphetamine or other stimulant dependence, or for cannabis dependence during pregnancy (Rayburn 2004).
**Psychosocial interventions**

In a Cochrane review of nine trials involving 546 pregnant women enrolled in illicit drug treatment programs, contingency management using positive supportive reinforcement (five trials) helped to keep women in programs, while motivational interviewing (four trials) did not show an effect on retention. Only two of the trials reported on birth outcomes which showed no differences between treatments (Terplan 2007).

**Brief motivational intervention with postpartum women**

A US RCT of a computerised brief intervention with postpartum women self-reporting substance use failed to find significant effects of the intervention. The research needs to be replicated to show if such an intervention holds some or little promise (Ondersma 2007).

**Breastfeeding**

Methadone (and probably buprenorphine) maintenance programs may help to support breastfeeding (Jones 2008, NSW Health 2006).

**Partner treatment**

Since a partner’s use of heroin increases the risk of relapse for the woman, partners should be offered priority access to opioid substitution programs (NSW Health 2006).

A Cochrane review found that there was insufficient evidence to determine the effects of home visiting for pregnant women and new mothers using drugs (Doggett 2005). A later randomised trial of 152 illicit drug-using pregnant women in WA also did not show effects of a home visiting program on breastfeeding duration or postpartum drug use (Bartu 2006).

**Strategies to help pregnant women and new mothers reduce or stop substance use**

**Australian guidelines for drug use**

The Australian guidelines for drug use state that effective partnerships between mainstream services and Aboriginal Community Controlled Health Services need to be developed to improve communication, integrate service delivery and provide continuity of care.

Six common principles were identified by the Ministerial Council on Drugs Strategy (2003-06) for addressing substance use by Aboriginal and Torres Strait Islander people:

- The use of alcohol, tobacco and other drugs must be addressed as part of a comprehensive, holistic approach to health that includes physical, spiritual, cultural, emotional and social wellbeing, community development and capacity building;
- Local planning is required to develop responses to needs and priorities set by local Aboriginal and Torres Strait Islander communities;
- Culturally valid strategies that are effective for Aboriginal and Torres Strait Islander people must be developed, implemented and evaluated;
- Aboriginal and Torres Strait Islander people must be centrally involved in planning and implementing strategies to address use of alcohol, tobacco and other drugs in their communities;
- Aboriginal and Torres Strait Islander communities should have control over their health, drug and alcohol and other related services;
- Resources to address the use of alcohol, tobacco and other drugs must be available at the level needed to reduce disproportionate levels of drug-related harm among Aboriginal and Torres Strait Islander people.

Priority should be given to providing Aboriginal and Torres Strait Islander cultural awareness training to all maternal and child health care providers, and drug and alcohol service providers (Ministerial Council on Drugs Strategy 2006).
Programs specifically for Aboriginal and Torres Strait Islander people, programs employing Aboriginal and Torres Strait Islander staff, and more flexible services seem to be more successful, for example in increased uptake of treatment. Models that consider whole families or communities, in addition to individuals, may be more successful with Aboriginal and Torres Strait Islander populations (Teasdale 2008).

An international review of community-based alcohol and substance use programs for Aboriginal people indicates that they are suitable alternatives to residential facilities located away from communities. Such programs appear to be successful when they have strong leadership; strong community engagement; adequate funding for infrastructure and for long term sustainability (Jiwa 2008).

**Targets, United States of America**
The US Healthy People 2010 target is 100% abstinence from illicit drugs for pregnant women (Goler 2008).

**Early Start, United States of America**
The US Early Start program places a substance abuse expert in departments of obstetrics and gynaecology with assessment and treatment appointments linked to women’s antenatal appointments. All women are screened for drug use by questionnaire, and by toxicology if they give informed consent; and all providers and women are educated about the effects of drugs, alcohol and cigarette use in pregnancy (Goler 2008).

In a retrospective cohort study of women who screened positive for substance use and/or at risk alcohol use, those who received no further assessment or management had worse outcomes than either the women assessed and treated, or assessed only; with significantly higher rates of low birthweight, preterm birth and intrauterine fetal death, and very high levels of placental abruption in the assessed only group. The business case analysis for Early Start shows a 30% return on investment (Goler 2008).

**What are the barriers to/facilitators for reducing or stopping substance abuse?**

Despite need, Aboriginal and Torres Strait Islander intravenous drug users may not use drug treatment services because the services were seen to be slow and inflexible; or because it was easier to continue drug use than to receive treatment. While the detoxification service in a Sydney clinic was used and antenatal service attendance increased, Aboriginal and Torres Strait Islander clients were not accessing the smoking cessation clinic or the out-patient alcohol treatment services. Some expressed the view that they would like Aboriginal and Torres Strait Islander staff to be involved in their care. Some Aboriginal and Torres Strait Islander people are concerned about methadone treatment, reporting that it may affect a person’s Dreaming. If methadone is an acceptable form of treatment, the high cost (after the first three months of free treatment) is a barrier. Access was a barrier in a number of ways – more visual images in printed resources needed, increased treatment hours needed, and direct transport services were needed (Teasdale 2008).

Although there is some indication that brief primary care interventions may have a positive effect on reducing drug use in pregnancy and postpartum, prevention takes time – one estimate suggests that a GP would need 4.4 hours a day to conduct all the recommended prevention-related activities (Yarnall 2003).

The reported incidence of drug use during pregnancy will vary in accuracy, depending on, for example, the judicial implications in a particular community (Abdel-Latif 2007).

Judgmental attitudes from staff may make pregnant drug users reluctant to engage with health and social care providers; and inappropriate pressure may lead to women not attending care (WA Health 2007).
Ongoing projects/programs

A study of ASSIST (the Alcohol, Smoking and Substance Involvement Screening Test) in pregnant women is currently underway at the Lyell McEwin and Women’s and Children’s Hospitals in South Australia (Hotham 2008).

In 2006 the Commonwealth Government agreed to double the $49.3 million in funding previously provided by COAG for substance and alcohol rehabilitation and treatment services, particularly in remote areas; and the states and territories have committed to complementary investments in services to support this initiative (Close the Gap 2008).

Koori Community Alcohol and Drug Resource Centres have been set up in Victoria and capital planning for a statewide Koori Youth Alcohol and Drug Healing Service is scheduled for June 2009 (Vic Dept of Human Services 2007; 2008).

The Victorian Aboriginal Health Service, in partnership with the Nexus Dual Diagnosis Service, is building capacity to recognise and respond to co-existing mental illness, and alcohol and drug problems experienced by Aboriginal people (Victorian Dept of Human Services 2008).

The Aboriginal and Torres Strait Islander Peoples Complementary Action Plan to the National Drug Strategy calls for enhanced community capacity to deal with substance use; and for more coordinated, whole of government approaches to reduce substance use-related harm (Ministerial Council on Drug Strategy 2006).

The Substance Use in Pregnancy and Parenting Service (SUPPS) in Wollongong, NSW uses a collaborative early intervention model to address the potential conflict that can arise between generally adult focussed drug and alcohol services, and the primarily child focussed child protection services. Team members include staff from the NSW Department of Community Services as well as nongovernment family support services (Moore 2006).

In a deprived area of Vancouver, Canada, the Sheway program offers a single access comprehensive street-front service to pregnant and parenting women (until children are 18 months old) with a history of alcohol and/or drug use. (Sheway means ‘growth’ in the local First Nations people’s language.) Sheway adopts a harm reduction, rather than an abstinence approach, and allows their clients choice and autonomy over which services they will use and which staff are involved in their care. Social support, meals, food and milk vouchers, and antenatal and postnatal care, are offered along with more direct drug and alcohol counselling services. In 1996, over 80% of clients self-identified as First Nation, Inuit or Metis women, with an average age of the mid-twenties. While women’s health and social problems have increased over the 9.5 years that Sheway has operated, indicators of infant health have either improved or remained stable. Over the nine years, eight stillbirths out of 1127 pregnancies were recorded. There were an additional 62 miscarriages and 62 abortions. The preterm birth rates have a U-shaped pattern over time with a ‘low’ of about 15% in 1998 subsequently rising to over 30% in 2002. Low birthweight shows a similar but less dramatic pattern, with a low birthweight rate of nearly 20% in 2003. There were six deaths of infants in their first among 827 live births recorded – three of these were classified as SIDS (Marshall 2005; Moore 2006).

Fir Square (‘Families in Recovery’) is a hospital ward in British Columbia’s Women’s Hospital in Vancouver. This ward provides antenatal and postnatal care to women who are drug dependent; and there are close links between Fir Square and Sheway (Moore 2006).

‘Breaking the Cycle’ is a non-government service in Toronto, Canada for pregnant women (or women with young children) who are involved with drugs or alcohol. This service regards its clients to be the relationship between a mother and her child. Services are provided through centres, outreach or home visits until a child goes to school (Moore 2006).
PROkids is a comprehensive primary care hospital based program for families suffering from substance use problems in Connecticut, USA. A paediatrician conducts clinics for babies and children, and home visitors address parental attachment and child development (Moore 2006).

Both the Women’s Reproductive Health Service in Glasgow, Scotland and the Specialist Midwifery Service in Manchester, England operate on a social model where drug use is seen as just one of the significant risk factors for the baby; and social disadvantage is recognised as a key determinant of birth outcomes (Moore 2006).

In Washington State, USA, the Parent-Child Assistance Program is a sustained home visiting program for substance dependent women during pregnancy and until the child is three years old (Moore 2006).

The ‘Cradling Our Future Through Family Strengthening Study’ RCT of in-home prevention of substance use risks for native teen families is currently recruiting at-risk teen mothers living in four Native American reservation communities. It will determine whether an in-home paraprofessional-delivered family strengthening curriculum ‘Family Spirit’ is effective at increasing parental competence, improving maternal and childhood outcomes (NCT00373750 – [clinicaltrials.gov]).

A randomised trial of methadone versus buprenorphine for maintenance therapy of pregnant opioid dependent women (the MOTHER study) is underway at the Johns Hopkins University in the USA.

**Further research/action required**

In a Sydney substance use clinic, the need for an Aboriginal and Torres Strait Islander women’s support group for the opioid maintenance treatment program was articulated by clients. This and other suggestions for improvements have been incorporated into a three year plan for service improvement (Teasdale 2008). Specific suggestions include:

- Providing a less formal and more culturally appropriate clinic environment;
- Improving transport services;
- Improving outreach services;
- Increasing brief intervention for Aboriginal and Torres Strait Islander youth;
- Advocating for subsidised pharmacotherapy dispensing in community pharmacies for Aboriginal and Torres Strait Islander clients;
- Conducting community awareness campaigns to reduce the harms associated with heavy alcohol and tobacco use;
- Increasing communication with key representatives of the Aboriginal and Torres Strait Islander communities to improve awareness regarding substance use and range of treatments;
- Reducing the uptake of substance use among children and young people;
- Enhancing the shared-care arrangements for treating individuals with drug-related health care problems.

Workforce issues in drug services for Aboriginal and Torres Strait Islander people require priority attention. In particular existing Aboriginal and Torres Strait Islander staff need support and career development, and recruitment and training of new staff is also a priority. Non-Indigenous staff expressed a need for cultural awareness training, for example how to provide advice on substance use in non-confronting ways (Teasdale 2008).

Oei 2007 lists the following as some areas needing research:
- Prevalence and healthcare utilisation of illicit drug dependent women in Australia;
- Long-term outcomes of infants born to illicit drug using mothers irrespective of whether the infants have shown signs of neonatal abstinence syndrome or not;
- Development of a social intervention program that would improve the long-term outcomes of these children.
References


Special Topic:

Epigenetics and Intergenerational Effects

Definitions and Introduction

There are now well-established links between low birthweight (as a marker of an adverse antenatal environment) and increased risk of diseases in later life. This process is thought to begin in utero with the fetus making physiological responses to an adverse environment in the womb, and may operate postnatally as well. The hypothesis that a number of adult diseases have their origins in antenatal exposures often referred to as the developmental origin of health and adult disease (DOHaD) or the Barker hypothesis (De Boo 2006). Evidence is also emerging that high birthweight may also be associated with later development of chronic disease (Harder 2007, Whincup 2008), indicating that various forms of fetal adversity may have an impact on later life.

As an embryo develops, over 200 different cell types form. The 30,000 human genes control cells through the inherited DNA sequences of genes (genotype), but cell function is also influenced by developmental history and environmental influences. At some stages of development some cells may undergo major ‘epigenetic’ reprogramming which can have short and long-term effects on individuals, and also on their progeny (Nafee 2007).

It is thought that nutritional and hormonal status during pregnancy and early life could interfere irreversibly with development of organs involved in control of food intake and metabolism (Djiane 2008). For example, altered maternal nutrition can lead to altered fetal nutrition through abnormal placental function and altered uterine blood flow. This in turn can affect growth and maturation of organs such as the liver, pancreas, kidney and heart, paving the way for diabetes, heart disease, hypertension and stroke in adult life (De Boo 2006).

In the predictive adaptive response hypothesis, the developing fetus is able to assess its current nutritional environment and reprogram accordingly. If the mother is under-nourished, the fetus can adapt by directing more glucose to the brain and heart (and away from other organs) by reducing insulin secretion. When abundant nutrition is available postnatally and beyond, the ‘reason’ for the in utero programming has disappeared. Since the effects of these epigenetic changes are permanent and cannot adjust to the unpredicted nutritional excess, glucose intolerance and diabetes may eventuate. In the Dutch famine of 1944-45 children of women exposed to famine mid and late gestation were born smaller than unexposed babies and had an increased risk of impaired glucose tolerance as adults (De Boo 2006).

Birthweight and later obesity and chronic disease

In a remote northern Australian Aboriginal community, Singh 2003 found that that low birthweight was significantly correlated with higher blood pressure in adult life. Overweight adults with low birthweight had the highest blood pressures.

In a systematic review, low birthweight was shown to be related to a higher risk of developing type 2 diabetes in later life in most populations. In two studies in native North American populations with high prevalences of maternal diabetes and one other population of young adults, the association was between high birthweight and risk of later type 2 diabetes (Whincup 2008), an association also noted in another systematic review (Harder 2007).

In utero exposure to maternal gestational diabetes may be part of the explanation of the latter association between high birthweight and type 2 diabetes, and also with being overweight or obese in childhood and youth (Fetita 2006).
Nutritional programming and obesity
In the Aboriginal Cohort Study, Singh 2008 found that even the children who were thinner than average had higher than expected waist measurements at age 11, which probably represents the early development of central obesity. This tendency to a high waist-hip ratio has been noted in all hunter-gatherer populations, as well as a substantial and increasing proportion of other populations, and may indicate an intolerance to carbohydrate, particularly refined carbohydrate (Wood 2006).

Maternal and child undernutrition
The effect of undernutrition spans at least three generations, as suggested by the small but significant association between grandmother’s height and birthweight of children born to their daughters. Thus preventing maternal and child undernutrition is a long-term investment that will benefit present and future generations (Victora 2008).

Breastfeeding
Long-term beneficial effects of breastfeeding in preterm and term low birthweight infants and improved neurodevelopment are likely; breastfeeding is also likely to have long-term beneficial effects on blood pressure, serum lipid profile and pro-insulin levels (Edmond 2006).

Low breastfeeding initiation and continuation rates among low-income and other disadvantaged families add to social inequalities in health outcomes and perpetuate the intergenerational cycle of poor health (Renfrew 2007).

Maternal stress and metabolic effects in the next generation
A small study suggests that the children of mothers who had stressful life experiences during that pregnancy have an elevated risk of insulin resistance in young adulthood (Entringer 2008).

Depression
Analysis of the 21 year follow-up of the Queensland Mater University Study of Pregnancy provides some support for a fetal origin of adult depression (Alati 2007).

Intergenerational effects of maternal alcohol use
In addition to the effects of high maternal alcohol consumption on the next generation in the form of fetal alcohol spectrum disorders, some evidence is emerging that maternal drinking in pregnancy is associated with increased use of alcohol in their children (Alati 2008).

The concept of social epigenetics has recently been used to refer to intergenerational effects of adversity, which are considered to operate through social, rather than (or as well as) biological, mechanisms. For example, daughters of teenage mothers are twice as likely to become teenage mothers themselves, thus contributing to the cycle of poverty (Shaw 2005). However Gisselman 2006 does propose some biological expression of maternal social disadvantage which may occur as early as the mother’s childhood, and which cannot be compensated for by moving to a higher socioeconomic position as an adult. Thus deprivation in a mother’s childhood may have an influence on the health of her children.

Intergenerational effects of forced family separations
For Aboriginal and Torres Strait Islander people, forced family separations are great sources of adversity and distress, and manifest in the causal pathways to poor health and social problems in subsequent generations (Stanley 2008).
References


2.2 Models and Programs

Australia

- Core of Life
- Early Intervention and Prevention Program (EIPP) – see ‘Family Violence’
- Healthy for Life (H4L)
- Nurse Family Partnership – see ‘Home Visits’
- Pregnancy Lifescripts – see ‘Alcohol Use’; ‘Nutrition’; ‘Obesity’ topics.
- Violence Against Women Australia Says NO campaign and White Ribbon Days – see ‘Family Violence’
- Women’s Safety Agenda – see ‘Family Violence’

South Australia

- Anangu Bibi – Regional Family Birthing Program
- Healthy Babies, Bright Futures – see ‘Home Visits’
- Mothercarers – see ‘Home Visits’
- Nganampa Health Services
- Ngangkitta Ngartotdli Karpandi (supporting mums and babies); The Southern Aboriginal Maternity Care Project
- Northern Women’s Community Midwifery Program, Muna Paendi
- SA Aboriginal Families Study
- SA Healthy Mothers Healthy Families
- SA Healthy Ways
  - share – see Question 6
  - SHine – see Question 6
- South Australian Universal Home Visiting Scheme – see ‘Home Visits’
- Talking realities...young parenting program
- The Young Mums Program (Whyalla)

Northern Territory

- Congress Alukura
- Gumileybirra Women’s Health Service
- Strong Women Strong Babies Strong Culture Program (NT)

Central Australia (NT/SA)

- Approaches to Failure to Thrive – see ‘Nutrition’ topic

New South Wales

- CenteringPregnancy – see US: CenteringPregnancy
- Daruk
- Djuli Galban
- Families NSW
- Gudaga
- NSW Aboriginal Maternal and Infant Health Strategy
- SUPPS – see ’Substance Use’ topic

Queensland

- Mums and Babies Program at the Townsville Aboriginal and Islanders Health Service (TAIHS)
- Ngua Gundi
- Yapatjarra
Victoria
- Best Start and Aboriginal Best Start
- Healthy Mothers Healthy Families: Maternal Health Survey
- Healthy Pregnancies, Healthy Babies – see ‘Alcohol Use’
- In-home support – also see ‘Home Visits’
- Koori Maternity Services
- Women’s Business Service, Mildura Aboriginal Health Service
- Victorian Indigenous Family Violence Strategy – see ‘Family Violence’

Western Australia
- Bibbulung Gnarneep
- Strong Women Strong Babies Strong Culture Program (WA)

Canada
- Aboriginal Healing Foundation – see ‘Social and Emotional Wellbeing’
- Hollow Water Community Holistic Circle Healing – see ‘Family Violence’
- Inuitlitsivik Midwifery Service and Education Program
- NAHO, North Canada
- Sheway – see ‘Substance Use’
- Vancouver Native Health Society

New Zealand
- Smokechange – see ‘Smoking’
- New Zealand Early Start – see ‘Home Visits’

United Kingdom
- Birthplace
- Family Nurse Partnership – see ‘Home Visits’
- Home Start – see ‘Home Visits’
- Sure Start – see ‘Home Visits’

United States
- CenteringPregnancy
- Children First – see ‘Home Visits’
- Early Head Start (and Head Start) – see ‘Home Visits’
- Early Intervention Program for Adolescent Mothers – see ‘Home Visits’
- Early Start – see ‘Alcohol Use’; and ‘Substance Use’
- Every Child Succeeds – see ‘Home Visits’
- Healthy Families/Healthy Start – see ‘Home Visits’
- Minding the baby – see ‘Home Visits’
- Nurse Family Partnership – see ‘Home Visits’
- UCLA Family Development Project – see ‘Home Visits’
- Women, Infants and Children (WIC) – see Children First (in ‘Home Visits’)
2.2.1 Core of Life – Indigenous Program

Scope:
Aboriginal and Torres Strait Islander adolescents (males and females)

Status:
Ongoing project

Background

The Core of Life program is a ‘hands on’ pregnancy, birth and early parenting education program for adolescents. The program was designed by midwives to present male and female adolescents with real and factual information on what is involved in becoming pregnant, giving birth and parenting a newborn. The aims of the program are to:

- Introduce teenagers to the realities of pregnancy, birth and parenting
- Encourage personal responsibility for their own health and wellbeing by allowing them to make informed choices
- Improve breastfeeding rates and hence child development
- Assist in reducing teenage pregnancy rates
- Increase social capital and community resources by informing youth about community support services who may in turn assist others, improving community cohesion and enlarging social connection
- Reduce the fear and anxiety surrounding one of life’s major milestones
- Familiarise adolescents with the role of midwives in providing holistic healthcare to families
- Raise awareness of the importance of parenting and hence improving the physical and mental health of the next generation
- Reduce isolation and alienation of young mothers and encourage them to stay in/return to school after a teenage birth.

The program managers aim to build on existing programs for each area and train local midwives, child health nurses, teachers and youth educators how to apply dynamic, early intervention skills for educating adolescents on sensitive life issues related to parenthood, thereby increasing the capacity of the community to provide education to local youth. These facilitators then offer the program to local schools and community groups, aiming to reduce teenage pregnancy rates and prepare young people for responsible parenting.

The program managers have been consulting and collaborating with Indigenous organisations and communities to provide individualised, specifically designed education resources for Aboriginal and Torres Strait Islander adolescents. Currently, Core of Life sessions for Indigenous youth are being developed for the following:

- Indigenous Coordination Centres in many locations
- Victorian Aboriginal Community Controlled Health Organisation (Maternity Strategy Unit)
- Strong Women Strong Baby Strong Culture Program
- Indigenous Maternity Strategy NSW
- Remote Health Cairns (QLD)
- Smaller groups at Yarra Ranges, Mildura, Echuca, Heywood and Shepparton (Vic)
- National Aboriginal Health Services.
Results

As a result of funding from the Australian Government's Stronger Families and Communities Strategy under the Early Childhood – Invest to Grow program, Core of Life have delivered the program to more than 60,000 year 10 students over the last three years. Evaluation of the Indigenous program has not yet been undertaken, however evaluation of the larger program is ongoing. Key findings from the most recent evaluation (2004) amongst 1620 Victorian male and female school students include:

- 89% of students responded stating that the Core of Life sessions increased their knowledge about the choices a woman/couple need to make during pregnancy and birth
- 89% of students thought that viewing a Core of Life session would encourage a young person to breastfeed in the future
- 81% of students stated that they had a clearer understanding about the effect of drugs/alcohol on the mother and her unborn child
- 92% of students believed that the timing of the sessions was appropriate to their age
- All trained educators believed that the sessions had influenced attitudes about substance abuse in a positive manner
- The majority of educators strongly believed that the sessions challenged students' attitudes towards feeding a newborn.

Funding

Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA).

References

[http://www.coreoflife.org/ accessed 14th January 2009]
2.2.2 Healthy for Life (H4L)

Status:
Ongoing program

Background

In 2005, the Federal Government launched the Healthy for Life (H4L) program, which is an ongoing program that aims to improve the capacity and performance of Aboriginal primary health care services around chronic disease, and maternal and child health. The program is based on the application of best practice and quality improvement principles in primary health care.

Methodology

Services funded through the program are required to submit de-identified information on 11 performance indicators covering maternal health, child health and chronic disease care on a regular basis (six and 12 months) as well as information about the characteristics of their service and organisational infrastructure. Targets include:

- An increase in first attendance for antenatal care in first trimester (in 1-4 years)
- An increase in mean birthweight to within 200 g of the non-Indigenous population (in 5-10 years)
- A decrease in incidence of low birth weight by 10% (in 5-10 years)
- A reduction in selected behavioural risk factors in pregnancy (e.g. smoking, harmful alcohol intake and others) in pregnancy by 10% (in 5-10 years)

(PMSEIC 2008)

Between January to June 2007, 59 H4L services submitted data to the AIHW (AIHW ATSI Framework 2009). Formal evaluation of the H4L program based on data submitted by participating services is currently underway.

Preliminary findings

Some preliminary data are available from the AIHW Healthy for Life data collection, for example antenatal care attendance patterns (see Antenatal care topic).

Case study

Wellington Aboriginal Community Health Service in western NSW has developed an information package on local antenatal services, and an educational DVD for Aboriginal women on how to manage their pregnancy and the experience of childbirth has been developed by a local mothers’ group with H4L funding. The service has participated in the H4L initiative since 2006 and since the formulation and implementation of its H4L Action Plan, a range of quality improvement and service activities have been introduced:

- Maternal and antenatal health protocols have been reviewed and updated
- Data collection processes have improved and patient information and recall software is currently being upgraded to improve tracking of antenatal care
- Workforce development has occurred and staff trained in the use of patient management systems
- Services have been widely promoted in the community
- Barriers to service access have been overcome through provision of transport an expansion of the antenatal clinic times.
**Funding**

Office for Aboriginal and Torres Strait Islander Health, Australian Government Department of Health and Ageing.

**References**


PMSEIC. (2008) PMSEIC Working Group on Aboriginal and Torres Strait Islander health focusing on maternal, fetal and postnatal health. Prime Minister’s Science, Engineering and Innovation Council (PMSEIC).
2.2.3 Anangu Bibi – Aboriginal Family Birthing Program

Scope:
Aboriginal women and teenage women, regional South Australia (Port Augusta and Whyalla)

Infant mortality, preterm birth, SGA and LBW outcomes:
From July 2004 to June 2006 there was one death (at 25 weeks gestation) of an Aboriginal baby (out of a total of 46 births to Aboriginal women).

Nine babies (20%) had birthweights under 2500 g; seven (18%) of these were Aboriginal babies.

Background
In response to a decade of Aboriginal community concerns about perinatal outcomes in the region, and with exposure to the issues raised by consultations for the Improving Aboriginal and Torres Strait Islander Birthing Outcomes for the Aboriginal Health Division of the SA Department of Health, a coalition of services in Port Augusta and Whyalla came together to implement a dedicated maternity service for Aboriginal women and teen mothers. Particular concerns included high perinatal mortality rates, low birthweights, maternal smoking, and alcohol use and other drug use.

At the time the program was planned, at the Port Augusta Hospital, there were considerable discrepancies between Aboriginal and non-Aboriginal pregnancy outcome statistics, with Aboriginal women more likely to have fewer than seven antenatal visits; be under 20 years of age; and have an emergency caesarean section birth.

The Northern and Far Western Region received supplemental funding in 2004 from the Commonwealth Alternative Birthing Services Stream of PHOFA (Public Health Outcome Funding Agreements) and agencies donated resources (staff, transport, clinical space) in kind. The program, which began in 2004, focuses on teen pregnancy, including Aboriginal teens, in Whyalla, and on Aboriginal women in Port Augusta. The service provides community-based, responsive continuity of care through pregnancy, birth and the postpartum period, based on a partnership model between the AMIC (Aboriginal and infant care) worker and a midwife. The Aboriginal Health Services in Port Augusta (Pika Wiya) and Whyalla (Nunyara) and the hospitals in each site work closely and the service promotes primary health care principles.

A key feature of the model is the role of AMIC workers who lead continuity of care for high-risk Aboriginal women and offer culturally safe clinical care and support in partnership with midwives and doctors during pregnancy, birth and the postnatal period.

The AMIC workers are selected because they are trusted and respected women who can relate to Aboriginal mothers. They may be trained Aboriginal Health Workers. All have participated in training, delivered at Port Augusta Hospital, in antenatal, birthing and postnatal care.

Design of evaluation
An evaluation has examined pregnancy outcomes and mothers’ views of the program.

The Victorian new mothers’ questionnaire modified by Campbell 2004 for use with Aboriginal women was modified further for local use. Aboriginal researchers conducted interviews with 10 Aboriginal women from both sites who had been through the program. Comparisons were then made between the Aboriginal mothers and 54 rural non-Aboriginal mothers from a study in progress in the Spencer Gulf area that also used the Victorian new mothers’ questionnaire.
Aims of Evaluation

- To seek participant’s views and experience of the program
- To obtain information about behaviours that may affect birth outcomes
- To document the process of establishment of the program and any barriers to implementation
- To investigate aspects of the working relationship between the AMIC workers and the midwives employed in the program
- To describe participants’ demographic profiles and perinatal outcomes.

A longer term aim of the program is to develop evidence of successful interventions that support at-risk women during their antenatal, birth and early postnatal periods.

Aims of the Whyalla antenatal/HealthWays program

1. To improve maternal and infant health and promote supportive environments for raising healthy children
2. Strengthen and further expand a functional referral network between service providers
3. To develop sustained community networks to facilitate supportive environments for young women
4. To develop locally culturally appropriate information and educational resources for community use
5. To develop a demonstration program model in partnership with young women and their partners, the broader Aboriginal community, and key service providers.

Description of model

The Port Augusta Aŋangu Bibi Birthing Program accepts Aboriginal and Torres Strait Islander women of all ages and provides antenatal, labour and birth, and postnatal care employing three AMIC workers and four part-time midwives to provide the care. The Whyalla Regional Family Birthing Program provides antenatal and postnatal care (excluding labour and birth) to Aboriginal women of all ages and teenage women from non-Aboriginal backgrounds; and employs midwife and AMIC worker staff.

The AMIC workers and midwives are allocated a case load and follow each woman’s care from date of acceptance into the program until six to eight weeks after the birth, when the baby and mother are referred to Child and Youth Health. Women are referred to their GP or obstetrician for antenatal assessments at 18, 28 and 36 weeks, unless more visits are required.

The AMIC workers work with the midwives and other local services to organise and offer antenatal classes.

The program emphasises health promotion and education through healthy eating (folate), support to quit smoking and other drugs, physical activity and promoting breastfeeding, using locally developed and other resources.

During labour and birth, each woman is cared for by a team midwife or her primary midwife, with the AMIC worker assisting and supporting the woman and her family during this time. After the birth, the team continues to support the mother and her new baby while in hospital; and visits the family for eight weeks after the birth. Support in areas such as housing and finance is also provided.

In 2008, the project team consisted of five part-time midwives and five part-time AMIC workers.

The AMIC workers have important advocacy and cultural brokerage roles, and support the midwives to increase their knowledge of Aboriginal culture relating to pregnancy, birth and motherhood. They receive perinatal clinical skills training from the midwives and can undertake clinical care in a mainstream hospital by delegation from a midwife.
The Aboriginal Women’s Advocacy Group gives advice and direction to the program as part of a broader strategy to improve birth outcomes for the region.

The key performance indicators of the program are:
- Antenatal attendance
- Smoking patterns
- Breastfeeding uptake
- Birthweights
- Women’s satisfaction
- Cultural satisfaction
- Health worker satisfaction.

**Results**

Birthing outcomes were available for up to 52 women in the 2006 evaluation; 90% were Aboriginal women and 25% overall were teenagers.

**Perinatal and infant mortality**
From July 2004 to June 2006 there was one death (at 25 weeks gestation) of an Aboriginal baby (in 51 births total, 46 to Aboriginal women).

**Low birthweight**
Nine babies (20%) had birthweights under 2500 g; seven (18%) of these were Aboriginal babies. (Data were missing for 6 babies.)

**Other outcomes**

**Breastfeeding**
Nearly 90% of women were breastfeeding at discharge from hospital – 35 women overall (87.5%) and 31 Aboriginal women (also 87.5%). At the last postnatal visit, 52.5% of the Aboriginal women were still breastfeeding, as was one of the teenage women.

**Number of antenatal visits**
15.6% of Aboriginal women had fewer than 7 visits (compared with 39% for Aboriginal women and 6% of non-Aboriginal women SA wide in 2004) (Chan 2006). (However data on antenatal visits was missing for 33% of all women (15/45).)

**Gestation at the first visit**
Only 17.3% of women had their first booking visit in the first trimester (before the 12th week) and 42.3% did not attend until after the 24th week. (Data were missing for 6% of women (3/52).

**Tobacco use (and cannabis use)**
Overall rate of tobacco smoking at the first visit was 56.4% (Aboriginal women only, 59%). This compares with SA rates for Aboriginal women in 2004 of 57.8%. Cannabis use was 10.3%. At the postnatal visit 65% were smokers. (Substantial missing data (nearly 30%) mean that the rates should be interpreted cautiously.)

In 2008, with 100 births in the program, good results continue in areas such as number of antenatal visits, ceasing smoking, birthweights and breastfeeding.

**Mothers’ views**
Although the sample is small, the Aboriginal women were more likely than non-Aboriginal rural women to rate birthing staff as very friendly and welcoming and to know the midwife who cared for them in labour. However they were also more likely to have had someone in the labour room whose presence was not
wanted; to have wanted more information in labour; and to have found feeding advice contradictory, compared with the sample of rural women. They were also less likely to be breastfeeding at six to eight weeks. This positive participant evaluation has continued with the program now having provided care for 100 births.

The employment of AMIC workers was viewed as one of the highlights of the program by all stakeholders. The role the AMIC workers played in facilitating positive experiences for the women and “bringing respect for culture” was clearly acknowledged. However, issues of adequacy of resources, including the number of hours the AMIC workers were employed, support, training and development were equally highlighted:

> And I think the good thing is this; they teach us the clinical way and we teach them the cultural way. So it just works really well...

Overall the group of Aboriginal women was disappointed that the Whyalla program had not provided labour and birthing care. They would have liked access to their AMIC worker or midwife in early labour to monitor and reassure them, and they felt the lack of the presence of a birth attendant they knew during the birth. They believed this acted as a barrier to being well informed about pain relief, birth options and support for a normal birth. They also believed that the cut-off point for postnatal visits was too soon.

Non-Aboriginal teenage mothers felt positive about their experiences with the program and program midwife but felt that their experiences of the health system as whole were dependent upon the attitudes and skills of the service providers they saw.

Staff views and experiences
Staff felt that the model offered clinical benefits as well as cultural safety, with Aboriginal women feeling comfortable with the midwives as well as the AMIC workers.

There were some initial challenges with infrastructure such as having a mobile phone to be on call; and privacy for staff and families.

Staff enjoyed working in partnership, but noted that relationships took some time to establish. Midwives noted that mentoring was time-intensive and there was not enough funding to have the same person working with a specific AMIC worker each day.

There was some lack of clarity about the role of AMIC workers, as well as some resistance from hospital workers at both sites.

The role of grandmothers and traditional ways was highlighted by both the AMIC workers and the midwives.

Limitations

So far, only a proportion of Aboriginal parents have been able to be part of this program. Overall numbers are still small and no control groups are available, limiting the interpretation of the findings. A further limitation ensues from a substantial amount of missing data.

Conclusions/recommendations

The evaluation report (Stamp 2007) made the following recommendations:

1. The Anangu Bibi AMIC worker/midwife partnership model be incorporated as a central component of the care offered to any Aboriginal women presenting for antenatal care in Whyalla or Port Augusta to increase the program’s sustainability.
2. That the feasibility of developing a model of care for teenage non-Aboriginal women equivalent to the AMIC worker / midwife partnership be investigated.

3. As the AMIC worker is pivotal to the success of the program we recommend that the role be further developed, resourced, and acknowledged.  
   **Strategy:** Support AMIC workers to participate in an established accredited course that leads to a professional qualification.

4. Set aside funding for increased AMIC worker hours and further employment opportunities for more AMIC workers from different language groups with links to the Spencer Gulf region in consultation with the Aboriginal Women’s Advocacy Group.

5. Develop processes to enable AMIC workers to continue in the care of mothers and babies beyond the six to eight week program cut-off point.  
   **Strategy:** Encourage working partnerships between AMIC workers with the CYH Indigenous Culture Consultant to enhance continuity of care for Aboriginal mothers from a range of language groups.  
   **Strategy:** Investigate the feasibility of employment of AMIC workers in the Universal Home Visiting program of the Child and Youth Health so they can continue to provide continuity of care.

6. That members of the Aboriginal Women’s Advocacy Group be provided with further opportunities to directly support mothers and families in the program in order to maximise and value their cultural role.  
   **Strategy:** Strengthen the cultural support provided by the program through linking Advocacy group members to women enrolled in the program from outside Port Augusta and Whyalla and/or those with limited family support.  
   **Strategy:** Legitimise formal links between the Advocacy group and program management through funding participation fees.

7. That adequate equipment, space and infrastructure be provided at both sites for the midwives and AMIC workers who work in the program.

8. To refine the program database in consultation with the midwife users to simplify the management, collection and analysis of outcomes and performance indicators, and further establish any clinical benefits of the program.

**Future directions**

Country Health SA is developing a proposal to expand the Anangu Bibi program and to develop new sites across rural South Australia. Extension of the program to form the SA Aboriginal Family Birthing Program is scheduled from June 2009, with funding assistance from the Council of Australian Governments.

The Aboriginal Health Council of SA is developing learning resources for the AMIC competencies at Diploma level from the new nationally accredited Aboriginal Primary Health Care course.
References


2.2.4 Nganampa Health Council

Scope:
Anangu Pitjantjatjara Yankunytjatjara (APY) Lands, South Australia.

Infant mortality, preterm birth, SGA and LBW outcomes:
2006-07
- In 49 pregnancies (51 babies), there was one stillbirth and two neonatal deaths (one at 21 weeks and one at 30 weeks gestation)
- 12 (23.5%) of babies were born preterm
- 11 (21.5%) of babies were low birthweight
- Only one baby born at term was low birthweight.

The rates for preterm births and low birthweight were all considerably higher in 2006-07 than for earlier periods. (Due to small numbers, any trend in perinatal mortality is less clear.)

Background

The Anangu Pitjantjara Yankunytjatjara (APY) Lands are approximately 105,000 square km of Aboriginal owned lands in the northwest of South Australia. The Nganampa Health Council (NHC), which is an Aboriginal Controlled Community Health Service, operates six main clinics and three smaller clinics in smaller communities throughout the APY Lands. It has links with the Alice Springs Hospital.

There are about 50 births a year to women from the APY Lands.

Prior to the establishment of the NHC, very few women are likely to have received adequate antenatal care.

Study aims

Targets for the Antenatal Care Program include:
- Early presentation
- More than five antenatal visits
- Standardised testing, screening and surveillance
- Optimal timing of ultrasound
- Birthweight.

Study design

2. Program evaluation 2003-04
3. Program evaluation 2007
4. STI program (see ‘Infection’ topic)

Description of model

In 1991 standard protocols for antenatal care and birthing were introduced. Midwives or nurses trained in maternal emergency care provide antenatal care on the lands. The midwives continue to offer support when the women return to the community after giving birth.

The components of the NHC Child and Maternal Health Program are:
- An antenatal care program
Development and delivery of key messages and health education packages for young mothers

A child health program.

In 2006, a Women’s Health Outreach Nurse was appointed to the Women’s Health Program; Tjukurpa Minymaku.

YAWEP is the Young Anangu Women’s Education Program. A series of six sessions have been developed by the Health Council and are delivered either in the schools or in the clinics.

One of the key messages of Tjukurpa Minymaku is for young women to make pregnancy a conscious decision; and to discuss the benefits of birth spacing with women who already have children. A recall facility assists women to plan pregnancy and to access contraception if required.

Results

There were 356 births from 1984-90 and 349 from 1991-96. From 2001-07, the annual number of pregnancies ranged from 46 to 64.

In financial year 2006-07 there were 55 pregnancies resulting in 48 livebirths (including two sets of twins) and one stillbirth (there were also two miscarriages, one TOP and three ectopic pregnancies).

The clinics also contributed to the care of a further 17 women who visited the APY Lands during their pregnancy.

Outcomes (perinatal mortality, low birthweight, preterm, SGA):

2006-07

- In 49 pregnancies (51 babies), there was one stillbirth and two neonatal deaths (one at 21 weeks and one at 30 weeks gestation)
- 12 (23.5%) of babies were born preterm
- 11 (21.5%) of babies were low birthweight
- Only one baby born at term was low birthweight.

2003-04

6% of babies were low birthweight.

1984-90 compared with 1991-96

In the earlier period the perinatal mortality rate was 45.2/1000, compared with 8.6/1000 in the 1991-2000 period (36.6/1000 reduction; 95% CI 12.8 to 60.3).

For births on the APY Lands (18% of the total), the perinatal mortality for 1984-90 was 7/86 compared with 1/38 – a reduction of 55.1/1000. The corresponding figures for births in hospital (82%) were 9/268 compared with 2/309 – a reduction of 27.1/1000.

Low birthweight improved from 14.2% (49/345) in 1984-90 to 8.1% (28/344) in 1991-2000 (a decrease of 6.1% 95% CI -10.7% to -1.4%).

Other outcomes:

2006-07

- The youngest mother was aged 12 and the oldest, 38
- The minimum birth spacing was 303 days
- Of the 49 women who had a live birth or stillbirth, 59% (29) presented for antenatal care in the first trimester
- Of those 29 who presented in the first trimester, 93% had 5 or more antenatal visits
Average birthweight for all 51 babies born > 20 weeks or > 400 g was 2933 g (including two sets of twins).

2003-04
60% of women presented at or prior to 16 weeks of pregnancy, with 6% having less than two visits, 50% 5-10 visits, 34% over 10 visits (9% information not available).

1984-90 compared with 1991-96
The mean birthweight increased from 3080 g to 3183 g from the earlier to the later period (increase of 103 g, 95% CI 5 to 202).

References


2.2.5 Ngangkitta Ngartotdli Karpandi (supporting mums and babies); The Southern Aboriginal Maternity Care Project

Scope:
Aboriginal women and babies, urban South Australia.

Infant mortality, preterm birth, SGA and LBW outcomes:
None of the 10 babies fully enrolled in the program were preterm or low birth weight.

Background

Southern Adelaide Health Service, in conjunction with the SA Department of Health, established the Southern Aboriginal Maternity Care Project which commenced in February 2006 as a pilot project to develop a service model that established linkages and partnerships, and to provide a framework for an integrated maternity care service for Aboriginal women and their babies that is accessible and provides culturally responsive and timely maternity care.

Standard provision of antenatal care in large hospital clinics or short visits with GPs is often experienced by Aboriginal women as inappropriate, unwelcoming or unaffordable, as well as often inaccessible due to transport difficulties.

Project Goals

The goal of the project was to establish a holistic service model that contributed to the development and implementation of a model of accessible and appropriate maternity care for Aboriginal women as well as design an appropriate evaluation framework that would effectively measure outcomes.

The project aimed to consider the young age of the Aboriginal population in the southern region, Aboriginal people as low users of health services, the transience of the Aboriginal population and the need for building community capacity and governance in the region. It aims to address housing, poverty, family violence, social and emotional wellbeing, and substance use.

The project was continuously evaluated with the following objectives:

- To evaluate the process of development of the model;
- To determine if the model of practice developed by the project delivers accessible, culturally sensitive and responsive maternal, birthing and postnatal care to Aboriginal women;
- To determine if the model recognises social determinants of health and addresses complex social issues including family violence, poverty and social and emotional wellbeing in a holistic way;
- To determine if the model incorporates effective and respectful consultation with Aboriginal women;
- To assess the extent to which the model has been implemented across the Southern Adelaide Health region and identify factors which have assisted the adoption of the model;
- To ascertain the success and responsiveness of the program through key performance indicators:
  - 100% of Aboriginal women in the program will have an antenatal plan for their pregnancy
  - There will be a 10% increase in the rate of Aboriginal women attending seven antenatal visits
  - The proportion of low birthweight babies will have decreased by 1%
  - The proportion of Aboriginal women who smoke during pregnancy will be reduced to the same level as non-Indigenous women
  - The nutritional uptake of Aboriginal women will be improved.
Design

Prospective cohort study (plus comparisons with population level data)

Description of model

The model that evolved over the first 12 months of the program was primarily a brokerage model in which:
- Pregnant Aboriginal women self-referred to the service or were referred by other agencies;
- The Project Officer provided information, support, and referrals to other agencies as needed, including ensuring that women were linked into an antenatal clinical care pathway;
- The Project Officer met with women as required and transport assistance was provided;
- The Project Officer also provided support and referrals in the postnatal period.

Research method

- Phase 1 – consultation with the Project Management Team and Project Reference Group about the evaluation methodology
- Phase 2 – Development of tools for measuring key performance indicators (KPIs)
  - The Smoke-free Pregnancy Assessment and Intervention form was modified
  - A ‘food diary’ was developed
  - Both were circulated for input
- Phase 3 – evaluation of the process of establishing the model
- Phase 4 – interviews with clients
  - Women who consented were interviewed approximately two months after giving birth
- Phase 5 – telephone interviews with service providers
- Phase 6 – analysis of data about KPIs

Results

For birth outcomes, data were available for 10 infants (in most instances). Fourteen women completed the maternal satisfaction survey.

Over the two years, 72 women who identified as Aboriginal gave birth in the southern region; 47 (65%) of these births were at Flinders Medical Centre.

Main outcomes

Preterm
All 10 babies were born at term (between 37 and 42 weeks).

Low birthweight
No infant was under 2500 g at birth – the range of birthweights was 2948 g to 4100 g.

Other outcomes

Antenatal care
Five out of eight women presented late for care (after the first trimester). Range of gestation at first visit was 11 weeks to 32 weeks. All women had midwives providing some part of their antenatal care, but only some had GP or obstetric involvement. The number of visits with midwives ranged from one to 12 visits. Six women saw a GP for some of their antenatal care (range one to six visits). Only four out of 10 women had any visits with an obstetrician, indicating that there were not many complicated pregnancies. All women had an antenatal plan.

Birthplace
All of the women birthed at Flinders Medical Centre, their local maternity service.
Breastfeeding
Three women breastfed with no problems; two began but ceased; two didn’t breastfeed due to their babies’ medical conditions (one congenital malformation and one neonatal abstinence syndrome). Three women chose to bottle feed from birth – one noted ‘problems with the midwives in hospital’. The low rate of breastfeeding is consistent with overall state and national findings for Aboriginal women.

Smoking
Five out of 12 women were non-smokers. Another woman had stopped smoking two months before her pregnancy. Four women were referred to Quitline by the Project Officer and two others reduced smoking during their pregnancies without referral to Quitline. A number of women expressed interest in nicotine replacement therapy, but maternity care providers were unclear about its appropriate use in pregnancy.

Nutrition
Only three women agreed to complete the Food Diary tool. In a focus group women said that it was too time-consuming to keep a food diary. They also said that it was very expensive to eat well.

Support, referral and transport
The project was seen to be safe and culturally appropriate and particularly helpful for young Aboriginal women. It was successful in referring Aboriginal women to a wide range of appropriate services. Aid with transport was particularly appreciated by the participants.

Maternal Satisfaction Survey
The women greatly appreciated the support of the Project Officer in the areas of communication, education, sharing of information, education, connecting with clinical care, referrals and transport.

Views of the overall project were:

| Positive difference: | 11/14 agreed or strongly agreed (3 neutral) |
| Better care: | 11/14 agreed or strongly agreed (3 neutral) |
| Too much conflicting advice: | 8/14 disagreed or strongly disagreed; 6 neutral (though one gave an example where conflicting advice had been given) |
| Saw too many people: | 11/14 disagreed or strongly disagreed; 1 was neutral; 2 women agreed |
| Referred to services that were helpful: | 13/14 agreed or strongly agreed; 1 woman was unhappy with Families SA involvement |

All 14 women would recommend the program to family and friends (12 strongly agreed and two agreed).

Some aspects of hospital care were seen to need improvement.

Limitations

Of the study
The small numbers of women and babies and the short duration of the project precluded sufficient understanding of project outcomes.

Of the model
The model would need greater resourcing over a longer period to enable full development and evaluation of its services, as well as awareness of the project and its aims. At present the separation of acute hospital-based care from community-based care and lack of clear clinical pathways are limitations. The model would need to find a way to provide a comprehensive and consistent transport service. The model would need to address ways to engage women about smoking and nutrition in pregnancy. Any appropriate service model would also need to address how to raise cultural awareness and respect in clinical care for relevant clients.
Conclusions/recommendations

The evaluation supports the model of an integrated maternity care service for Aboriginal women and their babies.

The project is valued by service providers in the region although they are cautious about interpreting data about specific outcomes at this stage.

The recommendations made by the evaluators are summarised below:

1. Clinical pathways for maternity care be clarified, with an understanding of the implications of each pathway for accessibility, suitability, and cultural appropriateness for Aboriginal clients in the southern region.
2. Printed material be produced for clients and for the Aboriginal community, clarifying the model and care pathways (also for caregivers and agencies).
3. Processes to provide clinical support and debriefing for the project worker, including access to maternity care practitioners, are articulated and formalised.
4. Need to support appropriate transport resources for Aboriginal women seeking care during their pregnancy and postnatally.
5. Expand service to include another project worker (to address increasing Aboriginal birthing population in the southern region and help develop integration into existing maternity services in the southern region).

Future plans

Not addressed in the document.

References

2.2.6 Northern Women’s Community Midwifery Program Muna Paendi

In the northern metropolitan region publicly funded midwives work from a community health centre, targeting a maternity service particularly for disadvantaged and Aboriginal young women. The program offers continuity of care through pregnancy, birth and postpartum, with a range of birthing services linking clients to all relevant support and specialty services.

The midwives work in tandem with the Aboriginal Health Team at Muna Paendi, the local Aboriginal Community Health Centre, providing an accessible, empowering and culturally appropriate service.

The service has been well attended by Aboriginal and Torres Strait Islander women including teen mothers. Postnatal care is provided to mother and infant, linking with Child Youth Health and followed through by the Aboriginal health worker.

Antenatal care is also provided in a ‘one-stop shop’ format at Muna Paendi, with the NWCMP midwives, hospital midwives, Aboriginal health workers and an Aboriginal Young Mothers worker providing collaborative care, with access to medical and specialist care when required.

A ‘Mothercarers’ program works from Lyell McEwin Hospital providing care and practical support in the home for women in the weeks just after birth (see ‘Home Visits’). The ‘Mothercarers’ have been trained through a youth employment scheme for young women, including Aboriginal young women. Aboriginal Mothercarers are linked with Aboriginal clients.

References

2.2.7 SA Aboriginal Families Study

Scope:
Aboriginal families in South Australia

Status:
Ongoing project

Background

The Healthy Mothers Healthy Families Research Group is working in partnership with the Aboriginal Health Council of SA (AHCSA) to plan a research project about pregnancy and postnatal care for Aboriginal families in SA. It is a sister study to the state-wide postal survey of recent mothers carried out in SA and Victoria in early 2008.

Study aims

- To find out what Aboriginal women and women with an Aboriginal partner having a baby in SA think of their pregnancy care, care during labour and birth, and care after the baby is born.
- To use the information to advocate for changes to improve pregnancy, birthing and postnatal care for Aboriginal women and families.

Study design

Survey

Description of study

During 2008, the research team has been consulting with Aboriginal communities, organisations and groups throughout SA. This information will be used to develop a plan for the research phase of the project (2008-10).

An Aboriginal Advisory Group with representation from metropolitan and regional health services, AHCSA, Aboriginal family and support services and Aboriginal health workers with technical expertise in maternity and postnatal care has been formed to guide and advise the research team.

Results

Ongoing, no results yet available.

Funding

NHMRC; SA Department of Health, Victorian Department of Human Service.

References

2.2.8 SA Healthy Mothers Healthy Families

Scope:
Recent mothers in South Australia

Status:
Ongoing project

Background

The Healthy Mothers Healthy Families Survey is a population-based survey of recent mothers in South Australia (and Victoria – see overall ‘Healthy Mothers Healthy Families’ Model’). The study builds on previous surveys of recent mothers in Victoria and will investigate the impact of changing patterns in the provision and organisation of maternal and early postnatal care.

Study aims

To explore women’s view and experiences of care received during pregnancy, labour and birth and in the first six months following the birth of their baby, through:

- Monitoring the impact of maternity service strategies including increased opportunities for continuity of care/caregiver, increased choice regarding options for care in the public system and the uptake of evidence to inform practice
- Assessing and contrasting experiences and views of women using established and newer models of maternity care
- Monitoring the impact of the current length of postnatal hospital stay
- Assessing the prevalence of maternal depression and intimate partner violence and investigating women’s views about the responsiveness of primary care, public hospital and specialist services to psychosocial issues in pregnancy and the first six months following birth.

Study design

Postal survey

Description of survey

Thirty-four SA public and private hospitals with births from September to October 2007 agreed to participate in the survey and assist with distributing questionnaires to women when their infants were six months of age. A study reference group in SA comprising midwifery, medical, public health, health policy and consumer representatives is assisting with the conduct of the study.

Results

Ongoing, no results yet available – preliminary results are expected in mid-2009.

Funding

NHMRC: SA Department of Health: Victorian Department of Human Service.

References

2.2.9 SA Healthy Ways

Scope:
Aboriginal women and families, rural and remote South Australia

Infant mortality, preterm birth, SGA and LBW outcomes:
Ongoing project, evaluations not yet completed

Background

This initiative is a partnership between the SA Department of Health and the Department of Education and Children’s Services. In 2001 it was established in seven areas across SA, selected on the bases of poor health status of women, high smoking rates and low infant birthweights.

The SA Department of Health and the Commonwealth Department of Education, Science and Training provided $1.5 million for the project.

Study aims

- To increase Indigenous women’s understanding of how to be healthy during pregnancy in order to have a healthy baby
- Increase Indigenous women’s confidence in themselves and in their ability to support the learning of their infants and young children
- Identify, implement and support learning opportunities for Indigenous women, particularly young women
- Identify the training needs of young Indigenous women to develop and sustain careers.

More specific aims were to:
1. Reduce the uptake and maintenance of the use of tobacco and tobacco substitutes by women and children in the target communities
2. Increase the incidence of good nutrition in targeted communities
3. Improve health outcomes for mothers, babies and children in the target communities (particularly the APY Lands)
4. Reduce the likelihood of children having access to tobacco products.

Study design

The project is predicated on principles of community development. All Healthy Ways funded community programs are set up in response to community-identified priorities and are driven by senior Indigenous women within the community.

Description of model

The project focuses on the education of young women to achieve sustainable health and wellbeing benefits for families and communities.

The four key elements are:
1. *Mums to be* – understanding pregnancy, looking after yourself, and infant health
2. *Growing little kids up* – increasing women’s confidence in supporting the growth and development of their infants and children
3. *Kids and young mums learning* – provision of safe space and private time for kids and mums learning together
4. **School building bridges** – peer education and support in and out of school

Each community has produced action plans; some of the activities to address specific needs include:

**Coober Pedy**
- *Young Mums Group* – focuses on art and craft activities and cooking to encourage mothers to learn healthy recipes in a smoke-free environment
- *Traineeship positions* – two trainees have been employed under the Child, Family and Home Support Program
- *Healthy Living Workshops* – seek to educate community members about health and preventing illness
- *Tobacco cessation* – a program to help people reduce smoking has had little success.

**Oodnadatta**
- *QuitSkills training and support*
- *Advocacy work to access further funding* – renovation of Women’s Shed, crèche, youth traineeships and mental health worker funding.

**Marree**
- *Pika Wiya Health Promotion Program* – health programs delivered to the Marree Aboriginal School and the whole community, that focus on nutrition and tobacco
- *Women’s leadership group*
- *Training and Employment Action Plan* – Aboriginal Health Worker, two enrolled nursing cadetships, first aid training, nutrition training, Aboriginal apprenticeship scheme.

**Whyalla**
- *Indigenous antenatal program for teenage mothers*
- *Traineeship positions* – two trainee Aboriginal antenatal workers
- *New baby package* – resources and supplies for new mums, including a breastfeeding guide
- *Indigenous antenatal information sessions*
- *Postnatal support program* – the Anangu Bibi Regional Birthing and Healthy Ways have similar objectives and the two have been integrated to provide continuing postnatal support.

**Yalata**
- *Women’s Group*
- *Store Health Promotion*
- *School Uniform Program*

**APY Lands**
- *Supporting the Early intervention, child and family support program*
- Identifying priorities such as home hygiene, nutrition, safe meeting places for women and children; developing training units on tobacco and nutrition.

**Oak Valley**
- School-based activities around hygiene, nutrition and healthy eating, and encouraging drinking water.

Each community receives a day a week of dietician time, which is allocated to increasing accessibility to healthy foods, support to schools and support to the program at Nunyara Aboriginal Health and Wellbeing Centre in Whyalla.
Results

Women’s leadership
The Aboriginal Women’s Leadership Groups have been important in:

- Reinforcing the need for places where babies and young children gather in the community, to be smoke free
- Talking to the store about providing healthy rather than unhealthy food
- Encouraging the store to remove tobacco advertising and to keep tobacco products out of public view
- Helping to link agencies to work with families to improve home-making skills so that
  - houses are healthy places for children
  - facilities to store and cook food in homes are in good repair.

Nutrition
Community nutrition knowledge is good, but achieving healthier eating needs to address transport, budgeting and management of community stores.

Tobacco
Communities placed less emphasis on tobacco strategies – these are often seen to focus on wrong-doing and blame.

Infrastructure
Provision of infrastructure made some community development projects happen, and conversely lack of adequate infrastructure prevented some other projects.

Workforce and training
Trainee positions have been successfully developed in Whyalla, Marree and Coober Pedy. There may be some disincentives for Community Development Employment Trainees to take on many hours of work.

A 2006 evaluation of the program recommended that:

1. The project continue with the following initiatives:
   - Ongoing paid community support to the established women’s leadership groups and young mothers’ groups
   - Traineeship and employment initiatives supported by Healthy Ways continue to have the support of the Aboriginal Health Division, Department of Health and other relevant services/Government departments
   - Funding is provided to continue the dedicated nutrition support provided in Healthy Ways communities and to build on an Aboriginal health workforce with nutrition training to address the priorities identified in the National Aboriginal and Torres Strait Islander Nutrition Islander Nutrition Strategy and Action Plan 2000-2010
   - Funding is provided to continue activities such as women in leadership groups, local and regional workers, including school staff involved in nutrition related programs
   - A community based and controlled approach should be the preferred model when circumstances permit. In any event, funding arrangements need to reflect a close partnership between mainstream and community controlled agencies
   - The Department of Education and Children’s Services and the Department of Health explore and encourage funding for successful Healthy Ways programs in schools and for the program conducted by Nunyara Aboriginal Health and Wellbeing Centre
   - Established links with the Commonwealth Building Healthy Communities project initiatives in Marree and Oodnadatta are maintained.
2. **Tobacco use be reduced by:**
   - Considering employing a dedicated Aboriginal and Torres Strait Islander Tobacco Program Worker who can travel between remote and regional communities and provide expertise and support in implementing community tobacco strategies
   - Mandatory and continuous training in tobacco control for health professionals in remote Aboriginal and Torres Strait Islander communities
   - Recognising the significant need for information on the prevalence and impact of tobacco use in order to measure progress, increase profile of issue and increase advocacy
   - *Healthy Ways* communities being supported to implement tobacco control strategies with guidance from the Centre for Excellence in Indigenous Tobacco Control’s *Galnya Angin* document.

3. **Culturally appropriate evaluation mechanisms be developed.**

4. **In any future developments of the Healthy Ways type in regional and remote Indigenous South Australian communities, the template from the Cooperative Research Centre for Aboriginal and Achievements in Aboriginal and Torres Strait Islander Health should be used.**

**Other outcomes**

**Other information:**
Nutrition strategies were more positively viewed than tobacco initiatives, and this has skewed emphasis away from tobacco toward nutrition issues. Views were expressed that it was inappropriate to try to stop people smoking without addressing structural poverty and injustices. The evaluation report also notes that "comprehensive community tobacco control programs require appreciable resources and energy for them to be successful'.

Structural issues such as ongoing oppression and injustice, poverty, unemployment, high prices for electricity, food supply issues, transport issues, loss and grief, and family violence are inherently linked and need to be addressed.

**Limitations**

Some of the participants felt that *Healthy Ways* had tried to cover too much. For example, “bigger doses in fewer places” might have worked better.

There were some tensions between ‘top down’ and ‘bottom up’ approaches with some community members feeling that ‘outsiders’ had not spent long enough in their communities to understand what might and might not work.

**Difficulties in implementation**

There have been challenges in understanding the community development foundation of this project and the time required. The communities are remote and very disadvantaged; some have small, highly mobile populations, and there are some language barriers. Community politics, the precedence taken by ceremonial business and the number and impact of deaths are other issues.

Complex governance and management mechanisms also contributed to lost opportunities and a loss of engagement and enthusiasm.
References


2.2.10 Talking Realities...young parenting program

Background

The Talking Realities Early Childhood Development program is being developed to support young and vulnerable parents (14-25 years) in parenting their children.

The Adelaide Talking Realities Program is a multilevel, community-based, collaborative support program engaging with teenage parents and their children. It incorporates peer education, formal training and qualifications, flexible and accessible family support services (including parenting and child development groups), school-based education regarding the realities of young parenthood, and linkages with a range of other supports and services. It has worked in partnership with FaHCSIA Stronger Families and Communities Strategy; Children, Youth and Women’s Health Service, Parenting SA and SHine SA.

Talking Realities evolved from four teenage mothers identifying gaps in education and support. From modest beginnings in the north-western suburbs of Adelaide in 1997 with a $1500 grant from Parenting SA, funding has grown to a total of nearly $1.5 million over the 1999-2010 period (from local, state and federal governments, non-government bodies and private enterprises).

In South Australia Talking Realities projects have been established in the Riverland (2002), Whyalla (2003), and the northern suburbs of Adelaide (2005). Interstate programs have been established in Perth and Melbourne (2004-05), NSW (two programs in 2007) and Queensland (two programs in 2007).

Program aims

Specific aims of the program are to:

- Provide information about the role of being a parent and the responsibilities and values that are involved;
- Provide an opportunity for parents to learn about and strengthen emotionally positive child-parent relationships;
- Provide information about child development in a strengths based approach that identifies the strengths and positive attributes of families;
- Facilitate the building of community networks and support for young and vulnerable parents, to assist in positive family building and wellbeing;
- Provide educational and vocational pathways for young and vulnerable parents by accrediting attendance and completion towards a TAFE SA unit in Certificate 3 in Community Services Work and a SACE unit.

Description of model

The initial basis of the program was peer education, which now represents one component of a multi-level, collaborative approach. The peer education components are effective because the educators can communicate on the basis of personal experience and because they aim to provide information and support for informed decision-making rather than trying to directly influence behaviour.

The ‘Peer Connector’ project is a partnership between Shine, the Central Northern Adelaide Health Service Talking Realities...young parenting program, and the Parks Children’s House. Young parents are provided with 17 ‘peer connector’ sessions followed by 20 early childhood development sessions. Transport and childcare assistance is provided and some funding assistance is also available. The program will enable participants to undertake volunteer ‘peer connector’ roles and will give them a pathway to further vocational training. The ‘peer connector’ sessions are accredited towards six units from the TAFE Certificate 3 Community Services Work.
One of the entry points to Talking Realities... young parenting is the Friday Fun Group. The non-threatening drop-in nature of this group is important as ‘advice centres’ are not as readily accepted by young parents.

Peer educators in the program also present to schools and youth services about sexual health and a range of services for young people. Presentations are interactive and use artwork developed in consultation with young parents.

In her 2007 report, Angela Lawless from the SA Community Health Research Unit (SACHRU) describes the Talking Realities program as “an exemplary example of community development”.

A need for the program to include specific population groups has been identified. These groups include:
- young Aboriginal and Torres Strait Islander parents;
- recent arrival communities;
- very young parents (13-16 years).
Evaluation

The peer education and school presentation components have been evaluated by SACHRU in 2001 and 2004. These evaluations revealed that the program “successfully increased young peoples’ understanding of the realities of parenting, demonstrated social, psychological, educational and vocational gains for the peer educators, and reported gains for the children of participants through improved parenting and increased social connectedness. The program received strong support from teachers with 89% of those surveyed indicating they would recommend the school-based presentation return the following year.”

In the Victorian program, which is an initiative of the Kingston Bayside Primary Care Partnership and the Central Bayside Community Health Services, significant increases in confidence, esteem, psychological wellbeing, social connections and friendships were seen in the 32 young women who trained as peer educators. Two-thirds of peer educators were engaged in further training and of the remainder, three were in fulltime work, three were parenting fulltime and two were in part-time work. The young women also reported that their parenting and communication skills had increased.

Students who participated in the peer education presentations significantly increased their knowledge and awareness of the potential consequences of early parenting; and over 90% of teachers found that the program was beneficial and relevant to the students.

Factors contributing to the success of the Victorian program were judged to be well researched foundations and reflective implementation; high quality program management; continuity of staffing; providing child care and intensive casework; qualifications, remuneration and leadership opportunities for peer educators; and networking and partnerships. Challenges included establishing child care arrangements, maintaining peer educator involvement; involving fathers; and securing ongoing funding.

References


2.2.11 The Young Mums Program (Whyalla)

Scope:
Pregnant and parenting teenagers, Whyalla, SA

Infant mortality, preterm birth, SGA and LBW outcomes:
Not reported to date.

Background

Whyalla has one of the highest teenage pregnancy rates in SA. These pregnant teenagers rarely complete high school and may later find it difficult to secure stable employment.

Program aims

- Pregnant and parenting teenagers (and their children) remain engaged in their education to the completion of year 12 or its equivalent
- Future employment options and higher education aspirations of pregnant and parenting teenagers are identified, supported and secured
- Health and wellbeing issues are identified early, addressed, and risks subsequently reduced
- Pregnant and parenting teenagers and their children participate in a range of community and recreational activities
- Community perceptions of pregnant and parenting teenagers are improved, with higher levels of advocacy
- There is a decrease in unwanted teenage pregnancies due to a range of programs in local schools.

Description of model

In a 2003 pilot program, 17 pregnant and parenting students and their children were collected from their homes each morning to attend high school. The students helped design the structure and curriculum of the program. Each student also received support to organise housing, childcare, Centrelink and medical support.

In 2004, the Edward John Eyre High School attracted substantial funding from the Department of Premier and Cabinet’s Social Inclusion School Retention Plan to operate and staff a fulltime Young Mums program for a further period of three years. Community learning experiences and achievements of individual students can be counted towards accredited SACE subjects.

Results

The program has not yet been formally evaluated. However attendance, participation and retention rates have improved and greater levels of acceptance are apparent in the wider school community.

Other information

The key to the success of this program has been the whole community working together to improve the educational, recreational and health outcomes of pregnant and parenting teenagers and their families.

Limitations

Future funding needs to be secured and planning for this is underway.
Difficulties in implementation

Long-term stable childcare cannot be secured for every participant and so many students bring their children to school. Attempts to establish an onsite crèche have not yet been successful.

Conclusions/recommendations

The program has not yet been replicated elsewhere but it is expected to be quite feasible to transfer the entire program or parts as is, or adapted to meet the local needs of other communities.

References

2.2.12 Congress Alukura, NT

Scope:
Aboriginal women in Alice Springs, as well as from rural and remote areas within 100km of Alice Springs.

Infant mortality, preterm birth, SGA and LBW outcomes:
Not reported.

Background
Following consultation with women from over 60 Aboriginal communities, Alukura was established in the early 1980s to provide maternity and gynaecology services to Aboriginal and Torres Strait Islander women.

Description of models
Alukura is a women’s health service within a primary health care model embedded with the knowledge of traditional grandmothers. From 1994 to 1997, there were 16 births, but births at Alukura ceased in June 1997, mostly due to a lack of resources. The necessary 24 hour service would require six midwives plus additional health care workers plus support for traditional grandmothers; and Alukura has never been funded at this level.

Women are more likely to use the hospital to birth due to pregnancy complications or through personal choice.

The service originally included:
- a comprehensive antenatal and postnatal care program
- shared antenatal care
- gynaecological services
- sexual assault and domestic violence counselling and examinations
- health education
- transportation
- health care worker training
- bush mobile
- clinic birthing centre.

Results
In the 10 year period from 1986 to 1995, mean birth weights of babies born to urban Alice Springs mothers increased from 3168 g in 1986-90 to 3271 g from 1991-95, narrowing the gap between Aboriginal and non-Aboriginal babies to just under 50 g.

In 1994, Alukura was used for all or some antenatal care by 98% of urban Aboriginal women (n=122) in Alice Springs and by 18% of rural Aboriginal women in the Alice Springs area.

In 1994, 35% of Alukura clients had their first antenatal visit in the first three months; this rose to 40% in 1995. Fewer than 20% of women had a first antenatal visit at 25 weeks or later.
References


2.2.13 Gumileybirra Women’s Health Service

Scope:
Women’s health clinic at Danila Dilba Health Service in Darwin, Northern Territory.

Infant mortality, preterm birth, SGA:
Not reported

Background

Gumileybirra was opened in 1994 and is a Larrakia term meaning “women in a group”. It is staffed by women and provides evidence based quality health care to Aboriginal and Torres Strait Islander women and their children, in a culturally comfortable environment.

A new Mums and Bubs program commenced in 2008.

Description of model

Gumileybirra offers an urban clinic for Aboriginal and Torres Strait Islander women, with a ‘women’s only’ clinic twice a week with female only staff. Services include antenatal and postnatal care, well women screening, women and infant health, linking into community and other health services.

Key principles of the service include health education, health promotion, advocacy and coordination of care delivered primarily by Aboriginal and Torres Strait Islander staff.

Results

In 1994, 15% of Aboriginal and Torres Strait Islander women birthing at the Royal Darwin Hospital had attended Gumileybirra. The corresponding figure for 1999 was 19%; and the corresponding figures for antenatal visits were 6% for 1994 and 9% for 1999.

Women’s views were positive particularly about staff and the clinic environment, which was regarded as friendly, helpful and comfortable. However women wanted more clinic days to be available.

References


2.2.14 Strong Women Strong Babies Strong Culture Program (NT)

Scope:
Aboriginal women from three self-selected pilot communities in the Northern Territory

Infant mortality, preterm birth, SGA and LBW outcomes:
Early improvements for low birthweight were not sustained; no effects on preterm birth were seen.

Background

In the early 1990s the NT Department of Health and Community Services developed a community-based intervention program ‘Strong Women, Strong Babies, Strong Culture Program’ (SWSBSC) in response to poor pregnancy outcomes. The particular concerns were about babies being born too small, not growing well and being anaemic.

The program aimed to employ senior women within Aboriginal communities to help younger Aboriginal women prepare for pregnancy. The program began in 1993 as a pilot project in three Top End communities in the Northern Territory. The Commonwealth Government provided funding for the initial 18 months. Funding was then provided by the NT Government.

The relative contribution of preterm birth and IUGR to low birthweight in the Aboriginal population has been a topic of intense debate. Major antecedents of low birthweight and IUGR in Aboriginal infants born at Royal Darwin Hospital included factors such as maternal weight before pregnancy, weight gain during pregnancy and smoking during pregnancy, along with alcohol use and infectious morbidity. Some of these factors are potentially reversible, and were targeted in the SWSBSC program through early attendance for antenatal care and change in behaviours.

As a result of information fed back to communities about high hospital admission rates for conditions associated with underweight in infants and toddlers, three communities offered to participate in the SWSBSC program. In 1996-97, the program was extended to a second group of communities with poor perinatal health status.

In 1998, the NT Government funded an expansion of the program to a total of 14 communities over three years.

Project Goals

To increase infant birthweights by earlier attendance for antenatal care, and improve maternal weight status in communities with lower mean birthweight and a higher prevalence of low birthweight than the rest of the Top End.

Initial evaluation of the program consisted of:
- A quantitative assessment of effects on birthweight, attendance for antenatal care, and various antecedents
- A qualitative assessment of acceptability to the community and the processes of intervention.

A later evaluation of the program in 2001 aimed to:
- Assess whether initial improvements in birthweight had been sustained in the three pilot communities
- Whether there had been changes in the additional intervention group
- To examine the impact of the program on factors addressed by midwives during routine antenatal care, such as detection and management of infections, anaemia, gestational diabetes, hypertension, smoking and alcohol consumption.
Design

1st phase
Comparison of mean birthweight, per cent of low birthweight and trimester of presentation for antenatal care for two-year periods from 1988 to 1995 for the three pilot communities compared with three rural Top End regions (Darwin Rural, East Arnhem and Katherine). These factors were also compared over time within the three pilot communities.

The following groups were compared:
- The three communities where the program was first implemented in early 1993 (n=1406 livebirths; 577 in the preintervention period 1988-93 and 829 in the postintervention period 1994-2001)
- The additional communities where the program commenced in 1996 and 1997 (n=814 in the preintervention period (1988-97) and 322 in the postintervention period (1998-2001))
- Their respective control groups were rural Top End communities and each control group consisted of 5188 livebirths.

The years 1992 and 1993 were excluded as this was the set-up period of the project; and it was decided (prospectively) that data for 1996 would be collected. One of the three pilot communities did not give permission to visit and collect data for 1996.

Later phase
Data were collected for 1998 to 2001 for the second group of communities added in and for 1994 to 2001 for the first group of three communities.

Description of model
In early 1993, a well-respected Aboriginal woman was employed to head the project and subsequently other positions such as Strong Women Workers (SWW) were filled. The first workshop to train the Strong Women Workers was held in August 1993. The role of the SWWs was to support pregnant women within the community, in a number of ways including encouragement to seek early antenatal care, to eat properly and to have any infections treated. Later in the program, the role of the SWWs extended to promoting health care for children and other members of the communities.

The program consisted of a ‘fluid’ community-based program of individual and community support. It was designed to target:
- Nutrition – by encouraging young pregnant women to maintain a healthy diet of locally available bush food and store food
- Dangers – by talking about issues that can cause unhealthy babies and by using a diagram called ‘The Road to Long Life, Good Health and Happiness’
- Protection and prevention – using traditional values and customs combined with western style education to protect against diseases and social problems
- Sharing – by Aboriginal women teaching community health nurses traditional antenatal and postnatal care; and by community health nurses teaching Aboriginal women how to take care of each other using the latest methods of antenatal and postnatal care
- Caring – by Aboriginal women sharing knowledge throughout the community including young adolescent girls.

Between late 1996 and early 1997, the program was implemented in a second group of communities also with poor perinatal health status.

Research method
Two sources were used for the quantitative assessments – data extracted from antenatal records in the three communities; and data from the NT Midwives Collection.
Two groups of communities were assessed – Group 1 from 1994-2001 compared with a preintervention period (both with concurrent controls) and Group 2 from 1998-2001 also compared with a preintervention period (again both with concurrent controls) – see table below.

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<tr>
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<th>Intervention</th>
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<td><strong>Period</strong></td>
<td><strong>Numbers of women</strong></td>
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<td>Preintervention</td>
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**Results**

**Main outcomes**

**Preterm**

1st phase (group 1: 1994-95 intervention period)

Within the three pilot communities, the preterm birth rate was 22.4% in 1990-91 (214 babies), falling to 13.1% in 1994-96 (236 babies) which is a fall of 9.3% (95% CI -16.3 to -2.3; p=0.01) using the SWSBSC data. Part of this fall may have been due to more accurate dating with increased availability of ultrasounds. (Using the Midwives Data Collection did not show a significant decrease in preterm birth over time.)

Preterm births rose by nearly 1% in the areas not receiving the program (from 13.2% to 14%), over the 1990-91 to 1994-95 period.

**Low birthweight**

1st phase (group 1: 1994-95 intervention period)

Within the three pilot communities, the low birthweight rate was 21.0% in 1990-91 (224 babies), falling to 13.0% in 1994-96 (238 babies). This decrease of 8% was statistically significant (95% CI -14.8 to -1.1; p=0.03).

For infants with a birthweight less than 1500 g, there was a decline from 4.0% to 1.7%.

Just under 70% of low birthweight was associated with preterm birth.

Between 1990-91 and 1994-95, the prevalence of low birthweight declined by 1.5% (from 17.4% to 15.9%) in the control communities.

**Overall**

Group 1: 1994-2001 intervention period

The low birthweight rate improved significantly post-intervention compared with pre-intervention (10.9% v 15.3%; p=0.01). The corresponding post-intervention and control rates were 10.9% v 13.8%.

Group 2: 1998-2001 intervention period

The low birthweight rates were not significantly different between post-intervention and pre-intervention for group 2 (13.0% v 16.8%, p=0.14). The corresponding post-intervention and control rates were 13.0% v 13.5%.

**SGA/IUGR**

1st phase (group 1: 1994-95 intervention period)

In 1990-91, 30.7% of the babies (65/212) were classified as IUGR. The corresponding rate for 1994-6 was 25.7% (58/226). About 12% of IUGR was associated with preterm birth.
There appeared to be two distinct types of IUGR in this population:
- Babies who are both shorter and lighter than would be expected; and
- Babies who are light in relation to their length.

*IUGR was defined as < 10th percentile of gestational age and sex specific curve.

Other outcomes

Antenatal care

1st phase (group 1: 1994-96 intervention period)
Number of antenatal care visits and gestational age at first visit remained fairly similar over time (8.9 versus 7.3 visits; and 19.1 weeks [SD 6.8] versus 18.4 [SD 7.8] weeks for 1990-91 to 1994-96); consistent with the general pattern of antenatal care for Indigenous women in the NT. In one community, presentation for antenatal care reduced from 25.5 weeks gestation to 19.3 weeks. Women initiating care in the first trimester increased from 16.7% to 24.4% over time.

Birthweight

1st phase (group 1: 1994-96 intervention period)
Within the three pilot communities, mean birthweight increased 108 g from 2916 g [SD 607] in 1990/91 (224 babies) to 3,024 g [SD 551] in 1994-96 (238 babies).

About half the birthweight increase over time was estimated to be due to improved preterm birth rates and maternal weight gain (but the other half remains unexplained).

Overall

Group 1: 1994-2001 intervention period
There was no significant difference seen in mean birthweights for low birthweight babies pre and post-intervention, but the difference for babies weighing more than 2500 g at birth was significantly in favour of the intervention group (p=0.0025). A similar change was seen in the control group, indicating similar changes over time for both intervention and control groups.

Group 2: 1998-2001 intervention period
In group 2, no significant differences in mean birthweight were seen for either the low or normal birthweight babies, pre and post-intervention. This pattern was also reflected in the mean birthweights of the low and normal birthweight babies in the control group.

Infant length

1st phase (group 1: 1994-95 intervention period)
No significant differences were seen over time for babies’ lengths at birth (p=0.5).

Infant head circumference

1st phase (group 1: 1994-95 intervention period)
No significant differences were seen over time for babies’ head circumferences (p=0.97).

Maternal weight gain during pregnancy

1st phase (group 1: 1994-95 intervention period)
Mean weight gain in pregnancy was just less than 10 kgs (likely to be an underestimate as the last weight recording usually has to be made several weeks before the expected birth due to the need to travel to a centre for birth).

Smoking and alcohol
Although the intention was to collect information on use of tobacco and alcohol, this was rarely noted in women’s antenatal records.
Maternal characteristics

1st phase (group 1: 1994-95 intervention period)

Before pregnancy, women in the three pilot communities were estimated to have an average BMI of 19.9 compared with 23.6 for the overall Australian average. The prevalence of anaemia rose to 41% in the women from the pilot communities while the proportion of women with pre-existing and gestational diabetes remained fairly constant (2.0% and 7.7% respectively in 1994-96).

Skin, chest and urinary tract infections decreased over time, while detection of genital tract infections rose to 37.4% (likely to be due, in part, to trials of a new screening program).

Limitations

Of the study

- A substantial amount of information was missing for measures such as maternal weight and maternal weight gain.
- Since there was no formal control group, it was not possible to attribute changes to the SWSBSC program.
- The results were not able to be adjusted for important confounders such as maternal smoking.
- Reporting at different time points makes the study results difficult to summarise and interpret.

Of the model

Features of the program that may not be generalisable to other contexts include:

- a population where the mean birthweight was substantially lower than the NT or national mean;
- where prevalence of infection was high;
- and where the intervention depended on the traditional authority of older women.

Conclusions/recommendations

The different results between the group 1 (earlier start) and group 2 (later start) communities could possibly be due to differences in program content between the two sets of communities.

Future Plans

Another evaluation of the program is currently underway.

References


2.2.15 Daruk

Scope:
Urban Aboriginal women in western Sydney, NSW

Infant mortality, preterm birth, SGA and LBW outcomes:
Daruk clients had lower rates of perinatal mortality, preterm birth and low birthweight than women not attending Daruk, but none of these differences reached statistical significance.

Background

Before Daruk was funded in 1990, perinatal mortality was 2-3 times higher among Aboriginal women than among non-Aboriginal women, with late attendance (> 20 weeks) at antenatal clinics more than twice as likely for Aboriginal women. There has been a background of poor education, low income, high unemployment, racial discrimination, low self-esteem and a general lack of social supports among Aboriginal people in the region.

Study design

Economic evaluation, concurrent comparison with two hospitals (Nepean and Blacktown) from 1990 to 1996, focus groups and interviews.

Description of model

The Daruk Aboriginal Medical Service is a community-controlled health service based in Mt Druitt in the outer western suburbs of Sydney. The midwifery program has serviced the local Aboriginal population of around 12,000 since 1990 and is staffed by a fulltime Aboriginal health worker, a non-Aboriginal midwife and two female GPs.

Main activities include:
- Regular antenatal check-ups
- Booking in to hospital
- Transport
- Home visits
- Labour support and delivery
- Hospital visits
- Management of high-risk pregnancies in the community in consultation with a specialist medical team
- Assistance with infant feeding
- Provision of cultural awareness services with local hospital staff.

Results

Perinatal mortality
There were no perinatal deaths among Daruk clients giving birth at Nepean Hospital (0/174) and 2% (5/219) perinatal deaths for Aboriginal women who were not Daruk clients. There was one perinatal death among Daruk clients giving birth at Blacktown Hospital (1/29) and 6/259 (2%) deaths among non-Daruk clients.

Preterm birth
- Nepean Hospital: 9% (16/174) Daruk clients v 12.3% (27/219) non-Daruk clients
- Blacktown Hospital: 0% (0/29) Daruk clients v 9.3% non-Daruk clients (24/259).
Low birthweight (< 2500 g)
- Nepean Hospital: 12% (21/174) Daruk clients v 12% (27/219) non-Daruk clients
- Blacktown Hospital: 0% (0/29) Daruk clients v 7% (19/259) non-Daruk clients.

Other outcomes:
Gestational age, mean (weeks) at first visit
- 17.2 weeks for Daruk clients (n=185) v 21.2 weeks for non-Daruk clients (n=105) having care at Nepean Hospital, p < 0.01
- 17.2 weeks for Daruk clients (n=185) v 19.9 weeks for non-Daruk clients having care at Blacktown Hospital (n=90), p< 0.05.

Women initiating care in the first trimester
- 37% for Daruk clients (n=185) v 22% for non-Daruk clients (n=105) having care at Nepean Hospital, p < 0.01
- 37% for Daruk clients (n=185) v 24% for non-Daruk clients (n=90) having care at Blacktown Hospital, p < 0.05.

Number of antenatal visits, mean
- 10.5 visits for Daruk clients (n=185) v 5.5 visits for non-Daruk clients (n=105) having care at Nepean Hospital, p < 0.01
- 10.5 visits for Daruk clients (n=185) v 9.5 visits for non-Daruk clients (n=90) having care at Blacktown Hospital.

Attendance for routine antenatal tests
- 94% for Daruk clients (n=185) v 71% for non-Daruk clients (n=105) having care at Nepean Hospital, p < 0.01
- 94% for Daruk clients (n=185) v 84% for non-Daruk clients (n=90) having care at Blacktown Hospital, p < 0.05.

Pregnancy-induced hypertension
- Nepean Hospital: 11% (19/174) Daruk clients v 5.1% (11/219) non-Daruk clients (p < 0.05)
- Blacktown Hospital: 3% (1/29) Daruk clients v 3% (8/259) non-Daruk clients.

Smoking in pregnancy
- Nepean Hospital: 70% (62/89) Daruk clients v 71% (89/216) non-Daruk clients
- Blacktown Hospital: 59% (10/17) Daruk clients v 69% (116/169) non-Daruk clients.

Smoking more than 10 cigarettes a day
- Nepean Hospital: 79% (48/61) Daruk clients v 60% (50/84) non-Daruk clients, p < 0.05
- Blacktown Hospital: 56% (5/9) Daruk clients v 65% (73/112) non-Daruk clients.

Alcohol consumption during pregnancy
- Nepean Hospital: 26% (38/153) Daruk clients v 28% (24/87) non-Daruk clients
- Blacktown Hospital: 26% (38/153) Daruk clients v 15% (12/79) non-Daruk clients.

Costs of running the program
The cost per pregnancy/birth was about $1200, after calculating savings incurred by other services. This was based on 42 Daruk clients a year (about 40% of Aboriginal pregnancies in the area).

Length of hospital stay
Average length of stay was lower for Daruk clients than for non-clients (3.85 days v 5.05 days).
Women’s views

Before Daruk, women felt that there was a lack of relationship with hospital staff and inadequate communication between hospital staff and Aboriginal women. There were also problems of accessibility, problems relating to alienation and racism, and the nature of hospital care for Aboriginal women was felt to be disempowering.

In the focus groups, women felt that Daruk provided an ongoing relationship of trust and support, and was seen to be more accessible than mainstream services because it provides a transport service, waiting time is shorter and informal child care is provided.

Some women felt that there was a stigma associated with a service predominantly for the Aboriginal population. Some also perceived that it was a service for disadvantaged people.

References


2.2.16 Djuli Galban, NSW

Scope:
Aboriginal women, Macleay Valley in regional NSW

Infant mortality, preterm birth, SGA and LBW outcomes:
Possible reductions in preterm birth, but not in low birthweight.

Background

The Djuli Galban Program is part of the Durri Aboriginal Medical Service based in Kempsey, NSW. It provides accessible community-based, culturally sensitive outreach services to families during pregnancy and after birth.

The program began in 1992 as a pilot project funded by the NSW Alternative Birthing Services Program. It was developed in response to the large Aboriginal population in the area and high perinatal morbidity and mortality rates experienced by Aboriginal women. The Djuli Galban Program has been refunded over the past 13 years and is recognised nationally as a model of excellence for Aboriginal maternal and infant health services.

Study design

Descriptive (largely):
Some comparison with NSW overall; some trends over time.

Description of model

- Staffed by a fulltime midwife and Aboriginal maternal health worker team
- Weekly antenatal clinic at Durri AMS provided on a shared care basis between the midwife and GP obstetrician (antenatal also provided at other times or at home when required)
- Participating women are provided with individualised, flexible and supportive care and education appropriate to their individual needs
- This care includes close monitoring for high-risk pregnancies, appropriate referrals and support to access other services (including the hospital for birthing) and recalling women for antenatal care
- Women are assisted with transport for clinic, screening and specialist appointments
- One-to-one antenatal education at each pregnancy check-up and/or at other times.
- Support to access other antenatal classes (e.g. young women supported to attend young parent antenatal classes conducted by the young parent worker and midwife from Kempsey Hospital)
- Develops antenatal care and child health resources
- Established an antenatal recall system (as some women had irregular antenatal care attendance)
- Encouraging and supporting women to book into hospital for the birth of their baby (this includes assistance with completing the maternity booking papers and transport to the hospital)
- Provides brief educational interventions for smoking and drug use as women present for antenatal care
- Access to other Durri AMS programs such as mental health, drug and alcohol services and ‘Families First’
- Postnatal care is offered as either home visits or clinic visits, whichever the women prefer (weekly or more frequently as needed, usually up to eight weeks postnatally); provides parenting support and education, life issues, infant care and breastfeeding and ensuring infants are growing optimally
- Immunisation clinic weekly, with transport assistance provided; provides parents/carers with education regarding the importance of immunisation, vaccines available and associated side effects, as well as immunisation certificates
Child growth and development is checked at the immunisation clinics, with opportunities to discuss health and parenting issues and for parents/carers to ask questions and discuss concerns.

- Immunisation register and recall system
- Pregnancy testing, support and referral
- Healthy messages calendar – short targeted messages each month, including antenatal care, postnatal care, smoking, alcohol and other drugs, breastfeeding, introducing solids, SIDS and importance of self-care.

Over 75% of all Aboriginal women who give birth in the Macleay region use the Djuli Galban program. In 2004-05, 57 Aboriginal women and five other women used the service. (In late 2000 Durri AMS implemented a general policy of not accepting any new non-Aboriginal clients, unless they had family members already as clients.)

In 2004-05, 26% of women giving birth were 19 years or age or under.

Results

Preterm
- In 2004-05, 10.5% of babies born to Aboriginal mothers were preterm (< 37 weeks)
- This rate is lower than the 12.1% rate for all Aboriginal babies in NSW (2003 NSW Midwives Data Collection)
- The rate is higher than previous years – it has varied from 6.3% to 16.6% over 1999-2003.

Low birthweight
- In 2004-05, 13.2% of babies were low birthweight (most being preterm)
- Of the term babies, 4.4% were low birthweight
- The rate for all Aboriginal babies in NSW was 12.4% (2003 NSW Midwives Data Collection)

Other outcomes:
- Has increased the access to health services for Aboriginal women and their children
- This has led to associated improved health outcomes
- Group antenatal sessions have not been successful
- The antenatal recall system has been effective in reminding and encouraging women to access antenatal services
- In 2004-05, 88% of Aboriginal women in the Macleay area presented for antenatal care before 20 weeks gestation (higher than the 71% reported for Aboriginal women in NSW – reported in the 2003 NSW Midwives Data Collection).
- In 2004-05, 58.5% of clients smoked during their pregnancy, 21% reported using marijuana and 6% regularly consumed a significant amount of alcohol during pregnancy
- Utilisation of the postnatal service has increased from 60% to 93% in 2004
- Childhood immunisation rates have increased from 51% in 1997 to 95% in 2005
- The healthy message calendar was very well received, with the calendar being displayed in most Aboriginal homes.

Other information

Resources developed through NSW Health have not always been appropriate for women attending Djuli Galban.

References

2.2.17 Gudaga

(Gudaga means “healthy baby”)

**Scope:**
ATSI women and babies, Campbelltown: urban New South Wales.

**Infant mortality, preterm birth, SGA and LBW outcomes:**
None reported to date

**Background**

In 1997, researchers from the University of NSW (UNSW) met with Aboriginal Health Workers (AHWs) at Campbelltown Aboriginal Community Controlled Health Service, Tharawal Aboriginal Corporation, to discuss health problems faced by Aboriginal families living in the area. The AHWs were concerned at the difficulties in providing access to culturally appropriate, outreach services to mothers with babies once they had left hospital. After much discussion and planning with the local Aboriginal community in the Campbelltown area, a funding application was submitted to the Ingham Foundation for a small research grant to conduct a feasibility study for a home visiting program, which then led to NHMRC funding in 2003.

The Campbelltown region has one of the largest Aboriginal populations in NSW, with over 3,600 people (2.4% of the regional population of 150,000 and 5.1% of the state’s Aboriginal population). It is a relatively young population which has a generally lower socioeconomic status than the non-Aboriginal population (such as lower household incomes, higher unemployment, higher rates of incomplete schooling, higher public housing tenancy). Forty per cent of Aboriginal infants have a non-Aboriginal mother (Comino 2007).

**Study aims**

1. To establish how well Aboriginal infants are identified through health services
2. To describe the obstetric outcomes and health service use for mothers of Aboriginal infants
3. To describe the health, development and health service use of Aboriginal infants aged 0-12 months
4. To identify issues participating mothers would like addressed to improve the health and wellbeing of themselves and their families.

**Study design**

Birth cohort study of babies born at the Campbelltown Hospital between October 2005 and May 2007 (159 babies from 152 mothers).

For aims 1 and 2 of the study, all mothers admitted to the maternity ward of Campbelltown hospital were surveyed following the birth of their child to identify babies with an Aboriginal mother or father, with the routine antenatal data then being able to be compared with that from mothers of non-Aboriginal babies. Mothers of Aboriginal babies participating in the study were visited at 2-3 weeks, six and 12 months to take anthropometric measures and to answer a questionnaire on health status and health service use; and at 12 months all participating babies were examined by a paediatric registrar (Aim 3). Finally stories of mothers’ experiences of using health services were documented (Aim 4).
Seven groups are involved with Gudaga Project:

1. Gudaga mothers and their babies
2. the local Aboriginal community of Campbelltown
3. the local Aboriginal health care workers
4. Aboriginal health organisations
5. project management groups
6. mainstream academic and health organisations
7. other research activities in the region.

The latter three groups also have strong Aboriginal representation.

The project management groups consist of a steering committee, a working group and a grassroots group made up of mothers and grandmothers from the local community.

The relationship with the mothers and the local groups is one of trust, respect, open communication and reciprocity which have been built over 10 years of involvement with the community.

Description of model

In November 2000, a pilot Aboriginal home visiting team was established.

Soon after the birth of their babies at Campbelltown Hospital, mothers were offered participation in the Home Visiting program, which included:

- Three home visits over 12 months – during times that would suit the participating mother and baby, lasting for half an hour.
- A home visit two to three weeks after mother and baby have left hospital where the baby would be weighed and measured, visits would then be made at six and 12 months.
- At each home visit a health pack with information on age appropriate health issues, such as SIDS (first home visit), transition to solids, immunisation (six month visit) and dental care (12 month visit), contact telephone directory, fridge magnet (local telephone numbers of health services) and a photo of the baby.
- Each home visit allowed the Project Officer to take a photo of the baby and the photograph is given to the mother at the following visit – a means for the mothers and research team to watch the babies grow and develop.
- At six months all babies received a screen-printed “I’m a Gudaga baby” t-shirt.
- At 12 months all babies received a sunhat with the same wording and the mothers were given a Gudaga coffee mug.
- At 12 months each baby had a full paediatric assessment conducted by an independent paediatrician at no cost to the infant’s family.
- Inclusion of Aboriginal art in recognition of the cultural distinctiveness of Aboriginal peoples.

Staffing

Project officer positions were filled by local Aboriginal mothers.

Results

Not yet available (finished recruiting the 159 babies in May 2007).
Other information

Funding
Initial funding was from the Ingham Foundation and NHMRC funding was granted in 2003. Cost of the project to date has been $430,000. In 2008, the Gudaga Project received a further $1,339,125 from NHRMC towards understanding the health, development and service use of Aboriginal children in an urban environment. The researchers are seeking further funding to follow infants up to five years of age.

In the planning stages there was concern about a home visiting program being a potential vehicle for welfare officers to remove children. However this initial fear was allayed and mothers welcomed the home visiting team.

Difficulties in implementation

There have been some ongoing problems including organisational issues, inadequate funding, staff vacancies and difficulties in seeing all the mothers (Knight 2007).

It has been difficult for the mothers’ group to meet regularly and to attract sufficient numbers of mothers.

The lack of epidemiological data on the health and health service needs of the area’s Aboriginal infants has been a barrier to extending the Aboriginal Home Visiting Service.

References


2.2.18 NSW Aboriginal Maternal and Infant Health Strategy (AMIHS)

Scope:
Aboriginal and Torres Strait Islander women, NSW.

Infant mortality, preterm birth, SGA and LBW outcomes:
Perinatal deaths
In 2003 there were six perinatal deaths (18.6 deaths per 1000 births). In 2004, there were two deaths (5.4 deaths per 1000 births). This was a considerable decrease (although not statistically significant). The pre-AMIHS perinatal mortality for Aboriginal women in the relevant regions was 20.4 in 1996-2000 (47 deaths from 2,299 births).

Preterm
Preterm birth rates remained stable at 11% in 2003 and 2004; the pre-AMIHS rate for 1996-2000 was 20%. The comparable rate for non-Indigenous babies in NSW was 7%.

Low birthweight
Rate of low birthweight was minimally reduced, from 15% in 2003 to 12% in 2004. The comparable rate for non-Indigenous babies in NSW was 6%.

Background
AMIHS was funded by NSW Health in 2000 and commenced implementation in 2001.

Study/strategy aim
To improve the health of Aboriginal women during pregnancy and decrease the perinatal morbidity and mortality, through improving access to culturally appropriate antenatal and postnatal services.

Evaluation study design
Qualitative (interviews and focus groups with women, clinicians, managers and other stakeholders) and quantitative (program-specific information and population-based data from the NSW Midwives Data Collection) evaluation methods were used.

Description of model
The aim of AMIHS is to provide an enabling primary health care model.

A community midwife and an Aboriginal Health Worker (AHW) or Aboriginal Health Education Officer (AHEO) provided community-based services in conjunction with existing medical, midwifery, paediatric and child and family health staff, as well as community development programs. The midwives receive cultural awareness training. Transport services are provided, as they are essential for access.

A Training and Support Service employs a fulltime Midwifery Consultant who supports 54 midwives and AHW/AHEOS in 26 sites across NSW; and provides resources, particularly educational. An annual workshop/conference is held and telehealth broadcasts are also offered (four in 2004).

Women’s reference groups have been used to promote and support an enabling model of care. Coverage was seven targeted antenatal/postnatal programs across six of the former health services areas representing 20 local government areas, including Far West, Mid North Coast, Macquarie, New England, Hunter and Mid Western.
In 2003 and 2004 AMIHS provided care to 689 women, with about one in four women being less than 20 years of age.

**Results**

**Perinatal deaths**
In 2003 there were six perinatal deaths (18.6 deaths per 1000 births). In 2004, this decreased to two deaths (5.4 deaths per 1000 births). This was a considerable decrease (although not statistically significant). The pre-AMIHS perinatal mortality for Aboriginal women in the relevant regions was 20.4 in 1996-2000 (47 deaths from 2,299 births).

**Preterm**
Preterm birth rates remained stable at 11% in 2003 and 2004; the pre-AMIHS rate for 1996-2000 was 20%. The comparable rate for non-Indigenous babies in NSW was 7%.

**Low birthweight**
Rate of low birthweight was minimally reduced, from 15% in 2003 to 12% in 2004. The comparable rate for non-Indigenous babies in NSW was 6%.

**Antenatal care**
Attendance before 20 weeks in antenatal clinic was either stable or dramatically increased across the regions; 78% attended prior to 20 weeks in 2003 and 2004. The pre-AMIHS rate for 1996-2000 was 65%. The comparable rate for all NSW women in 2003 was 87%.

**Smoking**
No impact on smoking rates was seen – there was a slight but not statistically significant increase in overall rates from 58% in 2003 to 62% in 2004 (similar to smoking rates for Aboriginal women across NSW). These rates were similar to the pre-AMIHS rates for 1996-2000. The comparable rate for non-Aboriginal pregnant women in NSW was 14%.

**Breastfeeding**
There was a modest but encouraging trend towards increased initiation and length of breastfeeding – in 2003, 67% initiated breastfeeding with 59% of these women still breastfeeding at six weeks.

**Empowerment**
After initial visits to AMIHS, some women accessed services such as ultrasound on their own without an AMIHS team member being present. However many women will require the same level of care from AMIHS for subsequent pregnancies.

**Access**
Lack of transport makes it difficult for women, especially those with small children, to attend antenatal clinics or GP rooms. Hospital antenatal clinics have inflexible appointments, and long waits for appointments.

Some areas do not have public antenatal services and so the only alternative for many women is a local GP, although many Aboriginal women are unable to afford GP fees for antenatal care.

Being based in the community means that women coming to AMIHS were more often able to receive care close to home and in familiar surroundings, in contrast to hospitals and GP rooms which were unfamiliar and often inaccessible.
**Continuity of care**
The continuity of care and carer is greater in AMIHS but limited in many mainstream settings. Women who used AMIHS talked of having caregivers who ‘really cared about them’ and having an Indigenous worker ‘who understood them’. Mainstream services do not generally have Aboriginal people providing services and are not perceived as being ‘Aboriginal-friendly’.

**Education/workforce**
In 2004, six AHW/AHEOs graduated from the one year Maternal and Infant Preparatory Course at Yooroang Garang.

**Other information**
Providing primary health care rather than welfare-based care is a constant difficulty, with issues such as economic restraints and funding, staffing, transport and engagement with other services compete with provision of a quality primary health care service. Such services need to be linked into, but not run as mainstream services.

Women’s reference groups are important in supporting and enabling culturally and contextually appropriate models of care, but are difficult to establish and maintain. Sometimes reference groups lacked a clear purpose, and consisted more of information sharing by the health care workers.

Tools to measure time and motion; and to measure level of need were piloted but some problems were reported with both tools.

In order for the number of Aboriginal midwives to increase, there will need to be support provided, such as leave without pay provisions and/or a cadet program.

**References**
2.2.19 Mums and Babies Program at the Townsville Aboriginal and Islander Health Service (TAIHS)

Scope:
Australian and Torres Strait Islander women, Queensland (regional/provincial urban).

Infant mortality, preterm birth, SGA and LBW outcomes:
(2000-2005 data compared with historical data)
- Perinatal mortality rate decreased from 5/84 (60/1000 births) to 11/781 (14/1000 births); p=0.014
- Preterm births (< 37 weeks) decreased from 16.7% (14/84) to 9.5% (68/717); p=0.055
- Low birthweight (< 2500 g) decreased from 13/84 (15.5%) to 82/699 (11.7%); p=0.289.

Background
The Mums and Babies Program is an integrated model of antenatal shared care delivered from the community-controlled Townsville Aboriginal and Islanders Health Service (TAIHS).

The program, commencing in January 2000, was created in response to poor perinatal outcomes within the Indigenous community, with Townsville having the largest Indigenous population in Australia (5% of total population.) Data from the Townsville Hospital in 1998 showed that 64% of Indigenous women made fewer than four antenatal visits. The collaborative service replaced four previously independent providers of antenatal care (TAIHS, QLD Health Services Child Health, the Aboriginal and Islander Health program, and the Women’s and Children’s Institute at the Townsville Hospital.)

Prospective cohort study (comparative)
Women (91% Indigenous) attending TAIHS shared antenatal care with a singleton birth 2000-2005 (781 women) compared with a historical control group of 84 women who attended TAIHS for antenatal care prior to the intervention (1998-99) and a contemporary control group of 540 women who had a singleton birth at Townsville Hospital 2000-2003 but did not attend TAIHS for antenatal care. Results were also compared with state and national data.

Description of model

Components
- Delivered through daily maternal and child health clinics at TAIHS by staff from four previously independent providers of antenatal care – TAIHS, Queensland Health Services Child Health, the Aboriginal and Islander Health Program and the Women’s and Children’s Institute at Townsville Hospital
- Integrated team approach with each woman seen by:
  - Aboriginal health workers (TAIHS maternal and child health staff)
  - Midwives/child health nurses (Community Health, Queensland Health)
  - Doctors (TAIHS female doctors)
  - Obstetric team (Townsville Hospital, Queensland Health)
  - Indigenous outreach health worker (Community, Queensland Health)
- Pregnancy register (monthly recalls)
- Daily walk-in clinics
- Family orientation (playground, educational toys, weekly playgroup)
- Care plans emphasising essential elements of care (investigations, education, nutritional supplementation)
- Ultrasound dating
- PCR testing for STIs
- Lower vaginal swab for Group B Streptococcal infection
- Transport service
- Brief intervention for risk factors (smoking cessation, nutrition, antenatal education, breastfeeding, SIDS).

The program encompassed standard antenatal management, following antenatal shared-care protocols based on the 2004 RANZCOG guidelines with additional STI screening.

Participation in the program was voluntary, with no women refusing to participate. Women involved in the program delivered their babies at the Townsville Hospital, unless the mother was not a Townsville resident. Women who were high-risk or complicated pregnancies were referred to Townsville Hospital.

Delivery of the service was by staff from the four previous providers through daily maternal and child health clinics at TAIHS. The integrated team approach included Aboriginal Health Workers, midwives/child health nurses, female doctors from TAIHS, obstetric team from Townsville Hospital, and an Indigenous outreach worker.

**Results**

**Outcomes – infant mortality, preterm birth, SGA, LBW**

Comparison with historical controls:
- Perinatal mortality rate decreased from 5/84 (60/1000 births) to 11/781 (14/1000 births); p=0.014
- Preterm births (< 37 weeks) decreased from 16.7% (14/84) to 9.5% (68/717); p=0.055. This rate was also significantly lower than the overall rate of 13.0% for Indigenous births in Queensland.
- Low birthweight (< 2500 g) decreased from 13/84 (15.5%) to 82/699 (11.7%); p=0.289
- Increase in mean birthweight from 3043g to 3192g.

**Other outcomes**

Patterns of antenatal care:
- Before the introduction of the Mums and Babies Program, 52.4% of Townsville based women in the historical control group had pregnancies with inadequate care. This decreased to 16.7% for the women involved in the Mums and Babies Program 2000-2005 (p<0.001).
- There was a significant increase in the total number of antenatal care visits per pregnancy in the intervention group from a median of three (2-6) visits to six visits (4-10) (p<0.001).
- Preganancies with late first visit decreased from 17.9% to 11.5%.
- Gestation at first visit decreased from 14 weeks (7-22) to 13 weeks (8-20) overall; with non-Townsville based women still presenting late despite the intervention at a median of 18 weeks (11-25).
- Townsville-based women made significantly more antenatal care visits and presented earlier than non-Townsville based women.

Quality of antenatal care
- The results from the MB group show significantly positive trends in recorded care planning, smoking cessation and antenatal education activities.
- There was an increased proportion of women participating in pregnancy ultrasound scanning (95% had one or more scans), with the morphology scan performed at a median 20 weeks over the study period.
- 93% of women were screened for STIs
- 60% of women were screened for GBS
- 89% were screened for haemoglobin, hepatitis B, syphilis
- Women missing out on screening tests (either an ultrasound scan, or screening for sexually transmitted infections or a minimum blood screen) were significantly more likely to be non-Townsville residents (87/248 35.8%) compared to Townsville residents (95/533) 17.8%.
Participation
Participation in the Mums and Babies Program increased rapidly from its start, with access being maintained over the 6 years.

- The number of Townsville-based pregnant Indigenous participants who entered the MB program and gave birth at Townsville hospital rose from 23.8% in 2000 to 61.2% in 2003.
- 25% are returning for care of subsequent pregnancies.

Independent risk factors

- Demographic characteristics of women in the MB group were compared with and found to be similar to the historical control group (of women attending TAIHS), and the contemporary control group (women who delivered at Townsville Hospital 2000-2003).
- Tobacco use within the MB group was 64%, (10 cigarettes per day), compared to the historical group of 59.5% and contemporary control of 50%.
- Data for the following risk factors is available for the MB group only:
  - 27% report alcohol use (with 51% of those being within the range of harmful/hazardous use),
  - 13.8% report recreational drug use (with 87.3% of those mothers using cannabis),
  - Domestic violence was reported by 15.1%,
  - Educational status of year 10 or below was reported by 62.6%.

Limitations

- Selection bias within the study may be significant, as both the historical control group and those participating in the Mums and Babies Program were self-selected, however demographic profiling suggest women in both groups shared significant risk loads and were not of high socioeconomic status.
- The studies suggest that decreased preterm birth may be, in part, attributed to selection bias through features such as lower risk profiles, improved infection screening, accurate dating, or differences in socioeconomic status of the Indigenous community in Townsville.
- Residence outside Townsville is a strong predictor of inadequate antenatal attendance.
- High parity (>4 pregnancies) appears to be a barrier to attendance.

Conclusion/recommendations

The results of the Mums and Babies program in Townsville for 2000-03 published in the 2005 report demonstrated improved access to quality antenatal care and significantly improved preterm birth rates but not perinatal mortality rates. The subsequent 2007 report of results for 2000-05 showed previously reported gains had been sustained, and the reduction in preterm births had translated into a significantly reduced perinatal death rate. This highlights the importance of long-term programs and sustainability.

The model may be adaptable in other urban centres with multiple antenatal care providers and significant number of Indigenous people across Australia.

The use of the MB program by women from outside Townsville reflects the mobility of Indigenous families and the ease patients experience using the Mums and Babies Program.

Interventions addressing specific risk factors such as smoking cessation, nutrition, antenatal education and breast feeding are not described in the publications however in the study it appears that care planning and educational activity performance have improved over the course of the project, suggesting that health workers are taking advantage of the contact these women are having with the health care system.
References


2.2.20 Ngua Gundi (mother/child project)

Scope
Aboriginal and Torres Strait Islander women, Rockhampton, Queensland.

Infant mortality, preterm birth, SGA and LBW outcomes:
Perinatal mortality
From 1993-96, there were 4/123 (3%) perinatal deaths, compared with 13/583 (3%) of all Aboriginal and Torres Strait Islander births in the same area and the same period.

Preterm birth
Thirteen per cent of the births (14/108) to Ngua Gundi antenatal clients from 1997 to 2000 were preterm compared with 13% (13/100) of Aboriginal and Torres Strait Islander women from the Woorabinda community (non-clients) in the same time period.

Low birthweight
From 1993 to 1996, 11/123 (10%) Ngua Gundi babies were less than 2500 g, compared with 59/583 (12%) of all Aboriginal and Torres Strait Islander births in the same area and the same period.

From 1997 to 2000, 9% of births (10/108) to Ngua Gundi antenatal clients were less than 2500 g compared with 10% (10/100) of Aboriginal and Torres Strait Islander women from the Woorabinda community (non-clients) in the same time period.

Background
In response to a needs assessment ‘The Women’s Business Report’, a community midwifery program was developed to care for the needs of mothers and children from pre-pregnancy to five years.

Many of the needs come from the high proportion (over half) of the local Aboriginal and Torres Strait Islander population being under 20 years of age.

During the evaluation period Ngua Gundi cared for 21% of women birthing at Rockhampton Hospital.

Study design
Comparison of pregnancy outcomes of women using Ngua Gundi and the known Aboriginal and Torres Strait Islander births in the area for the period 1993-96 and 1997-2000.

Description of model
Funding for a fulltime midwife and a health worker were provided from the Women’s Health Policy Unit, Alternative Birthing Services Program and Aboriginal Health. Later a part-time driver was recruited to provide transport for women without transport.

The service operates on a midwifery model of care, with referrals made to medical practitioners when necessary. Care covers the antenatal and postnatal periods, and involves home visiting as well as in the clinic. The service works closely with the extended midwifery service provided by the hospital, with the health worker visiting the maternity ward three times a week. She meets with new mothers, making them aware of the Ngua Gundi program, offering postnatal home visits and inviting women to join in activities.

The Midwifery program was established in a residential house next door to Aboriginal Health in north Rockhampton where most of the Aboriginal and Islander people tended to live.
Promotion of the service was largely by word of mouth, supplemented by pamphlets and posters with a specially designed logo. Before long, self-referral became the main source of referral and in 1997, the program provided services to 50% of all Aboriginal and Islander children born in Rockhampton. Media coverage and the awarding of Australia Day medallions to the midwife and health worker in 1997 further increased the program’s profile.

Health worker training
Health workers from Rockhampton and Woorabinda have completed short courses in obstetrics and gynaecology, breastfeeding, primary care, postnatal depression counselling, family planning and nutrition.

Antenatal education
Group or one to one antenatal education is offered and is well attended by young mothers and couples. Women have access to a library of resources and funding was obtained from the Women’s Health Policy Unit to produce an antenatal workbook in culturally appropriate language.

Mothers’ Group
The Mothers’ Group meets weekly in Rockhampton, and is largely responsible for setting the direction of program activities. For example mothers identified a need for easier access to immunisations. Mothers have organised many forms of support such as postnatal depression and SIDS support groups, and practical supports such as providing baby clothes and preparing lunches, and accompanying the health worker on visits to the hospital maternity ward. Mothers have participated in courses such as effective parenting.

Clinical service provision
The clinic established as part of the share care arrangement with Rockhampton Base Hospital soon became very popular, including bulk billing for ultrasounds.

Results
Between 1993 and 1996, there were 123 babies born to Ngua Gundi antenatal clients, and there were also 123 births between 1997 and 2000.

Perinatal mortality
From 1993 to 1996, there were 4/123 (3%) perinatal deaths compared with 13/583 (3%) of all Aboriginal and Torres Strait Islander births in the same area and the same period. From 1997-2000 there was no change in perinatal mortality rates.

Low birthweight
From 1993 to 1996, 11/123 (10%) babies of Ngua Gundi antenatal clients were less than 2500 g, compared with 59/583 (12%) of all Aboriginal and Torres Strait Islander births in the same area and the same period.

Nine percent of the births (10/108) to Ngua Gundi antenatal clients were less than 2500 g compared with 10% (10/100) of Aboriginal and Torres Strait Islander women from the Woorabinda community (non-clients) in the same time period.

Preterm birth
Thirteen per cent of the births (14/108) to Ngua Gundi antenatal clients from 1997 to 2000 were preterm compared with 13% (13/100) of Aboriginal and Torres Strait Islander women from the Woorabinda community (non-clients) in the same time period.
Other outcomes

Antenatal care
The proportion of women initiating care in the first trimester increased from 29% to 37%; and the number of women with more than six antenatal visits remained similar (65.4% and 64%).

References


2.2.21 Yapatjarra

Scope
Remote Aboriginal and Torres Strait Islander women, Mt Isa region, Queensland.

Infant mortality, preterm birth, SGA and LBW outcomes:
The perinatal mortality for the six months June to December 2002 was two, compared with eight in the previous six months.

Background
Just under a third of the population of 35,000 in the catchment area for the Mt Isa Health Service District are Aboriginal or Torres Strait Islander people. While some parts of Australia have shown a reduction in the perinatal mortality rate, the two to threefold Indigenous rate in the Mt Isa region compared with the non-Indigenous rate had not shown any reduction. From January to June 2002, the Mt Isa Hospital recorded eight perinatal deaths (all were intrauterine deaths between 25-35 weeks). On review, the following possible factors indicated a need to improve continuity of care:
- Inappropriate or inconsistent antenatal visits/care
- Variations between doctors, both in outreach clinics and at Mt Isa Hospital
- Poor attendance at antenatal care and adherence to advice
- Culturally inappropriate waiting and examination room
- High staff turnover and intermittent absence of consultant obstetricians.

Description of model
Consultations with Indigenous representatives identified a number of shortcomings with antenatal care services:
- Culturally inappropriate environment, waiting rooms and spaces
- Lengthy waiting times
- No continuity of care
- No regular transport to attend appointments
- No sharing of medical histories between Yapatjarra and the hospital.

Two changes were instituted to improve antenatal care for Indigenous women:
1. Establishing an antenatal clinic at the Yapatjarra Medical Centre, the local Aboriginal community controlled health service
2. A shared-care policy was drafted and implemented and distributed to all doctors in the region.

A medical officer was deployed to attend regular antenatal clinics in remote areas and a fortnightly shared care facility was established at Yapatjarra. At Yapatjarra, women were seen first by Indigenous staff and then by their own doctor. Aboriginal health workers made personal visits to Indigenous women to ensure they attended consultations and the medical centre also provided transport. Children and other family members were welcome to accompany pregnant women and to be involved in antenatal, such as viewing ultrasounds (which were previously only available through a private facility).
Results

Main outcomes
Perinatal mortality
The perinatal mortality for the six months June to December 2002 was two, compared with eight in the previous six months.

Other outcomes
Antenatal care
In the six months from June to December 2002, only two women presented to Mt Isa Hospital without any antenatal care compared with 10 in the previous six months.

When the antenatal clinic started, only five out of eight women booked actually presented. After some months, nine out of 10 women attend and the clinic is being held weekly instead of fortnightly.

Conclusions/recommendations

Although numbers were likely to be small (no denominators provided), the establishment of an antenatal clinic at the Aboriginal community controlled health service, with a shared-care model has shown increased access to antenatal and reduced perinatal mortality.

References


2.2.22 Best Start and Aboriginal Best Start (VIC)

(also see ‘Home Visits’ topic for In-Home support for Aboriginal families)

Scope
Mainstream and Aboriginal populations in Victoria.

Infant mortality, preterm birth, SGA and LBW outcomes:
Not reported.

Background
The Best Start program has been established jointly with the Victorian Department of Human Services and the Department of Education and Training. It aims to improve the health, development, learning and wellbeing of Victorian children aged up to eight years, with an emphasis on prevention and early intervention.

In 2002-06, 11 mainstream and two Aboriginal Best Start projects (Horsham and Morwell) were commissioned; and in 2005-09, 10 new mainstream and four new Aboriginal projects have, or are being commissioned (Geelong (Mingo Waloom), Bairnsdale, Echuca, and Dandenong/Casey).

Programs include universal services as well as those targeting ‘at risk’ or vulnerable populations defined as:

- Families on low incomes
- Sole parent families
- Families with young parents (under 20 years of age)
- Indigenous families
- Families from culturally and linguistically diverse backgrounds
- Families experiencing unstable housing or homelessness
- Families with a parent who has a disability, problematic substance use or a mental health problem
- Families who have had contact with child protection services or the criminal justice system
- Families experiencing domestic violence.

Project Goals
Best Start aims to improve the health, development, learning and wellbeing of all children across Victoria from pregnancy through to transition to school (children 0-8 years of age) by:

- Facilitating better access to child and family support, health services and early education
- Increasing the capacity and confidence of parents to enjoy parenting and improving family capacity to care for children
- Helping communities to become more child friendly.

References

2.2.23 Healthy Mothers Healthy Families: Maternal Health Survey

Scope:
1500 Victorian women and their children.

Background
The Maternal Health Study has been underway since 2002. It is investigating the health and wellbeing of women during their pregnancy and after the birth of their first child; and aims to provide a comprehensive picture of the relationship between physical health problems, sexual health, depression and changes in intimate partner relationships from early pregnancy until the woman’s first child is four years old.

It is designed to fill in some of the gaps in current research evidence regarding women’s physical and psychological health and recovery after childbirth. The findings will be used to inform clinical obstetric and midwifery practice, and strengthen primary care strategies for supporting women during and after pregnancy.

Study aims

Phase 1 (early pregnancy until first child is 18 months)
- To investigate the incidence and natural history (onset, severity and duration) of maternal health problems – in particular urinary and anal incontinence, perineal pain, sexual health issues and depression among women following the birth of their first child.

Funding
NHMRC; VicHealth; The William Buckland Foundation; and the Alfred Felton Bequest.

References
www.mcri.edu.au/healthymothers/
2.2.24 In-Home Support (VIC)

Background

The In-Home Support initiative seeks to build on the service delivery strengths implemented through Koori Maternity Services as the children move through infancy. The model is built on a universal platform, allowing flexibility for local Aboriginal organisations to respond to community requirements and to deliver additional supports where they are most needed and most likely to be effective.

All parents are able to participate in group and community activities that promote knowledge about health, wellbeing, safety and childhood development. Families identified as requiring more intensive parenting support are provided with individual support from an In-Home support worker using a coaching/modelling approach. Some parents who are facing very serious parenting challenges may be more appropriately assisted by other local programs, for example, Aboriginal Family Restoration.

Initially four Koori Maternity Service sites (Mildura Aboriginal Cooperative, Rumbalara Aboriginal Cooperative, Gippsland and East Gippsland Aboriginal Cooperative and the Victorian Aboriginal Health Service have implemented the In-Home Support program, with Wathaurong implementing Koori Maternity Services and In-Home Support concurrently.

Study aims

The Victorian In-Home Support program aims to:

- improve the health, development, learning and wellbeing of Aboriginal children from birth to three years
- strengthen, support and improve parenting capacity for Aboriginal parents and their families in a way that is respectful of their cultural identity and promotes Aboriginal child and family wellbeing
- promote social connections and links with community and community services.
### Design of ongoing evaluation

The intended outcomes and indicators to measure progress are:

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Indicators</th>
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<tbody>
<tr>
<td><strong>Building social connections</strong></td>
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<td>Communities that enable parents,</td>
<td>Increased proportion of children with parents who can turn</td>
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<tr>
<td>children and young people to</td>
<td>to someone for advice when having problems</td>
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<tr>
<td>build connections and draw on</td>
<td>Increased proportion of children from households where the</td>
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<td>informal assistance</td>
<td>respondent is able to get support in time of crisis from</td>
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<td></td>
<td>persons living outside the household</td>
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<tr>
<td><strong>Promoting health</strong></td>
<td></td>
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<tr>
<td>Adequate nutrition/healthy</td>
<td>Increased participation rate of children at key age and stage</td>
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<tr>
<td>weight</td>
<td>maternal and child health assessments</td>
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<tr>
<td>Safe from injury and harm</td>
<td>Reduced perinatal mortality rate</td>
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<tr>
<td>Free from preventable disease</td>
<td>Reduced reported smoking and alcohol use in pregnancy by</td>
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<td></td>
<td>Indigenous mothers</td>
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<td></td>
<td>Increased rate of breastfeeding at three and six months</td>
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<td>Increased percentage of babies with birthweight of or above 2500 g</td>
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<td></td>
<td>Increased proportion of children who are fully immunised at 1-3 years</td>
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<td>Decreased rate of unintentional injury</td>
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<td>Decreased rate of children exposed to tobacco smoke in the home</td>
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<tr>
<td><strong>Promoting developments</strong></td>
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<tr>
<td>Optimal language and cognitive</td>
<td>Increased participation in playgroups</td>
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<tr>
<td>development</td>
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<tr>
<td>Optimal social and emotional</td>
<td>Increased proportion of preschool age children who are read to by a family</td>
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<tr>
<td>development</td>
<td>member almost every day</td>
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<td></td>
<td>Increased three and four year old kindergarten participation rates</td>
</tr>
<tr>
<td><strong>Providing psychosocial support</strong></td>
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<tr>
<td>Parent promotion of child health</td>
<td>Increased proportion of children from families who report</td>
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<tr>
<td>and development</td>
<td>healthy family function</td>
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<tr>
<td>Parental mental health</td>
<td>Decreased proportion of women with postnatal depression</td>
</tr>
</tbody>
</table>

These outcome areas will be monitored through the Victorian Child and Adolescent Monitoring System.

An action research evaluation will be undertaken so that changes can be made to the service framework as the program develops.
## Description of Model

### Service elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Examples</th>
</tr>
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</table>
| **Individual support** | Provide one on one support to families, including role modelling and coaching to increase parenting knowledge and skills | Supporting mothers to breastfeed and linking them to expert advice when they experience difficulties  
Supporting parents to reduce exposure to smoking  
Reducing drug taking and alcohol consumption  
Role modelling developmentally appropriate play experiences in the home  
Coaching parents in positive parenting techniques to manage toddler behaviour  
Assisting families with appointments at key milestone events such as maternal child health visits, immunisation sessions, annual health check  
Introducing the Let’s Read early literacy program (an Aboriginal model is being developed) |
| **Group/social connection** | Developing and implementing family and children’s group activities which focus on educational, health and wellbeing outcomes for children and families | Involving community Elders in group/community activities  
Establishing/facilitating playgroups  
Establishing/facilitating parent education programs  
Providing, or assisting families to access transport to enable attendance at group activities |
| **Linking families with community** | Facilitating access to and participation in broader community activities, programs and events | Developing appropriate community events such as activities to engage fathers with their children  
Promoting and providing information on relevant community services available for children and families (e.g. promotion of the Healthy for Life program, enrolment in kindergarten, access to mental health services)  
Promoting positive health behaviours such as breastfeeding, immunisation, good parenting, developmental play |

### Staffing

- Aboriginal staff will have qualifications in areas such as nursing or early childhood development; or who will gain appropriate qualifications over time
- Staff need to have experience in working with vulnerable and complex families
- Staff need to adopt a modelling, rather than an expert, approach.
Family plans
In consultation with each family, an individual family plan is developed which is family and child centred and focuses on the strengths of the family (rather than focusing on ‘what’s wrong’). Staff and families should be assured that family plans are living, working documents and can be modified to reflect changing needs and goals.

Implementation working group
Sites are required to establish an implementation working group that includes representatives such as Aboriginal parents and Elders, Koori Maternity Services, Maternal and Child Health, the Local Aboriginal Educational Consultative Group representative(s) from other relevant early years program providers, multifunctional Aboriginal Children’s Services, kindergartens, playgroups and the Department of Education and Early Childhood Development region. This group may build on an existing network/partnership, such as Best Start, or may be established anew.

References
2.2.25 Koori Maternity Services Strategy, Victoria

Within the broader Maternity Services Strategy, the Koori Maternity Services Strategy aims to provide culturally appropriate support to Aboriginal women throughout pregnancy and the postnatal period, and to create partnerships between maternity services and Aboriginal women.

It employs AHWs and midwives across more than 12 sites through Aboriginal Community Controlled health organisations.

Preliminary data indicate that better antenatal care through the program is reducing the rate of low birthweight babies.

The Koori Maternity Services Strategy employs two basic models. The most comprehensive model employs both a midwife and an Aboriginal maternity health worker to provide a range of clinical-linkage-advocacy-health promotion services, including a focus on outreach. The other model involves employment of an Aboriginal maternity health worker who works with other clinical staff at the cooperative and/or local hospital.

The aims of the Koori Maternity Services Strategy are:

- To increase access to antenatal care, including antenatal care earlier in pregnancy
- Increase access to culturally appropriate care in pregnancy through to the postnatal period
- Decrease perinatal morbidity and mortality
- Increase women’s knowledge about, active participation in, and satisfaction with their care
- Increase breastfeeding rates, reduce smoking, and drug and alcohol use and encourage health promoting behaviour
- Increase confidence among Aboriginal women and their families both during pregnancy and childbirth and in their parenting abilities
- Improve parenting capacity among Aboriginal mothers and their families that is respectful of their cultural identity and promotes Aboriginal child and family health and wellbeing
- Promote partnership between Aboriginal communities and other services including mainstream health services, maternal and child health services and family support services.

Hume Region is moving towards a more integrated early childhood service system for the local Aboriginal community in Shepparton. Services include Koori Maternity Services, Gana n burri (an Aboriginal birthing suite and support for new parents run by the Rumbalara birthing program and Goulburn Valley Health maternity unit in partnership), in-home support services for Aboriginal families, and development of Lidje Batdja children’s services hub.

References


Department of Human Services; Department of Education and Early Childhood Development.

2.2.26 Women’s Business Service (WBS), Mildura Aboriginal Health Service

Scope:
Aboriginal women in Mildura, Vic (regional/rural).

Infant mortality, preterm birth, SGA and LBW outcomes:
In 2001-02, five of the 25 WBS mothers (20%) gave birth to a low birthweight baby.

Background

The Women’s Business Service (WBS) is a community-controlled primary health care service that operates alongside the general medical clinic at the Mildura Aboriginal Health Service (MAHS).

The WBS was established in May 2000 with recurrent funding from the Victorian Department of Human Services, after publication of a report that identified a number of rural areas in Victoria as lacking affordable, appropriate maternity services for Indigenous women (Campbell 2000).

The program provides antenatal and postnatal care, health education and information, and support for clients during labour and birth in hospital, or at home. Forty to fifty women a year use the WBS (approximately 25% of the WBS clientele are non-Aboriginal women). The philosophy of care is based on a broad conception of health encompassing the emotional, cultural, social and physical needs of clients, which is in a community setting.

Study design

Prospective cohort study (with retrospective comparison)
Face to face interview results from 25 clients of the WBS were compared with 333 rural women from the 2000 Victorian Survey of Recent Mothers. Twenty-five women whose child was three to 18 months old and who had received some or all their antenatal care from the WBS were invited to participate (all 25 agreed to take part). Nineteen of the 25 women interviewed were Aboriginal and six were non-Aboriginal.
Fourteen women were excluded because they were not residing in the Mildura area at the time of the study, two because their contact details were unknown, two were too unwell to be interviewed and one woman was excluded because she had a stillbirth. The interviews were conducted using a modified version of the questionnaire developed for the 2000 Victorian Survey of Recent Mothers. The interview covered women’s views and experiences of care in pregnancy, labour and birth and the postnatal period. Data on obstetric and sociodemographic characteristics were also collected. Open-ended questions were included, inviting women to comment on aspects of their care.

Description of model

WBS provides antenatal and postnatal care, health education and information, and support for clients during labour and birth in hospital, or at home. A registered midwife and an Aboriginal Maternal Health Worker provide personalised care on a 24 hour on call basis.

Results

Infant mortality, preterm birth, SGA and LBW outcomes:
WBS participants were more likely to have a low birthweight baby (< 2500 g) than rural survey participants; 5/25 (20%) v 7/333 (2%); (OR 11.84 95% CI 2.66 to 47.42) but no differences were seen between the two groups for preterm birth.
Other Outcomes

Women’s views of antenatal care
Compared with rural survey participants, WBS clients were significantly more likely to say that doctors and midwives always kept them informed, that midwives were never rushed, that they never had to wait more than half an hour, and to say that they were always happy with their medical care. A higher proportion of the WBS clients rated their antenatal care as ‘very good’ although this difference only bordered on statistical significance. The five aspects of antenatal care they were particularly happy with were:
- home visits provided by WBS (16/25)
- sensitivity, kindness, reassurance and respect shown by care providers (10/25)
- having care providers who were on-call and easy to contact (9/25)
- education and information offered (9/25)
- availability of transport (6/25).

Women’s views of care during labour and birth
Two WBS clients had their baby at home and 23 gave birth in hospital. The WBS midwife attended 13 births (11 hospital births and two homebirths). The WBS maternal health worker attended five births. WBS clients were more likely than the rural survey women to say that they knew the midwives that cared for them during labour very well and more likely to feel that they were given an active say in what happened during labour and birth in all cases; however the WBS clients were less likely to describe staff at the hospital as very friendly and welcoming.

There were no statistically significant differences in any other measures of women’s experiences of intrapartum care.

In the open-ended comments, WBS women were particularly happy about:
- having options in labour and an active say in decisions about care (11/25)
- knowing their care givers (9/25)
- sensitivity, kindness, reassurance and respect shown by caregivers (8/25)
- feeling informed about what was happening (6/25).

Women’s views of care in hospital after the birth
Less than half the WBS clients described their postnatal care in hospital as ‘very good’ in marked contrast to their largely positive views about antenatal and intrapartum care. They were significantly more likely than the rural women to say that midwives and doctors were never rushed or too busy to spend time with them.

Breastfeeding
A total of 24 WBS clients commenced breastfeeding, 21 were still breastfeeding at four weeks, and 14 at 12 weeks postpartum. All said help was readily available whenever it was needed.

Women’s views of care at home after the birth
A total of 22 WBS clients were visited by a midwife or health worker in the first few days after discharge, or in the first few days after birth in the case of the two women who gave birth at home. In contrast only 69% of the rural survey participants received a home visit from a midwife. WBS clients were more likely to feel very confident about looking after their baby in the first week at home, and less likely to want additional help or advice about feeding their baby or their own health and recovery.

Other information

Social and obstetric characteristics of WBS participants and rural participants:
WBS participants were more likely to:
- be less than 20 years (OR 9.48 95% CI 2.99 to 29.73)
- have a pension or benefit as their main source of income (OR 8.79 95% CI 3.45 to 22.86)
- smoke during pregnancy (OR 3.70 95% 1.50 to 9.23).

No differences were seen for parity, spontaneous onset of labour, or method of birth.

**Limitations**

**To the study**

- Sample size was restricted by the number of women using WBS and the geographic mobility of women using the service.
- Face-to-face interviewing (WBS) was compared with postal questionnaires used in the rural survey.
- WBS was compared with non-Aboriginal rural women which does not give information about how the WBS may have changed outcomes for Aboriginal women and babies before and after the introduction of the service.

**Conclusions/recommendations**

Findings provide support for Aboriginal community-controlled health services for pregnancy care and for stronger links between such services and mainstream services.

**References**


2.2.27 Bibbulung Gnarnieep (‘solid kid’), WA

Scope:
Aboriginal infants and their families in Perth, WA

Infant mortality, preterm birth, SGA and LBW outcomes:
In this cohort, there was a low birthweight rate of 9.0% and a preterm birth rate of 9.4% (lower than the respective rates of 14% and 13% for infants of all Perth Aboriginal mothers).

Background

Bibbulung Gnarnieep started in 1994 as a collaborative project between the Derbarl Yerrigan Health Service, the TVW Telethon Institute for Child Health Research, and the Perth Aboriginal community.

Study aims

To explore associations between a number of exposure variables and poor birth outcomes (low birthweight and/or preterm birth) in a cohort of Aboriginal infants using a causal pathways framework.

Study design

Prospective cross-sectional cohort study (five face-to-face interviews with mothers and record linkage with WA Midwives’ Notification System; community consultation and community reference group).

Description

Cohort of 273 Aboriginal infants and their families, recruited in the mid to late 1990s.

Results

Just over half the eligible population of women (53%) who gave birth during the recruitment period enrolled in the study. These 273 women completed the first interview when their infant was 6-12 weeks old.

Poor birth outcome (defined as low birthweight and/or preterm birth)
Thirty-three women (12.3%) had a poor birth outcome of either low birthweight (3%), or preterm birth (3.4%) or both (6%). This translates to a low birthweight rate of 9.0% and a preterm birth rate of 9.4% (lower than the respective rates of 14% and 13% for infants of all Perth Aboriginal mothers). This difference may be due in part to fewer teenagers and fewer first-time mothers in the Bibbulung Gnarnieep cohort.

Mission upbringing
The odds of a poor birth outcome among mothers raised in a mission/institution compared with mothers raised by their own parents were significantly higher (OR 5.0 95% CI 1.1 to 22.7).

Age of infant’s grandmother less than 41
A significant association between grandmother’s age and poor birth outcomes was not shown (OR 1.6 95% CI 0.6 to 4.1).

Alcohol use
Maternal consumption of more than two standard drinks containing alcoholic spirits on any occasion increased the odds of a poor birth outcome fourfold (OR 4.2 95% CI 1.7 to 10.1). Mothers from
circumstances where family members’ alcohol use caused hardship were twice as likely to have a poor birth outcome, but this did not reach statistical significance (OR 2.1 95% CI 0.9 to 4.6).

**Maternal illness before pregnancy**
Maternal illness before pregnancy significantly increased the risk of a poor birth outcome in the 4% of mothers who reported having high blood pressure (OR 8.4 95% CI 2.3 to 30.9); or the 50% who reported any medical problem (OR 1.8 95% CI 0.8 to 3.8); or who were not aware of the use of periconceptual folate (the latter two not being statistically significant increases).

**Antenatal care (late (> 20 weeks) or no antenatal care)**
A significant association with poor birth outcomes and late antenatal care was not shown (OR 1.4 95% CI 0.6 to 3.6).

**Maternal illness during index pregnancy**
Any medical problem during pregnancy (84 women) was associated with an OR of 3.3 for poor birth outcomes, 95% CI 0.8 to 14.2; for high blood pressure needing treatment the OR was 1.8 95% CI 0.4 to 8.9 (neither OR statistically significant); and for any vaginal bleeding the odds of a poor birth outcome were significantly higher (OR 2.4 95% CI 1.0 to 6.0).

**PROM (Prelabour rupture of membranes)**
A significant association with poor birth outcomes and PROM was not shown (OR 1.3 95% CI 0.6 to 3.2).

**Smoking**
The odds of having poor birth outcomes of the 64% of mothers who smoked were 2.2 95% CI 0.9 to 5.2 (not statistically significant). Passive exposure to tobacco smoke during pregnancy (83%) was associated with an OR for poor birth outcome of 3.2 95% CI 0.7 to 14.0 (not statistically significant).

**Education**
The odds of having poor birth outcomes for mothers who completed less than year 10 at secondary school were 1.9 95% 0.8 to 3.9 (not statistically significant).

**Other outcomes**
Many women said that they were unable to access antenatal when they needed to, largely because of transport and distance difficulties. Around 40% of women said that an antenatal home visiting service would help to overcome some of these problems.

**Limitations**
This cohort may not be truly representative, showing lower levels of poor birth outcomes than Aboriginal mothers in Perth overall. The sample size may be too small to show significant differences between poor birth outcomes and particular risk factors, although many important associations may be revealed with larger sample sizes in future studies.

In addition it was not possible to determine which infants had intrauterine growth restriction, as access to accurate gestational dating was not available in this study.

**Conclusions/recommendations**
A ‘solid kid’ would be one born to a mother who was free of medical problems such as high blood pressure before becoming pregnant, and who was not exposed to alcohol in utero. He or she would probably be born to a well educated non-smoking mother, living in a smoke-free household.
References


2.2.28 Strong Women Strong Babies Strong Culture Program (WA)

Scope:
Aboriginal communities in the Kimberley and Pilbarra regions of WA.

Infant mortality, preterm birth, SGA and LBW outcomes:
Unlikely to have shown a reduction in low birthweight or preterm birth.

Background

Five Aboriginal communities (three in the Kimberley and two in the Pilbara) were invited to take part in the WA implementation of the Strong Women, Strong Babies, Strong Culture (SWSBSC) program (see SWSBSC NT model and Mackerras 2001). Communities ranged from 200 to 600 residents and were between 30 and 160 km from towns with hospitals. The program is now managed by St John of God Health Care and works to provide culturally appropriate antenatal care and engagement of women at an early stage of their pregnancy.

The Roebourne site operates from the Mawarnkarra Aboriginal Health Service, but also operates outreach services and makes home visits. The Rio Tinto Child Health Partnership funded a midwife position, assisted by two senior Aboriginal women. This program has a strong emphasis on the use of bush medicine and the benefits of traditional bush tucker.

Project Goals

To improve the birthweights and to increase the growth rate of infants and children under three years of age in five Aboriginal communities in northwestern Australia’s Northern Health Region, through a nutritional intervention.

Design

The nutritional intervention had two parts:
1. Periodic nutritional assessment and counselling of pregnant women and of the mothers of infants and young children
2. The concurrent introduction of the Strong Women Strong Babies Strong Culture program.

Both programs continued for 14 months (n=43 births: 1996/7) before an assessment was made by comparing outcomes from a five-year pre-intervention cohort (n=204: 1991-96) from the same communities.

Description of model

This was based on the NT Strong Women Strong Babies Strong Culture program. Two suitably qualified Aboriginal women (one each from the Kimberley and the Pilbara) were trained in Darwin by the SWSBSC program leader, as well as participating in additional training in nutrition in pregnancy and postnatal nurturing. They then facilitated the introduction of the program to the five communities in WA.

During the program, education and support was extended to infants and children under three years of age, as well as to pregnant women.

The nutrition consultant visited each of the five communities to assess the nutritional status and measure the anthropometry of children less than three years old, and breastfeeding status was assessed at each interview.
Results

Main outcomes

Preterm
In 1991-96 the preterm birth rate was 21.1% (43/204) dropping to 14.0% (6/43) in 1996-97 after the introduction of SWSBSC, a non-significant reduction.

Low birthweight
In 1991-96 the overall low birthweight rate was 15.2% compared with 16.3% in 1996-97. The corresponding rates for preterm and low birthweight; and term and low birthweight were 13.7% v 9.3%; and 1.5% v 7.0%.

The numbers are considered too small to interpret reliably except to note that both preterm and low birthweight rates remained very high in comparison to non-Indigenous rates.

Other outcomes

Birthweight
There were no significant differences in birthweights in the two periods before and after the introduction of SWSBSC.

Infant growth
By 36 months, the 1996-97 cohort had a significant difference in body weight compared with the pre-intervention group. Excluding the low birthweight infants, the intervention group grew more slowly than the pre-intervention group prior to six months but this reversed in the 6-12 month period, with females doing better than males.

Breastfeeding
Breastfeeding rates were high, with more than 95% of infants breastfed for the first six months, and 85% at 12-18 months. The corresponding figures for preterm infants were 91% and 67%.

Roebourne
Outcomes include:

- 80% of pregnant Aboriginal women in the communities linked to the program are having direct contact with the workers and access to good antenatal care in the first trimester;
- An increase in the number of Aboriginal men actively engaged in the birthing process of their child;
- An increase in the number of Pap smears, especially among women who have never been checked;
- A Baby Festival promoting healthy family messages which was well attended and praised by community members;
- Compiling a storybook designed to identify and facilitate discussion on, pregnant women’s expectations concerning birth planning
- Regular participation of up to 30 women in healthy cooking classes.

Limitations

Of the study
Numbers were too small to indicate if the program was having effects on birth outcomes.

Parts of the study depended on retrospective data collection.

Accurate estimation of gestational age was not always available.
Of the model
It may be difficult to replicate the intervention.

Program outcomes will depend on the underlying characteristics of a population e.g. breastfeeding rates, maternal nutritional status.

Conclusions/recommendations

Shortfalls in term infants’ birthweights were addressed by near universal breastfeeding in these five communities (which is not as high as this in some other Aboriginal communities (Smith 2000)). There was a highly significant improvement in weight for age during the intervention period, indicating that appropriate nutritional advice and community support can make a difference in the growth of term infants.

However infants who were both preterm and low birthweight (a much larger group than term low birthweight infants) failed to respond to the intervention.

References


2.2.29 Inuulitsivik Midwifery Service and Education Program, Canada

Scope:
Inuit people, Nunavik (Inuit region of Quebec), Canada.

Infant mortality, preterm birth, SGA and LBW outcomes:
The perinatal mortality rate for the areas served by the Inuulitsivik midwifery service and education program was 9 per 1000 for the period between 1986 and 2004 (which is comparable to the overall rate for Canada).

Background
The Inuulitsivik midwifery service and education program was established by the Inuulitsivik Health Centre in 1986. The centre employs midwives to provide antenatal and postnatal support; and to staff the maternity ward at Puvirnituq in Nunavik. The midwifery service is an internationally recognised approach to returning childbirth to the remote Hudson coast communities of Nunavik, the Inuit region of Quebec; and to reconcile traditional practices with modern medical services.

The midwifery services cover seven Nunavik communities with a total population of about 5500. Half the residents are < 20; with a birth rate twice the Canadian average. First-time mothers are young, with 25% of births occurring in women under 20.

The nearest tertiary centre is at Montreal, 1000 kms or four to eight hour flight away.

Evacuation is associated with a loss of autonomy, a poor diet, substance use, family stress and child neglect. Inuit report that care in the south is often marked by a lack of understandable information, a lack of sensitive, culturally appropriate care and high rates of intervention.

Indications for local evacuation are:
- Hypertension that is unresponsive to therapy
- History of postpartum haemorrhage or retained placenta
- Postdates > 42 weeks
- First trimester complications
- Preterm labour before 36 weeks.

Indications for evacuation to Montreal are:
- Women with twins
- breech presentation
- VBAC (Vaginal birth after Caesarean)
- Severe hypertension
- Preexisting/other medical conditions
- Preterm labour before 35 weeks.

The most common reason for transfer was for preterm labour.

There are about 200 births a year in the largest communities – births take place at the three local health centres. Women from the four smaller villages (300 to 700 population) receive antenatal care from nurses in the nursing stations in consultation with the midwives and travel to one of the birth centres at 37 to 38 weeks gestation for birth. Although this means that 25% of women still have to ‘leave home’ for birth, they receive care in their own region, language and culture from Inuit midwives. Women who travel for birth often stay with relatives in the larger villages and give birth surrounded by relatives or friends. Air Inuit, the only regional airline, offers reduced airfare for partners to travel with women for childbirth. This is markedly different than the loneliness and disruption of evacuation to southern hospitals.
The use of fetal fibronectin tests is being explored to see if unnecessary transfers can be reduced. Births are usually attended by two midwives and a doctor is on 24-hour call.

**Study design**

Evaluation of the Inuulitsivik midwifery service and education program.

**Results**

**Perinatal mortality**

There were 21 perinatal deaths between 1986 and 2004 – 12 antepartum or intrapartum deaths and nine neonatal deaths (nine per 1000). The 12 antepartum/intrapartum deaths consisted of seven intrauterine fetal demise, two placental abruptions, one cord prolapse/compound presentation, one baby had multiple congenital anomalies, and one cause of death was unexplained. The nine neonatal deaths consisted of seven extreme prematurity, two term infants with IUGR (1) and congenital anomalies (1).

One of the Nunavik communities, Inukjuak, has reported its birth outcomes for the five year period 1998-2002 (Houd 2003). Of the 182 women giving birth in this period, 72.5% gave birth in their own community; with 4.5% requiring a medical evacuation. There was one perinatal death – a preterm birth at 29 weeks at home. There were six preterm births (3.3%) during the period.

As a whole, Canada has a perinatal mortality rate of 8 to 10 per 1000. Nunavik outcomes are lower than in comparable populations of the Northwest Territories (19/1000) and the Nunavut Territory (11/1000) (2003 figures).

Genetic screening and termination of pregnancy are almost universally declined by women in this population. Some of the underlying assumptions and cultural norms dominant in urban perinatal care in southern Canada, such as the quest for perfect outcomes, immediate access to interventions and a culture of blame and liability, are very different in this region.

**References**


[www.naho.ca/inuit](www.naho.ca/inuit)
2.2.30 Inuit women’s views on birthing, North Canada (NAHO)

Scope:
Inuit people, north Canada.

Infant mortality, preterm birth, SGA and LBW outcomes:
Not reported (qualitative study).

Background

The majority of the 53 Inuit communities in north Canada are served only by nursing stations, although some centres such as Iqaluit have a population of over 5000 with a hospital and support services.

Challenges include isolation; lack of fully equipped facilities and services in most communities; lack of staff and inability to retain those with medical training; lack of coordinated and consistent maternity services (due to variation in provincial and territorial government health systems). In addition Inuit women have a higher risk of complications during pregnancy, childbirth and postpartum. Some of the factors include isolation; teen pregnancies; housing shortages; domestic violence; poor nutrition; high cost of living; persistent organic pollutants in country foods; lack of knowledge about available services; and general insensitivity of the medical system to Inuit culture.

Support for incorporating traditional birthing techniques into routine pregnancies varies between jurisdictions, with Inuit women expressing that the present health care systems are not responding to their needs.

Most expectant women (many of them teenagers) are relocated thousands of kilometres during their pregnancy.

Study aims

To document the views of Inuit women, new Inuit mothers and service providers about their views of current maternal care services.

Study design

In 2004, a focus group of 10 Inuit women (from several communities) in Iqaluit, Nunavut was held in Iqaluit, Nunavut, plus a questionnaire was given to those from the focus group who had given birth in the past three years (five questionnaires were completed). Nine health care professionals were also interviewed by telephone.

Results

Need for better support
Concern was expressed that support was not available outside the larger centres – for example there was no link between Iqaluit maternity care programs and the smaller isolated communities. Boarding home facilities offering antenatal and maternity care support and education were suggested.

Need for better information
More information was needed about medical policies, services and procedures, as well as more information about traditional Inuit birthing practices. Three of the five new mothers had never spoken with a GP during their pregnancy, four did not visit a medical doctor, a public health nurse, an obstetrician or gynaecologist, or a midwife. None of the five new mothers visited or talked with other medical professionals, social
workers or traditional healers. Women wanted proper counselling about birthing options as well as parenting skills, healthy living and eating, travelling when pregnant, how to prevent miscarriages; and they wanted to be able to receive services and information in the Inuktitut language.

**Access to care**

Although respondents said they were satisfied with their antenatal care, some indicated a lack of access to antenatal care. Access to cultural and traditional forms of support was rated as uneven. They felt that midwife training should support traditional knowledge and practices, and that governments need to acknowledge and support this training.

Physical access (transport) is often difficult and in some seasons, not available.

Respondents felt that partners should be funded to attend births.

Professionals confirmed that access to antenatal care and maternal facilities was limited (e.g. ultrasound tests are not readily available in smaller remote communities). However one of the main centres also rated poorly for equipment and diagnostic facilities, with comments about waiting lists, negative attitudes (particularly towards teenagers) and costly pregnancy tests.

**Leaving home for antenatal care or birthing**

Pregnant women may have to travel out of their communities for antenatal care (e.g. for tests) as well as three to four weeks before and after the birth.

The lack of family support as a result of women having to leave home to give birth can put a strain on keeping the family together and extended periods away from home can foster family breakups. Women can also experience financial strains, lack of self-esteem, a strain on the relationship with their partner, and a sense of disconnect because fathers often cannot attend the birth. There is also a lack of counselling and support for new mothers while they are away.

**Choice in birthing; and gaps in services**

Women may want to pursue a traditional Inuit way where they can decide that a midwife attends the birth, but there is a lack of coordination in terms of recording and passing down the traditional knowledge on maternity care and parenting skills. Schools for midwives need to be recognised and certified. Traditional midwives are prevented from providing services in hospitals. If they support an Inuit woman’s home birth, local health services may not provide follow-up support to the women; and midwives are not paid for their services. A key gap in birthing services and programs is the lack of policies and standards that support the role of traditional midwives and compensate them for their services.

Other gaps were perceived to be:
- Lack of education in healthy living and healthy choices related to smoking, diet, alcohol and drugs.
- Lack of support for dealing with postnatal depression
- Lack of support for very young mothers
- Lack of after care programs
- Lack of support for mothers living in boarding homes.

On the other hand, some services were felt to be duplicated with a lack of knowledge about what was happening.

**Interactions with doctors and other health professionals**

Some respondents felt that the medical profession was not sensitive to the needs and desires of pregnant Inuit women; and that doctors should not need to monitor every pregnancy, only those with special conditions.
The high turnover of professional staff and the lack of services in Inuktitut are common issues plaguing health care delivery in the North.

Aboriginal women tend not to see the same doctor – doctors are often not located in the community so people lack a family doctor.

There is a lack of counselling about family planning; and a lack in diagnosing pregnancy early – if problems are found later, this may preclude being able to terminate the pregnancy.

Eighty per cent of the focus group stated that traditional and midwife postnatal support was not available to them at the community level.

Cultural and traditional practices are almost lost – there is little communication between elders and young people about pregnancy and childbirth. The influence of the church and general loss of culture prevent young people from actively practising traditions.

Aboriginal midwives are becoming too old to teach. Elders may not be comfortable entering maternity wards because they see these as ‘white man’s’ territory.

The respondents suggested that there be:

- Cultural sensitivity workshops
- Elder in residence or on call at the hospitals (on a paid basis)
- Anti-racism workshops.

**Recommended solutions**

Respondents recommended the following solutions:

**Educational programs or classes**

- Enhanced programs with more intense information about all stages of maternity
- Hold classes by trimester with both experienced and inexperienced mothers
- Partners should participate in the prenatal classes
- Traditional midwives must participate in components of the training
- Community radio services should be used to ask midwives (traditional and registered) to share their learning and provide information
- Provide classes on what to expect during labour and address physical and mental issues
- Classes should be more than one day
- Explain the stages of labour
- Explain options that are available during labour, such as possible birthing positions and the use of medications
- Ask experienced mothers to provide advice and share their experiences
- More experienced young women need to act as mentors to other young women and to be available for counselling and support
- Young women need support from peers on all stages of maternity; pregnancy testing, support and help in telling their parents; healthy options and guidance; how to deal with their fathers; coaching during labour
- Organise other outside agency support (e.g. social workers)
- Help fathers feel more connected and invested in the childbirth experience
- Provide support to be a good parent and husband/partner
- Provide teaching on how to build strong relationships while building a family
- Develop broad-based community-level presentations on such topics as: healthy lifestyles, self-esteem, safety, family relations, partner support and dealing with grief
- Promote social wellness (with community workers)
- Midwife training and certification (with mandatory traditional midwife training).
Counselling and lifestyle programs

- See above

Administrative, policy and procedural changes

- Interagency cooperation
- Changes to hospital protocols – allow birthing women to grant permission over who attends the birth.

Improved facilities

- Need a birthing centre in each Inuit region
- Staffed with community midwives who speak Inuktitut
- Provide mandatory external and ongoing professional followup for mothers and newborns.

References

www.naho.ca/inuit

Nunavik:
2.2.31 Rankin Inlet, Canada

The birthing centre was judged to be both economically viable and medically safe. A standard medical risk scoring approach was used (primipara birth, smoking, drug use, high multipara) which limits the number of local births to about 20% of the total in the Killaviq region, since Rankin Inlet can only accept second to fourth births which are judged low risk.

Many Inuit women refuse to participate, or are unable to participate, in research studies.

The results of resistance to full scale evacuation for birthing – the Inulitsivik Maternities in Nunavik and the Rankin Inlet Birthing Centre in Nunavut – are attempts to resolve the tension between Inuit culture and biomedicine by creating a hybrid form of health care.

There is a pressing need for comprehensive qualitative and quantitative research on Inuit childbirth since health information on all aspects of Inuit birthing – infant mortality, morbidity, antenatal care and postnatal care – is both fragmentary and largely out of date.

References

2.2.32 Vancouver Native Health Society, Canada

Scope:
Urban Aboriginal women, Vancouver, Canada.

Infant mortality, preterm birth, SGA and LBW outcomes:
Not reported to date.

Background

More than half of Canada’s Aboriginal population live in urban centres, particularly in Western Canada. Urban Aboriginal people in Canada are typically young, low income, with housing needs, and at risk of substance use and of developing diabetes.

In Vancouver’s Downtown Eastside (DTES), teen births are 13 times higher than in other regions of Vancouver; half of Aboriginal families are headed by single mothers and 80% of Aboriginal children live in poverty. Many of these urban Aboriginal women do not have a strong social or cultural support system. Of the more than 40,000 residents, just under half are of Aboriginal background.

Over the last decade, Urban Aboriginal Heath Centres (UAHCs) have emerged across Canada, with control and administration by a qualified team of Aboriginal people, recruitment of Aboriginal health professionals (including nurses, doctors and social workers). A holistic philosophy of care blends traditional Aboriginal healing and Western medicine.

Although originally intended to be an Aboriginal administered heath centre exclusively for Aboriginal people from DTES, the Vancouver Native Health Society’s (VNHS) Aboriginal clientele is now 40%, with a minority of the staff having an Aboriginal background.

Design

Three separate focus groups conducted with Aboriginal women who were clients of the Vancouver Native Health Society; its sister organisation Sheway; or residents of Vancouver’s Downtown Eastside.

Description of model

The VNHS Walk-In Medical Clinic provides free, non-judgmental primary care and health promotion to all DTES residents.

Sheway is a distinct program for substance-using pregnant women (see ‘Substance Use’ topic). On-site professionals include two part-time doctors, three community health nurses, two social workers, one outreach worker, a dietician, an infant development program worker and an alcohol and drug counsellor (with partnerships with, and access to, other services such as financial aid workers). Other services include a daily nutritious hot lunch, food hampers, vitamin supplements, bus tickets, infant formula, baby supplies and emergency services.
Results

When the Sheway program opened in 1993, 40% of babies born in the DTES had FAS/NAS syndrome (with a third of these being low birthweight) and virtually all these infants were apprehended by child protection authorities. By 1998, 86% of pregnant women who used Sheway services had infants with birthweights over 2500 g; and child custody was not a major concern for 58% of new mothers.

Many of the women in the focus groups said that they had initially approached Sheway for non-medical reasons, including gaining access to wholesome food and socialising with other new mothers. Once trust with staff began to develop, new arrivals felt they could start to address their health issues. A more intrusive approach from staff would have prevented many women from coming to Sheway at all. In addition, the Sheway staff were thought to be supportive. Sheway was also perceived to be a safe place. However it was also seen to be overcrowded, lacking privacy and exposing children to clients who were 'high'. Concern was expressed that people who were not pregnant were allowed access and received meals before pregnant women and their children.

During 1996-97, midwifery services were offered at Sheway as a pilot project but this project was not continued. Sheway clients said that they missed the continuity of care that they had experienced with the midwifery project.

The fluid and informal service delivery, a collective, non-hierarchical staff structure and horizontal relationships between staff and clients are perceived to be in tune with Aboriginal culture although clients wanted more to be done to promote traditional Aboriginal healing.

References

2.2.33 Birthplace (The Birthplace in England Research Programme), UK

This ongoing research program is designed to compare outcomes of births planned at home, in different types of midwifery units, and in hospital units with obstetric services. Birthplace combines the Evaluation of Maternity Units in England research and the Birth at Home study. These studies will answer questions about wellbeing, safety and quality, women’s experience of care, the process of transfer from planned place of birth, and the cost-effectiveness of different systems for care.

References

2.2.34 Sure Start (UK)

Scope:
Areas of deprivation, UK.

Infant mortality, preterm birth, SGA and LBW outcomes:
Not reported.

Background

Sure Start is a large-scale early childhood intervention that was established by the UK Government in 1999. By 2004, 524 local programs were serving over 400,000 children and the overall program is currently being expanded to 3500 Sure Start Children’s Centres by 2010.

It has more similarities with the large scale targeted US Head Start and Early Head Start programs than with some of the European programs which aim at universal coverage, sometimes with reduced fees or no charge for children from low income households; or with countries such as Canada and Australia where programs are targeted at poor children but are still small-scale with uneven coverage.

The impetus for the Sure Start program came from national review of provision for young children and drew heavily on US evidence about the effectiveness of early childhood interventions.

Study aims

To make a positive contribution to the health of children and their families; and to reduce health inequalities.

Description of model

Sure Start differs from most other early childhood interventions in two ways:

1. It is area-based rather than being targeted at specific groups of parents and children; this broadens access and avoid potential problems of stigma.
2. Local programs have been given considerable autonomy (in contrast to the US model which is designed to maintain program fidelity).

Sure Start Children’s Centres provide parenting support, health advice and support for parents moving into employment. Some centres provide childcare themselves, others will direct parents to other local providers.

The national Sure Start Unit oversees Service Delivery Agreements, ensuring that flexibility does not come at the expense of quality.

Results

To date, evaluations have shown (compared with other communities):

- Less chaos in households with nine month old children
- Mothers of 36 month old children were more accepting of their children
- Less negative parenting by non-teen mothers (the large majority)
- Children with fewer behavioural problems and greater social confidence.

In the 2005 evaluation, less disadvantaged families exhibited modest beneficial effects, but more severely disadvantaged families (children of teen mothers, lone parents, and workless households) were adversely
affected by the program. (These findings are consistent with the evaluation results for the US Early Head Start program.)

In Birmingham, through the Birmingham Health and Wellbeing Partnership, mainstream antenatal services are being located in Sure Start Children’s Centres and this transfer of community maternity services has received very positive feedback from service users and providers. Midwives also report that they are accessing women earlier and experiencing better attendance.

**Other information**

It is not possible to attribute the, so far, modest effects of Sure Start to poor implementation of interventions, ineffective interventions or failure to find an effect because of problems with the evaluation. Successes from other programs may able to be transferred to Sure Start. These include peer volunteers to deliver health messages; formative evaluation to refine the intervention and to customise it to the context and target group; and focussing on changing a few specific target behaviours rather than multifaceted interventions.

**Limitations**

**Of the studies**

There is no RCT of Sure Start, and the quasi-experimental evaluation (Belsky 2006) shows mixed results (Olds 2007).

**Of the model**

Olds maintains that the mandate of Sure Start is too broad and therefore lacks focus (Olds 2007).

**References**


2.2.35 Centering Pregnancy, USA (and Australia)

**Scope:**
USA (mostly African-American women); pilot scheduled to commence in Australia in 2008.

**Infant mortality, preterm birth, SGA and LBW outcomes:**

**Infant mortality**
In a randomised trial, no significant difference between group care and standard care was seen for fetal death (Ickovics 2007).

**Preterm birth**
In a randomised trial, the group care women were significantly less likely to have a preterm birth than the standard care group; 9.8% compared with 13.8%; OR 0.67 95% CI 0.44 to 0.98 (Ickovics 2007).

**Small for gestational age**
In a randomised trial, no significant difference between group care and standard care was seen for SGA (Ickovics 2007).

**Low birthweight**
In a randomised trial, no significant difference between group care and standard care was seen for LBW (Ickovics 2007).

**Background**
Centering Pregnancy was developed in 1994 by a certified nurse-midwife, Sharon Schindler Rising, as an innovative model providing complete prenatal care to women within a group setting. The model integrates extensive health education and group support with the standard antenatal visit (Novick 2004).

**Study design**
Centering Pregnancy has been evaluated in one multicentre randomised trial (Ickovics 2007) and a number of cohort studies (Baldwin 2006, Grady 2004 (adolescents); Massey 2006).

**Description of model**
Centering Pregnancy provides antenatal care to groups of 8 to 12 women of similar gestational age over 10 visits, with the group staying together for the duration of the pregnancy. After an initial visit in which history, physical examination and laboratory testing are done on a one-to-one basis, subsequent visits (usually starting at 12-16 weeks of pregnancy) consist of group sessions lasting 90 to 120 minutes. In these visits women make self-assessments and are examined in the group setting. Clinicians order appropriate laboratory tests and ultrasounds and can arrange individual follow-up requiring more time or privacy. The remainder of the session consists of group discussion that includes nutrition, early pregnancy concerns and self-care, substance use, preparation for childbirth, adaptation to the postpartum period, infant feeding, contraception and parenting. Group interaction is a very important part of the model (Novick 2004) which integrates assessment, education and skills building, and support (Ickovics 2007).

The group process is based on the needs and experiences of the women and adheres to principles of adult learning (Rising 2004).

Teen groups are considered particularly effective as they provide opportunities to socialise with peers. Many of the groups continue as play groups (Rising 2004).

Women can ask partners, mothers, sisters or friends to participate; and groups can decide by consensus if they would prefer to keep the group as a women-only time (Rising 2004).
Providers of CenteringPregnancy are specifically trained in the program – in the US by The CenteringPregnancy and Parenting Association.

In a recent RCT individual antenatal care throughout the pregnancy (the standard care group) amounted to about two hours, while group care amounted to 20 hours (Ickovics 2007).

CenteringPregnancy has recently been successfully piloted in NSW and the investigators have suggested that a multicentre RCT is needed to test the effects of the model across a range of settings in Australia (Teate 2008).

Results

Infant mortality, preterm birth, SGA and LBW outcomes:

RCT

In a US RCT (Ickovics 2007), over a thousand women aged 14 to 25 were randomly assigned to group (n=623) or standard (n=394) antenatal care. Eighty per cent of the women were African American.

The group care women were significantly less likely to have a preterm birth; 9.8% compared with 13.8%; OR 0.67 95% CI 0.44 to 0.98 (Ickovics 2007). For every 100 births, this equates to 25 fewer preterm births.

No significant differences in fetal death, low birthweight or SGA were seen (Ickovics 2007).

Cohort studies

In Grady 2004, preterm birth and low birthweight were 50% lower in the adolescents in the CenteringPregnancy group compared with the comparison group.

Other outcomes

RCT

In a US RCT (Ickovics 2007), women in group care were less likely to have suboptimal antenatal care (26.6% compared with 33%; OR 0.68 95% CI 0.50 to 0.91), had significantly greater prenatal knowledge, felt more ready for labour and birth; and had greater satisfaction with care. Breastfeeding initiation was higher in group care (OR 1.73 95% CI 1.28 to 2.35). There were no significant differences in admission rates to NICU; or in the costs associated with antenatal care or birth.

Cohort studies

In a concurrent comparison of 124 pregnant women, while the CenteringPregnancy group showed greater knowledge about pregnancy, no differences were seen between the CenteringPregnancy group and the standard care group regarding perception of social support and satisfaction (Baldwin 2006).

In a study of adolescents, those attending CenteringPregnancy missed fewer appointments and had increased rates of breastfeeding compared with those attending traditional antenatal care (Grady 2004).

The program can be argued to be more cost efficient because 8-12 women are seen in one space for two hours therefore reducing clinic space and waiting times. More extensive education leads to less phone calls and emergency visits and women have greater confidence in labour and newborn care.
Other information

Some communities have used this model to partner with community-based organisations, linking women to social services and more fully into their communities.

In the programs for adolescents, a reward system called ‘Baby Bucks’ may be offered. This system provides encouragement and rewards women for positive health behaviours and achievement of goals, such as graduating from school or attending antenatal care. Baby Bucks can then be used to purchase donated items including car seats, clothes or other baby items.

Conclusions/recommendations

CenteringPregnancy has been shown to reduce adverse birth and neonatal outcomes including low birthweight, and preterm births and is a promising model. Adoption and implementation of the model may prove challenging as it is a fundamentally different way of managing antenatal care. While women have been highly satisfied with the model so far, it will need careful piloting in particular groups such as Aboriginal and Torres Strait Islander women to assess both outcomes and satisfaction.

References


2.2.36 Early Head Start (US)

Scope:
Program for low-income families with young children, US

Infant mortality, preterm birth, SGA and LBW outcomes:
Not reported.

Background

Early Head Start is a federally funded program targeting children aged 0-3 years from low income homes. (The Head Start Program is aimed at pre-school children from the age of four years and has been operating since 1965.)

Early Head Start was established in 1994 as an extension to Head Start, in response to the growing body of evidence about the critical nature of the period from birth to three years for later development. Currently it provides services for pregnant women and children in 63,000 low income families, about 3% of the eligible families.

Services include early education (at home or at a centre); home visits; parent education and health services, both antenatal and postnatal; case management and home support.

Both Head Start and Early Head Start are widely considered to be successful, with Early Head Start having significant positive impacts on key developmental indicators and on parents.

Study design

Early Head Start has been evaluated in a multisite RCT of 3001 families.

Results

The early years programs have shown short-term effectiveness for low-income children and children with developmental delays and disabilities; and longer term benefits for academic achievement and averted expenditure for criminal justice, welfare and special education.

A major evaluation of Early Head Start in 2002 showed that the program had a significant positive impact overall on children’s cognitive and language development, on their social and emotional development and on parenting behaviour. The program had greatest impact on African-American families, on mothers who were enrolled during pregnancy (rather than postnatally) and on families with a moderately high number of demographic risk factors. However the program may not be sufficient to meet the needs of families at greatest risk, and may even have unfavourable impacts on a small proportion of families, including those with a single parent, receiving welfare cash assistance, being neither employed, nor in school or training, being a teenage parent or lacking a high school diploma.

In the RCT no program effects were seen on parents’ physical or mental health. However some effects on birth spacing were seen. The mixed model implementation of Early Start (combined home visiting and centre-based programs) were more effective than either home visits or centre-based programs alone.
Limitations

Some critics of Head Start argue that the parental involvement in earlier periods of the program has been ‘diluted’ to activities such as fund raising; and that some staff perceive parents to be ‘deficient’ in parenting skills. As well as the potential for conflict between a commitment to parental empowerment and a ‘deficit’ model of the poor, other issues facing the rapid expansion of large scale early childhood interventions include:

- Funding and maintenance of quality
- Balancing fidelity to models with flexibility to local conditions
- Differential impact.

An economic assessment of Early Head Start has concluded that nett economic benefits have not been seen, which has led to subsequent efforts to improve program delivery (Olds 2007).

References


2.3 Maternal Education (addressing Question 4)

Rebecca Tooher
Philippa Middleton

Maternal education and infant mortality in Aboriginal and teenage women

“Education is important, not only because of its direct effects, but also because it is intertwined with many other factors directly and indirectly relevant to health, such as adequate income, better preconception health of the mother, good nutrition during pregnancy and after birth, effective access to pre and postnatal care, knowledge of risk factors, and avoidance of risk behaviours.”

(Chen 1998, p.62)
**Background**

**Links between maternal education and infant mortality**

Education is linked to health at a population level and increasing maternal education levels have also been consistently linked to declines in infant mortality rates worldwide (Bell 2007, Caldwell 1991).

Figure 1 shows a model explaining possible causal pathways and suggested relationships between socioeconomic and other factors, including maternal education, and infant mortality (reproduced from Turrell & Mengerson 2000). Socioeconomic factors are likely to mediate the impact of other factors on infant mortality and birthweight. Intervening factors in the prenatal period include maternal characteristics and behaviours such as smoking, drinking, diet and nutrition, maternal morbidity and health service utilisation. These factors may in turn lead to low birthweight or other adverse obstetric outcomes which then cause infant mortality. Or it may be possible to link factors in the prenatal period directly to neonatal morbidity and hence rates of infant morbidity. Socioeconomic factors influence other issues during the postnatal period such as health service utilisation, living environment, accidents, infections and respiratory conditions and these things can be directly linked to postneonatal mortality and hence to rates of infant mortality.

*Figure 1: Model of factors influencing infant mortality (from Turrell & Mengerson, 2000)*

It has been proposed that the mechanism by which increasing education might influence those factors known to affect infant mortality is by increasing the real or perceived control which a mother has over her life circumstances including health-related behaviours (Bell 2007, Malin & Maidment 2003, Boughton 2000, Tsey 2003). However, for Indigenous Australians the relationship between better education and health, in particular between levels of maternal education and infant mortality, may not be as straightforward as it is in the many developing countries in which such a relationship has been demonstrated (Bell 2007, Boughton 2000). Indigenous Australians specifically lack control over the delivery of both educational and health services (Lowell 2003, Malin & Maidment 2003). Rather, the current situation in Australia may be contributing to “social exclusion, through dispossession, family separation, poverty and racism” (Malin & Maidment 2003, p.92) and leading to poor health and stress levels and associated use of alcohol and other
drugs, smoking and poor nutrition. Therefore, it is not certain that a link demonstrated between maternal education and infant mortality in other populations will hold true for Indigenous Australians. As Malin & Maidment 2003 point out, even other Indigenous populations, such as New Zealand Maoris and Canada’s First Nations Peoples have more direct control over the delivery of education and health services.

As Boughton 2000 explains:

“While a woman who has had more years of schooling may be able...to ensure her husband and mother-in-law allocate more resources to the health of her children, actually having a health service to go to depends not so much on the education of the individual mother, as on the political power of the community, or of the nation of which it is a part, to enforce a distribution of health care resources in its favour. By the same token, while her own education may be a factor in how well she is listened to at the health centre...the degree of community involvement and participation in the centre’s staffing and/or management may also be a contributing factor; and this in turn may be an effect of the education level not of the individual mother but of her community.” (p.21)

A focus on maternal education may also be problematic given the social structure of many Aboriginal populations (Lowell 2003).

**Educational disadvantage among Aboriginal and Torres Strait Islanders**

**School retention rates (see Table 1)**

Aboriginal Australians have lower school retention and completion rates than non-Indigenous Australians. In 2006, one in 11 Aboriginal students left school before completing year 10 compared with one in 90 non-Indigenous students (ABS 2006). In 2007 year 10 retention rates were 90.5% for Indigenous students and 99.4% for non-Indigenous students. Beyond year 10 the gap in completion rates widens so that year 11 retention rates were 71.2% for Indigenous students and 91% for non-Indigenous students, and year 12 retention rates were 42.9% for Indigenous students and 75.6% for non-Indigenous students (AIHW 2008).

Indigenous female students had similar retention rates to males for year 10 (91% compared with 90%) but slightly higher year 11 (75% vs. 68%) and year 12 (46% vs. 39%) completion rates (AIHW 2008). In South Australia, female Indigenous students had retention rates of 87.6% for year 10, 75.8% for year 11 and 43.9% for year 12 (AIHW 2008).

**Year 12 attainment (See Table 1)**

In 2007 the proportion of Indigenous students in year 11 who went on to complete year 12 (the attainment rate) was 63.3% compared with 83.3% of non-Indigenous students. Female Indigenous students had a higher attainment rate than males (64.6% compared with 61.9%) and South Australian female Indigenous students had an attainment rate of 71.9% compared with 83.1% for non-Indigenous female students and 54.1% for Indigenous males (AIHW 2008).

**Highest level of school completed (See Table 1)**

In 2006 24% of Indigenous people aged 18 and over had completed year 12, 31% had completed year 10 and 34% had completed year 9 (compared with 49%, 25% and 16% for non-Indigenous people respectively). For people aged 18-24, 36% of Indigenous people had completed year 12, 28% had completed year 10 and 22% had completed year 9 (compared with 74%, 13% and 4% for non-Indigenous people respectively). By comparison for Indigenous people aged 35-44, 19% had completed year 12, 40% had completed year 10 and 28% year 9 (AIHW 2008).
In 2006 25% of Indigenous women aged 18 and over had completed year 12, 31% year 10 and 32% year 9. In 2004-05 20% of Indigenous women with children had completed year 12, compared with 40% for women who had not had children. The rates for completion of year 10 or 11 were 47% for Indigenous women who had had children compared with 43% for those without children. One third (34%) of Indigenous women with children reported year 9 as the highest level of schooling compared with 17% for women without children (AIHW 2008).

Table 1: Indigenous educational outcomes 2006-07 (from AIHW 2008)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Indigenous</th>
<th>Non-Indigenous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Male</td>
</tr>
<tr>
<td>Retention rates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yr 10</td>
<td>90.5%</td>
<td>90%</td>
</tr>
<tr>
<td>Yr 11</td>
<td>71.2%</td>
<td>68%</td>
</tr>
<tr>
<td>Yr 12</td>
<td>42.9%</td>
<td>39%</td>
</tr>
<tr>
<td>Yr 12 attainment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>63.3%</td>
<td>61.9%</td>
</tr>
</tbody>
</table>

Indigenous literacy and numeracy outcomes
A consistent 15 to 20 percentage point gap has been found between achievement of national literacy benchmarks for Indigenous students and non-Indigenous students (for example, in 2005 approximately 72% of Indigenous students met the year 7 literacy benchmark compared with around 91% of all students). There is a substantially wider gap in attainment of the national numeracy benchmark at year 7, which has been consistently reported at around 30 percentage points difference between Indigenous and all students (DEST 2006). Across all students, literacy and numeracy benchmarks are attained by far fewer students living in remote areas of Australia. The National Report to Parliament on Indigenous Education and Training 2005 found that since benchmark testing began in 1999 there has not been a sustained improvement in the proportion of Indigenous students meeting the benchmarks and overall the gaps between Indigenous and non-Indigenous students have tended to widen, and to increase with the age of the students (DEST 2006). In the latest Aboriginal and Torres Strait Islander Health Performance Framework (2008), year 7 benchmarks for South Australian Indigenous students were 71.4% for reading, 59.3% for writing and 55.4% for numeracy (compared with 93.3%, 87.7% and 87.3% respectively for non-Indigenous students) (AIHW 2008).

Measuring education level
In studies of infant mortality which examine the effect of differences in maternal education, education level may be measured in a variety of ways. Many studies record the number of years of schooling a woman has completed and describe the education level numerically. Other studies describe the level of schooling a woman has attained (e.g. primary, secondary, higher education). Some studies record the age at which a woman left school. Finally, international country comparisons of infant mortality rates tend to measure female literacy or illiteracy rates. One study of Australian Aboriginal populations (Weald 2003) used a composite education measure consisting of years of schooling, whether the woman had earned a formal qualification, whether the woman was literate and whether the woman had attended college.
Research question

What is the impact of maternal education level on infant mortality among Aboriginal and teenage women?

Research approach

Literature search
A systematic search of the literature was undertaken from the inception of databases to December 15, 2007.

Databases searched
Medline, EMBASE, PsychInfo, ERIC, Social Science Abstracts, Emerald, Austhealth, FAMILY, ATSIHealth, Maternity and Infant Care, Google Scholar, Google.

Search terms used
(Oceanic Ancestry Group/ OR aborig$ OR Indigenous OR Maori) AND (Australia/ OR New Zealand/) OR Indians, North American/ OR (first nation$ or aborig$ or Indigenous or maori or native american) OR (Adolescent OR teenager$ or teen) AND Educational Status/ OR maternal education OR literacy AND Infant Mortality/ OR Infant, Low Birth Weight/ OR Infant, Small for Gestational Age/ OR Sudden Infant Death/ (note: only free-text terms were used in databases that do not use MESH headings)

Pearling and other sources of information
The reference lists of all fulltext papers considered for inclusion were also checked for any relevant studies. The publications list of the Cooperative Research Centre for Aboriginal Health was also searched in January 2008.

Inclusion and exclusion criteria

Inclusion criteria
Ideally the search would identify studies of infant mortality or its proxies in the Aboriginal or teenage population which considered the impact of maternal education levels. In the absence of such studies, the inclusion criteria needed to be expanded to include studies in other populations that could be thought to be similar to the Australian Aboriginal population, so studies in other Indigenous populations in developed countries (namely North American Indians, First Nations peoples, Maoris and other Indigenous populations) were included. In order to provide context for the results in Indigenous populations, we also included studies in minority populations within developed countries (in particular African-American and Hispanic populations of North America) and in developing countries with a mix of Indigenous and non-Indigenous populations (such as some South American countries). Finally, studies in developed and developing countries were included to complete the picture of the effect of maternal education on infant mortality and to explore the possibility of a low birthweight paradox.
Exclusion criteria
In the first instance we limited studies to those published after 1992 (15 years before the search) as technology around pregnancy and childbirth has improved greatly in that time, and we felt that studies of infant mortality prior to this date may not reflect the current reality in South Australia. However studies that were excluded on the basis of publication date were reconsidered in light of the results obtained from the included studies, and any that were felt to add substantially to the evidence base were included. Only studies in the English language were included unless it was thought, after assessing the English abstract, that the study would add substantially to the evidence base.

Studies were excluded if they did not report maternal education data in a way that could be meaningfully extracted from the results of the study, or if they reported child mortality not infant mortality.

Identification of relevant studies
All abstracts were read by one researcher and those that seemed likely to meet the inclusion criteria were downloaded into a reference manager database for further consideration. Two researchers independently applied the inclusion criteria and any differences were resolved by discussion. When a paper was thought to be of marginal relevance it was usually included.

Results of the literature search
Results of the literature search are shown in the flowchart (Figure 2). We considered 160 papers for inclusion. We excluded 46 abstracts published prior to 1992 and another 41 that did not meet the inclusion criteria. After consideration of the fulltext we excluded 32 studies that were found not to meet the inclusion criteria. These are listed in Appendix A with reasons for exclusion. Altogether we excluded 119 studies.

We included 41 studies. One study considered the effect of maternal education on infant mortality in an Australian Aboriginal population. We also included three studies which considered the impact of maternal education level on health behaviours and childhood morbidity and survival in Australian Aboriginal populations. We identified four studies in other Indigenous populations, six in minority populations in developed countries, eight in developing countries, 15 in developed countries, and four international ecological studies (See Table 2 – Included studies).

Data extraction and analysis
Data extraction
Data was extracted by one researcher and checked by a second researcher. The majority of studies used some sort of correlational analysis (regression analysis) and reported relative risks or odds ratios with 95% confidence intervals. Crude and adjusted analyses were usually available. Study summary tables are provided in Appendix B.

Data presentation and analysis
Random effects meta-analysis was used to calculate relative risks with 95% confidence for unadjusted rates of infant mortality and other outcomes by population subgroup using RevMan 5.0 software. Other data was grouped by the population(s) studies and the outcomes reported and presented in tabular form.

Critical appraisal
Included studies were evaluated with respect to: the quality of data sources and attempts to verify the accuracy and completeness of data obtained; the representativeness of the included samples; adequacy of methods to address confounding (adjustment for a minimum of maternal age, parity, smoking and socioeconomic status was considered adequate); and risk of misclassification bias consistent with NHMRC and NICE methods.
Figure 2: Flowchart of included studies

160 abstracts considered for inclusion
- excluded 46 published prior to 1992
- excluded 41 that did not meet inclusion criteria

69 fulltext papers
- excluded n=32
  - not ME – 16
  - not IM – 4
  - no useful data – 7
  - not relevant - 5

included n=41

- Australian Aboriginal populations n=4 (child survival)
- Other Indigenous or aboriginal populations n=4
- Minority populations in developed countries n=6
- Developing countries n=8
- Developed countries n=15
- International ecological studies n=4

Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009
### Included studies

Included studies are shown in Table 2.

<table>
<thead>
<tr>
<th>Study</th>
<th>Dates</th>
<th>Population</th>
<th>N live births</th>
<th>Outcomes</th>
<th>Risk of bias</th>
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</thead>
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<tr>
<td><strong>Australian Aboriginal populations</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Eades 2008</td>
<td>Mid-late 1990s</td>
<td>Aboriginal mothers and infants in Perth, Western Australia</td>
<td>273 mothers</td>
<td>LBW, PT</td>
<td>mod</td>
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<td>Gray 1988</td>
<td>1986</td>
<td>Children of Aboriginal mothers in Australia (from 1986 census)</td>
<td>19777 children ever born</td>
<td>child survival</td>
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<td><strong>Other Indigenous or Aboriginal populations</strong></td>
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<td></td>
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<tr>
<td>Study</td>
<td>Dates</td>
<td>Population</td>
<td>N live births</td>
<td>Outcomes</td>
<td>Risk of bias</td>
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<tr>
<td><strong>Developing countries</strong></td>
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<td></td>
</tr>
<tr>
<td>Hertel-Fernandez 2007</td>
<td>1990 – 2005</td>
<td>Chilean women</td>
<td>Totals not reported</td>
<td>IM</td>
<td>mod</td>
</tr>
<tr>
<td>Klufio 1994</td>
<td>1990</td>
<td>Papua New Guinean women</td>
<td>673</td>
<td>LBW</td>
<td>mod-high</td>
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<tr>
<td>Lansky 2007</td>
<td>1999</td>
<td>Brazilian women</td>
<td>36469</td>
<td>PM</td>
<td>mod-high</td>
</tr>
<tr>
<td>Poerwanto 2003</td>
<td>1983 – 1997</td>
<td>Indonesian women</td>
<td>28810 women</td>
<td>IM</td>
<td>mod</td>
</tr>
<tr>
<td>Sandiford 1997</td>
<td>NR</td>
<td>Nicaraguan women</td>
<td>1294 women</td>
<td>NM, PNM</td>
<td>mod</td>
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<td>Brazilian women</td>
<td>Totals not reported</td>
<td>IM</td>
<td>mod</td>
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<tr>
<td><strong>Developed countries</strong></td>
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<td>Bakkeig 1993</td>
<td>1979 – 1986</td>
<td>Scandinavian women</td>
<td>Denmark: 102215, Sweden: 185156, Norway: 199596</td>
<td>Late fetal death, NM, LBW</td>
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<tr>
<td>Chen 1998</td>
<td>1990 – 1991</td>
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<td>192150</td>
<td>FM, NM, PM, NM, EPM, PNM, LBW, PT, SGA</td>
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</tr>
<tr>
<td>Gisselmann 2005</td>
<td>1973 – 1990</td>
<td>Swedish women</td>
<td>1065234</td>
<td>IM, LBW, NM, PNM</td>
<td>mod</td>
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<tr>
<td>Hoyert 1990</td>
<td>1990</td>
<td>American women</td>
<td>22098 fetal deaths</td>
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<td>1991 – 1992</td>
<td>Danish women</td>
<td>113814</td>
<td>IM, stillbirth, NM, PNM, PM</td>
<td>mod</td>
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</table>
Table 2 continued: Studies of maternal education and infant mortality and other outcomes

<table>
<thead>
<tr>
<th>Study</th>
<th>Dates</th>
<th>Population</th>
<th>N live births</th>
<th>Outcomes</th>
<th>Risk of bias</th>
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<td>International Ecological Studies</td>
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</tr>
<tr>
<td>Bicego 1993</td>
<td>1987 – 1990</td>
<td>developing countries</td>
<td>17 countries</td>
<td>NM</td>
<td>low-mod</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(number of births not reported)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee 1997</td>
<td>1987 – 1990</td>
<td>international</td>
<td>78/207 countries</td>
<td>IMR, maternal literacy rate</td>
<td>low but unclear</td>
</tr>
<tr>
<td>Schell 2007</td>
<td>2003</td>
<td>international</td>
<td>152 countries</td>
<td>IM, female illiteracy</td>
<td>low</td>
</tr>
<tr>
<td>Tresseras 1992</td>
<td>1960 – 1982</td>
<td>international</td>
<td>103 countries</td>
<td>IM, adult illiteracy</td>
<td>mod</td>
</tr>
</tbody>
</table>

Critical appraisal

Overall, according to our predefined criteria, the risk of bias in the included studies was moderate. Included studies ranged from very small local studies to those which analysed large national datasets, and the quality of the data reflect these differences with some studies studying the whole population whereas others sampled only a small proportion with varying degree of representativeness. Some studies were prone to misclassification bias, either of the ethnicity of the participants or more commonly with respect to classification of the outcomes, particularly for SIDS. Of the four confounding factors we considered to be most important (maternal age, parity, smoking and socioeconomic status) adjustment was rarely made for all four in any of the included studies making comparisons difficult.

Results

Infant mortality


Meta-analysis

Infant mortality, neonatal mortality and postneonatal mortality rates comparing low education (as per study definitions – from no schooling to less than 12 years education) to all other educational categories are shown in Table 3 and Figures 3, 4 and 5. Lower education was associated with an increased risk for all three outcomes in the range of 1.1 to 2 times: infant mortality OR 1.64 (95%CI 1.19 to 2.28); neonatal mortality 1.31 (95%CI 1.21 to 1.41) and postneonatal mortality 1.89 (95%CI 1.62 to 2.20). However for neonatal mortality and postneonatal mortality the results are drawn only from populations in developed countries and it is difficult to be certain whether they are applicable to the ATSI population.
Table 3: Pooled odds ratios of infant mortality outcomes: lowest education vs. all other educational levels

<table>
<thead>
<tr>
<th>OR (95%CI)</th>
<th>Overall</th>
<th>ATSI</th>
<th>Developed country minority</th>
<th>Developing country</th>
<th>Developed country</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM</td>
<td>1.64 (1.19, 2.28)</td>
<td>NA</td>
<td>1.53 (0.75, 3.10)</td>
<td>1.95 (0.94, 4.01)</td>
<td>1.39 (1.30, 1.49)</td>
</tr>
<tr>
<td></td>
<td>(9 studies, 6683482 live births)</td>
<td></td>
<td>(1 study, 2684 live births)</td>
<td>(4 studies, 141516 live births)</td>
<td>(4 studies, 6539282 live births)</td>
</tr>
<tr>
<td>NM</td>
<td>1.31 (1.21, 1.41)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1.31 (1.21, 1.41)</td>
</tr>
<tr>
<td></td>
<td>(8 studies, 10337083 live births)</td>
<td></td>
<td></td>
<td></td>
<td>(8 studies, 10337083 live births)</td>
</tr>
<tr>
<td>PNM</td>
<td>1.89 (1.62, 2.20)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1.89 (1.62, 2.20)</td>
</tr>
<tr>
<td></td>
<td>(6 studies, 5830524 live births)</td>
<td></td>
<td></td>
<td></td>
<td>(6 studies, 5830524 live births)</td>
</tr>
</tbody>
</table>

KEY: IM – infant mortality; NM – neonatal mortality; PNM – postneonatal mortality; LBW – low birth weight; SGA – small for gestational age; ATSI – Aboriginal and Torres Strait Islander

Figure 3: Odds ratio (95%CI) of infant mortality: lowest maternal education category vs. all other educational categories

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>lowest education</th>
<th>all other education</th>
<th>Odds Ratio</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events</td>
<td>Total</td>
<td>Events</td>
<td>Total</td>
</tr>
<tr>
<td>1.1.1 Minority pop in developed countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stoltenberg 1998</td>
<td>22</td>
<td>1467</td>
<td>12</td>
<td>1217</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>22</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 1.18 (P = 0.24)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.2 Developing countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adetunji 1995</td>
<td>113</td>
<td>2114</td>
<td>35</td>
<td>511</td>
</tr>
<tr>
<td>Klufio 1994</td>
<td>9</td>
<td>158</td>
<td>11</td>
<td>514</td>
</tr>
<tr>
<td>Pena 2000</td>
<td>290</td>
<td>4758</td>
<td>52</td>
<td>1636</td>
</tr>
<tr>
<td>Poerwanto 2003</td>
<td>16549</td>
<td>82723</td>
<td>3231</td>
<td>49102</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>89763</td>
<td>51763</td>
<td>41.8%</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>16961</td>
<td>3329</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.49; Ch² = 71.82; df = 3 (P &lt; 0.00001); I² = 96%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 1.81 (P = 0.07)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.3 Developed countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gisselman 2005</td>
<td>1577</td>
<td>214617</td>
<td>4968</td>
<td>850617</td>
</tr>
<tr>
<td>Olsen 1999</td>
<td>54</td>
<td>5587</td>
<td>571</td>
<td>100019</td>
</tr>
<tr>
<td>Singh 2007</td>
<td>7314</td>
<td>861645</td>
<td>18740</td>
<td>3109515</td>
</tr>
<tr>
<td>Stoltenberg 1998</td>
<td>3809</td>
<td>313900</td>
<td>9088</td>
<td>1083382</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>1395749</td>
<td>5143533</td>
<td>50.2%</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>12754</td>
<td>33367</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.00; Ch² = 18.87; df = 3 (P = 0.0003); I² = 84%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 9.90 (P &lt; 0.00001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>1488699</td>
<td>5196513</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>29737</td>
<td>36708</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.21; Ch² = 1736.36; df = 6 (P &lt; 0.00001); I² = 100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 2.99 (P = 0.003)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 4: Odds ratio (95%CI) of neonatal mortality: lowest maternal education category vs. all other educational categories

Figure 5: Odds ratio (95%CI) of postneonatal mortality: lowest maternal education category vs. all other educational categories

Discussion of individual studies
Table 4 shows odds ratios and 95% confidence intervals for infant mortality, neonatal mortality, postneonatal mortality, perinatal mortality, and fetal mortality by maternal education. Table 5 shows infant mortality, neonatal mortality, postneonatal mortality, perinatal mortality, and fetal mortality rates (per 1000 live births) by maternal education. Table 6 shows correlations between female literacy and infant mortality rate and ecological relative risks of infant mortality for four international ecological studies.

Non- Australian Indigenous women (see Table 4)
1 study – Kieffer 1994

Kieffer 1994 compared rates of preterm, low birthweight, infant mortality, neonatal mortality and postneonatal mortality for women of Hawaiian origin and women of Caucasian origin in Hawaii. Hawaiian women had higher rates of infant mortality, neonatal and postneonatal mortality, low birthweight and preterm births than Caucasian women. In a logistic regression analysis controlling for maternal birth and socioeconomic factors (maternal age, parity, marital status, educational attainment, levels of antenatal care, and urban/rural residence), educational attainment was not a significant factor in explaining differences in neonatal mortality and postneonatal mortality between Hawaiian and white women.
Minority women in developed countries (see Tables 4 and 5)

Din Dzietham 1998 compared African American and White women and found that the African-American women are at significantly increased risk of infant mortality compared to White women at every level of educational attainment. Furthermore, as education level increases the risk of infant mortality also increases so that African-American women with the highest level of educational attainment (more than 12 years) have 2.5 times the risk of infant mortality compared with white women whereas African-American women with less than 12 years of education have only a 1.8 times increased risk compared to white women (even when the models are adjusted for maternal age, smoking, high parity, antenatal care utilisation, rural residence and gestational age). When the two groups were assessed separately, an educational benefit for African American women was found to exist comparing 12 years of education to less than 12 years of education (around a 10% reduction in risk) but more than 12 years of education conferred no further benefit. On the other hand, white women with more than 12 years of education received an additional 10% risk reduction compared to white women with only 12 years of education and a 20% risk reduction compared to white women with less than 12 years education.

Singh 1995 studied infant mortality trends and projections in the United States from 1950 to 2010. Over the period 1950 to 1991 infant mortality rates declined significantly, however the disparity between white and African-American infant mortality rates increased (as the rate of decline for African-American infant mortality was lower than for white women). An inverse relationship between maternal education and infant mortality rates was demonstrated for both white and African-American women. However the effect appeared to be larger for white women compared with African-American women. The ratio of white to African-American infant mortality increased for increasing levels of maternal education suggesting a widening disparity in infant mortality as educational attainment increased.

Stoltenberg 1998 studied the influence of consanguinity (interruption between cousins) and maternal education on risk of stillbirth and infant death in Norway comparing Norwegian born and Pakistani born mothers. Consanguinity was markedly higher among the Pakistani born (31% vs 0.1%). Overall, the Pakistani group had higher infant mortality compared to the Norwegian group (relative risk for stillbirth 1.3 and for infant mortality 1.7) but differences between groups were nonsignificant after adjusting for consanguinity, maternal education, maternal age, parity and year of birth. There was a significant negative association between education level and stillbirth and infant mortality for Norwegian group but not for the Pakistani group.

Women in developing countries (see Tables 4 and 5)

Adetunji 1995 found an unexpected relationship between infant mortality and maternal education in Nigeria, with infants of women with the highest levels of education (secondary or higher) showing the highest levels of infant mortality. Logistic regression analyses found that this effect could be explained by controlling for maternal age at childbirth and duration of breastfeeding. The author suggested that these two factors are reflective of harsh economic conditions in Nigeria prevailing during the study period which resulted in many teenage mothers (with secondary education) being forced to work, leaving the care of their child to their uneducated/illiterate parents/in-laws and reducing the duration of breastfeeding.

Hertel-Fernandez 2007 examined differential risk in infant mortality on a national and regional basis in Chile between 1990 and 2005. Overall, infant mortality rates declined over the period but the rate of decline slowed in the most recent years. There was a marked disparity between the infant mortality rate for women with a college education or above and those with no education (for example the infant mortality rate in 2005 was 6.5 per 1000 live births for women with at least a college education compared with 30.5 per 1000 live births for women with no education).
Klufio 1994 studied infant mortality and low birthweight among women in Papua New Guinea. Overall, neonatal mortality was 7.4 per 1000 live births and perinatal mortality 29.6 per 1000 live births (stillbirth rate was 22.2 per 1000 births). Maternal education was associated with perinatal mortality in univariate analysis. Compared with women with schooling, women with no schooling were 2.76 times more likely to experience perinatal mortality, but was not a significant risk factor in multiple logistic regression analysis controlling for maternal age, parity, antenatal care, residence, social status and previous perinatal death.

Lanksy 2007 studied infant mortality in Brazil and found that mothers with less than four years education were found to have a significantly higher risk of perinatal mortality compared to mothers with four to eight years of education when adjusted for infant sex, multiple pregnancy, caesarean, birthweight and maternal age.

Pena 2000 studied effect of poverty and social inequality on infant mortality in Nicaragua. Mother’s position in the household, distance to health services, urban versus rural residency, and study period were not significantly related to infant mortality. There was a clear inverse relationship between maternal education and infant mortality rate (from 65.5 per 1000 live births in women with no formal education to 29.7 per 1000 live births for women with secondary schooling or higher). However, when stratified by socioeconomic status (as measured by household ability to meet basic needs), only women in poor households realised a benefit of higher levels of maternal education.

Poerwanto 2003 studied maternal education and income inequality (as indicated by family welfare status) in Indonesia. Women with the lowest levels of education (less than seven years) were found to have a 3.4 times higher risk of infant mortality than women with the highest levels of education (more than seven years).

Sandiford 1997 studied maternal intelligence, maternal literacy and child survival (including infant mortality) in Nicaragua. No significant difference in infant mortality, neonatal mortality or postneonatal mortality was observed between women with no formal schooling who were illiterate and those who had gained literacy either through formal schooling or adult education.

Terra de Souza 1999 (not included in Tables 3 and 4 – see Appendix B) compared infant mortality rates across municipalities in one state in Brazil taking into consideration a range of proximate determinants (adequate weight gain and breastfeeding), health service variables (adequate antenatal care, participation in growth monitoring, immunisation, decentralisation of health services) and socioeconomic factors (female literacy rate, household income, adequate water supply, adequate sanitation, municipality income GMP). The infant mortality rate ranged from 14 to 193 per 1000 live births. In a logistic regression analysis, 41% of the variation in infant mortality by local municipalities was explained by a model which included breastfeeding, prenatal care, household income, female illiteracy rate, adequacy of water supply, urbanisation and per capital GMP. The ecological relative risk of infant mortality (which may be interpreted as the risk to a child born in a community with 100% prevalence of the variable of interest compared to a child born into a community with a 0% prevalence) was 2.24 (p=0.00001) for female illiteracy.

Women in developed countries (see Tables 4 and 5)

Arntzen 1996 examined trends in the effect of maternal education on postneonatal mortality in Norway between 1968 and 1991. The highest levels of infant mortality were found for the lowest level of maternal education even when adjusted for maternal age and marital status, and taking into consideration birth order.

Arntzen 2006 considered cause-specific postneonatal mortality rates in Norway from 1969 to 1995. Major causes of death were congenital conditions, sudden infant death syndrome and infections. Postneonatal mortality declined from 3.2/1000 live births in the 1970s to 1.9 per 1000 live births in the 1990s. However
over the study period the disparity in postneonatal mortality risk increased between women with low and high education.

Arntzen 2007 aimed to assess if the educational gradient in neonatal and postneonatal mortality was increasing, decreasing or stable between 1981 and 2000. Overall, mortality decreased in all educational groups and education levels increased over study period. Absolute and relative differences in NM by educational level decreased in Finland and Sweden and increased in Denmark. In Norway there was an increase in absolute difference but a decrease in relative difference. For PNM relative educational differences increased in all four countries whereas absolute differences decreased.

Bakkteig 1993 used maternal education level as a measure of socioeconomic status to examine differences in infant mortality and low birthweight in three Scandinavian countries. Socioeconomic differences in all three countries impacted on birthweight and infant mortality. The association between parental education and postneonatal mortality appeared stronger in Denmark and Norway than Sweden, however, postneonatal mortality rates were the same in all three countries. In Norway, the association between paternal education and perinatal and neonatal mortality was as strong as the association between maternal education and infant death. Risk of infant mortality and perinatal mortality was 50% to 80% higher for infants whose parents had the lowest levels of education.

Bobak 1997 studied neonatal mortality rates by maternal education level and also infant birthweight. An inverse relationship between maternal education and neonatal mortality rates was found with mothers with primary school education having a neonatal mortality rate of 9 per 1000 live births compared with mothers with university education having a neonatal mortality rate of 4.8 per 1000 live births and a relative risk of neonatal mortality of 0.53 compared with mothers with primary education.

Chen 1998 studied the impact of maternal education levels on fetal and infant mortality in Quebec in Canada. Both fetal mortality and infant mortality rates were higher for mothers with less than 12 years of education compared to mothers with at least 14 years of education, even after adjusting for maternal age, parity, marital status and infant sex. However, when the analysis was also adjusted for birthweight, gestational age and fetal growth, risk of infant mortality, neonatal mortality and postneonatal mortality were not significantly different for women with 12-13 years of education compared to women with more than 14 years of education, although differences between women with lower levels of education (0-10 years and 11 years) and women with more than 14 years of education persisted.

Gisselmann 2005 studied birthweight specific infant mortality in Sweden between 1973 and 1990 to examine the effect of maternal education levels on infant mortality. Women with low (compulsory education only) and low-intermediate (two years of upper secondary school) levels of education demonstrated an increased risk of infant mortality, neonatal mortality and postneonatal mortality compared to women with the highest levels of education (college or university).

Morrison 1989 examined effect of socioeconomic status on pregnancy outcomes in Brisbane, Australia. No significant effect of maternal education level on perinatal mortality was evident when the analysis was adjusted for age, parity, marital status, maternal BMI, smoking and eating breakfast regularly.

Olsen 1999 studied the effect of maternal education on stillbirths and infant mortality in Denmark. The lowest educational level was associated with the highest mortality for all outcomes with an inverse relationship demonstrated between maternal education levels and infant mortality rates although differences between women with different levels of further education were not clearly demonstrated. However, when the analysis was adjusted for maternal age, parity and smoking no clear educational advantage persisted for rates of stillbirth, but a clear educational advantage was evident for rates of neonatal mortality and postneonatal mortality. When birthweight was included in the analysis there was no statistically significant difference in outcomes between any of the educational groups.
Singh 2007 studied infant mortality trends and in relation to socioeconomic deprivation in the US from 1969 to 2001. Over the period IM rates in the US declined significantly, however, relative disparities in infant mortality increased. Relative risk of IM increased for the most deprived group between 1969 and 2001 compared with the least deprived. Education-specific risk of PNM and NM also increased between 1969 and 2001.

Table 4: Odds ratios for infant mortality by maternal education level

<table>
<thead>
<tr>
<th>Study</th>
<th>Maternal education</th>
<th>IM   OR (95%CI)</th>
<th>NM   OR (95%CI)</th>
<th>PNM  OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-Australian Indigenous women</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kieffer 1994</td>
<td>&lt;12 yrs</td>
<td>0.8 (0.6 to 1.1)</td>
<td>0.9 (0.7 to 1.1)</td>
<td>1.3 (0.9 to 1.8)</td>
</tr>
<tr>
<td>Hawaiian: n=50165 White: n=66840</td>
<td>&gt; 12 yrs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Minority women in developed countries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Din-Dzietham 1998</td>
<td>&lt;12 yrs</td>
<td>1.8 (1.6 to 2.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black: n=139601 White: n=400359</td>
<td>12 yrs</td>
<td>2.0 (1.9 to 2.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;12 yrs</td>
<td>2.5 (2.3 to 2.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stoltenberg 1998</td>
<td>&lt;10yrs</td>
<td>P: 4.5 (0.6 to 33.8)</td>
<td>N: 1.5 (1.4 to 1.6)</td>
<td></td>
</tr>
<tr>
<td>Pakistani: n=7274 Norwegian=1431055</td>
<td>10-12yrs</td>
<td>P: 4.4 (0.6 to 35.3)</td>
<td>N: 1.2 (1.2 to 1.3)</td>
<td></td>
</tr>
<tr>
<td>reference: &gt; 12 yrs education</td>
<td>adjusted for: consanguinity, ME, maternal age, parity and year of birth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Women in developing countries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adetunji 1995</td>
<td>primary</td>
<td>M1: 0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigeria: n=2635</td>
<td>secondary</td>
<td>M2: 0.82 p&gt;0.05</td>
<td>M1: 1.14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>adjusted for: maternal age, birth order; M2 adjusted for: breastfeeding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klufio 1994</td>
<td>no schooling</td>
<td>2.76 (1.03 to 7.33)</td>
<td>p=0.022</td>
<td></td>
</tr>
<tr>
<td>Papua New Guinea: n=673 women</td>
<td>reference: schooling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lansky 2007</td>
<td>&lt; 4 yrs</td>
<td>2.9 (1.7 to 5.1)</td>
<td>0.8 (0.7 to 1.1)</td>
<td></td>
</tr>
<tr>
<td>Brazil: n=36469</td>
<td>&gt; 8yrs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pena 2000</td>
<td>none</td>
<td>2.2 (1.6 to 3.0)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nicaragua: n=7073</td>
<td>primary</td>
<td>1.6 (1.2 to 2.2)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>adjusted for: sex, multiple pregnancy, caesarean, birthweight, maternal age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poerwanto 2003</td>
<td>&lt;6yrs</td>
<td>3.36 (1.60 to 7.06)</td>
<td>p=0.0014</td>
<td></td>
</tr>
<tr>
<td>Indonesia: n=28810</td>
<td>ME x FWI (interaction)</td>
<td>0.88 (0.41 to 1.89)</td>
<td>0.45 (0.21 to 0.98)</td>
<td>p=0.04</td>
</tr>
<tr>
<td></td>
<td>&lt;6yrs + poor*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt; 6yrs + near poor*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>reference: secondary or higher</td>
<td>M1 adjusted for: maternal age, year of birth, sex of child, order of birth; M2 adjusted for: family formation variables, water supply, ownership of toilet, ownership of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>* poor neighbourhoods with low family welfare index score, and near poor neighbourhoods with low prosperous family welfare index score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandiford 1997</td>
<td>illiterate</td>
<td>C:1.2 (1.0 to 1.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nicaragua: n=7475</td>
<td>schooled literate</td>
<td>A:1.2 (0.9 to 1.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C:1.0 (0.8 to 1.3)</td>
<td>A:1.0 (0.8 to 1.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C:1.3 (0.9 to 1.9)</td>
<td>A:1.3 (0.9 to 1.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C:0.9 (0.6 to 1.5)</td>
<td>A:0.9 (0.7 to 1.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C:1.1 (0.9 to 1.5)</td>
<td>A:1.1 (0.9 to 1.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C:1.1 (0.8 to 1.4)</td>
<td>A:1.1 (0.8 to 1.4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

<table>
<thead>
<tr>
<th>Women in developed countries</th>
<th>First born/later born</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arntzen 1996</strong></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td></td>
</tr>
<tr>
<td>n=153941</td>
<td></td>
</tr>
<tr>
<td>&lt;10 yrs</td>
<td></td>
</tr>
<tr>
<td>10 – 12 yrs</td>
<td></td>
</tr>
<tr>
<td>High v Low</td>
<td></td>
</tr>
<tr>
<td>reference: &gt;12 yrs education; low v high education dichotomized at median; adjusted for: maternal age and marital status,</td>
<td></td>
</tr>
</tbody>
</table>

| **Arntzen 2006**            |                       |
| Norway                      |                       |
| n=342433                    |                       |
| <10 yrs                     |                       |
| 10-12 yrs                   |                       |
| Congenital: 1.6 (1.0 to 2.7) |
| Infections: 11.2 (3.1 to 40.6) |
| Other: 3.3 (1.9 to 5.7)      |
| Congenital: 1.2 (0.9 to 1.7) |
| Infections: 6.3 (1.9 to 29.5) |
| Other: 2.1 (1.4 to 3.3)      |

| **Arntzen 2007**            |                       |
| Denmark: n=117983           |                       |
| Finland: n=834299           |                       |
| Sweden: n=1971645           |                       |
| Norway: n=1017168           |                       |
| <10 yrs                     |                       |
| 10-12 yrs                   |                       |
| Denmark: 1.7**              |
| Sweden: 1.6**               |
| Norway: 1.4**               |

| **Bakkteig 1993**           |                       |
| Denmark: n=102215           |                       |
| Sweden: n=185156           |                       |
| Norway: n=199596           |                       |
| low*                        |                       |
| Denmark: 1.7**              |
| Sweden: 1.6**               |
| Norway: 1.4**               |

| **Bobak 1997**              |                       |
| Czech Republic              |                       |
| n=380633                    |                       |
| vocational                  | 0.7                   |
| secondary                   | 0.6                   |
| university                  | 0.5                   |

| **Chen 1998**               |                       |
| Canada (Quebec)             |                       |
| n=192150                    |                       |
| 0-10 yrs                    |                       |
| 11 yrs                      |                       |
| 12-13 yrs                   |                       |
| Denmark: 1.7**              |
| Sweden: 1.6**               |
| Norway: 1.4**               |

| **Gisselmann 2005**         |                       |
| Sweden                      |                       |
| n=642859                    |                       |
| low                         | 1.3 (1.2 to 1.4)      |
| low-inter                   | 1.2 (1.1 to 1.3)      |
| high-inter                  | 1.0 (0.9 to 1.2)      |

| **Morrison 1989**           |                       |
| Australia: n=8556           |                       |
| <grade 10                   | 0.88                  |
| grade 10                    | 0.65                  |
| grade 12/uni                | 0.99                  |

| **Olsen 1999**              |                       |
| Norway                      |                       |
| n=103184                    |                       |
| grade 8                     | 1.5 (1.1 to 2.0)      |

---

**reference:** College education (non-tertiary); *: perinatal mortality (stillbirths and neonatal deaths up to 28 days of life); adjusted for: maternal age, parity, marital status, BMI, smoking, eating breakfast regularly.
### Denmark

<table>
<thead>
<tr>
<th>Grade</th>
<th>FE – short</th>
<th>FE – med</th>
<th>FE – long</th>
</tr>
</thead>
<tbody>
<tr>
<td>grade 9</td>
<td>1.2 (0.9 to 1.5)</td>
<td>1.0 (0.7 to 1.3)</td>
<td>0.8 (0.5 to 1.1)</td>
</tr>
<tr>
<td>grade 12</td>
<td>1.0 (0.7 to 1.3)</td>
<td>0.8 (0.5 to 1.1)</td>
<td>0.8 (0.4 to 1.4)</td>
</tr>
</tbody>
</table>

Reference: grade 10 – 11; adjusted for: age, parity, smoking; NOTE: when adjusted for BW none of the educational differences significant – results not reported.

### Singh 2007

<table>
<thead>
<tr>
<th>Age Group</th>
<th>United States</th>
<th>Denmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12 yrs</td>
<td>1.4 (1.4 to 1.5)</td>
<td>1.2 (1.1 to 1.3)</td>
</tr>
<tr>
<td>12 yrs</td>
<td>1.3 (1.2 to 1.4)</td>
<td>1.2 (1.1 to 1.2)</td>
</tr>
<tr>
<td>13-15 yrs</td>
<td>1.2 (1.1 to 1.3)</td>
<td>1.1 (1.1 to 1.2)</td>
</tr>
</tbody>
</table>

Reference: ≥16 yrs of education; Relative risk; adjusted for: maternal age, parity, marital status, race/ethnicity, plurality, antenatal care, birth order, infant sex, BW and, GA
<table>
<thead>
<tr>
<th>Study (n of live births)</th>
<th>Maternal education</th>
<th>IM rate</th>
<th>NM rate</th>
<th>PNM rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minority women in developed countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stoltenberg 1998</td>
<td>&lt;10 yrs</td>
<td>P: 15.0 N: 12.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pakistani: n=7274</td>
<td>10-12 yrs</td>
<td>P: 12.0 N: 8.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norwegian: n=1431055</td>
<td>&gt;12 yrs</td>
<td>P: 2.8 N: 6.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singh 1995</td>
<td>0-8 yrs</td>
<td>B: 21.6 W:12.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-11 yrs</td>
<td>B: 20.0 W:12.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>12 yrs</td>
<td>B: 16.6 W: 8.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White: 1814669</td>
<td>13-15 yrs</td>
<td>B: 14.7 W: 6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black: 1782007</td>
<td>16+ yrs</td>
<td>B: 13.3 W: 5.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women in developing countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adetunji 1995</td>
<td>no school</td>
<td>54.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>primary</td>
<td>51.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=2635</td>
<td>secondary</td>
<td>68.5 p&gt;0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hertel-Fernandez 2007</td>
<td>none</td>
<td>30.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chile: n=NR</td>
<td>≥college</td>
<td>6.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lansky 2007</td>
<td>&lt;4yrs</td>
<td>51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brazil: n=36469</td>
<td>4-8 yrs</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;8yrs</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pena 2000</td>
<td>none</td>
<td>65.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nicaragua: n=7073</td>
<td>primary</td>
<td>48.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>secondary+</td>
<td>29.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poerwanto 2003</td>
<td>&lt; 7 yrs</td>
<td>189.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia: n=28810</td>
<td>&gt; 7 yrs</td>
<td>81.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandiford 1997</td>
<td>illiterate</td>
<td>93.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nicaragua: n=7475</td>
<td>adult ed literate</td>
<td>67.0 (p&lt;0.01 v illit.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>schooled literate</td>
<td>72.0 (p&lt;0.005 v illit.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women in developing countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arntzen 1996*</td>
<td>&lt;10 yrs</td>
<td>FB: 2.9 LB: 5.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway: n=153941</td>
<td>10-12 yrs</td>
<td>FB: 2.3 LB: 2.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;12 yrs</td>
<td>FB: 1.1 LB: 1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arntzen 2006</td>
<td>&lt;10 yrs</td>
<td>3.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway: n=342433</td>
<td>10-12 yrs</td>
<td>2.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;12 yrs</td>
<td>1.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bakkeftig 1993</td>
<td>&lt;9 or 10yrs</td>
<td>D: 6.6, S: 11.9, N: 4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark: n=102215</td>
<td>&gt;12yrs</td>
<td>D: 4.0, S: 7.6, N: 2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden: n=185156</td>
<td>(fetal mortality)</td>
<td>D: 3.3, S: 5.8, N: 2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway: n=199596</td>
<td></td>
<td>D: 2.4, S: 4.4, N: 2.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bobak 1997</td>
<td>primary</td>
<td>9.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>vocational</td>
<td>6.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=380633</td>
<td>secondary</td>
<td>5.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>university</td>
<td>4.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gisselmann 2005</td>
<td>compulsory only</td>
<td>7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>2yrs upper sec</td>
<td>6.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=642859</td>
<td>3yrs upper sec</td>
<td>5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>college/uni</td>
<td>5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olsen 1999</td>
<td>8th grade</td>
<td>9.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>9th grade</td>
<td>7.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=113814</td>
<td>10-11th grade</td>
<td>5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>upper secondary</td>
<td>3.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>further education</td>
<td>2.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singh 2007</td>
<td>&lt;12 yrs</td>
<td>8.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>12 yrs</td>
<td>4.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=4026323</td>
<td>13-15yrs</td>
<td>4.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥16 yrs</td>
<td>3.23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* FB – first born, LB – last born
Table 6: Correlations and ecological relative risks (RR) for infant mortality by maternal education level

<table>
<thead>
<tr>
<th>Study</th>
<th>Maternal education</th>
<th>Infant mortality (correlation coefficients)</th>
<th>Neonatal mortality (ecological RR)</th>
<th>Postneonatal mortality (ecological RR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>unadjusted</td>
<td>unadjusted</td>
<td></td>
</tr>
<tr>
<td>Bicego 1993*</td>
<td>none</td>
<td>A – 1.7 B - 1.3</td>
<td>A – 2.5 B – 1.6</td>
<td></td>
</tr>
<tr>
<td>17 developing countries</td>
<td></td>
<td>adj 1</td>
<td>adj 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A – 1.4 B – 1.1</td>
<td>A – 2.0 B – 1.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>adj 2</td>
<td>adj 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A – 1.5 B – 1.2</td>
<td>A – 1.9 B – 1.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>adj 3</td>
<td>adj 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A – 1.3 B – 1.1</td>
<td>A – 1.8 B – 1.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>urban/rural</td>
<td></td>
<td>urban/rural</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A – 1.2 B – 1.1</td>
<td>A – 0.5 B – 0.9</td>
<td></td>
</tr>
</tbody>
</table>

Reference: secondary education; relative risks of neonatal mortality and postneonatal mortality (in this case from 1 to 23 completed months life); adjusted for: adj 1 – economic status, adj 2 – economic status and family formation, adj 3 – economic status, family formation, health service use, urban/rural is a test of interaction.

Lee 1997
78 countries
literacy rate
-0.90 (95% CI: 0.84 to 0.93) p<0.001

Schell 2007
152 countries
young female illiteracy
All countries
Univariate:
0.82 p<0.001
Multivariate
0.46 p<0.001
Low income
Univariate:
0.65 p<0.001
Multivariate
0.55 p<0.001
Middle income
Univariate:
0.65 p<0.001
Multivariate
0.36 p=0.018

Tresseras 1992
103 countries
female illiteracy
0.855 p<0.05
ecological RR:
5.8 (95% CI: 5.2 to 10.7)

Low birthweight (LBW) and small-for-gestational-age (SGA)

Meta-analysis
Low birthweight and small for gestational age rates comparing low education (as per study definitions – from no schooling to less than 12 years education) to all other educational categories are shown in Table 7 and Figures 6 and 7. The overall odds ratio for low birthweight was significant in favour of more education, OR 1.72 (95% CI: 1.37 to 2.15). A significant benefit in favour of more education was also detected for SGA, OR 1.53 (95% CI: 1.23 to 1.91).
Table 7: Pooled odds ratios of low birthweight and small for gestational age: lowest education vs. all other educational levels

<table>
<thead>
<tr>
<th>OR (95%CI)</th>
<th>Overall</th>
<th>ATSI</th>
<th>Developed country minority</th>
<th>Developed country</th>
<th>Developed country</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LBW</strong></td>
<td>1.72(1.37, 2.15)</td>
<td>1.79 (0.82, 3.92)</td>
<td>1.49 (1.16, 1.92)</td>
<td>2.13 (1.42, 3.20)</td>
<td>1.67 (1.29, 2.15)</td>
</tr>
<tr>
<td></td>
<td>(9 studies, 6275769 live births)</td>
<td>(1 study, 267 live births)</td>
<td>(1 study, 3322 live births)</td>
<td>(2 studies, 1084 live births)</td>
<td>(6 studies, 6271186 live births)</td>
</tr>
<tr>
<td><strong>SGA</strong></td>
<td>1.53 (1.23, 1.91)</td>
<td>NA</td>
<td>1.25 (1.01, 1.55)</td>
<td>NA</td>
<td>1.59 (1.25, 2.03)</td>
</tr>
<tr>
<td></td>
<td>(7 studies, 409586 live births)</td>
<td></td>
<td>(2 studies, 113140 live births)</td>
<td></td>
<td>(5 studies, 296355 live births)</td>
</tr>
</tbody>
</table>

KEY: IM – infant mortality; NM – neonatal mortality; PNM – postneonatal mortality; LBW – low birth weight; SGA – small for gestational age; ATSI – Aboriginal and Torres Strait Islander

Figure 6: Odds ratio (95%CI) for low birthweight: lowest maternal education category vs. all other educational categories

Study or Subgroup | log(Odds Ratio) | SE | Weight | Odds Ratio IV, Random, 95% CI | Odds Ratio IV, Random, 95% CI |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5.1 Australian aboriginal populations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eades 2008</td>
<td>0.502216</td>
<td>0.400416</td>
<td>4.6%</td>
<td>1.79 [0.82, 3.92]</td>
<td>1.79 [0.82, 3.92]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td></td>
<td></td>
<td>4.6%</td>
<td>1.79 [0.82, 3.92]</td>
<td>1.79 [0.82, 3.92]</td>
</tr>
<tr>
<td>Heterogeneity: Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 1.45 (P = 0.15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.2 Minority women in developed countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parker 1994</td>
<td>0.398776</td>
<td>0.129424</td>
<td>9.1%</td>
<td>1.49 [1.16, 1.92]</td>
<td>1.49 [1.16, 1.92]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td></td>
<td></td>
<td>9.1%</td>
<td>1.49 [1.16, 1.92]</td>
<td>1.49 [1.16, 1.92]</td>
</tr>
<tr>
<td>Heterogeneity: Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 3.06 (P = 0.002)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.3 Developing countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klufio 1994</td>
<td>0.131028</td>
<td>0.271216</td>
<td>6.6%</td>
<td>1.14 [0.67, 1.94]</td>
<td>1.14 [0.67, 1.94]</td>
</tr>
<tr>
<td>Mondal 2000</td>
<td>1.629241</td>
<td>0.320385</td>
<td>5.7%</td>
<td>5.10 [2.72, 9.56]</td>
<td>5.10 [2.72, 9.56]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td></td>
<td></td>
<td>12.3%</td>
<td>2.39 [0.55, 10.37]</td>
<td>2.39 [0.55, 10.37]</td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.73; Chi² = 12.74, df = 1 (P = 0.0004); I² = 92%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 1.16 (P = 0.25)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2.5.4 Developed countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arntzen 2007 (Denmark)</td>
<td>0.405465</td>
<td>0.086122</td>
<td>9.8%</td>
<td>1.50 [1.27, 1.78]</td>
<td>1.50 [1.27, 1.78]</td>
</tr>
<tr>
<td>Arntzen 2007 (Finland)</td>
<td>0.215111</td>
<td>0.114364</td>
<td>9.4%</td>
<td>1.24 [0.99, 1.55]</td>
<td>1.24 [0.99, 1.55]</td>
</tr>
<tr>
<td>Arntzen 2007 (Norway)</td>
<td>0.378436</td>
<td>0.166915</td>
<td>8.5%</td>
<td>1.46 [1.05, 2.03]</td>
<td>1.46 [1.05, 2.03]</td>
</tr>
<tr>
<td>Arntzen 2007 (Sweden)</td>
<td>0.19062</td>
<td>0.117228</td>
<td>9.3%</td>
<td>1.21 [0.96, 1.52]</td>
<td>1.21 [0.96, 1.52]</td>
</tr>
<tr>
<td>Chen 1998</td>
<td>0.722706</td>
<td>0.030922</td>
<td>10.3%</td>
<td>2.06 [1.94, 2.19]</td>
<td>2.06 [1.94, 2.19]</td>
</tr>
<tr>
<td>Gisselman 2005</td>
<td>1.085169</td>
<td>0.013793</td>
<td>10.3%</td>
<td>2.96 [2.86, 3.04]</td>
<td>2.96 [2.86, 3.04]</td>
</tr>
<tr>
<td>Morrison 1989</td>
<td>0.371664</td>
<td>0.119899</td>
<td>9.3%</td>
<td>1.45 [1.15, 1.83]</td>
<td>1.45 [1.15, 1.83]</td>
</tr>
<tr>
<td>Parker 1994</td>
<td>0.662688</td>
<td>0.236245</td>
<td>7.2%</td>
<td>1.94 [1.22, 3.08]</td>
<td>1.94 [1.22, 3.08]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td></td>
<td></td>
<td>74.0%</td>
<td>1.67 [1.29, 2.15]</td>
<td>1.67 [1.29, 2.15]</td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.12; Chi² = 302.45, df = 7 (P &lt; 0.00001); I² = 98%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 3.91 (P &lt; 0.0001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td>100.0%</td>
<td>1.72 [1.37, 2.15]</td>
<td>1.72 [1.37, 2.15]</td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.13; Chi² = 337.51, df = 11 (P &lt; 0.00001); I² = 97%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 4.73 (P &lt; 0.0001)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Discussion of individual studies

Australian Indigenous women
1 study – Eades 2008
Eades 2008 explored the causal pathways leading to poor birth outcomes (LBW and /or PT) for a cohort of urban Aboriginal infants. Poor birth outcome was experienced by 12.3% of the cohort. Independent predictors of poor birth outcome were history of maternal hypertension, vaginal bleeding and consumption of excess spirits during pregnancy. Other risk factors identified included mother being raised on a mission, smoking during pregnancy and exposure to passive smoke during pregnancy. Maternal education less than year 10 was associated with a 1.8 times greater risk of poor birth outcome than education beyond year 10.

Non-Australian Indigenous women
1 study – Kieffer 1994
Kieffer 1994 compared rates of preterm, low birthweight, infant mortality, neonatal mortality and postneonatal mortality for women of Hawaiian origin and women of Caucasian origin in Hawaii. Hawaiian women had higher rates of infant mortality, neonatal and postneonatal mortality, low birthweight and preterm births than white women. In a logistic regression analysis controlling for maternal birth and socioeconomic factors (maternal age, parity, marital status, educational attainment, levels of prenatal care, residence [urban/rural]), there was a significant effect of educational attainment on rates of low birthweight and preterm, with Hawaiian women with low educational attainment having 1.43 times the risk of low birthweight and 1.2 times the risk of preterm compared with white women with average educational attainment. Hawaiian women with high educational attainment had 0.79 times the risk of low birthweight and 0.92 times the risk of preterm compared to white women with average educational attainment.

Minority women in developing countries
Collins 1998 compared small for gestational age (SGA) births among US-born Mexican Americans mothers and foreign-born Mexican American mothers living in Chicago. The overall SGA rate for infants of foreign-born mothers was 1.4% compared with 2.1% for US-born Mexican American mothers (RR 1.5, 95%CI 1.1 to 2.1). The infant mortality rate for SGA infants was 64 per 1000 compared with 3.4 per 1000 for non-SGA infants. The relative risk of SGA was 2.2 times higher for US-born mothers with less than 12 years of education compared with foreign born mothers (RR 2.2, 95%CI 1.5 to 3.3) but there were no other differences between the two groups according to educational attainment. In a multiple logistic regression
the odds ratio for SGA among US-born Mexican American mothers was not significant (1.2, 95%CI: 0.6 to 2.9) when maternal age, education level, marital status, parity, adequacy of prenatal care and income level were controlled.

Mondal 2000 studied rate of low birthweight among Nepali women living in India. Overall, incidence of low birthweight was 21.53%. Mother’s education level was independently associated with low birthweight (OR4.68, 95%CI: 4.15 to 5.20 comparing literate to illiterate mothers) and was a significant risk factor in a multiple logistic regression analysis (which also found that infant sex, maternal age, parity, gestational period were significant risk factors).

Parker 1994 studied low birthweight, SGA and preterm births among black and white women in the United States to examine the impact of five socioeconomic indicators – maternal and paternal education, family income, and maternal and paternal occupation. Maternal and paternal education levels were the best overall predictors of the outcomes but the patterns differed for black and white people. Maternal education was significantly associated with risk of low birthweight and preterm among black mothers whereas small for gestational age was significantly associated with low maternal education among white mothers.

**Women in developing countries**

1 study – Klufio 1994

Klufio 1994 studied infant mortality and low birth weight among women in Papua New Guinea. There was no significant association between maternal education and low birth weight (OR1.12, 95%CI:0.63 to 1.95).

**Women in developed countries**


Astone 2007 studied the effect of maternal socioeconomic status throughout the lifespan on infant birthweight, specifically to examine whether maternal socioeconomic status during childhood, and at time of pregnancy were independently associated with birthweight when biological determinants were controlled. Astone 2007 used intergenerational study design studying three generations of mothers and grandmothers of the index infants over a 25 year period. Maternal and grandmaternal education level were significantly associated with infant birthweight. There was a 81.7 g mean difference in birthweight comparing mothers with low versus high education and 117.3 g mean difference in birthweight comparing grandmothers with low versus high education. Among women with low education (less than high school diploma) there was a mean difference in birthweight of 181g comparing grandmothers with high versus low education. These results were adjusted for a large range of maternal and grandmaternal socioeconomic and pregnancy related factors.

Chen 1998 studied the impact of maternal education levels on low birthweight, small for gestational age and preterm births in Quebec Canada. A significant educational gradient was demonstrated for all three outcomes. Compared to a woman with 14 or more years of education, a woman with 0-10 years of education had 2.1 times the risk of having a low birthweight infant, 2.0 times the risk of having a SGA infant and 1.5 times the risk of having a preterm infant, even when the analysis was adjusted for maternal age, marital status, parity and infant sex.

Clausson 1998 studied risk factors for small for gestational age and infant mortality rates among SGA births. Overall there were 3.8% SGA infants (among 96,662 live births), and 1.2% very preterm and 5.2% moderately preterm (8.1% and 11.8% of SGA infants). Compared to mothers with high levels of education, mothers with low education had higher rates of moderately preterm and term SGA infants. Low education levels were associated with an increased risk of very and moderately preterm SGA. Compared to women with 13-14 years of education, women with less than nine years of education had twice the risk of having a moderately preterm SGA infant and 1.6 times the risk of having a very preterm SGA infant. Women with 10
to 12 years of education had 1.4 times the risk of having a moderately preterm SGA infant and 1.6 times the risk of having a very preterm SGA infant. The overall risk of having an SGA infant was 1.2 time higher for both groups of women compared to women with higher levels of education. There was no significant difference in SGA rates between women with 13 to 14 years of education and women with 15 or more years of education. Analyses were adjusted for maternal age, height, body mass index, smoking, country of birth and hypertension.

Gisselmann 2005 studied birthweight specific infant mortality in Sweden between 1973 and 1990 to examine the effect of maternal education levels on infant mortality. Risk of having a low birthweight baby decreased with increasing levels of maternal education. For women with the lowest levels of education the risk of having a low birthweight baby was 1.7 times higher than for women with the highest level of educational attainment.

Millar 1998 studied risk factors for SGA infants among Canadian women. Overall the SGA rate was 6%. A higher proportion of SGA infants were born to women with low education (12% for mothers with less than high school education compared with 5% for mothers with a postsecondary qualification). The risk of having a SGA infant was 2.1 times higher for women with low education compared to higher levels of education, even when controlling maternal age, household income, family status, antenatal care and smoking. For a lone mother aged 25 to 34 with a low income, who received no prenatal care and who did not smoke during her pregnancy, the chance of having a SGA infant was 11% for women with less than a high school education and 6% for women with a postsecondary education.

Morrison 1989 examined effect of socioeconomic status on pregnancy outcomes in Brisbane, Australia. No significant effect of maternal education level on preterm birth, low birthweight or small for gestational age was evident when the analysis was adjusted for age, parity, marital status, maternal BMI, smoking and eating breakfast regularly.

Raum 2001 compared rates of SGA for women living in the former West and East Germany in order to compare the effect of maternal education on SGA in different social and political systems. When the analysis was adjusted for maternal body mass index, smoking, marital status, mother’s age, parity and maternal height, women with the lowest levels of education in East Germany were found to have twice the risk of SGA compared to women with a university level of education, but there were no other significant differences according to maternal education level in either East German or West German women.
### Table 8: Odds ratios for LBW, SGA and PT by ME level

<table>
<thead>
<tr>
<th>Study</th>
<th>Maternal education</th>
<th>low birth weight OR (95%CI)</th>
<th>small for GA OR (95%CI)</th>
<th>preterm OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Australian Indigenous women</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eades 2008</td>
<td>&lt;yr 10</td>
<td>1.8 (0.8 to 3.9)</td>
<td>* LBW and/or PT</td>
<td>reference: &gt; yr 10 education</td>
</tr>
<tr>
<td>273 mothers of infants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non-Australian Indigenous women</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kieffer 1994</td>
<td>&lt;12 yrs</td>
<td>1.4 (1.3 to 1.6)</td>
<td></td>
<td>1.2 (1.1 to 1.3)</td>
</tr>
<tr>
<td>Hawaiian: n=50165</td>
<td>&gt; 12 yrs</td>
<td>0.8 (0.7 to 0.9)</td>
<td></td>
<td>0.9 (0.8 to 0.9)</td>
</tr>
<tr>
<td>White: n=66840</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Minority women in developed countries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collins 1998</td>
<td>&lt;12 yrs</td>
<td>2.2 (1.5 to 3.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign-born Mexican-American: n=8746</td>
<td>12 yrs</td>
<td>1.0 (0.4 to 2.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US-born Mexican-American: n=2253</td>
<td>&gt;12 yrs</td>
<td>1.1 (0.4 to 3.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mondal 2000 Nepal: n=418</td>
<td>illiterate</td>
<td>4.7 (4.2 to 5.2)</td>
<td></td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Parker 1994</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black: n=3242</td>
<td>&lt;12 yrs</td>
<td>B: 2.1* W: 2.3</td>
<td>B: 1.3 W: 1.9*</td>
<td>B: 2.1* W: 0.9</td>
</tr>
<tr>
<td>White: n=3252</td>
<td>12 yrs</td>
<td>B: 1.6* W: 1.3</td>
<td>B: 1.1 W: 1.5</td>
<td>B: 1.7* W: 1.3</td>
</tr>
<tr>
<td>13-15 yrs</td>
<td>B: 1.3 W: 1.1</td>
<td>B: 0.9 W: 1.1</td>
<td>B: 1.2 W: 1.0</td>
<td></td>
</tr>
<tr>
<td>Klufio 1994 Papua New Guinea: n=673 women</td>
<td>no schooling</td>
<td>1.1 (0.6 to 2.0)</td>
<td></td>
<td>p=0.682</td>
</tr>
<tr>
<td><strong>Women in developed countries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astone 2007 United States n=987</td>
<td>≤ high school dip</td>
<td>mean BW 3138 [645] g</td>
<td></td>
<td>mean BW 3255 [610] g</td>
</tr>
<tr>
<td>≥ some college</td>
<td></td>
<td></td>
<td></td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Chen 1998 Canada (Quebec) n=192150</td>
<td>0-10 yrs</td>
<td>2.1 (1.9 to 2.2)</td>
<td>2.0 (2.0 to 2.1)</td>
<td>1.5 (1.4 to 1.6)</td>
</tr>
<tr>
<td>11 yrs</td>
<td>1.8 (1.7 to 1.9)</td>
<td>1.7 (1.7 to 1.8)</td>
<td>1.4 (1.3 to 1.4)</td>
<td></td>
</tr>
<tr>
<td>12-13 yrs</td>
<td>1.4 (1.3 to 1.5)</td>
<td>1.4 (1.4 to 1.5)</td>
<td>1.2 (1.2 to 1.3)</td>
<td></td>
</tr>
<tr>
<td>reference: 14+ yrs of education; p&lt;0.05 for all categories</td>
<td>adjusted for: maternal age, marital status, parity and infant sex</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8 cont: Odds ratios for LBW, SGA and PT by ME level

<table>
<thead>
<tr>
<th>Study</th>
<th>Maternal education</th>
<th>low birth weight OR (95%CI)</th>
<th>small for GA OR (95%CI)</th>
<th>preterm OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clausson 1998</td>
<td>&lt;9 yrs</td>
<td>1.2 (1.1 to 1.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden:</td>
<td>10-12 yrs</td>
<td>1.2 (1.0 to 1.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15+ yrs</td>
<td>1.0 (0.9 to 1.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=96662</td>
<td></td>
<td>reference: 13-14 yrs of education</td>
<td>adjustment could include maternal age, height, BMI, smoking and country of birth</td>
<td></td>
</tr>
<tr>
<td>Gisselmann 2005</td>
<td>low</td>
<td>1.7 (1.5 to 1.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden:</td>
<td>low intermediate</td>
<td>1.4 (1.3 to 1.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>high intermediate</td>
<td>1.1 (1.0 to 1.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=652859</td>
<td></td>
<td>reference: high education; low education – compulsory only, low-intermed – 2 yrs upper secondary school (vocational), high intermed – 3 yrs upper secondary (academic), high – college or university adjusted for: maternal age and parity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Millar 1998d</td>
<td>low</td>
<td>2.1 (1.4 to 3.1)</td>
<td>p&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Canada: n=4060</td>
<td>high school/some</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>post-secondary</td>
<td>1.3 (0.9 to 1.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reference: post-secondary</td>
<td>adjusted for: smoking status, household income, family status, age at birth of child, received prenatal care</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morrison 1989</td>
<td>&lt;grade 10</td>
<td>1.3</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Australia:</td>
<td>grade 10</td>
<td>1.0</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>grade 12</td>
<td>1.0</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>university</td>
<td>p=0.43</td>
<td>p=0.76</td>
<td>p=0.76</td>
</tr>
<tr>
<td>reference: college (i.e.non-tertiary)</td>
<td>adjusted for: maternal age, parity, marital status, BMI, smoking, eating breakfast regularly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raum 2001e</td>
<td>I</td>
<td>W: 2.0 (0.9 to 4.7)</td>
<td>E: 2.0 (1.0 to 3.7)</td>
<td></td>
</tr>
<tr>
<td>Former West-Germany:</td>
<td>II</td>
<td>W: 1.4 (0.8 to 2.4)</td>
<td>E: 1.4 (0.8 to 2.3)</td>
<td></td>
</tr>
<tr>
<td>n=3374</td>
<td>III</td>
<td>W: 1.4 (0.8 to 2.4)</td>
<td>E: 1.3 (0.6 to 2.6)</td>
<td></td>
</tr>
<tr>
<td>Former East-Germany:</td>
<td>IV</td>
<td>W: 1.3 (0.7 to 2.5)</td>
<td>E: 1.1 (0.6 to 1.9)</td>
<td></td>
</tr>
<tr>
<td>n=3070</td>
<td>reference: university education; education I - &lt;8yrs East and West Germany, II – 9yrs West 10 yrs East, III – 10yrs West 12 yrs East, IV – 13 yrs West Tech College East p=0.0001 for West and p=0.02 for East adjusted for: BMI, smoking, marital status, parity, age of mother, maternal body height;</td>
<td></td>
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</tr>
</tbody>
</table>

Sudden infant death syndrome (SIDS)

Rates of SIDS were reported in five studies: three in non-Australian Indigenous populations (Mitchell 1993, Oyen 1990, Pezzino 1996) and two in developed countries (Arntzen 2006, Chen 1998). See Table 9.

Non-Australian Indigenous women

Mitchell 1993 compared SIDS rates for Maori and non-Maori women in New Zealand and found that maternal education level was not a significant factor in risk of SIDS. Two studies compared risk of SIDS in American Indian women compared with white women (Oyen 1990 and Pezzino 1996). Both studies found an educational gradient for SIDS risk among white American women, but did not see such a gradient for American Indian women.

Women in developed countries

In two studies risk of SIDS was increased for women with low education compared to women with the highest level of education, even when the analysis was adjusted for maternal age, parity, marital status, infant sex and plurality (Arntzen 2006, Chen 1998).
Table 9: Odds ratios for sudden infant death by maternal education level

<table>
<thead>
<tr>
<th>Study</th>
<th>Maternal education</th>
<th>SIDS RR (95%CI)</th>
<th>SIDS rate (per 1000 LB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Australian Indigenous women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitchell 1993</td>
<td>&lt;16 yrs</td>
<td>Maori: 2.3 (1.4 to 3.8)</td>
<td></td>
</tr>
<tr>
<td>Maori: n=582</td>
<td>16 yrs</td>
<td>Maori: 1.3 (0.9 to 1.8)</td>
<td></td>
</tr>
<tr>
<td>Non-Maori: n=1650</td>
<td></td>
<td>Non-Maori: 1.7 (0.9 to 2.9)</td>
<td></td>
</tr>
<tr>
<td>reference: 17 yrs education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oyen 1990a</td>
<td>1-8 yrs</td>
<td>American Indian: 2.4 (0.9 to 6.3)</td>
<td>American Indian: 9.3</td>
</tr>
<tr>
<td>American-Indian: n=17644</td>
<td>9-12 yrs</td>
<td>American Indian: 1.8 (0.9 to 3.8)</td>
<td>American Indian: 5.9</td>
</tr>
<tr>
<td>White: n=164364</td>
<td>&gt;12 yrs</td>
<td>White: 1.7 (1.3 to 2.3)</td>
<td>White: 1.7</td>
</tr>
<tr>
<td>reference: &gt;12 yrs education</td>
<td></td>
<td></td>
<td>White: 2.6</td>
</tr>
<tr>
<td>adjusted for: trimester prenatal care began</td>
<td></td>
<td></td>
<td>American Indian: 0.9</td>
</tr>
<tr>
<td>Pezzino 1996b</td>
<td>&lt;12 yrs</td>
<td>American Indian: 1.4 (0.9 to 2.0)</td>
<td></td>
</tr>
<tr>
<td>American Indian: n=157709</td>
<td>12 yrs</td>
<td>American Indian: 1.2 (0.8 to 1.7)</td>
<td></td>
</tr>
<tr>
<td>White: 14193381</td>
<td></td>
<td>White: 1.2 (1.1 to 1.2)</td>
<td></td>
</tr>
<tr>
<td>reference: &gt;12 yrs education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>adjusted for: mother’s age, marital status, parity and adequacy of prenatal care and babies sex, GA and BW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women in developed countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arntzen 2006c</td>
<td>&lt;10 yrs</td>
<td>2.9 (1.9 to 4.6)</td>
<td></td>
</tr>
<tr>
<td>Norway: n=324433</td>
<td>10-12 yrs</td>
<td>1.9 (1.3 to 2.6)</td>
<td></td>
</tr>
<tr>
<td>reference: &gt;12 yrs education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>adjusted for: maternal age, parity and plurality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chen 1998d</td>
<td>0-10 yrs</td>
<td>1.7 (1.0 to 3.2)</td>
<td></td>
</tr>
<tr>
<td>Canada (Quebec): n=192150</td>
<td>11 yrs</td>
<td>2.3 (1.3 to 4.2)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>adjusted for: 14+ yrs education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>adjusted mortality hazard ratios</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>adjusted for: maternal age, marital status, parity and infant sex</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Child health in Australian Aboriginal populations

Three studies were identified which considered the impact of maternal education levels on child survival (Gray 1988), child health markers (Ewald 2002) and health-related behaviours (Gray 2001).

Gray 1988 used data from the 1986 Australian census to examine the relationship between child survival (death of children up to 15 years of age) and the age at which the child’s mother left school for respondents identifying as Aboriginal or Torres Strait Islander in the Census. Table 10 shows the index of child survival (number of children not surviving per 1000 children ever born) and the child mortality rate per 1000 live births for each level of maternal education (as calculated for this review). The index of child survival may be interpreted as similar to an odds ratio comparing children of mothers in each educational category to children of all mothers. An index of 100 may be interpreted as similar to an odds ratio of one. Child survival was worst for children of women who left school before the age of 14 and best for children of women who left school at age 15. However, it is not clear whether the differences between the educational groups are significant for mothers who left school after age 14.
Table 9: Index of child survival and child mortality rate for children of Aboriginal mothers in the 1986 Australian Census (from Gray 1988)

<table>
<thead>
<tr>
<th>Age left school</th>
<th>Live births</th>
<th>Still alive</th>
<th>Not living</th>
<th>Index of child survival</th>
<th>Child mortality rate (per 1000 LB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;14</td>
<td>4079</td>
<td>3892</td>
<td>187</td>
<td>161</td>
<td>46</td>
</tr>
<tr>
<td>14</td>
<td>6094</td>
<td>5919</td>
<td>175</td>
<td>101</td>
<td>29</td>
</tr>
<tr>
<td>15</td>
<td>19767</td>
<td>19279</td>
<td>488</td>
<td>88</td>
<td>25</td>
</tr>
<tr>
<td>16</td>
<td>15113</td>
<td>14701</td>
<td>412</td>
<td>99</td>
<td>27</td>
</tr>
<tr>
<td>17+</td>
<td>7905</td>
<td>7691</td>
<td>214</td>
<td>98</td>
<td>27</td>
</tr>
<tr>
<td>NR, still in school</td>
<td>4316</td>
<td>4189</td>
<td>127</td>
<td>104</td>
<td>29</td>
</tr>
</tbody>
</table>

Ewald 2002 studied child health markers (trachoma, scabies, skin sores, ear disease, nose disease, stunted, underweight) in 183 Aboriginal children aged less than 13 in Central Australia from 1998 to 1999. The maternal education of women identified as carer-mothers (the primary female caregiver for the child) was measured by years of schooling, whether the woman had earned a formal qualification, whether the woman was literate and whether the woman had attended college. A composite education group was also studied of women who had a qualification or had more than eight years of schooling or were literate. This study failed to find any statistically significant association between maternal education and the various child health markers, with the exception of scabies with years of schooling (OR 1.2, 95%CI 1.0 to 1.46) and qualification (OR 0.34, 95%CI 0.13 to 0.89); and nose disease and years of schooling (OR 0.81, 95%CI 0.67 to 0.98). No education variables were significant in multiple regression analysis.

Gray 2001 studied health-related actions undertaken in the previous fortnight for children of mothers surveyed in the National Aboriginal and Torres Strait Islander Survey (NATSIS) of 1994. Table 11 shows adjusted odds ratios of health-related actions by maternal education and also rates of health-related actions taken by the parent-reported health status of the child. The adjusted odds ratio of taking any health-related action in the previous fortnight was significantly higher for women with the lowest levels of education and the highest levels of education. Women who left school aged less than 14 were 1.5 times more likely to have taken a health-related action for their child than women who left school at 14. Women who left school at 17 or older were 1.4 times more likely to have taken a health-related action for their child. Gray 2001 suggests that this result may be explained by differences in the way data is reported by mothers with higher levels of education compared to mothers with lower levels of education.

Table 11: Adjusted\textsuperscript{a} odds ratios of health-related actions\textsuperscript{b} for children < 14 yrs in previous fortnight by maternal education (NATSIS 1994) (from Gray 2001)

<table>
<thead>
<tr>
<th>Age left school</th>
<th>child health status</th>
<th>Adjusted OR</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>excellent</td>
<td>good/v. good</td>
<td>poor/fair</td>
</tr>
<tr>
<td>&lt;14</td>
<td>33.8%</td>
<td>43.8%</td>
<td>75%</td>
</tr>
<tr>
<td>14</td>
<td>26.3%</td>
<td>32.4%</td>
<td>66.7%</td>
</tr>
<tr>
<td>15</td>
<td>21.1%</td>
<td>39.4%</td>
<td>75.9%</td>
</tr>
<tr>
<td>16</td>
<td>29.2%</td>
<td>42.8%</td>
<td>56.2%</td>
</tr>
<tr>
<td>17+</td>
<td>36.3%</td>
<td>49.5%</td>
<td>83.3%</td>
</tr>
</tbody>
</table>

\textsuperscript{a} – adjusted for geographical location and age of mother
\textsuperscript{b} – visited emergency department/outpatients, admitted to hospital, consulted doctor, consulted Aboriginal health worker, consulted nurse, used medication, used bush medicine, had days of reduced activity

Teenage women

One study reported fetal mortality rates (including stillbirth) by maternal age, ethnicity and maternal education level (Hoyert 1990). The fetal mortality rate was higher for women aged less than 20 compared with women aged 20 to 34, but there did not appear to be any real difference according to years of completed education (see Table 12).
Table 12: Fetal mortality rates by maternal education and age of women

<table>
<thead>
<tr>
<th>Age of mother</th>
<th>Fetal mortality rate (95%CI) (per 1000 live births and fetal deaths)</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Education (yrs completed school)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total &lt;12 yrs &gt;12 yrs</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>7.0 (6.9 to 7.1) 7.8 (7.6 to 8.0) 6.7 (6.6 to 6.9) 1.16</td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>8.2 (7.9 to 8.5) 8.1 (7.8 to 8.5) 8.3 (7.8 to 8.8) 0.98</td>
<td></td>
</tr>
<tr>
<td>20-34</td>
<td>6.5 (6.4 to 6.6) 7.2 (6.8 to 7.5) 6.4 (6.3 to 6.5) 1.13</td>
<td></td>
</tr>
<tr>
<td>35-49</td>
<td>9.6 (9.3 to 10.0) 12.5 (11.4 to 13.6) 9.2 (8.8 to 9.6) 1.36</td>
<td></td>
</tr>
</tbody>
</table>

The results were broken down according to women’s ethnicity and age (See Table 13). Overall there was a clear educational gradient for white and non-Hispanic women but not for black and Hispanic women. However, for teenage women there did not appear to be a clear relationship between education level and fetal mortality rate. Indeed for black teenage women with the highest levels of education (13 to 15 years) the fetal mortality rate was higher (13.9 per 1000 live births and fetal deaths) than for black teenage women with the lowest level of education (0 to 8 years) (12.0 per 1000 live births and fetal deaths). For non-Hispanic teenage women (including Native American women), the fetal mortality rate was similar for women with the highest and lowest levels of education.

Table 13: Fetal mortality rates by maternal education and women’s age and ethnicity

<table>
<thead>
<tr>
<th>Age of mother</th>
<th>White completed years of school</th>
<th>Black completed years of school</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total 0-8 9-11 12 13-15 16</td>
<td>Total 0-8 9-11 12 13-15 16</td>
</tr>
<tr>
<td>All</td>
<td>6.0 8.4 7.2 6.5 5.4 4.8 11.9 12.5 11.7 12.3 11.1 11.8</td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>7.5 8.0 7.9 6.8 7.0 - 10.8 12.0 10.3 11.0 13.9 -</td>
<td></td>
</tr>
<tr>
<td>20-34</td>
<td>5.6 7.7 6.7 9.9 10.9 7.8 6.7 11.8 12.5 12.6 10.6 11.6</td>
<td></td>
</tr>
<tr>
<td>35-49</td>
<td>8.3 16.6 9.9 10.9 7.8 6.7 17.6 - 18.9 21.4 16.1 12.7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age of mother</th>
<th>Hispanic completed years of school</th>
<th>Non-Hispanic completed years of school</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total 0-8 9-11 12 13-16</td>
<td>Total 0-8 9-11 12 13-15</td>
</tr>
<tr>
<td>All</td>
<td>6.6 7.0 5.9 6.9 6.4 6.3 7.0 8.7 8.5 7.5 6.3 5.2</td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>6.4 5.6 6.2 7.7 - 8.5 9.2 8.7 8.0 9.1 -</td>
<td></td>
</tr>
<tr>
<td>20-34</td>
<td>6.2 6.5 5.5 6.5 6.2 6.0 6.5 7.8 8.0 7.2 5.9 4.9</td>
<td></td>
</tr>
<tr>
<td>35-49</td>
<td>11.3 12.9 11.7 11.6 6.7 8.1 9.2 12.6 13.6 12.1 8.8 6.9</td>
<td></td>
</tr>
</tbody>
</table>

Millar 1998 reported risk factors for SGA births by maternal age and education level. Teenage mothers with less than a high school education were 11 times more likely to have an SGA infant than teenage mothers with at least a high school graduation (OR 11.2, 95%CI: 7.8 to 16.2, p<0.01). However, the analysis was not adjusted for any confounding variables.
Discussion

Limitations of the review
Maternal education may be an important contributor to infant mortality and other associated outcomes. However, at present there is no direct evidence about the influence of levels of maternal education on infant mortality for Indigenous Australians. Only one study was identified which examined the effect of maternal education on rates of poor birth outcome (defined as low birthweight and preterm) in an Australian Aboriginal population. Instead we must rely on evidence from other populations to estimate the possible impact of maternal education levels of infant mortality and associated outcomes.

Evidence from minority women in developed countries, women in developing countries and women in developed countries showed a clear educational gradient, such that increasing levels of education were associated with decreased levels of infant mortality and other associated outcomes. However a very large number of confounding factors may be influencing these results including maternal age, parity, smoking and socioeconomic status, infant birthweight, sex, gestational age, birth order and breastfeeding. The included studies adjusted outcomes for a variety of these factors but none adjusted for all factors and not all adjusted for those considered to be most important (maternal age, parity, smoking and SES).

Furthermore, the overall risk of bias in the included studies was assessed to be moderate with a lot of variability in the types of data analysed (from large national datasets to small local data collection) and differences in the way outcomes were defined. It is also unclear which populations included in this review might be most like the Australian Indigenous population, many of whom do not live in the urban environments characteristic of other developed country minorities.

Educational disadvantage in ATSI populations
Aboriginal and Torres Strait Islander populations continue to be at considerable educational disadvantage compared with the rest of the Australian population. School retention and completion rates are significantly lower with 42.9% of ATSI students completing Year 12 compared with 75.6% for non-ATSI students. Educational attainment is also lower. In South Australia in 2007 71.9% of female ATSI students attained a Year 12 qualification compared with 83.1% for non-ATSI female students. Fewer Aboriginal and Torres Strait Islander students are meeting the national literacy, numeracy and writing benchmarks.

Pooled odds ratios of infant mortality and other outcomes by maternal education
As a result of the differences in the factors controlled for in individual studies, it was not possible to pool adjusted rates of infant mortality and other outcomes. Crude odds ratios were calculated which showed that the risk of infant mortality, low birthweight and small for gestational age was increased by a magnitude of around 1.5 times for women with the lowest level of education. However these results must be viewed with caution given the lack of adjustment for important confounding factors, the use of non-randomised data and the large heterogeneity between studies. As discussed below, when adjustments were made many of the studies failed to find a statistically significant impact of maternal education. Other factors in particular maternal age, smoking and socioeconomic status and infant birthweight were found to dominate analyses.

Table 14 is a summary of the results showing whether a significant effect of increasing education on infant mortality (and related outcomes, i.e. an educational gradient, was demonstrated. It also shows which possible confounding factors were included in the analyses. Overall, the educational gradient was demonstrated in most of the included studies. The four international ecological studies illustrate the pattern clearly for country by country comparisons, showing a distinct correlation between maternal literacy (or illiteracy) and infant mortality rates. However different patterns emerge, depending on the outcomes measured and the populations studied.
Aboriginal and Torres Strait Islander populations
No studies of Aboriginal infant mortality were identified which considered the effect of maternal education level. One study reported rates of low birthweight and preterm birth among a cohort of urban Australian Aboriginal women (Eades 2008). While not an independent (statistically significant) predictor of poor birth outcome, maternal education less than year 10 was associated with nearly twice the risk of low birthweight and preterm (OR 1.8). Three studies of maternal education level on child survival, parental health seeking behaviours and child health markers (such as ear diseases) showed no clear effect of maternal education level on these outcomes (Gray 1998, Ewald 2002, Gray 2001). While some patterns of outcomes related to maternal education were observed it seemed likely that these might be explained by differences in the way the outcomes were reported by different women and problems appropriately defining maternal education.

Non-Australian Indigenous populations
Only one study reported infant mortality rates for an Indigenous population (Kieffer 1994) and found no effect of maternal education level on infant mortality for either white or Hawaiian women. However Hawaiian women with low educational attainment had an increased risk of low birthweight and preterm compared to white women with average educational attainment. Three of the four studies in Indigenous populations looked at risk of SIDS. One study of New Zealand Maori women found no effect of educational attainment on risk of SIDS (Mitchell 1993). Two studies of American Indian women found the educational gradient existed for white Americans but not for American Indian women (Pezzino 1996, Oyen 1990).

Minority populations in developed countries
Six studies in minority populations within developed countries also showed some inconsistent results. While the educational gradient was identified in most studies, Din-Dzietham 1998 found that for African American women the risk of infant mortality increased with increasing educational attainment and the disparity between African American and White women increased so that White women gained a relative benefit from increasing education compared to African American women. Singh 1995 also demonstrated an increasing disparity between African American and white infant mortality with increasing educational attainment. Parker 1994 found that increasing maternal education reduced the risk of low birthweight and preterm for black mothers but SGA for white mothers. Collins 1998 did not find a significant relationship between education level and risk of SGA for US-born Mexican American mothers. Stoltenberg 1998 found an educational gradient for risk of infant mortality and stillbirth among Norwegian mothers but not Pakistani mothers in Norway.

Developing countries
In studies of populations in developing countries the picture was generally clearer and the educational gradient was demonstrated in all but two studies. Adetunji 1995 found there was no significant effect of increasing education on reducing infant mortality rates when the analysis controlled for breastfeeding, maternal age and birth order. Sandiford 1997 did not find a significant effect of education level on infant death in Nicaragua, however, this study was primarily interested in the impact of maternal intelligence on infant death rates. While overall Pena 2000 showed the educational gradient, when the results were stratified by socioeconomic status, only women in the poorest households realised a benefit from increasing maternal education.

Developed countries
Similarly, the results from studies in developed countries generally conformed to the expected educational gradient. In three studied, birthweight appeared to modify the impact of educational attainment on infant deaths. Bobak 1997 showed that when the results were stratified by infant birthweight the risk of infant mortality was lowest for mothers with the lowest levels of education. In Chen 1998 differences in infant mortality, neonatal mortality and postneonatal mortality were only significant between mothers with more than 14 years of education compared to mothers with less than 10 years of education when analysis controlled for birthweight, gestational age and fetal growth. Similarly, Olsen 1999 found no statistically significant effect of maternal education when the analysis adjusted for birthweight.
Teenage women
Hoyert 1990 found that for Black teenage women increasing levels of education were associated with an increased risk of fetal mortality, whereas overall there did not appear to be a clear relationship between educational attainment in teenagers and fetal mortality. Millar 1998 found a relationship between SGA and educational attainment for teenage women but did not adjust the analysis for any important confounding factors.

Conclusions
Maternal education may be an important factor in determining poor birth outcome and infant mortality in Australian Indigenous populations. However it is likely that maternal education is a mediating factor which impacts on other more directly linked risk factors for infant mortality such as smoking and nutrition. We were not able to determine whether maternal education is in fact a proxy for socioeconomic status or operates independently on infant mortality and associated outcomes. Recent data again demonstrates that Indigenous Australians are educationally disadvantaged compared to the rest of the Australian population and we have clear data regarding higher rates of infant mortality and other outcomes for Indigenous women. Unfortunately, to date to our knowledge, these two sets of data have not been linked so we are unable at this time to definitively quantify the impact of maternal education on poor birth outcomes for Aboriginal and Torres Strait Islanders.
Table 14: Summary of results – presence of an educational gradient and control of confounding factors

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Analysis adjusted for:</th>
<th>Maternal factors</th>
<th>Other factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Infant factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>Birth weight</td>
<td>Gestational Age</td>
</tr>
<tr>
<td>Study</td>
<td>IM</td>
<td>FM</td>
<td>NM</td>
</tr>
<tr>
<td>Australian indigenous populations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eades 2008</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Other Indigenous populations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differ 1994</td>
<td>NS</td>
<td>NS</td>
<td>SIG</td>
</tr>
<tr>
<td>Mitchell 1993</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pezzino 1996</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oyen 1990</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minority populations in developed countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collins 1998</td>
<td>SIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Din-Dzietham 1998</td>
<td>SIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mondal 2000</td>
<td>SIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parker 1994</td>
<td>SIG</td>
<td>SIG</td>
<td>SIG</td>
</tr>
<tr>
<td>Singh 1995</td>
<td>SIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stoltenberg 1998</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Developing countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adetunji 1995</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hertel-Fernandez 2007</td>
<td>SIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klufio 1994</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Lansky 2007</td>
<td>SIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pena 2000</td>
<td>SIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poerwanto 2003</td>
<td>SIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandiford 1997</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Terra de Souza 1999</td>
<td>SIG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Hertel-Fernandez 2007 – education data not adjusted for any other factors; Singh 1995 – a whole of population study Other factors controlled for: Lansky 2007 – caesarean section; Mitchell 1993 – season, infant age, sleeping position, bed sharing; Mondal 2000 – paternal education level; Klufio 1994 – previous perinatal death; Poerwanto 2003 – contraceptive methods, antenatal tetanus shots, marital duration, birth interval, place of delivery, province; Sandiford 1997 – water supply, ownership of toilet, ownership of fridge or car, aspects of house construction, literacy of woman’s mother, household structure (single or cohabiting and number of occupants per bedroom), woman’s calf circumference; Terra de Souza 1999 – adequacy of water supply, per capita gross Municipality product.
Table 14 continued: Summary of results – presence of an educational gradient and control of confounding factors

| Study                  | IM | FM | NM | PM | PNM | LBW | SGA | PT | SIDS | Sex | Birth weight | Gestational Birth order Multiple birth Fetal growth Age Parity Body mass Body height Marital status Smoking Prenatal care Age at first Breastfeeding Residence Consanguinity Country of birth Income/SES Year of birth |
|------------------------|----|----|----|----|-----|-----|-----|----|------|-----|--------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Developed countries    |    |    |    |    |     |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Arntzen 1996           | SIG|    |    |    |     |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Arntzen 2006           | SIG|    |    |    |     |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Arntzen 2007           | SIG| SIG|    |    |     |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Astone 2007            | SIG|    |    |    |     |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Bakkeig 1993           | SIG|    |    |    |     |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Bobak 1997             | SIG|    |    |    |     |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Chen 1998              | SIG| SIG| SIG| SIG| SIG| SIG| SIG| SIG|      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Clausson 1998          | SIG| SIG| SIG| SIG| SIG| SIG| SIG| SIG|      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Gisselmann 2005        | SIG| SIG| SIG| SIG| SIG| SIG| SIG| SIG|      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Hoyert 1990            | SIG|    |    |    |     |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Millar 1998            | SIG|    |    |    |     |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Morrison 1989          |    | NS | NS | NS | NS |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Olsen 1999             |    | NS | NS | NS | NS |     |     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Raum 2001              |    |    |    |    |     | SIG|     |    |      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |
| Singh 2007             | SIG| SIG| SIG| SIG| SIG| SIG| SIG| SIG|      |     |              |                |                |                |                |                |                |                |                |                |                |                |                |

NOTE: Bakkeig 1993 – no adjustments made; Bobak 1997 – no information about adjustment reported; Chen 1998 – LBW, SGA and PT analysis only adjusted for maternal age, marital status, parity and infant sex (and not BW, GA and fetal growth); Singh 2007 – a whole of population study. Other factors controlled for: Astone 2006 - mother’s family structure in childhood, mother’s number of siblings, grandmother received public assistance during mother’s childhood, income/needs ratio of mother’s household in childhood, mother’s activity status at pregnancy, grandmother’s pre-pregnancy BMI, median BW of grandmother’s children, grandmother’s smoking during pregnancy with mother, grandmother had sexually transmitted disease during or before pregnancy with mother, mother’s deviation from median BW of grandmother’s children, mother hospitalised before age 8; Morrison 1989 – eating breakfast regularly.
Preventing infant deaths among Aboriginal and teenage women in South Australia and infant mortality in Quebec.


References


## Appendix A – Excluded studies

<table>
<thead>
<tr>
<th>Reference</th>
<th>Ref#</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baldwin 2002</td>
<td>77</td>
<td>ME in native pop but not linked to IM</td>
</tr>
<tr>
<td>Bennett 2006</td>
<td>199</td>
<td>not IM</td>
</tr>
<tr>
<td>Bulterys 1990</td>
<td>224</td>
<td>not ME</td>
</tr>
<tr>
<td>Chandrashekar 1998</td>
<td>148</td>
<td>not ME</td>
</tr>
<tr>
<td>Chang 2007</td>
<td>57</td>
<td>not ME</td>
</tr>
<tr>
<td>Connolly 1999</td>
<td>39</td>
<td>letter and not ME</td>
</tr>
<tr>
<td>Cowden 2001</td>
<td>38</td>
<td>not ME</td>
</tr>
<tr>
<td>de Silva 1999</td>
<td>127</td>
<td>IM and ME not linked</td>
</tr>
<tr>
<td>Finch 2003</td>
<td>204</td>
<td>cannot extract meaningful ME data</td>
</tr>
<tr>
<td>Finger 2003</td>
<td>170</td>
<td>not relevant to topic</td>
</tr>
<tr>
<td>Fleshman 1992</td>
<td>100</td>
<td>Background</td>
</tr>
<tr>
<td>Grossman 2004</td>
<td>46</td>
<td>not ME</td>
</tr>
<tr>
<td>Irwin 1992</td>
<td>223</td>
<td>not ME</td>
</tr>
<tr>
<td>Jacob 2000</td>
<td>85</td>
<td>not ME</td>
</tr>
<tr>
<td>Matteson 1998</td>
<td></td>
<td>cannot extract meaningful ME data</td>
</tr>
<tr>
<td>Matthews 2007</td>
<td>4</td>
<td>general background IM</td>
</tr>
<tr>
<td>Mitchell 1997</td>
<td>217</td>
<td>doesn’t report SIDS x ME by ethnicity</td>
</tr>
<tr>
<td>MMRW 1999</td>
<td>89</td>
<td>not ME</td>
</tr>
<tr>
<td>Najman 1994</td>
<td>95</td>
<td>not ME</td>
</tr>
<tr>
<td>Oechsli 1995</td>
<td>135</td>
<td>Background</td>
</tr>
<tr>
<td>Olausson 1999</td>
<td>14</td>
<td>letter and not ME</td>
</tr>
<tr>
<td>Panaretto 2002</td>
<td>174</td>
<td>not ME</td>
</tr>
<tr>
<td>Paterson 2002</td>
<td>216</td>
<td>not SIDS – knowledge of risk factors</td>
</tr>
<tr>
<td>Pena 1999</td>
<td>48</td>
<td>exclude as only trend data</td>
</tr>
<tr>
<td>Phipps 2002</td>
<td>37</td>
<td>?teenage</td>
</tr>
<tr>
<td>Rich-Edwards 2003</td>
<td>205</td>
<td>cannot separate out ME data</td>
</tr>
<tr>
<td>Shaw 2005</td>
<td>8</td>
<td>not IM (child mortality)</td>
</tr>
<tr>
<td>Sims 2007</td>
<td>198</td>
<td>not ME</td>
</tr>
<tr>
<td>Singh 1996</td>
<td>21</td>
<td>not IM (child mortality)</td>
</tr>
<tr>
<td>Turrell 2000</td>
<td>230</td>
<td>Australia – not ME (uses SES)</td>
</tr>
<tr>
<td>van Enk 1998</td>
<td>181</td>
<td>not ME (uses SES)</td>
</tr>
</tbody>
</table>
Appendix B – Study summary tables

<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adetunji 1995 (#50)</td>
<td>Infants born to women aged 15-49.</td>
<td>IM: Death before age one or birth and 11 months (?)</td>
<td>Ondo State Demographic and Health Surveys for birth history, mortality and education</td>
<td>IM rates by ME:</td>
</tr>
<tr>
<td></td>
<td>Infants born between Jan 1982 and Dec 1985: n=2635</td>
<td>Education: No schooling, primary schooling, secondary or higher</td>
<td>Data analysis: Logistic regression</td>
<td>No schooling – 54.5 per 1000 (of 1229 live births)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Primary – 51.4 per 1000 (of 895 live births)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Secondary/higher – 68.5 per 1000 (of 511 live births)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Breaking down into</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Secondary – 83.3 per 1000 (of 348 live births)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Higher than secondary – 36.8 per 1000 (of 163 live births)</td>
</tr>
</tbody>
</table>

**Study context and overall findings**

The study found an unexpected relationship between IM and ME, with infants of women with the highest levels of education (secondary or higher) showing the highest levels of IM. Logistic regression analyses found that this effect could be explained by controlling for maternal age at childbirth and duration of breastfeeding. The author suggested that these two factors are reflective of harsh economic conditions in Nigeria prevailing during the study period which resulted in many teenage mothers (with secondary education) being forced to work and leave the care of their child to their uneducated/illiterate parents/in-laws and which resulted in reduced duration of breastfeeding.

**Reference IM rate**: Not reported separately

**Critical appraisal comments**

- Method of selecting groups: Well reported but sampled only one state in Nigeria – not clear if this is representative of whole country.
- Adjustment for confounding: (age, parity, SES, smoking)
- Only adjusted for maternal age, birth order and breastfeeding.
- Completeness of dataset: Based on data derived from surveys of mothers which seems likely to be incomplete. No information is given about how the quality of data collection and recording was assured.
- Risk of misclassification bias: Moderate
- Other comments: It is not clear whether the logistic regression which controlled for breastfeeding also controlled for maternal age and birth order.
- Overall risk of bias: Moderate-high
### Reference

Arntzen 1996 (#137)

**Location:** NORWAY  
**Dates:** 1989 – 1991

### Population

Singleton infants born live who survived the neonatal period (neonatal survivors)  
All live births  
\( n = 153,941 \)

### Definitions

**PNM:** Death from 28 to 364 days of life  
**Neonatal survivors:** Infants who survived neonatal period and were born with at least 28 weeks of gestational age  
**Education:**  
- Elementary (0-9 yrs schooling)  
- High school (10-12 yrs schooling)  
- Post high school (13+ yrs schooling)  
Those with unknown level of education excluded (3.5%)  

### Data sources and analysis

Medical Birth Registry of Norway for all live births and stillbirths after 16 wks GA and deaths in first year of life  
Population and Housing Census for 1990  
**Analysis:** First born and later born children studied separately. PNM rates expressed at deaths per 1000 infants surviving neonatal period. ORs and 95% CIs obtained from logistic regression using subgroup with lowest mortality rate as reference. Adjusted for maternal age and marital status. Not adjusted for smoking

### Maternal education outcomes

**PNM for first born and later born by ME (of all neonatal survivors):**

<table>
<thead>
<tr>
<th>Education Level</th>
<th>First Born</th>
<th>Later Born</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>rate per 1000</td>
</tr>
<tr>
<td>&lt;10</td>
<td>22/7261</td>
<td>2.9</td>
</tr>
<tr>
<td>10-12</td>
<td>98/42465</td>
<td>2.3</td>
</tr>
<tr>
<td>&gt;12</td>
<td>19/17598</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Adjusted and unadjusted OR (95%CI) for PNM by ME first born and later born:

<table>
<thead>
<tr>
<th>Education Level</th>
<th>First Born</th>
<th>Later Born</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR, Adj OR</td>
<td>OR, Adj OR</td>
</tr>
<tr>
<td>&lt;10</td>
<td>2.7, 2.5 (1.8 – 3.4)</td>
<td>2.7, 2.1 (1.4 – 3.1)</td>
</tr>
<tr>
<td>10-12</td>
<td>2.1, 1.6 (1.2 – 2.1)</td>
<td>1.5, 1.3 (0.9 – 1.8)</td>
</tr>
<tr>
<td>&gt;12</td>
<td>1.0, 1.0</td>
<td>1.0, 1.0</td>
</tr>
</tbody>
</table>

Adjusted for maternal age and marital status

**ORs for PNM comparing low vs high education (dichotomized variable):**

<table>
<thead>
<tr>
<th>First Born</th>
<th>Later Born</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4 (p=0.07)</td>
<td>1.5 (p=0.002)</td>
</tr>
</tbody>
</table>

### Study context and overall findings

This paper studied trends in PNM in Norway between 1968 and 1991. For the purposes of this report, only data from the most recent cohort (born 1989-1991) were extracted. Over the full study period the inverse relationship between ME and PNM was found to have increased such that in the final period an inverse relationship between ME and PNM was found for first and later born children. Over the same period the education levels generally improved significantly so that women with the lowest level of education reduced from 56.3% in the first cohort (1968-1971) to 10.7% in the final cohort. Highest levels of IM were found for the lowest level of ME even when adjusted for maternal age and marital status.

**Reference rates:** PNM (per 1000 neonatal survivors):  
First born – 2.1  
Later born – 3.0

### Critical appraisal comments

**Method of selecting groups:** Well reported and representative  
**Adjustment for confounding (age, parity, SES, smoking):** Only adjusted for maternal age and marital status. Did not adjust for smoking. However, studied first and later born children separately  
**Completeness of data set:** Good, as data obtained from Birth Registry.  
**Risk of classification bias:** Low as coding of IM and ME consistent over study period  
**Overall risk of bias:** Low-moderate
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arntzen 2006 (#2)</td>
<td>Live born infants with record linkages for parental education n=342433</td>
<td>PNM: Death from 28 to 364 days of life</td>
<td>Medical Birth Registry of Norway for all live births and stillbirths after 16 wks GA and deaths in first year of life</td>
<td>Cause specific PNM rates by ME</td>
</tr>
<tr>
<td>** Location: NORWAY **</td>
<td>** Dates: 1990 - 1995 **</td>
<td>Cause of death: (based on ICE) Congenital, Infection, SIDS, Other (asphyxia, immaturity, other specific, external, remaining) Education: Highest exam passed according to International Standard Classification of Education &lt;10, 10-12, &gt;12</td>
<td>Statistics Norway for parental education levels at Dec 31, 1998</td>
<td>ME Level: N rate per 1000 live births &lt;10 yrs 101/29705 3.42</td>
</tr>
<tr>
<td>** consistent with inclusion criteria for this review have only extracted data from last cohort born 1990-1995 **</td>
<td></td>
<td></td>
<td></td>
<td>10-12 yrs 436 /206635 2.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;12 yrs 121 /106140 1.14</td>
</tr>
<tr>
<td>Study context and overall findings</td>
<td></td>
<td></td>
<td></td>
<td>Adjusted OR (95%CI) for cause-specific PNM by ME:</td>
</tr>
<tr>
<td>This study considered cause-specific PNM rates in Norway from 1969 to 1995. Major causes of death were congenital conditions, sudden infant death syndrome and infections. PNM declined from 3.2/1000 live births in the 1970s to 1.9 per 1000 live births in the 1990s. Absolute risk for SIDS increased over the same period for mothers with low education and decreased for mothers with high education. Relative risk of SIDS in infants for mothers with low education increased from 1.02 in 1970s to 5.63 in the 1990s. Authors concluded that increased social inequality for PNM due to increases in absolute and relative risk of SIDS among infants of mothers with low education.</td>
<td></td>
<td><strong>Congenital conditions</strong></td>
<td><strong>Infections</strong></td>
<td></td>
</tr>
<tr>
<td>Method of selecting groups: Well reported and representative Adjustment for confounding (age, parity, SES, smoking): Only adjusted for maternal age and parity. Did not adjust for smoking or SES</td>
<td></td>
<td>10-12 yrs 1.24 (0.89-1.73) 6.30 (1.94-29.53)</td>
<td></td>
<td>&gt;12 yrs 1.00 1.00</td>
</tr>
<tr>
<td>Completeness of data set: Good, as data obtained from Birth Registry</td>
<td></td>
<td>SIDS Other</td>
<td></td>
<td>&lt;10 yrs 2.94 (1.89-4.57) 3.30 (1.89-5.74)</td>
</tr>
<tr>
<td>Risk of misclassification bias: low as coding of IM and ME consistent over study period</td>
<td></td>
<td>10-12 yrs 1.85 (1.30-2.62) 2.14 (1.40-3.26)</td>
<td></td>
<td>&gt;12 yrs 1.00 1.00</td>
</tr>
<tr>
<td>Overall risk of bias: Low to moderate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Critical appraisal comments**

| **Method of selecting groups:** Well reported and representative **Adjustment for confounding (age, parity, SES, smoking):** Only adjusted for maternal age and parity. Did not adjust for smoking or SES **Completeness of data set:** Good, as data obtained from Birth Registry **Risk of misclassification bias:** low as coding of IM and ME consistent over study period **Overall risk of bias:** Low to moderate |
Preventing infant deaths among Aboriginal and teenage women in South Australia

Sweden: 4.7
Norway: 5.3
Finland: 4.2
Denmark: 5.9

Reference rate: infant mortality per 1000 live births 1987-2000

<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arntzen 2007 (#7)</td>
<td>Live born singletons with a gestational age of 22 weeks or more</td>
<td>NM: Death from 0 to 27 days of life</td>
<td>Medical Birth Registry of Denmark, Finland, Sweden and Norway</td>
<td>Crude RR (95% CI) of NM by ME (1996-2000)</td>
</tr>
<tr>
<td>Location: SCANDINAVIA</td>
<td>Denmark: 1179831</td>
<td>PNM: Death from 28 to 364 days of life</td>
<td>Data-linked to national registries and censuses on parental education and other sociodemographic factors</td>
<td>Denmark: 1.50 (1.27 to 1.78)</td>
</tr>
<tr>
<td>Dates: 1996-2000</td>
<td>Finland: 834999</td>
<td>Education: Highest exam passed according to International Standard Classification of Education</td>
<td>Analysis: Association between ME and NM and PNM estimated as absolute risk difference (RD) using linear regression and relative risk (RR) using log binomial regression.</td>
<td>Finland: 1.24 (0.99 to 1.55)</td>
</tr>
<tr>
<td>** consistent with inclusion criteria for this review have only extracted data from last cohort born 1996-2000</td>
<td>Norway: 1017168</td>
<td>Low: &lt;10 yrs</td>
<td>Analysis adjusted for maternal age and parity.</td>
<td>Norway: 1.46 (1.05 to 2.02)</td>
</tr>
<tr>
<td></td>
<td>Sweden: 1971645</td>
<td>Medium: 10-12 yrs</td>
<td></td>
<td>Sweden: 1.21 (0.96 to 1.52)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High: &gt;12 yrs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Study context and overall findings

This study aimed to assess if the educational gradient in neonatal and postneonatal mortality was increasing, decreasing or stable between 1981 and 2000. Overall, mortality decreased in all educational groups and education levels increased over study period. Absolute and relative differences in NM by educational level decreased in Finland and Sweden and increased in Denmark. In Norway there was an increase in absolute difference but a decrease in relative difference. For PNM relative educational differences increased in all four countries whereas absolute differences decreased.

### Definitions

- **NM**: Death from 0 to 27 days of life
- **PNM**: Death from 28 to 364 days of life
- **Education**: Highest exam passed according to International Standard Classification of Education

### Data sources and analysis

- Medical Birth Registry of Denmark, Finland, Sweden and Norway
- Data-linked to national registries and censuses on parental education and other sociodemographic factors

### Critical appraisal comments

- **Method of selecting groups**: Well reported and representative
- **Adjustment for confounding (age, parity, SES, smoking)**: Only adjusted for maternal age and parity. Did not adjust for smoking or SES
- **Completeness of data set**: Very good. Infant mortality considered to be 100% ascertained for Nordic Medical Birth Registries. Maternal education also high ascertainment and reliability.
- **Risk of misclassification bias**: Low as coding of IM and ME consistent over study period. However, as education level was only obtained in 2000 possible that mothers who obtained educational qualification after childbirth may lead to overestimation of level of education and underestimation of educational differences. However, authors state that results likely to largely unbiased.
- **Overall risk of bias**: Low to moderate

### Maternal education outcomes

<table>
<thead>
<tr>
<th>Location</th>
<th>Crude RR (95% CI) of NM by ME (1996-2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>1.50 (1.27 to 1.78)</td>
</tr>
<tr>
<td>Finland</td>
<td>1.24 (0.99 to 1.55)</td>
</tr>
<tr>
<td>Norway</td>
<td>1.46 (1.05 to 2.02)</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.21 (0.96 to 1.52)</td>
</tr>
</tbody>
</table>

### Unadjusted RR (95% CI) for NM by ME:

<table>
<thead>
<tr>
<th>Location</th>
<th>Unadjusted RR (95% CI) for NM by ME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>1.18 (0.76 to 1.59)</td>
</tr>
<tr>
<td>Finland</td>
<td>0.65 (0.25 to 1.05)</td>
</tr>
<tr>
<td>Norway</td>
<td>1.09 (0.47 to 1.70)</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.18 (0.76 to 1.59)</td>
</tr>
</tbody>
</table>

### Adjusted RR (95% CI) for NM by ME:

<table>
<thead>
<tr>
<th>Location</th>
<th>Adjusted RR (95% CI) for NM by ME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>1.15 (0.98 to 1.35)</td>
</tr>
<tr>
<td>Finland</td>
<td>0.80 (0.02 to 1.54)</td>
</tr>
<tr>
<td>Norway</td>
<td>0.85 (0.05 to 1.04)</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.09 (0.92 to 1.30)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Crude RD (95% CI) of NM by ME (1996-2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>2.32 (1.77 to 3.04)</td>
</tr>
<tr>
<td>Finland</td>
<td>1.80 (1.31 to 2.47)</td>
</tr>
<tr>
<td>Norway</td>
<td>2.94 (1.88 to 4.59)</td>
</tr>
<tr>
<td>Sweden</td>
<td>2.57 (1.93 to 3.42)</td>
</tr>
</tbody>
</table>

### Adjusted RD (95% CI) for NM by ME:

<table>
<thead>
<tr>
<th>Location</th>
<th>Adjusted RD (95% CI) for NM by ME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>1.12 (0.96 to 1.31)</td>
</tr>
<tr>
<td>Finland</td>
<td>1.09 (0.92 to 1.30)</td>
</tr>
<tr>
<td>Norway</td>
<td>1.09 (0.93 to 1.28)</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.09 (0.92 to 1.30)</td>
</tr>
</tbody>
</table>

### Adjusted RD (95% CI) for PNM by ME:

<table>
<thead>
<tr>
<th>Location</th>
<th>Adjusted RD (95% CI) for PNM by ME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>1.46 (1.05 to 2.02)</td>
</tr>
<tr>
<td>Finland</td>
<td>1.21 (0.96 to 1.52)</td>
</tr>
<tr>
<td>Norway</td>
<td>1.24 (1.02 to 1.47)</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.24 (1.02 to 1.47)</td>
</tr>
</tbody>
</table>

### Adjusted RD (95% CI) for PNM by ME:

<table>
<thead>
<tr>
<th>Location</th>
<th>Adjusted RD (95% CI) for PNM by ME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>1.33 (0.76 to 1.91)</td>
</tr>
<tr>
<td>Finland</td>
<td>0.50 (-0.05 to 1.04)</td>
</tr>
<tr>
<td>Norway</td>
<td>0.80 (0.02 to 1.54)</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.37 (-0.10 to 0.84)</td>
</tr>
</tbody>
</table>

### Adjusted RD (95% CI) for PNM by ME:

<table>
<thead>
<tr>
<th>Location</th>
<th>Adjusted RD (95% CI) for PNM by ME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>2.32 (1.77 to 3.04)</td>
</tr>
<tr>
<td>Finland</td>
<td>1.80 (1.31 to 2.47)</td>
</tr>
<tr>
<td>Norway</td>
<td>2.94 (1.88 to 4.59)</td>
</tr>
<tr>
<td>Sweden</td>
<td>2.57 (1.93 to 3.42)</td>
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</table>
Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

### Reference: Astone 2007 (#197)

#### Location: UNITED STATES

#### Dates: 1990 - 1995

| Live born infants with no known disabilities at birth who were children of women born from 1960 to 1964. 80% African American, 20% European American highly disadvantaged. Excluded infants without a BW recorded; twins; BW<500g; mothers with diabetes. Final sample for study: n=987 infants. |

#### Education: High school diploma or less; some college or more

**Pathways to Adulthood Study (PAS) part of the National Collaborative Perinatal Project. Studied women who presented to Johns Hopkins Hospital for prenatal care 1960 to 1964 (Generation 1 – G1); the children of these women (G2) and the children of the G2 women (G3). Data for the PAS collected when G2 women were between 27 and 33 years old (response rate 65.5%).**

- **Analysis limited to only infants whose mother was only female child (or eldest female child) of original sample of G1 mothers (to avoid difficulties with clustering of siblings and cousins in this intergenerational study design)**

#### Data sources and analysis

**Infant birthweight in grams as reported by the mother**

- BW: Infant birthweight in grams as reported by the mother
- Education: High school diploma or less; some college or more

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<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
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<td>Pathways to Adulthood Study (PAS) part of the National Collaborative Perinatal Project. Studied women who presented to Johns Hopkins Hospital for prenatal care 1960 to 1964 (Generation 1 – G1); the children of these women (G2) and the children of the G2 women (G3). Data for the PAS collected when G2 women were between 27 and 33 years old (response rate 65.5%). <strong>Analysis limited to only infants whose mother was only female child (or eldest female child) of original sample of G1 mothers (to avoid difficulties with clustering of siblings and cousins in this intergenerational study design)</strong></td>
<td>Mean [SD] BW by ME: High school diploma or less – 3138 [645]g n=678 Some college or higher – 3255 [610] g n=311 p=0.001</td>
</tr>
</tbody>
</table>

#### Mean difference in BW: some college compared to high school only 81.7 g (95%CI: 3.7 to 159.6)

**Mean BW by mother’s (G2) and grandmothers’ (G1) education level: G2 high school diploma or less G1 <HS diploma – 3077g reference for mean differences G1 HS diploma or higher – 3338g unadjusted mean difference: 261 (95%CI:71 to 292)g adjusted mean difference: 181 (95%CI:71 to 292)g G2 high school diploma or higher G1 <HS diploma – 3253g unadjusted mean difference: 176 (95%CI:151 to 201)g adjusted mean difference: 131 (95%CI: 42 to 221) g G1 HS diploma or higher – 3261g unadjusted mean difference: 185 (95%CI:113 to 257)g adjusted mean difference: 136 (95% CI: -7 to 279)g**

- Adjusted for: G2 family structure in childhood, G2 number of siblings, G1 received public assistance during G2 childhood, income/needs ratio of G2 household in childhood, G2 activity status at pregnancy with G3, G2 marital status at pregnancy with G3, G2 age at first birth, G3 infant sex, G1 pre-pregnancy BMI, median BW of G1 children, G1 smoking during pregnancy with G2, G1 had sexually transmitted disease during or before pregnancy with G2, G2 deviation from median BW of G1’s children, G2 adult height, G2 hospitalised before age 8, G2 smoking during pregnancy with G3 infant, parity.

#### Study context and overall findings

- Studied the effect of maternal socioeconomic status throughout the lifespan on infant birthweight, specifically whether maternal SES during childhood and at time of pregnancy were independently associated with birthweight when biological determinants controlled for. Used intergenerational study design using three generations of mothers and grandmothers of the index infants over a 25 year period. Maternal and grandmaternal education level were significantly associated with infant birthweight. There was a 81.7g mean difference in birthweight comparing mothers with low versus high education and 117.3g mean difference in birthweight comparing grandmothers with low versus high education. Among women with low education (less than high school diploma) there was a mean difference in birthweight of 181g comparing grandmothers with high versus low education. These results were adjusted for a large range of maternal and grandmaternal socioeconomic and pregnancy related factors.

#### Critical appraisal comments

- Method of selecting groups: Well reported. 80% of sample African-American and other 20% highly disadvantaged European Americans
- Adjustment made for confounding (age, parity, SES, smoking)
- Adjusted for all four factors
- Completeness of dataset: Attrition analysis showed sample unbiased in terms of SES. Infant health determined from survey and not from birth certificates.
- Risk of misclassification bias: Low
- Overall risk of bias: Low-moderate

#### Reference data: mean birthweight in g

- 3175g (SD637g, median 3232, range 680 to 5358g)
### Reference

**Bakketeig 1993 (#26)**

**Location:** SCANDINAVIA

**Dates:**
- Denmark 1982-1983
- Sweden 1985-1986
- Norway 1979-1982

**Population**
- Singleton live born infants (greater than 28wks GA)
- Denmark 1982-1983: n=102215
- Sweden 1985-1986: n=185156
- Norway 1979-1982: n=199596

**Definitions**
- **Fetal death:** 16 wks GA or more
- **NM:** 0-27 days of life
- **PNM:** 28 to 364 days of life
- **LBW:** <2500 grams
- **Education:**
  - low: <10 yrs (<9yrs Denmark)
  - high: >12 yrs

**Data sources and analysis**
- Medical birth registries Denmark, Norway, Sweden for births
- Death registries for deaths
- Medical birth registries of Denmark and Sweden for level of education, and record linkage with Norwegian Census data 1980.

### Maternal education outcomes

<table>
<thead>
<tr>
<th>Location</th>
<th>Late fetal death per 1000 livebirths and relative risks by ME:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low education</td>
</tr>
<tr>
<td>Denmark</td>
<td>6.6 per 1000</td>
</tr>
<tr>
<td></td>
<td>4.0 per 1000</td>
</tr>
<tr>
<td>Norway</td>
<td>11.9 per 1000</td>
</tr>
<tr>
<td></td>
<td>7.6 per 1000</td>
</tr>
<tr>
<td>Sweden</td>
<td>4.0 per 1000</td>
</tr>
<tr>
<td></td>
<td>2.8 per 1000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>NM per 1000 livebirths and relative risks by ME:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low education</td>
</tr>
<tr>
<td>Denmark</td>
<td>5.3 per 1000</td>
</tr>
<tr>
<td></td>
<td>4.4 per 1000</td>
</tr>
<tr>
<td>Norway</td>
<td>5.5 per 1000</td>
</tr>
<tr>
<td></td>
<td>3.7 per 1000</td>
</tr>
<tr>
<td>Sweden</td>
<td>3.2 per 1000</td>
</tr>
<tr>
<td></td>
<td>2.9 per 1000</td>
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<table>
<thead>
<tr>
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<td></td>
<td>low education</td>
</tr>
<tr>
<td>Denmark</td>
<td>4.3 per 1000</td>
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<td>2.4 per 1000</td>
</tr>
<tr>
<td>Norway</td>
<td>4.4 per 1000</td>
</tr>
<tr>
<td></td>
<td>2.4 per 1000</td>
</tr>
<tr>
<td>Sweden</td>
<td>2.7 per 1000</td>
</tr>
<tr>
<td></td>
<td>1.6 per 1000</td>
</tr>
</tbody>
</table>

### Critical appraisal comments

**Method of selecting groups:** Well reported and representative

**Adjustment made for confounding (age, parity, SES, smoking):**
- Used some stratified analysis but did not include all confounders in a multiple regression. Specifically did not adjust for maternal age, parity, SES or smoking

**Completeness of dataset:** Good

**Risk of misclassification bias:** Unclear

**Overall risk of bias:** Moderate

### Study context and overall findings

- Used maternal education level as a measure of socioeconomic status to examine differences in IM and LBW in three Scandinavian countries. Found socioeconomic differences in all three countries impacted on birthweight and infant mortality. Association between parental education and PM appeared stronger in Denmark and Norway than Sweden, for PNM same in all three countries. In Norway, association between paternal education and PM and NM equally strong as with maternal education.
## Preventing infant deaths among Aboriginal and teenage women in South Australia

### Reference

**Bicego 1993 (#25)**

**INTERNATIONAL**

**Location:** 17 developing countries

**Dates:** 1987 to 1990

### Definitions

- **NM:** Death from zero completed months to less than 31 days of life.
- **PNM:** Death at 1 to 23 completed months of life

**Education:**
- no education
- some primary but no secondary
- some secondary

Categories with less than 10% of births collapsed into no education and any education (group B countries)

### Data sources and analysis

Demographic and Health Survey Data sets from 17 developing countries: Bolivia, Colombia, Dominican Republic, Guatemala, Burundi, Ghana, Kenya, Mali, Senegal, Togo, Uganda, Zimbabwe, Egypt, Morocco, Tunisia, Thailand, Sri Lanka. Surveys conducted between 1987 and 1990.

Analysis: Logistic regression with theoretically low risk category as reference (i.e. higher education).

Adjusted for:
- Model 1: economic status
- Model 2: economic status and family formation
- Model 3: economic status, family formation, health service use
- Urban vs Rural (interaction)

### Maternal education outcomes

**RR of NM by ME:** no education vs secondary education

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<th>trimean of B countries</th>
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<tbody>
<tr>
<td>unadjusted RR</td>
<td>32 per 1000</td>
<td>40 per 1000</td>
</tr>
<tr>
<td>model 1</td>
<td>1.65</td>
<td>1.25</td>
</tr>
<tr>
<td>model 2</td>
<td>1.40</td>
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<td>model 3</td>
<td>1.31</td>
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<td>interaction</td>
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</table>

**RR of PNM by ME:** no education vs secondary education

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<tr>
<td>unadjusted RR</td>
<td>39 per 1000</td>
<td>53 per 1000</td>
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<td>model 1</td>
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<td>model 3</td>
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<tr>
<td>interaction</td>
<td>0.47</td>
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Adjusted for:
- Model 1: economic status
- Model 2: economic status and family formation
- Model 3: economic status, family formation, health service use
- Urban vs Rural (interaction)

### Study context and overall findings

Survey data from 17 developing countries comparing level of maternal education and infant and child survival for children under 2 years. Identified an educational gradient that was more pronounced in the postneonatal period and was moderated to a varying degree by the link between education and household economic status. Overall, PNM risk was found to be nearly twice as sensitive to effects of ME as NM risk when household economic status taken into account.

### Critical appraisal comments

- **Method of selecting groups:** Well reported and representative
- **Adjustment made for confounding (age, parity, SES, smoking):**
- Adjusted for economic status only but population level data analysis
- **Completeness of dataset:** Good
- **Risk of misclassification bias:** Likely to be some underreporting of child deaths among less educated mothers producing downward bias in estimate
- **Overall risk of bias:** Low-moderate
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<td></td>
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<td>LBW: &lt;2500 grams</td>
<td>Education level: Source not reported.</td>
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<td></td>
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<tr>
<td>Overall risk of bias: High</td>
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Reference rates: per 1000 live births

- All BW – 6.1
- BW<1500g – 392.0
- BW 1500-2499 – 32.7
- BW>2500 – 1.8
Preventing infant deaths among Aboriginal and teenage women in South Australia

Reference: Chen 1998 (#200)

**Population**: Singleton live births of any BW or GA in Quebec, Canada during study period

**Definitions**
- IM: 0 to 364 days of life
- NM: 0 to 27 days of life
- ENM: 0 to 6 days of life
- LNM: 7 to 27 days of life
- PNM: 28 to 364 days of life
- Stillbirth: Death of fetus weighing at least 500g at birth regardless of GA
- FIM: Stillbirth + IM
- FM: Stillbirth
- PM: Stillbirth + early NM
- EPM: Stillbirth + NM
- LBW: 500g to 2499g
- SGA: Below 10th percentile of Canadian BW norms
- AGA: 10th to 90th percentile
- LGA: Greater than 90th percentile
- Preterm: Birth less than 37 weeks completed gestation

**Data sources and analysis**
- Canadian Birth Database and Canadian Mortality Database.
- Analysis: Crude RR, crude and adjusted ORs (logistic regression) and HR (using survival analysis) calculated to investigate relationship between maternal education and fetal and infant mortality. Adjusted for maternal age, parity, marital status, infant sex, BW, GA and fetal growth. When GA and fetal growth included in models LBW was excluded because it is known to be a result of preterm birth, fetal growth restriction or a combination of the two. Population attributable risk calculated and attributable fraction in two groups with lowest education calculated.

**Maternal education outcomes**

<table>
<thead>
<tr>
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<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
</table>
| Chen 1998 (#200) | Singleton live births of any BW or GA in Quebec, Canada during study period | Singleton births: 192150 Stillbirths: 859 Infant deaths: 1004 | Canadian Birth Database and Canadian Mortality Database. | Unadjusted feto-infant mortality rates (per 1000 live births) by ME:
| Location: Quebec, CANADA | Dates: 1990-1991 | IM: 0 to 364 days of life NM: 0 to 27 days of life ENM: 0 to 6 days of life LNM: 7 to 27 days of life PNM: 28 to 364 days of life Stillbirth: Death of fetus weighing at least 500g at birth regardless of GA FIM: Stillbirth + IM FM: Stillbirth PM: Stillbirth + early NM EPM: Stillbirth + NM LBW: 500g to 2499g SGA: Below 10th percentile of Canadian BW norms AGA: 10th to 90th percentile LGA: Greater than 90th percentile Preterm: Birth less than 37 weeks completed gestation | Analysis: Crude RR, crude and adjusted ORs (logistic regression) and HR (using survival analysis) calculated to investigate relationship between maternal education and fetal and infant mortality. Adjusted for maternal age, parity, marital status, infant sex, BW, GA and fetal growth. When GA and fetal growth included in models LBW was excluded because it is known to be a result of preterm birth, fetal growth restriction or a combination of the two. Population attributable risk calculated and attributable fraction in two groups with lowest education calculated. |
| Reference rate: infant deaths per 1000 births (live births plus stillbirths) | 10 | Unadjusted OR (95%CI) FIM by ME: (ref 14+ yrs ME) | |

**Study context and overall findings**

Studied the impact of maternal education levels on fetal and infant mortality. Both FM and IM rates were higher for mothers with less than 12 years of education compared to mothers with at least 14 years of education, even after adjusting for maternal age, parity, marital status and infant sex. However, when the analysis was also adjusted for birthweight, gestational age and fetal growth risk of IM, NM and PNM were not significantly different for women with 12-13 years of education compared to women with more than 14 years of education, although differences between women with lower levels of education (0-10 years and 11 years) and women with more than 14 years of education persisted.

**Critical appraisal comments**

Method of selecting groups: Well reported and representative
Adjustment made for confounding (age, parity, SES, smoking): Did not adjust for smoking or SES
Completeness of dataset: Good
Risk of misclassification bias: Low
Overall risk of bias: Low-moderate

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| Reference rate: infant deaths per 1000 births (live births plus stillbirths) | 10 | Unadjusted OR (95%CI) FIM by ME: (ref 14+ yrs ME) | |

**Study context and overall findings**

Studied the impact of maternal education levels on fetal and infant mortality. Both FM and IM rates were higher for mothers with less than 12 years of education compared to mothers with at least 14 years of education, even after adjusting for maternal age, parity, marital status and infant sex. However, when the analysis was also adjusted for birthweight, gestational age and fetal growth risk of IM, NM and PNM were not significantly different for women with 12-13 years of education compared to women with more than 14 years of education, although differences between women with lower levels of education (0-10 years and 11 years) and women with more than 14 years of education persisted.

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Risk of misclassification bias: Low
Overall risk of bias: Low-moderate
Maternal Education

### Unadjusted mortality hazard ratio (95%CI) by cause of death and ME: (ref 14+ yrs ME)

<table>
<thead>
<tr>
<th>ME ed (yrs)</th>
<th>0-10</th>
<th>11</th>
<th>12-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>all FIM</td>
<td>1.67 (1.20 to 2.33)</td>
<td>1.61 (1.14 to 2.28)</td>
<td>1.06 (0.78 to 1.43)</td>
</tr>
<tr>
<td>all IM</td>
<td>1.62 (1.38 to 1.90)</td>
<td>1.52 (1.29 to 1.79)</td>
<td>1.18 (1.03 to 1.35)</td>
</tr>
<tr>
<td>congenital</td>
<td>1.61 (1.37 to 1.91)</td>
<td>1.52 (1.29 to 1.79)</td>
<td>1.18 (1.03 to 1.35)</td>
</tr>
<tr>
<td>asphyxia</td>
<td>1.50 (1.27 to 1.78)</td>
<td>1.48 (1.26 to 1.73)</td>
<td>1.11 (0.94 to 1.31)</td>
</tr>
<tr>
<td>immaturity</td>
<td>1.50 (1.27 to 1.78)</td>
<td>1.48 (1.26 to 1.73)</td>
<td>1.11 (0.94 to 1.31)</td>
</tr>
<tr>
<td>SIDS</td>
<td>1.50 (1.27 to 1.78)</td>
<td>1.48 (1.26 to 1.73)</td>
<td>1.11 (0.94 to 1.31)</td>
</tr>
<tr>
<td>infection</td>
<td>1.50 (1.27 to 1.78)</td>
<td>1.48 (1.26 to 1.73)</td>
<td>1.11 (0.94 to 1.31)</td>
</tr>
<tr>
<td>external</td>
<td>1.50 (1.27 to 1.78)</td>
<td>1.48 (1.26 to 1.73)</td>
<td>1.11 (0.94 to 1.31)</td>
</tr>
<tr>
<td>other</td>
<td>1.50 (1.27 to 1.78)</td>
<td>1.48 (1.26 to 1.73)</td>
<td>1.11 (0.94 to 1.31)</td>
</tr>
</tbody>
</table>

p<0.05 for each category of mortality

### Adjusted mortality hazard ratio (95%CI) by cause of death and ME: (ref 14+ yrs ME)

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p<0.05 for each category of mortality
### Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

<table>
<thead>
<tr>
<th>Category</th>
<th>Adjusted OR (95%CI) for FIM by ME: (ref 14+ yrs ME)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ed (yrs) 0-10 11 12-13</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.05 for each category of mortality</td>
</tr>
<tr>
<td>ME</td>
<td>LBW (95%CI)</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------</td>
</tr>
<tr>
<td>PM</td>
<td>1.02 (0.82 to 1.27)</td>
</tr>
<tr>
<td>NM</td>
<td>0.93 (0.70 to 1.22)</td>
</tr>
<tr>
<td>EPM</td>
<td>1.01 (0.82 to 1.24)</td>
</tr>
<tr>
<td>PNM</td>
<td>1.40 (1.00 to 1.96)</td>
</tr>
</tbody>
</table>

Adjusted for maternal age, marital status, parity and infant sex and BW

**Unadjusted OR (95%CI) for LBW, PT and SGA by ME:** (ref 14+ yrs ME)

<table>
<thead>
<tr>
<th>ed (yrs)</th>
<th>LBW (95%CI)</th>
<th>PT (95%CI)</th>
<th>SGA (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>2.06 (1.94 to 2.19)</td>
<td>1.78 (1.66 to 1.90)</td>
<td>1.39 (1.32 to 1.47)</td>
</tr>
<tr>
<td>11</td>
<td>1.53 (1.44 to 1.62)</td>
<td>1.36 (1.28 to 1.45)</td>
<td>1.20 (1.15 to 1.26)</td>
</tr>
<tr>
<td>12-13</td>
<td>1.94 (1.86 to 2.03)</td>
<td>1.69 (1.61 to 1.78)</td>
<td>1.40 (1.35 to 1.46)</td>
</tr>
</tbody>
</table>

p<0.05 for all categories

**Adjusted OR (95%CI) for LBW, PT and SGA by ME:** (ref 14+ yrs ME)

<table>
<thead>
<tr>
<th>ed (yrs)</th>
<th>LBW (95%CI)</th>
<th>PT (95%CI)</th>
<th>SGA (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>2.07 (1.94 to 2.21)</td>
<td>1.79 (1.67 to 1.92)</td>
<td>1.42 (1.34 to 1.50)</td>
</tr>
<tr>
<td>11</td>
<td>1.48 (1.39 to 1.58)</td>
<td>1.35 (1.26 to 1.44)</td>
<td>1.21 (1.15 to 1.27)</td>
</tr>
<tr>
<td>12-13</td>
<td>2.04 (1.95 to 2.15)</td>
<td>1.73 (1.65 to 1.82)</td>
<td>1.43 (1.38 to 1.49)</td>
</tr>
</tbody>
</table>

p<0.05 for all categories

Adjusted for maternal age, marital status, parity and infant sex
<table>
<thead>
<tr>
<th>Reference</th>
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<th>Maternal education outcomes</th>
</tr>
</thead>
</table>
| Clausson 1998 (R131) | Liveborn singleton infants to nulliparous women during the study period n=96662 | **SGA**: Birthweight 2 standard deviations below the mean weight for GA and gender on Swedish national birthweight curve  
32 wks completed GA: 1500g  
36 wks completed GA: 2100g  
40 wks completed GA: 2750g  
**AGA**: Appropriate for GA – weight above -2SD but below +2SD  
**Preterm (PT)**:  
very PT – < 32 completed wks  
mod PT – 33 – 36 completed wks  
term - >37 wks  
**Maternal age**: Completed age at time of delivery  
**Maternal education**: Number of completed years at school  
**NM**: Death occurring during first 27 completed days of life  
**PNM**: Death occurring from 28 completed days to 1 year | Swedish Medical Birth Register for BW information  
Statistics Sweden for education and country of birth | **SGA infants**: 3700/96662 (3.8%)  
Very PT – 8.1% (compared with 1.2% of all infants)  
Mod PT – 11.8% (compared with 5.2% of all infants)  
In very PT infants: 24.7% SGA  
In mod PT infants: 8.7% SGA  
In term infants: 3.3% SGA |
|                 | Excluded stillborn, multiple gestations, births to parous women, missing maternal age, missing GA at delivery. | **SGA rates by ME**:  
<9: 566/11790 (4.8%)  
10-12: 1956/51481 (3.8%)  
13-14: 486/15675 (3.1%)  
15+: 372/10340 (3.6%)  
(Adjusted for: not reported but could include maternal age, height, BMI, smoking, and country of birth) | **Adjusted OR (95%CI) for SGA by GA and ME**:  
education up to 32  
<9: 1.6 (1.0 to 2.7)  
10-12: 1.6 (1.1 – 2.3)  
13-14: 1.0  
15+: 1.2 (0.7 to 1.9) | **Critical appraisal comments**  
Studied risk factors for small for gestational age and IM rates among SGA births. Compared to mothers with high levels of education, mothers with low education had higher rates of moderately preterm and term SGA infants. Low education levels were associated with an increased risk of very and moderately preterm SGA. Compared to women with 13-14 years of education, women with < 9 years of education had twice the risk of having a moderately PT SGA infant and 1.6 times the risk of having a very PT SGA infant. Women with 10 – 12 years of education had 1.4 times the risk of having a moderately PT SGA infant and 1.6 times the risk of having a very PT SGA infant. The overall risk of having an SGA infant was 1.2 time higher for both groups of women. There was no significant difference in SGA rates between women with 13 to 14 years of education and women with 15 or more years of education.  
**Reference rates**:  
SGA – 3.8% (n=96662)  
Very preterm – 1.2% (8.1% in SGA infants)  
Preterm – 5.2% (11.8% in SGA infants) | Method of selecting groups: Well reported and representative  
Adjustment made for confounding (age, parity, SES, smoking): Did not adjust for parity.  
Completeness of dataset: Good  
Risk of misclassification bias: Low  
Other comments: Prospective data collection on exposures during pregnancy limited effect of recall bias on results.  
Overall risk of bias: low |
### Reference

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</table>
| Collins 1998 (#211) | Liveborn Mexican-American singleton infants born to Chicago residents during study period | **GA**: Based on first day of last menstrual period  **SGA**: Weight for GA <10th percentile  **ME**: <12 years, 12 years, >12 yrs | Linked Birth-Death records 1982-1983 and 1980 US Census.  **Analysis**: Proportion of SGA infants in each subgroup by maternal age, education, marital status, prenatal care, parity, median family income. RR (95%CI) for each group (foreign born and US born Mexican Americans) by risk factors. Multiple regression analysis used to estimate independent effect of maternal nativity on SGA | RR (95%CI) of SGA by ME: US born compared to foreign born  
Education (yrs):  
<12 - 2.2 (1.5 to 3.3) (US born 3.1% foreign born 1.4%)  
12 - 1.0 (0.4 to 2.5) (US born 1.1% foreign born 1.1%)  
>12 – 1.1 (0.4 to 3.2) (US born 1.8% foreign born 1.7%)  
In multiple logistic regression: adjusted OR (95%CI) for SGA – 1.2 (0.6 to 2.9) for US born. Adjusted for maternal age, education level, marital status, parity, adequacy of prenatal care and income level |

### Study context and overall findings

- Studied small for gestational age (SGA) rate among Mexican Americans mothers born in the US compared with those born in Mexico. The relative risk of SGA was 2.2 times higher for US-born mothers with less than 12 years of education compared with foreign-born mothers (RR 2.2, 95%CI:1.5 to 3.3) but there were no other differences between the two groups according to educational attainment. In a multiple logistic regression the odds ratio for SGA among US born Mexican American mothers was not significant (1.2, 95%CI: 0.6 to 2.9) when maternal age, education level, marital status, parity, adequacy of prenatal care and income level were controlled.

### Critical appraisal comments

- **Method of selecting groups**: Well reported and representative  
- **Adjustment made for confounding** (age, parity, SES, smoking): Did not adjust for SES or smoking  
- **Completeness of dataset**: Good  
- **Risk of misclassification bias**: Low, however, not clear whether reports of SGA on the US Vital statistics records are accurate (due to difficulties with ESL). Not clear whether interuterine growth retardation curves are appropriate for Mexican American infants.  
- **Other comments**: Authors note that recently arrived foreign-born Mexican American women may not have accumulated sufficient funds to move out of impoverished areas and schooling systems differ in Mexico making comparisons of income and educational level problematic.  
- **Overall risk of bias**: Moderate.
Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

### Reference

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</tr>
</thead>
<tbody>
<tr>
<td>Din-Dzietham 1998 (#49)</td>
<td>Infants of black and white mothers born during study period.</td>
<td>Infant death: Death per 1000 live births</td>
<td>ORs (95%CI) black infant death by ME: reference white:</td>
</tr>
<tr>
<td>Location: North Carolina, USA</td>
<td>All black or white births: n=595645 (other racial groups excluded – 2.6%)</td>
<td>Race: As reported by woman</td>
<td>Unadj</td>
</tr>
<tr>
<td>Dates: 1988 – 1993</td>
<td>Data matched n=569960</td>
<td>GA: delivery date – date of last normal menstrual period</td>
<td>&lt;12 yrs</td>
</tr>
<tr>
<td></td>
<td>Education:</td>
<td></td>
<td>12 yrs</td>
</tr>
<tr>
<td></td>
<td>&lt;12 yrs; 12 yrs; &gt;12 yrs</td>
<td></td>
<td>&gt;12 yrs</td>
</tr>
<tr>
<td></td>
<td>Prenatal care initiation:</td>
<td>Analyses: Results adjusted for GA (data imputed for 19% (119094) providing a final match for 99.8) using race-specific percentiles of GA.</td>
<td>Stratification and bivariate analyses used to identify important predictors of infant death. Multiple logistic regression models were adjusted for confounders including maternal age, smoking, parity, prenatal care, GA, residence (urban/rural).</td>
</tr>
<tr>
<td></td>
<td>At month 7 or later - &lt;50% recommended care</td>
<td></td>
<td>Excluded marital status, prenatal care utilization and nulliparity – not independent predictors or confounders.</td>
</tr>
<tr>
<td></td>
<td>month 5-6 – 50% - 79% recommended care</td>
<td></td>
<td>Multiple logistic regression including maternal race, maternal education and interaction of race and education.</td>
</tr>
<tr>
<td></td>
<td>month 3-4 – 80% to 109% recommended care</td>
<td></td>
<td>Adj 1: adjusted for maternal age, smoking, high parity, prenatal care utilization, rural residence</td>
</tr>
<tr>
<td></td>
<td>month 1-2 - &gt;110% recommended care</td>
<td></td>
<td>Adj 2: adjusted for maternal age, smoking, high parity, prenatal care utilization, rural residence and percentile GA</td>
</tr>
</tbody>
</table>

### Study context and overall findings

Compared African American and White women and found that the Af Am women are at significantly increased risk of infant mortality compared to White women at every level of educational attainment. Furthermore, as education level increases the risk of infant mortality also increases so that Af Am women with the highest level of educational attainment have 2.5 times the risk of IM compared with white women whereas Af Am women with less than 12 years of education have only a 1.8 times increased risk compared to white women (even when the models are adjusted for maternal age, smoking, high parity, prenatal care utilization, rural residence and GA). When the two groups were assessed separately, an educational benefit for Af Am women was found to exist comparing 12 years of education to less than 12 years of education (around a 10% reduction in risk) but more than 12 years of education conferred no further benefit. On the other hand, white women with more than 12 years of education received an additional 10% risk reduction compared to White women with only 12 years of education and a 20% risk reduction compared to White women with less than 12 years education.

Reference rates: IM rate per 1000 live births
White | 7.6 (n=400359)
Black | 15.3 (n=169601)

### Critical appraisal comments

Method of selecting groups: Well reported and representative
Adjustment made for confounding age, parity, SES, smoking: Did not adjust for SES
Completeness of dataset: Good
Risk of misclassification bias: Low.
Used percentile based standardisation for comparing groups with marked differences in GA distributions. Most of the maternal factors and behaviours were recorded before delivery not obtained retrospectively.

Overall risk of bias: Low
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</table>
| Eades 2008  | Aboriginal mothers and their infants residing in Perth, Western Australia who gave birth during a 15 month period during the mid to late 1990s. 273 mothers (53% of mothers giving birth during study period) | Poor birth outcome: LBW or PT or both  
LBW: <2500g  
PT: <37 weeks gestation  
Education:  
Completed less than year 10  
Completed higher than year 10 | Mothers identified from WA Midwives Notification System.  
Data obtained from face-to-face interviews with mothers. Data in this study obtained from first interview when infant was 6-12 weeks old.  
Birthweight and gestational age data: WA Midwives Notification System.  
Analysis: Associated variables analysed using univariate logistic regression. Multiple logistic regression analysis used to control for associated factors.  
Study states that few differences were seen between unadjusted OR and OR adjusted for smoking and maternal education therefore unadjusted analysis was reported in paper. | Unadjusted OR of LBW and/or PT by maternal education:  
Less than yr 10 education - 11/62  
higher than yr 10 education - 22/205  
OR 1.8 (0.8 to 3.9) |

**Study context and overall findings**

This study explored the causal pathways leading to poor birth outcomes (LBW and/or PT) for a cohort of urban Aboriginal infants. Poor birth outcome was experienced by 12.3% of the cohort. Independent predictors of poor birth outcome were history of maternal hypertension, vaginal bleeding and consumption of excess spirits during pregnancy. Other risk factors identified included mother being raised on a mission, smoking during pregnancy and exposure to passive smoke during pregnancy. Maternal education less than year 10 was associated with a 1.8 times greater risk of poor birth outcome than education beyond year 10.

Reference rates:  
LBW: 8/267 (3%)  
PT: 9/267 (3.4%)  
Both: 16/267 (6%)  
Normal birth outcome (neither LBW or PT): 234/267 (87.7%)

**Critical appraisal comments**

Method of selecting groups: Well reported. However, compared to all Perth Aboriginal women who gave birth during study period, study mothers less likely to teenagers and primiparous, and study infants less likely to be preterm or LBW  
Adjustment made for confounding (age, parity, SES, smoking): None  
Completeness of dataset: Good  
Risk of misclassification bias: Unclear  
Overall risk of bias: Moderate
### Reference

Ewald 2002 (#227)

**Location:** Central Australia, AUSTRALIA  
**Dates:** 1998-1999

**Quality comment:** Education data available only for around 45-70% of children and carer-mothers

### Study context and overall findings

Studied child health markers (trachoma, scabies, skin sores, ear disease, nose disease, stunted, underweight) in 183 Aboriginal children aged less than 13 in Central Australia from 1998 to 1999. The maternal education of women identified as carer-mothers (the primary female caregiver for the child) was measured by years of schooling, whether the woman had earned a formal qualification, whether the woman was literate and whether the woman had attended college. A composite education group was also studied of women who had a qualification or had more than 8 years of schooling or were literate. This study failed to find any statistically significant association between maternal education and the various child health markers, with the exception of scabies with years of schooling (OR: 1.2, 95%CI:1.0 to 1.46) and qualification (OR: 0.34, 95%CI:0.13 to 0.89); and nose disease and years of schooling (OR: 0.81, 95%CI:0.67 to 0.98). No education variables were significant in multiple regression analysis.

### Critical appraisal comments

Differences in definition of mother and multiple definitions of education make comparison with other studies difficult. Small numbers reduce the power of the study to find meaningful differences.

### Maternal education outcomes

| ME: Calculated by subtracting 6 from the age reported by the informant as last attending school higher - >8yrs schooling or a qualification or literate other – none of these markers Literate: Able to read survey questions in English Carer-mother: Woman thought to be providing primary care to the child (could be grandmother, other relative or other) Health conditions: Stunted – >2SD below median reference values Underweight - >2SD below median reference values Systematic health screening for the National Aboriginal Health Strategy Environmental Health Program (NAHS-EHP) for child health markers Education collected as part of a community census in Nov 1998 and June 1999 and from survey of carer-mothers in Aug-Sep 2000 Analysis: Univariate and multivariate logistic or linear regression to assess association between education and health variables Qualitative data available

### Data sources and analysis

| Education data available only for around 45-70% of children and carer-mothers | Systematic health screening for the National Aboriginal Health Strategy, Environmental Health Program (NAHS-EHP) for child health markers | Education collected as part of a community census in Nov 1998 and June 1999 and from survey of carer-mothers in Aug-Sep 2000 | Analysis: Univariate and multivariate logistic or linear regression to assess association between education and health variables Qualitative data available |

| Educational level | trachoma – 0.99 (0.84 to 1.18) n=96 scabies – 1.2 (1.001 to 1.46) n=92 skin sores – 1.08 (0.82 to 1.4) n=81 ear disease – 1.19 (0.72 to 1.9) n=97 nose disease – 0.81 (0.67 to 0.98) n=97 stunted – 0.97 (0.67 to 1.4) n=92 underweight – 0.89 (0.5 to 1.5) any disease marker – 1.01 (0.8 to 1.2) more than 1 disease marker – 1.2 (0.96 to 1.5) earned a qualification trachoma – 1.5 (0.64 to 3.9) n=104 scabies – 0.34 (0.13 to 0.89) n=98 skin sores – 1.2 (0.2 to 5.1) n=88 ear disease – 6.8 (0.59 to 7.9) n=105 nose disease – 0.97 (0.37 to 2.5) n=105 stunted – 1.7 (0.29 to 10.1) n=100 underweight – 0.0007 (extrm) any disease marker – 0.47 (0.15 to 1.4) n=100 more than 1 disease marker – 0.84 (0.27 to 2.6) literate trachoma – 1.02 (0.35 to 2.9) n=83 scabies – 0.43 (0.12 to 1.4) n=77 skin sores – 0.97 (0.17 to 5.3) n=69 ear disease – 0.13 (0.01 to 1.5) n=83 nose disease – 3.1 (0.8 to 12.1) n=83 stunted – 1962 (0-extrm) n=76 underweight – 0.25 (0.04 to 1.3) n=76 any disease marker – 0.3 (0.03 to 2.5) n=77 more than one disease marker – 1.2 (0.35 to 4.6) n=83 attended college trachoma – 1.2 (0.26 to 6.3) n=37 scabies – 1.5 (0.32 to 7.0) n=35 skin sores – 13854 (0-extrm) n=30 ear disease – 0.0004 (0-extrm) n=37 nose disease – 1.4 (0.3 to 6.6) n=37 stunted – 3372 (0 to extrm) n=36 underweight – 0.13 (0.01 to 1.7) n=36 any disease marker – 1.00 (0.09 to 11.0) n=36 more than one disease marker – 0.0003 (0 to extrm) n=37 higher education group (as per definition) trachoma – 0.58 (0.22 to 1.4) n=131 scabies – 1.8 (0.7 to 4.8) n=123 skin sores – 2.3 (0.2 to 19.3) n=111 ear disease – extrm (0 – extrm) nose disease – 0.52 (0.2 to 1.3) n=132 stunted – 0.48 (0.8 to 2.7) n=123 |
| Maternal Education | 
|-------------------|-------------------|
| Weight for age Z score | Height for age Z score |
| yrs schooling | yrs schooling |
| B = 0.038 (0.2 to 0.14) n=85 (unadjusted r²: 0.038) | B = 0.127 (0.087 to 0.36) n=85 |
| literate | literate |
| B = 0.095 (-0.6 to 1.6) n=100 | B = 0.126 (-0.49 to 2.2) n=100 |
| college | college |
| B = 0.051 (-1.0 to 0.76) n=36 | B = 0.106 (-2.2 to 0.89) n=76 |
| education gp | education gp |
| B = 0.007 -0.031 (-1.2 to 0.88) n=123 | B = 0.048 (-1.4 to 1.8) n=36 |
| B = 0.051 (0.19 to 2.6) n=132 | B = 0.065 (-0.89 to 1.9) n=123 |

Multivariate regression analysis: adjusted R², B coefficient (95%CI)

- underweight – 0.6 (0.06 to 6.1) n=123
- any disease marker – 0.74 (0.19 to 2.7) n=125
- more than 1 disease marker – 0.71 (0.19 to 2.6) n=132

Multivariate regression analysis: adjusted R², B coefficient (95%CI)

- weight for age Z score: yrs schooling = 0.01  B=0.038 (0.2 to 0.14) n=85 (unadjusted r²: 0.038)
- literacy = 0.12  B=0.158 (-2.1 to 0.38) n=76
- college = 0.027  B=0.051 (-1.0 to 0.76) n=36
- education gp = 0.007  B=0.031 (-1.2 to 0.88) n=123

Multivariate regression analysis: adjusted R², B coefficient (95%CI)

- height for age Z score: yrs schooling = 0.005  B=0.127 (0.087 to 0.36) n=85
- literacy = 0.002  B=0.106 (-2.2 to 0.89) n=76
- college = 0.027  B=0.048 (-1.4 to 1.8) n=36
- education gp = 0.004  B=0.065 (-0.89 to 1.9) n=123
### Study context and overall findings

Studied birth-weight specific infant mortality in Sweden between 1973 and 1990 to examine the effect of maternal education levels on IM. Women with low (compulsory education only) and low-intermediate (2 years of upper secondary school) levels of education demonstrated an increased risk of infant mortality, neonatal mortality and postneonatal mortality compared to women with the highest levels of education (college or university). Risk of having a low birthweight baby also decreased with increasing levels of maternal education. For women with the lowest levels of education the risk of having a low birthweight baby is 1.7 times higher than for women with the highest level of educational attainment.

### Critical appraisal comments

**Method of selecting groups:** Well reported and representative 

**Adjustment made for confounding:** Age, parity, SES, smoking) 

**Did not adjust for SES and smoking.** 

**Completeness of dataset:** Good 

**Risk of misclassification bias:** Low, however, change in rate of stillbirth among VLBW infants may reflect change in registration practices 

**Overall risk of bias:** Moderate

<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
</table>
NM: Death at 0-27 completed days of life  
PNM: Death at 28 days completed days of life to 1 year  
LBW: Weight below 2500g  
Education: Highest achieved at 1990  
low – compulsory only whether or not completed  
low intermediate – vocational training (2 yr upper secondary school)  
high intermediate – secondary academic (3 yrs upper secondary school)  
Educational Register for completed education at 31.12.1990 | IM: 6544/1065234 = (0.61% or 6.1 per 1000)  
LBW: 35344/1065234 = 3.3% |
| Location: SWEDEN | Dates: 1973-1990 | Singleton births n=1065234  
Births to women aged 25-32 at delivery n=652859 infants | Swede | 20-24: 1633/224223 (0.73%)  
8361/224223 (3.73%)  
20-29: 2574/445234 (0.58%)  
13476/445234 (3.03%)  
30-34: 1606/287776 (0.56%)  
8807/287776 (3.06%)  
35-39: 428/75898 (0.56%)  
3042/75898 (4.01%)  
>39: 46/7586  
460/7586 (6.06%) |
| | | | Data analysis: OR and 95%CI obtained using logistic regression controlled for maternal age and parity. Reference category high education. CIs adjusted using Huber and White's estimates for nested data (i.e. one mother has several infants) | IM and LBW by maternal age |
| | | | **ME** | **IM** | **LBW** |
| low: 1577/214617 (0.73%) | 8764/214617 (4.08%) |  
low intermed: 2779/430199 (0.65%) | 15096/430199 (3.51%) |  
high intermed: 535/95855 (0.56%) | 2746/95855 (2.86%) |  
high: 1654/324563 (0.51%) | 8728/324563 (2.69%) |
| | | | ORs (95%CI) for IM and LBW by maternal education | IM and LBW by maternal education |
| | | | **ME** | **IM** | **LBW** |
| low: 1.30 (1.20-1.41) | 1.30 (1.14-1.48) |  
low intermed: 1.18 (1.10-1.27) | 1.14 (1.02-1.28) |  
high intermed: 1.07 (0.96-1.18) | 1.12 (0.94-1.33) |  
high: 1.00 | 1.00 |  
| ORs (95%CI) for NM and PNM by maternal education | | | Study context and overall findings |
| | | | **ME** | **NM** | **PNM** |
| low: 1.30 (1.18-1.43) | 1.30 (1.14-1.48) |  
low intermed: 1.20 (1.11-1.30) | 1.14 (1.02-1.28) |  
high intermed: 1.04 (0.92-1.18) | 1.12 (0.94-1.33) |  
high: 1.00 | 1.00 |  
<p>| Overall risk of bias: Moderate | | | Also has birth weight specific ORs for IM (not extracted) |</p>
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray 1988</td>
<td>Children of Aboriginal and non-Aboriginal mothers reported to the 1986 Census</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Location: AUSTRALIA</td>
<td></td>
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<tr>
<td>Dates: 1986</td>
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<td>Aboriginal n=19777</td>
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<tr>
<td>Non-Aboriginal n=637269</td>
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<tr>
<td>Study context and overall findings</td>
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<td></td>
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<tr>
<td>Examined relationship between child survival (death of children up to 15 years of age) and the age at which the child’s mother left school for respondents identifying as Aboriginal or Torres Strait Islander in the Census. Child survival was worst for children of women who left school before the age of 14 and best for children of women who left school at age 15. However, it is not clear whether differences between the educational groups are significant for mothers who left school after age 14.</td>
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<tr>
<td>Critical appraisal comments</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Author commented that results for maternal education may not reflect an actual relationship between ME and child survival but rather reflect differences in the way women with different levels of education report child survival.</td>
<td></td>
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<tr>
<td>Australian Bureau of Statistics 1986 Census</td>
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<tr>
<td>Children of aboriginal mothers ever born and surviving by ME:</td>
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<td>Ever born</td>
<td>Still alive</td>
<td>Not living</td>
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### Reference

<table>
<thead>
<tr>
<th>Gray 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location: AUSTRALIA</td>
</tr>
<tr>
<td>Dates: 1990 – 2005</td>
</tr>
</tbody>
</table>

### Population

- Australian Aboriginal children aged less than 15 at the time of the survey
- Total adults surveyed: 15700
- Number of children: n=6596
- 0-4yrs: 2468
- 5-9yrs: 2197
- 10-14yrs: 1831

### Definitions

- **Health-related actions**: Visited emergency department/outpatients, admitted to hospital, consulted doctor, consulted Aboriginal health worker, consulted nurse, used medication, used bush medicine, had days of reduced activity
- **Education**: Age when mother left school
- **Health status**: Self-rated (by mothers for their child) excellent, very good, good, fair, poor

### Data sources and analysis

- Australian Bureau of Statistics National Aboriginal and Torres Strait Islander Survey (NATSIS) 1994
- Health related activities as reported by the child’s parents
- Analysis: Logistic regression adjusted for geographical location (capital city, other urban, rural/remote), age of mother, mother’s age leaving school

### Maternal education outcomes

- Any health action previous 2 wks for children aged less than 15 yrs by maternal education:
  - Age left school | Health status | Poor/fair |
  - <14 | 33.8% | 43.8% | 75.0% |
  - 14 | 26.3% | 32.4% | 66.7% |
  - 15 | 21.1% | 39.4% | 75.9% |
  - 16 | 29.2% | 42.8% | 56.2% |
  - 17+ | 36.3% | 49.5% | 83.3% |

- Adjusted OR of taking any health action for child under 15 by ME:
  - <14 – 1.55 p=0.0177
  - 15 – 0.87 p=0.1838
  - 16 – 1.12 p=0.2733
  - 17+ - 1.40 p=0.0060

### Study context and overall findings

- Studied health-related actions undertaken in the previous fortnight for children of mothers surveyed in the National Aboriginal and Torres Strait Islander Survey (NATSIS) of 1994. Adjusted odds ratio of taking any health related action in the previous fortnight was significantly higher for women with the lowest levels of education and the highest levels of education. Women who left school aged less than 14 were 1.5 times more likely to have taken a health-related action for their child than women who left school at 14. Women who left school at 17 or older were 1.4 times more likely to have taken a health-related action for their child.

### Critical appraisal comments

- Author suggests that results may be explained by differences in the way data is reported by mothers with higher levels of education compared to mothers with lower levels of education.
<table>
<thead>
<tr>
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<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hertel-Fernandez 2007</td>
<td>All live births during study period</td>
<td><strong>IM</strong>: Not defined but appears to be death prior to 12 months of life&lt;br&gt;<strong>Education</strong>: Years of approved education (level of instruction + last completed course) – 6 categories: no ME, 1-3yrs, 4-6yrs, 7-9yrs, 10-12yrs, 13+ yrs</td>
<td>Chilean National Registry of Vital Events for mortality and education data.&lt;br&gt;Chilean census data, data from World Bank’s World Development Index and national life table cohorts used to confirm reliability of infant mortality data</td>
<td><strong>IM rate per 1000 by ME</strong> (data extrapolated from graph)</td>
</tr>
</tbody>
</table>

**Study context and overall findings**

Hertel-Fernandez 2007 examined differential risk in IM on a national and regional basis in Chile between 1990 and 2005. Overall IM rates have declined over the period however, these declines have levelled off in the most recent years. There is a marked disparity between the IM rate for women with a college education or above and those with no education (for example the IM rate in 2005 was 6.5 per 1000 live births for women with at least a college education compared with 30.5 per 1000 live births for women with no education).

**Reference rates**: IM per 1000 live births

**Critical appraisal comments**

Method of selecting groups: Well reported. Low SES areas and some geographical regions may be underrepresented due to missing data (but not through selection bias).
Adjustment made for confounding (age, parity, SES, smoking): None, however, analysis stratified by socioeconomic status and geographic region.
Completeness of dataset: Good
Risk of misclassification bias: Moderate to high. Poorly defined deaths ranging from 1.5% to 13.7% of National Registry data and varied by geographical region and SES.
Overall risk of bias: Moderate
Preventing infant deaths among Aboriginal and teenage women in South Australia

<table>
<thead>
<tr>
<th>Study context and overall findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Studied fetal mortality rates (including stillbirth) by maternal age, ethnicity and maternal education level. FM was higher for women aged less than 20 compared to women aged 20 to 34, but there did not appear to be any real difference according to years of completed education. Overall there was a clear educational gradient for white and non-Hispanic women but not for black and Hispanic women. However, for teenage women there did not appear to be a clear relationship between education level and fetal mortality rate. For black teenage women with the highest levels of education (13 to 15 years) the fetal mortality rate was higher (13.9 per 1000 live births and fetal deaths) than for black teenage women with the lowest level of education (0 to 8 years) (12.0 per 1000 live births and fetal deaths). For non-Hispanic teenage women (including Native Americans), the fetal mortality rate was similar for women with the highest and lowest levels of education.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fetal mortality rates (Cl) by ME and age of women:</strong></td>
</tr>
<tr>
<td>Education (yrs completed education)</td>
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<tr>
<td><strong>Fetal mortality rates by ME and ethnicity:</strong></td>
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</table>

*includes American Indians

<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoyert 1990 (#195)</td>
<td>Data from 37 US states with data for fetal deaths, maternal education and ethnicity. Includes all live births for each variable of interest, however, total number (denominator) changes for each variable. Total n not reported. Fetal deaths n=22098</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetal death: Death after 20 wks or more completed gestation. Fetal mortality rate: Per 1000 live births and fetal deaths Education: Years completed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data sources and analysis</th>
</tr>
</thead>
</table>

**Method of selecting groups:** Well reported and representative
**Adjustment made for confounding (age, parity, SES, smoking):** None but analysis stratified by education level and ethnicity.
**Completeness of dataset:** Good
**Risk of misclassification bias:** Low
**Overall risk of bias:** Low
### Reference
Kieffer 1994

**Location:** Hawaii, USA
**Dates:** 1979 – 1990

---

### Population

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hawaiian: Any part Hawaiian ancestry</td>
<td>LBW: &lt;2500 grams</td>
<td>VLBW: &lt;1500 grams</td>
<td>NM: Not defined</td>
<td>PNM: Not defined</td>
<td>Education: Low – 2 or more years below expected grade level for age for adolescents (&lt;18 yrs) or &lt;12 for adults</td>
</tr>
</tbody>
</table>

### Data sources and analysis

Hawaiian linked live birth-infant death vital record.

**Analysis:** Significance of bivariate relationships between maternal characteristics and infant outcomes tested with chi-squared and t-test. Multiple logistic regression used to estimate associations between independent effects of maternal characteristics and infant outcomes. Did not measure smoking or alcohol consumption.

### Maternal education outcomes

| OR (95%CI) of LBW for Hawaiian infants by ME: | Low – 1.43 (1.33 to 1.55) | High – 0.79 (0.74 to 0.85) |
| OR (95%CI) of preterm for Hawaiian infants by ME: | Low – 1.2 (1.12 to 1.28) | High – 0.87 (0.82 to 0.92) |
| OR (95%CI) of NM for Hawaiian infants by ME: | Low – 0.80 (0.59 to 1.10) | High – 0.92 (0.74 to 1.14) |
| OR (95%CI) of PNM for Hawaiian infants by ME: | Low – 1.31 (0.96 to 1.80) | High – 0.89 (0.66 to 1.19) |

### Study context and overall findings

Compared rates of preterm, low birthweight, infant mortality, neonatal mortality and postneonatal mortality for women of Hawaiian origin and women of Caucasian origin. Hawaiian women had higher rates of infant mortality, neonatal and postneonatal mortality, low birthweight and preterm births than white women (see reference data below). In a logistic regression analysis controlling for maternal birth and socioeconomic factors (maternal age, parity, marital status, educational attainment, levels of prenatal care, residence (urban/rural), educational attainment was not a significant factor in explaining differences in NM and PNM between Hawaiian and White women. However, there was a significant effect of educational attainment on rates of low birthweight and preterm, with Hawaiian women with low educational attainment having 1.43 times the risk of LBW and 1.2 times the risk of preterm compared with White women with average educational attainment. Hawaiian women with high educational attainment had 0.79 times the risk of LBW and 0.92 times the risk of preterm compared to White women with average educational attainment.

### Critical appraisal comments

Method of selecting groups: Well reported and representative.
Adjustment for confounding (age, parity, SES, smoking): Did not adjust for smoking or SES.
Completeness of dataset: Good
Risk of misclassification bias: Unclear.
Overall risk of bias: Moderate

### Reference rates: per 1000 live births

<table>
<thead>
<tr>
<th></th>
<th>NM</th>
<th>PNM</th>
<th>IM</th>
<th>LBW</th>
<th>PT</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>4.3</td>
<td>1.9</td>
<td>6.3</td>
<td>4.8</td>
<td>6.6</td>
</tr>
<tr>
<td>Hawaiian</td>
<td>6.2</td>
<td>3.8</td>
<td>10.0</td>
<td>6.6</td>
<td>10.3</td>
</tr>
</tbody>
</table>

**p-value**

<p>|     | &lt;0.01 | &lt;0.01 | &lt;0.01 | &lt;0.01 | &lt;0.01 |</p>
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Klufio 1994</td>
<td>Women giving birth at Port Moresby General Hospital between May and June 1990</td>
<td>No definitions provided</td>
<td>Survey of all postpartum women at discharge during the study period. Analysis: Univariate and stepwise logistic regression used to examine effect of ME on perinatal death and LBW.</td>
<td>Perinatal death by ME (for women with no schooling) 9/158 OR (95%CI) – 2.76 (1.03 to 7.33) p=0.022 for both univariate and stepwise logistic regression. LBW by ME (for women with no schooling) 21/158 OR(95%CI) – 1.12 (0.63 to 1.95) p=0.682 for univariate and logistic regression.</td>
</tr>
</tbody>
</table>

**Study context and overall findings**

Studied infant mortality and low birth weight among women in Papua New Guinea. Maternal education was associated with PM in univariate analysis but was not a significant risk factor in multiple logistic regression analysis controlling for maternal age, parity, antenatal care, residence, social status and previous perinatal death. Compared with women with schooling, women with no schooling were 2.76 times more likely to experience perinatal mortality. However, there was no significant association between maternal education and low birth weight (OR 1.12, 95%CI 0.63 to 1.95).

Reference rates: per 1000 live births
Neonatal mortality – 7.4 per 1000 LB
Perinatal mortality – 29.6 per 1000 LB
Stillbirth rate – 22.2 per 1000 births

**Critical appraisal comments**

Method of selecting groups: Only obtained from one hospital so difficult to generalise beyond. Adjustment made for confounding (age, parity, smoking, SES). Did not adjust for smoking.
Completeness of dataset: Unclear.
Data obtained from survey of hospital patients. No details are given about data collection or verification.
Risk of misclassification bias: Unclear.
Other comments: Results presented for unadjusted and adjusted analysis together making it difficult to interpret.
Overall risk of bias: Moderate to high.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
</table>
| Lanksy 2007 | Births that occurred at maternity hospitals in Belo Horizonte (n=40953 births in 36 hospitals) | PM: Fetal deaths plus early neonatal deaths with BW of 500g or more or GA 22wks or more Education: <4 yrs, 4-8 yrs, >8yrs | Data from original population based cohort study (Lansky 1999) | PM by ME (reviewer-calculated %PM): Education n/live births in sample |<4 yrs | 23/452 (5.1%) 51 per 1000  
>4-8 yrs | 259/19622 (1.3%) 13 per 1000  
>8yrs | 137/16395 (0.8%) 8 per 1000 |
|             | Study sample: n=36469 births in 24 hospitals  
Excluded: 2497 births in private hospitals; 793 live births with missing hospital data; 1809 individuals with missing maternal education data; 3 deaths in nonmaternity hospitals, 231 antepartum deaths (prior to onset of labour) |                                                                                                                                 | Brazilian National Live Birth Information System and National Death Information System | Mortality surveillance by hospital chart review for all perinatal deaths | Analysis: Logistic regression to model variations in PM as a function of individual predictor variables including ME |<4yrs | 2.92 (1.67 – 5.09)  
>8 yrs | 0.83 (0.65 – 1.07)  
4-8 yrs | 1.0 |
|             | Study context and overall findings |                                                                                                                                 | Controlling for: sex, multiple pregnancy, caesarean, birthweight and maternal age |                                                                                                                                                                                                                                                   | Method of selecting groups: Well reported. Unclear whether data from one city can be generalised to other cities/contexts.  
Adjustment made for confounding factors: age, parity, smoking, SES. Did not adjust for parity, smoking, SES  
Completeness of dataset: Good.  
Risk of misclassification bias: Low to moderate. Missing data was systematically lower for maternal education at State Health system hospitals possibly resulting in an underestimated risk of PM for less educated mothers  
Overall risk of bias: Moderate to high. |
|             | Investigated the possibility that differences in hospital care between State Health system hospitals and private hospitals may contribute to PM. There is a significantly higher rate of PM for babies born in public health system hospitals (public, philanthropic and private contractors) in Brazil than for babies born in private non-health system hospitals. (OR 2.92 for private health system, 1.81 for philanthropic health system and 1.30 for public health system compared to private hospitals). Mothers with less than 4 years education were found to have a significantly higher risk for PM. However, this did not explain the difference in PM attributable to differences in hospitals. | Reference rate: per 1000 live births (reviewer calculated)  
PM – 419/36469  11.5 per 1000 live births | | |
### Reference

Lee 1997

**Population**
- Data from 78 of 207 countries which reported all data used in this analysis (approximately 78.8% world population)

**Definitions**
- **IMR**: Number of deaths before 1 year of age per 1000 live births
- **Literacy rate**: Proportion of literate women among all women aged 15yrs and older
- **HDI**: (Human Development Index) composed of life expectancy at birth, literacy rate, and GDP – 0 worst to 1 best

**Data sources and analysis**
- World Bank and United National Statistical and Demographic Yearbook
- **Analysis**: Pearson product moment correlation coefficients with 95%CI using Fisher's transformation used to estimate relationship between HDI components (including maternal literacy) and IMR

**Maternal education outcomes**
- IMR and female literacy rate (correlation coefficients and 95% CIs)
  - -0.90 (-0.84 to around -0.93) p<0.001

### Study context and overall findings

Used the human development index (composite of life expectancy, literacy and per capita GDP) to predict maternal and infant mortality rates in 78 countries (approximately 79% of world population). Also examined predictive power of individual components of HDI. Global infant mortality rate 67 per 1000. HDI responsible for 85% to 92% of variance in infant mortality. Maternal literacy strongly negatively correlated with IM rate (-0.90, 95%CI: -0.84 to -0.93) p<0.001

### Critical appraisal comments

- **Method of selecting groups**: Used population data
- **Adjustment made for confounding**: (age, parity, smoking, SES); NA as analysis at a population level.
- **Completeness of dataset**: Unclear
- **Risk of misclassification bias**: Unclear
- **Overall risk of bias**: Unclear
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millar 1998 (#209)</td>
<td>Children younger than 2 whose biological mother responded to the NLSCY survey who were SGA All children n=4181 All children with data for all study variables n=4060</td>
<td><strong>SGA</strong>: BW less than 10th percentile for infant sex, gestational age and singleton or multiple birth status (includes full-term births that are too small for their GA) <strong>ME</strong>: Less than high school graduation, high school graduation or some postsecondary education, post-secondary education. Could not obtain education levels for mothers of children who died within first two years of life (as data obtained from participant report)</td>
<td>National Longitudinal Survey of Children and Youth 1994-1995. In each household up to 4 children selected at random. The person most knowledgeable about them responded to the survey (89.9% biological mother, 1.4% step or adopted mother)</td>
<td>Adjusted ORs (95%CI) for SGA by ME:</td>
</tr>
</tbody>
</table>

**Study context and overall findings**

Studied risk factors for SGA infants among Canadian women. The risk of having a SGA infant were 2.1 times higher for women with low education compared to higher levels of education, even when controlling maternal age, household income, family status, antenatal care and smoking. For a lone mother aged 25 to 34 with a low income, who received no prenatal care and who did not smoke during her pregnancy, the chance of having a SGA infant was 11% for women with less than a high school education and 6% for women with a postsecondary education.

Reference rates:
SGA – 6% less than high school education – 12% postsecondary education – 5%

**Critical appraisal comments**

Method of selecting groups: Well reported. Association between SGA and risk factors subject to selection bias. Analysis limited to infants who survived first 2 years of life.
Adjustment made for confounding (age, parity, smoking, SES): Did not adjust for parity
Completeness of dataset: Good
Risk of misclassification bias: Low-moderate
Overall risk of bias: Low-moderate
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitchell 1993 (#221)</td>
<td>Maori and non-Maori infants in New Zealand who participated in the New Zealand Cot Death Study</td>
<td>SIDS: Abrupt death of seemingly healthy infant from unknown cause ME: Age mother left school &lt;16yrs, 16 yrs, &gt; 17yrs</td>
<td>New Zealand Cot Death Study (included 78% live births in NZ between Nov 1 1987 and Oct 31 1990). All cases of SIDS compared in this study with a control group randomly sampled from full dataset. Obstetrics records examined in 465/485 (96%) cases (deaths from SIDS) and 1762/1800 (98%) controls (healthy infants). Parental interviews completed with 393 (81%) cases and 1592 (88%) controls</td>
<td>Univariate OR (95%) for risk of SIDS by ME: education Maori Non-Maori &lt;16yrs 2.27 (1.35 to 3.82) 2.25 (1.55 to 3.27) 16 yrs 1.27 (0.88 to 1.82) 1.65 (0.94 to 2.91) 17 yrs 1.00</td>
</tr>
</tbody>
</table>

**Study context and overall findings**

Studied risk factors for SIDS among Maori and non-Maori women in New Zealand. Risk of SIDS was 3.8 times higher for Maori infants than non-Maori infants. The prevalence of risk factors among Maori control infants was higher than among non-Maori control infants. Four risk factors – prone sleeping position, maternal smoking, no breast feeding, and bed sharing were found to account for 89% of SIDS deaths in Maori infants and 79% in non-Maori infants. Mothers with the lowest levels of education had a significantly higher univariate risk of SIDS than mothers with the highest level of education but there was no difference between Maori and non-Maori infants. Maternal education was not a significant factor in multivariate analysis.

**Reference rates:** OR for SIDS in Maori infants: 3.81 (95%CI:3.06 to 4.76)

**Critical appraisal comments**

Method of selecting groups: Well reported and representative. Adjustment made for confounding (age, parity, smoking, SES): Adjusted for all 4 factors. Completeness of dataset: Proportion of missing data among Maori cases higher than among non-Maori. Risk of misclassification bias: Low-moderate Overall risk of bias: Low-moderate

**Analysis:** Separate univariate analysis considering variables related to sociodemographic factors (region, SES, ME, married, age of mother at childbirth), pregnancy factors (age of mother at first pregnancy, no previous pregnancies, GA at first antenatal visit, attended antenatal classes) and infant variables (BW, GA, infant sex) and multivariate analysis controlling for all factors. Also controlled for breast feeding, season, infant age, maternal smoking, sleeping position, bed sharing.

**Multivariate analysis:** OR (95%CI) for risk of SIDS in Maori 1.37 (0.95 to 2.01) pns Significant interaction between bed sharing and Maori ethnicity.

No other data reported for multivariate analysis.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mondal 2000 (#208)</td>
<td>Live born singleton Nepali infants born during study period in Meghalaya (North-East India) n=418 Excluded still and twin births, and infants with missing information on BW (n= NR). Also excluded 12 infants from the analysis due to missing information about maternal education (6), age (3), parity (2), paternal education (1)</td>
<td>LBW: BW less than 2500g Maternal education: Illiterates – cannot read and write primary – can read up to standard IV of formal education Middle – can read up to class V to VIII Secondary – education beyond class VIII (class definitions not provided - ? probably equate to grade levels?) SES: Poor – patients admitted to general ward of hospital Well-off – patients admitted to semi-private and private wards of hospital</td>
<td>Birth register of Khasi-Jaintia Presbyterian Synod Hospital of Shillong, Meghalaya. Analysis: Multiple logistic regression used to analyse relationship between LBW and seven biosocial factors (sex of baby, mother's age, parity, GA, economic condition, mothers education and fathers education)</td>
<td>LBW by ME: (not controlled for any potential confounders) education BW&lt;2500g BW&gt;2500g illiterate 65/187 (34.8%)? 122/187 (65.2%) primary 10/60 (16.7%) 50/60 (83.3%) middle 7/72 (9.7%) 65/72 (90.3%) secondary or higher 6/93 (6.5%) 87/93 (93.5%) p&lt;0.001 OR (95%CI) for LBW by ME education (illiterate vs literate): 4.68 (4.15 to 5.20) p&lt;0.001</td>
</tr>
</tbody>
</table>

**Study context and overall findings**

Studied rate of LBW among Nepali women living in India. Mothers education level was independently associated with LBW (OR4.68, 95%CI 4.15 to 5.20 comparing literate to illiterate mothers) and was a significant risk factor in a multiple logistic regression analysis (which also found that infant sex, maternal age, parity, gestational period were significant risk factors).

Reference rate: LBW 21.53%

**Critical appraisal comments**

Method of selecting groups: Poorly reported. Results for women birthing in only one Nepali hospital may not be generalisable.
Adjustment made for confounding factors: age, parity, smoking, SES: Did not adjust for smoking.
Completeness of dataset: Unclear
Risk of misclassification bias: Unclear
Overall risk of bias: Moderate to high
### Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

#### Reference

**Morrison 1989**

- **Location**: AUSTRALIA
- **Dates**: 1981 – 1983

#### Definitions

- **PM**: All stillbirths >20 wks GA or ≥400g and neonatal deaths within 28 days of birth
- **LBW**: <2500 grams
- **PT**: ≤36 wks completed gestation
- **SGA**: BW <5th centile for gestation

#### Data sources and analysis

- **Prospective cohort study** of 8556 patients. Data obtained from questionnaires and medical records.

#### Maternal education outcomes

<table>
<thead>
<tr>
<th>Education</th>
<th>OR ME 1</th>
<th>aOR ME 1</th>
<th>p-value ME 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete grade 10</td>
<td>1.33</td>
<td>1.15</td>
<td>0.14</td>
</tr>
<tr>
<td>Complete grade 10</td>
<td>1.02</td>
<td>0.94</td>
<td>0.50</td>
</tr>
<tr>
<td>Grade 12/university</td>
<td>1.00</td>
<td>1.00</td>
<td>0.76</td>
</tr>
</tbody>
</table>

#### Critical appraisal comments

- **Method of selecting groups**: Well reported. Authors canvass but dismiss possibility that study sample under-represents upper SES women.
- **Adjustment made for confounding (age, parity, smoking, SES)**: Adjusted for all 4 factors
- **Risk of bias**: Low to moderate

#### Study context and overall findings

Examined effect of socioeconomic status on pregnancy outcomes in Brisbane, Australia. Found significant effect of maternal education level on perinatal mortality, preterm birth, low birthweight or small for gestational age when analysis was adjusted for age, parity, marital status, maternal BMI, smoking and eating breakfast regularly.

#### Maternal education outcomes

<table>
<thead>
<tr>
<th>Education</th>
<th>OR ME 1</th>
<th>aOR ME 1</th>
<th>p-value ME 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete grade 10</td>
<td>1.56 (1.1 to 2.2)</td>
<td>1.48 (1.0 to 2.1)</td>
<td>0.01</td>
</tr>
<tr>
<td>Complete grade 10</td>
<td>1.12</td>
<td>1.10</td>
<td>0.05</td>
</tr>
<tr>
<td>Grade 12/university</td>
<td>1.00</td>
<td>1.00</td>
<td>0.43</td>
</tr>
</tbody>
</table>

### Data sources and analysis

#### Maternal education outcomes

<table>
<thead>
<tr>
<th>Rates: per 100 live births</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>incomplete grade 10</td>
</tr>
<tr>
<td>complete grade 10 (4126)</td>
</tr>
<tr>
<td>college (921)</td>
</tr>
<tr>
<td>grade 12/university(1130)</td>
</tr>
</tbody>
</table>

#### Critical appraisal comments

- **Method of selecting groups**: Well reported. Authors canvass but dismiss possibility that study sample under-represents upper SES women.
- **Adjustment made for confounding (age, parity, smoking, SES)**: Adjusted for all 4 factors
- **Completeness of dataset**: Unclear
- **Risk of bias**: Low to moderate

#### Study context and overall findings

Examined effect of socioeconomic status on pregnancy outcomes in Brisbane, Australia. Found significant effect of maternal education level on perinatal mortality, preterm birth, low birthweight or small for gestational age when analysis was adjusted for age, parity, marital status, maternal BMI, smoking and eating breakfast regularly.
Studied the effect of maternal education on stillbirths and infant mortality in Denmark. The lowest educational level was associated with the highest mortality for all outcomes with an inverse relationship demonstrated between maternal education levels and infant mortality rates although differences between women with different levels of further education (short course versus postgraduate study) were not clearly demonstrated. However, when the analysis was adjusted for maternal age, parity and smoking no clear educational advantage persisted for rates of stillbirth, but a clear educational advantage was evident for rates of NM and PNM.

Analysis adjusted for LBW:

- Analysis adjusted for SES: Clear
- Risk of misclassification bias: Unclear
- Other comments: When BW included in analysis all differences between groups disappeared.

Adjusted OR (95%CI) for stillbirth by ME:

<table>
<thead>
<tr>
<th>Education</th>
<th>unadj</th>
<th>Adj 1</th>
<th>Adj 2</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>1.02</td>
<td>0.98</td>
<td>1.07</td>
<td>0.74 to 1.75</td>
</tr>
<tr>
<td>8th grade</td>
<td>1.39</td>
<td>1.33</td>
<td>1.06</td>
<td>0.70 to 1.59</td>
</tr>
<tr>
<td>9th grade</td>
<td>1.20</td>
<td>1.22</td>
<td>1.12</td>
<td>0.87 to 1.45</td>
</tr>
<tr>
<td>10-11th grade</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>upper second</td>
<td>0.91</td>
<td>0.90</td>
<td>1.00</td>
<td>0.72 to 1.38</td>
</tr>
<tr>
<td>short FE</td>
<td>1.04</td>
<td>1.04</td>
<td>1.12</td>
<td>0.69 to 1.80</td>
</tr>
<tr>
<td>medium FE</td>
<td>0.89</td>
<td>0.88</td>
<td>1.01</td>
<td>0.70 to 1.45</td>
</tr>
<tr>
<td>long FE</td>
<td>1.04</td>
<td>1.01</td>
<td>1.10</td>
<td>0.65 to 1.85</td>
</tr>
</tbody>
</table>

Critical appraisal comments:

- Method of selecting groups: Well reported and representative
- Adjustment made for confounding: None
- Overall risk of bias: Moderate

Data sources and analysis:

- Danish Fertility Database (comprises select data from Medical Birth Register and National Bureau of Statistics)
- Analysis: Logistic regression to estimate effect of maternal education with and without control for confounders of maternal age, parity and smoking.
- Aetiological fraction calculated according to Miettinen 1974.

Maternal education outcomes:

<table>
<thead>
<tr>
<th>Infant deaths by ME: (number per 100 live births)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>NR</td>
</tr>
<tr>
<td>8th grade</td>
</tr>
<tr>
<td>9th grade</td>
</tr>
<tr>
<td>10-11th grade</td>
</tr>
<tr>
<td>upper second</td>
</tr>
<tr>
<td>short FE</td>
</tr>
<tr>
<td>medium FE</td>
</tr>
<tr>
<td>long FE</td>
</tr>
</tbody>
</table>

Olsen 1999

**Location:** DENMARK

**Dates:** 1991 – 1992

**Population:** Singleton births during study period to women aged 15-44 who were Danish citizens

**n:** 113814 (103611 for subgroup analysis)

**Definitions:**

- Stillbirth: Fetal death after 28 wks
- GA
- PNM: Stillbirths + death in first week of life
- NM: Death in first 4 weeks of life
- IM: NM + PNM
- Education: 8th grade, 9th grade, 10-11th grade, upper secondary, short further education (FE), medium course FE, long course FE

**Data sources and analysis:**

- Danish Fertility Database (comprises select data from Medical Birth Register and National Bureau of Statistics)
- Analysis: Logistic regression to estimate effect of maternal education with and without control for confounders of maternal age, parity and smoking.
- Aetiological fraction calculated according to Miettinen 1974.

**Study context and overall findings:**

Studied the effect of maternal education on stillbirths and infant mortality in Denmark. The lowest educational level was associated with the highest mortality for all outcomes with an inverse relationship demonstrated between maternal education levels and infant mortality rates although differences between women with different levels of further education (short course versus postgraduate study) were not clearly demonstrated. However, when the analysis was adjusted for maternal age, parity and smoking no clear educational advantage persisted for rates of stillbirth, but a clear educational advantage was evident for rates of NM and PNM.

**Critical appraisal comments:**

- Method of selecting groups: Well reported and representative
- Adjustment made for confounding: None
- Overall risk of bias: Moderate

**Reference rate:** per 1000 live births

- Stillbirth: 4.6 per 1000 live births
- NM – 3.6 per 1000 live births
- PNM – 2.3 per 1000 live births

**Infant deaths by ME: (number per 100 live births)**

<table>
<thead>
<tr>
<th>Education</th>
<th>births</th>
<th>stillbirths</th>
<th>NM</th>
<th>PNM</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>8298</td>
<td>0.45</td>
<td>0.28</td>
<td>0.22</td>
</tr>
<tr>
<td>8th grade</td>
<td>5587</td>
<td>0.61</td>
<td>0.54</td>
<td>0.43</td>
</tr>
<tr>
<td>9th grade</td>
<td>18912</td>
<td>0.53</td>
<td>0.47</td>
<td>0.30</td>
</tr>
<tr>
<td>10-11th grade</td>
<td>48798</td>
<td>0.44</td>
<td>0.36</td>
<td>0.22</td>
</tr>
<tr>
<td>upper second</td>
<td>12843</td>
<td>0.40</td>
<td>0.34</td>
<td>0.19</td>
</tr>
<tr>
<td>short FE</td>
<td>4835</td>
<td>0.46</td>
<td>0.21</td>
<td>0.17</td>
</tr>
<tr>
<td>medium FE</td>
<td>10,529</td>
<td>0.39</td>
<td>0.28</td>
<td>0.12</td>
</tr>
<tr>
<td>long FE</td>
<td>4102</td>
<td>0.46</td>
<td>0.17</td>
<td>0.17</td>
</tr>
</tbody>
</table>
Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

### Adjusted OR (95% CI) for IM by ME:

<table>
<thead>
<tr>
<th>Education</th>
<th>unadj</th>
<th>Adj 1</th>
<th>Adj 2</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>0.92</td>
<td>0.88</td>
<td>0.91</td>
<td>0.64 to 1.30</td>
</tr>
<tr>
<td>8th grade</td>
<td>1.96</td>
<td>1.50</td>
<td>1.47</td>
<td>1.07 to 2.01</td>
</tr>
<tr>
<td>9th grade</td>
<td>1.36</td>
<td>1.22</td>
<td>1.18</td>
<td>0.94 to 1.47</td>
</tr>
<tr>
<td>10-11th grade</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>upper second.</td>
<td>0.87</td>
<td>0.93</td>
<td>0.96</td>
<td>0.72 to 1.29</td>
</tr>
<tr>
<td>short FE</td>
<td>0.78</td>
<td>0.73</td>
<td>0.79</td>
<td>0.47 to 1.31</td>
</tr>
<tr>
<td>medium FE</td>
<td>0.55</td>
<td>0.78</td>
<td>0.78</td>
<td>0.54 to 1.12</td>
</tr>
<tr>
<td>long FE</td>
<td>0.78</td>
<td>0.66</td>
<td>0.76</td>
<td>0.43 to 1.35</td>
</tr>
</tbody>
</table>

**Tests of trend**

- Adj 1 – adjusted for age and parity, p=0.008
- Adj 2 – adjusted for age, parity and smoking, p=0.003

### Adjusted OR (95% CI) for PM by ME:

<table>
<thead>
<tr>
<th>Education</th>
<th>unadj</th>
<th>Adj 1</th>
<th>Adj 2</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>0.93</td>
<td>0.93</td>
<td>0.97</td>
<td>0.71 to 1.32</td>
</tr>
<tr>
<td>8th grade</td>
<td>1.44</td>
<td>1.36</td>
<td>1.16</td>
<td>0.85 to 1.59</td>
</tr>
<tr>
<td>9th grade</td>
<td>1.28</td>
<td>1.25</td>
<td>1.18</td>
<td>0.97 to 1.45</td>
</tr>
<tr>
<td>10-11th grade</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>upper second.</td>
<td>0.93</td>
<td>0.93</td>
<td>1.00</td>
<td>0.77 to 1.29</td>
</tr>
<tr>
<td>short FE</td>
<td>0.93</td>
<td>0.96</td>
<td>1.04</td>
<td>0.70 to 1.54</td>
</tr>
<tr>
<td>medium FE</td>
<td>0.88</td>
<td>0.89</td>
<td>1.01</td>
<td>0.76 to 1.35</td>
</tr>
<tr>
<td>long FE</td>
<td>0.83</td>
<td>0.80</td>
<td>0.90</td>
<td>0.57 to 1.41</td>
</tr>
</tbody>
</table>

**Tests of trend**

- Adj 1 – adjusted for age and parity, p=0.060
- Adj 2 – adjusted for age, parity and smoking, p=0.781 (test for trend, p=0.247)
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oyen 1990</td>
<td>Live born American Indian and White infants in South and North Dakota during study period</td>
<td>SIDS: sudden and unexplained death to 1 year&lt;br&gt;<strong>ME</strong>: 1-8 yrs, 9-12 yrs, &gt;12 yrs</td>
<td>Linked Birth and Death certificates for North and South Dakota</td>
<td><strong>Crude RR (95% CI) for SIDS by ME:</strong> &lt;br&gt;<strong>American Indians</strong>&lt;br&gt;1-8 yrs education – 12/1285 (9.3 per 1000 live births) 3.7 (1.5 to 8.9)&lt;br&gt;9-12 yrs education – 76/12953 (5.9 per 1000 live births) 2.3 (1.1 to 4.7)&lt;br&gt;&gt;12 yrs education – 8/3123 (2.6 per 1000 live births) 1.0 (reference)&lt;br&gt;<strong>Whites</strong>&lt;br&gt;1-8 yrs education – 13/2845 (4.6 per 1000 live births) 4.9 (2.7 to 8.8)&lt;br&gt;9-12 yrs education – 148/85070 (1.7 per 1000 live births) 1.9 (1.4 to 2.5)&lt;br&gt;&gt;12 yrs education – 71/75413 (0.9 per 1000 live births) 1.0 (reference)</td>
</tr>
<tr>
<td></td>
<td>American Indian: 17644&lt;br&gt;White: 164164&lt;br&gt;Black excluded.</td>
<td><strong>Analysis</strong>: Age at death distribution for SIDS deaths tested using Wilcoxon rank sum test. RR (95% CI) for SIDS calculated. Adjusted for birth weight, maternal education, maternal age, trimester care began.</td>
<td><strong>Critical appraisal comments</strong>&lt;br&gt;<strong>Method of selecting groups</strong>: Well reported and representative.&lt;br&gt;<strong>Adjustment made for confounding (age, parity, smoking, SES)</strong>: Only adjusted for maternal age.&lt;br&gt;<strong>Completeness of dataset</strong>: Good.&lt;br&gt;<strong>Risk of misclassification bias</strong>: Moderate due to nonuniformity of categorisation of race between different US states and difference in definitions of SIDS.&lt;br&gt;<strong>Overall risk of bias</strong>: Moderate.</td>
<td><strong>Crude and adjusted American Indian-White risk ratios (95% CI) for SIDS; variable adjusted</strong>&lt;br&gt;None – 3.9 (3.1 to 4.9)&lt;br&gt;BW – 3.8 (3.0 to 4.8)&lt;br&gt;Maternal age – 3.7 (2.9 to 4.7)&lt;br&gt;ME – 3.1 (2.4 to 4.0)&lt;br&gt;Trimester care began – 3.0 (2.3 to 3.9)&lt;br&gt;ME and trimester care began – 2.5 (1.9 to 3.4)</td>
</tr>
</tbody>
</table>
Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

**Reference**
Parker 1994

**Population**
Singleton live births to white or black non-Hispanic mothers at least 24 weeks GA.

**Definitions**
- **LBW**: Birth weight less than 2500g
- **PT**: GA less than 37 completed weeks
- **SGA**: BW below 10th percentile of birth weight for GA

**Data sources and analysis**
- **1988 National Maternal and Infant Health Survey from National Center for Health Statistics.**
- **BW** and **GA** from birth certificate
- **Education** from questionnaire mailed to mothers

**Analysis:** Spearman rank-order correlation coefficients calculated between socioeconomic indicators. Multiple logistic regression used to estimate relationship between birth outcome and measures of socioeconomic status. Adjusted for maternal age, parity, marital status, maternal height. Black and White reported separately.

### Maternal education outcomes

<table>
<thead>
<tr>
<th></th>
<th>LBW rate by ME: White and Black (per 100 live births)</th>
<th>SGA rate by ME: White and Black (per 100 live births)</th>
<th>PT rate by ME: White and Black (per 100 live births)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>White</td>
<td>Black</td>
<td>Education</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12 yrs</td>
<td>23/307</td>
<td>7.5</td>
<td>38/307</td>
</tr>
<tr>
<td>12 yrs</td>
<td>57/1321</td>
<td>4.3</td>
<td>124/1321</td>
</tr>
<tr>
<td>13 to 15 yrs</td>
<td>35/898</td>
<td>3.9</td>
<td>69/898</td>
</tr>
<tr>
<td>&gt;16 yrs</td>
<td>26/723</td>
<td>3.4</td>
<td>48/723</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Adjusted OR of LBW by ME: White and Black</th>
<th>Adjusted OR of SGA by ME: White and Black</th>
<th>Adjusted OR of PT by ME: White and Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>White</td>
<td>Black</td>
<td>White</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12 yrs</td>
<td>2.32</td>
<td>2.10</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>12 yrs</td>
<td>1.30</td>
<td>1.57</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>13 to 15 yrs</td>
<td>1.13</td>
<td>1.26</td>
<td></td>
</tr>
<tr>
<td>&gt;16 yrs</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

**Study context and overall findings**

Studied LBW, SGA and PT births among black and white women to examine impact of 5 socioeconomic indicators – maternal and paternal education, family income, maternal and paternal occupation. Maternal and paternal education levels were the best overall predictors of the outcomes but the patterns differed for black and white. Maternal education was significantly associated with risk of LBW and PT among black mothers whereas SGA was significantly associated with low maternal education among white mothers.

**Reference rate:** SGA rate per 100 births
- White infants – 8.5
- Black infants – 16.2

**Critical appraisal comments**

- **Method of selecting groups:** Well reported. LBW infants overrepresented to allow detailed analysis.
- **Adjustment made for confounding (age, parity, smoking, SES):** Did not adjust for smoking
- **Completeness of dataset:** More missing data for black than white women.
- **Risk of misclassification bias:** Low. However, maternal education was self-report.
- **Overall risk of bias:** Low to moderate

**Adjustment for confounding variables:**
- Adjusted for maternal age, parity, marital status, maternal height, marital status.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pena 2000</td>
<td>Children born alive during study period</td>
<td><strong>IM</strong>: Death before 12 months of life&lt;br&gt;&lt;br&gt;<strong>Education</strong>: No formal education, primary school, secondary school and above&lt;br&gt;&lt;br&gt;<strong>SES</strong>: Based on median unsatisfied basic needs assessment – based on 4 dimensions: housing quality, school enrolment among minors, dependency ratio and availability of sanitary services</td>
<td>Interviews with women of reproductive age in a random sample of geographical clusters in one city (Leon) were used to obtain data births, stillbirths, abortions, sex of child, and date of death (if applicable)</td>
<td><strong>IMR per 1000 live births by ME</strong>:&lt;br&gt;education cases/person-years IMR secondary or higher 52/1636 29.7 per 1000 primary 127/2451 48.1 per 1000 no formal education 163/2307 65.5 per 1000</td>
</tr>
<tr>
<td></td>
<td>Total women interviewed: 10867 (99.4% of sampled)</td>
<td>1. non poor household in non poor neighbourhood&lt;br&gt;2. non poor household in poor neighbourhood&lt;br&gt;3. poor household in poor neighbourhood&lt;br&gt;4. poor household in non poor neighbourhood</td>
<td><strong>Analysis</strong>: IM calculated as cumulative IMR based on monthly death rates calculated via lifetable technique (density method). Mantel-Haenszel age adjusted relative risk for IM calculated by comparing different exposure groups.</td>
<td><strong>RR (95%CI) of Maentel Haenszel Age-adjusted IM by ME</strong>:&lt;br&gt;education RR secondary or higher 1.00 primary 1.62 (1.18 to 2.23) no formal education 2.20 (1.62 to 2.98)</td>
</tr>
<tr>
<td></td>
<td>Live-born infants: n=7073</td>
<td>SES estimated using unsatisfied basic needs (UBN) assessment – based on 4 dimensions: housing quality, school enrolment among minors, dependency ratio and availability of sanitary services</td>
<td></td>
<td><strong>RR (95%CI) of IM by ME and SES</strong>:&lt;br&gt;&lt;br&gt;<strong>Non poor households (disregarding neighbourhood status)</strong>&lt;br&gt;&lt;br&gt;education RR PPE (%) PAP (%) secondary or higher 1.0 16 primary 1.2 (0.8,1.9) 14 3 no formal education 1.2 (0.7,2.2) 6 1</td>
</tr>
<tr>
<td></td>
<td>Location: NICARAGUA&lt;br&gt;Dates: Jan 1988 to Dec 1993</td>
<td></td>
<td></td>
<td>Poor households in poor neighbourhoods&lt;br&gt;&lt;br&gt;education RR PPE (%) PAP (%) secondary or higher 1.4 (0.8,2.4) 8 3 primary 1.6 (1.1,2.4) 21 11 no formal education 1.8 (1.2,2.7) 28 18</td>
</tr>
<tr>
<td></td>
<td>Study context and overall findings</td>
<td></td>
<td></td>
<td>Poor households in nonpoor neighbourhoods&lt;br&gt;&lt;br&gt;education RR PPE (%) PAP (%) secondary or higher 0.8 (0.2,3.5) 1 0 primary 1.4 (0.7,2.8) 3 1 no formal education 3.5 (1.2,6.2) 2 5</td>
</tr>
<tr>
<td></td>
<td>Pena 2000 studied effect of poverty and social inequality on IM and preventive effect of IM. Higher maternal education was associated with lower risk of IM but mother’s position in household, distance to health services, urban vs rural residency, study period not significantly related to IM. There was a clear inverse relationship between maternal education and IM rate (from 65.5 per 1000 live births in women with no formal education to 29.7 per 1000 for women with secondary schooling or higher). However when stratified by socioeconomic status (measured by meeting of household basic needs), only women in poor households realised a benefit of higher levels of maternal education</td>
<td></td>
<td></td>
<td>Adjusted for mother’s age, parity and child’s sex</td>
</tr>
<tr>
<td></td>
<td>Reference rate: IM per 1000 live births: 50 per 1000 live births</td>
<td></td>
<td></td>
<td>Overall risk of bias: Low to moderate</td>
</tr>
<tr>
<td></td>
<td>Critical appraisal comments</td>
<td></td>
<td></td>
<td>Method of selecting groups: Very well reported and representative (during study period some groups with low IM may have migrated from the area reducing social differentials in IM) Adjustments made for confounding (sex, parity, smoking, SES): Did not adjust for smoking Completeness of dataset: Good Risk of misclassification bias: Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Reference

**Pezzino 1996**

**Location:** UNITED STATES

**Dates:** 1983 to 1987

**Quality comment:** analysis did not adjust for some known risk factors for SIDS including maternal smoking, respiratory infections, seasonality and breastfeeding and sleeping position as information not available in dataset

**Population**

Singleton births to White and American Indian mothers residing in the United States during study period

Singleton births: White n=14193381 American Indian n=157709

**Definitions**

- **SIDS:** Sudden death of infant under 1 year of age which remains unexplained after thorough case investigation including performance of autopsy, examination of death scene and review of clinical history
- **Race:** obtained from birth certificate
- **Pernal care:** (Kessner’s Index based on GA, month of initiation and number of prenatal visits)
- **PNM education:** <12 – less than grade 12
  12 – grade 12
  >12 – higher than grade 12

**Data sources and analysis**

National Center for Health Statistics annual datasets for linked birth/infant death records. Race of the mother obtained from the birth certificate. Race of the infant based on mothers race.

**Analysis:** Pearson chi-squared used to test for differences in prevalence of risk factors for SIDS among American Indians and whites.

Prevalence of risk factors for SIDS analysed separately in nested case-control study using a random sample of records of survivors n=293959, 290641 white 3318 American Indian. Adjusted RR of SIDS estimated through logistic regression.

**Maternal education outcomes**

**SIDS deaths:**

- **White**
  - 17272/14193381  1.22 per 1000 live births neonatal–1111 postneonatal – 16161
  - Crude RR = 2.78 Adjusted RR=1.49
  - Age at SIDS death median 10 weeks for both groups

**Adjusted RR (95%CI) of SIDS by ME and race (white vs Am. Indian)**

**White education**

- n (%) SIDS cases RR

<table>
<thead>
<tr>
<th>Education</th>
<th>n (%)</th>
<th>SIDS cases</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>5189/17272 (40%)</td>
<td>1.84 (1.74 to 1.95)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>5087/17272 (39%)</td>
<td>1.17 (1.11 to 1.23)</td>
<td></td>
</tr>
<tr>
<td>&gt;12</td>
<td>2769/17272 (21%)</td>
<td>1.00 (reference)</td>
<td></td>
</tr>
</tbody>
</table>

**American Indian education**

- n (%) SIDS cases RR

<table>
<thead>
<tr>
<th>Education</th>
<th>n (%)</th>
<th>SIDS cases</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>212/534 (51%)</td>
<td>1.36 (0.93 to 1.97)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>160/534 (38%)</td>
<td>1.16 (0.81 to 1.68)</td>
<td></td>
</tr>
<tr>
<td>&gt;12</td>
<td>47/534 (11%)</td>
<td>1.00 (reference)</td>
<td></td>
</tr>
</tbody>
</table>

**Study context and overall findings**

Studied SIDS rates and risk factors among American Indians and white Americans. Overall the SIDS rate was higher among American Indian than white Americans and American Indian mothers had a higher prevalence of risk factors for SIDS than white mothers. When results were adjusted for mother’s age, marital status, parity, prenatal care, babies’ sex, GA and BW, there was an excess risk of SIDS for American Indians of 1.49. Maternal education level was associated with risk of SIDS for white Americans but there was no significant relationship between maternal education and risk of SIDS for American Indians.

**Critical appraisal comments**

- Method of selecting groups: Reported
- Adjustment made for confounding (age, parity, smoking, SES):
  - Smoking, respiratory infection, season, breastfeeding and sleeping position not controlled for
- Completeness of dataset: Unclear
- Risk of misclassification bias: Low
- Overall risk of bias: Moderate

Reference rates: per 1000 live births

- **PNM rate:** White – 3.08; American Indian – 7.41
- **SIDS:** White – 1.22 American Indian – 3.39
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poerwanto 2003</td>
<td>Reproductive women aged 15-49 n=28810</td>
<td>IM: Death in first 12 months of life&lt;br&gt;FWI: Family welfare status&lt;br&gt;low – preprosperous (poor)&lt;br&gt;medium – low prosperous (near poor)&lt;br&gt;high – medium to very prosperous (rich)&lt;br&gt;Education:&lt;br&gt;Low - &lt; 7 years formal education;&lt;br&gt;High - 7 or more years formal education</td>
<td>Macro IDHS (International-USA Demographic and Health Survey). Stratified probability sample from 27 Indonesian provinces. Random sample of 34255 households (response rate 99%) from 1413 Primary Sampling Units (mean cluster size per unit 25). Interviews with 28810 women of reproductive age. Aggregate weights for national, regional provincial and urban-rural were applied to the data to produce non-biased estimates.</td>
<td>%IM by ME:&lt;br&gt;&gt;7yrs - 8.1% (SE 1.3)&lt;br&gt;&lt; 7yrs - 18.9% (SE 1.8) Adjusted OR (95%CI) for IM by ME: Ref. high education&lt;br&gt;Low ed: 3.36 (1.6 to 7.06) p=0.0014 Interaction effects (FWI x ME): Low ed + poor : 0.88 (0.41 to 1.89) ref poor education high Low ed + near poor: 0.45 (0.21 to 0.98) ref: near poor education high There was a significant interaction effect in the logistic regression model for FWI and ME (p&lt;0.001)</td>
</tr>
</tbody>
</table>

**Study context and overall findings**

Poerwanto 2003 studied maternal education and income inequality (as indicated by family welfare status). Women with the lowest levels of education were found to have a 3.4 times higher risk of infant mortality than women with the highest levels of education (more or less than 7 years). Women with low family welfare index had a risk of IM 1.7 times higher than families with a high family welfare index and over three times higher (3.3) than families with a medium income. Reference rate: Not reported separately

**Critical appraisal comments**

Method of selecting groups: Well reported and representative<br>Adjustment made for confounding (age, parity, smoking, SES): Did not adjust for smoking.<br>Completeness of dataset: Unclear<br>Risk of misclassification bias: Low to moderate (FWI may be problematic)<br>Overall risk of bias: Moderate
### Reference

Raum 2001

**Location:** GERMANY

**Dates:** 1987 – 1991

### Population

Singleton liveborn infants of mothers in the former West and East Germany surveyed during the study period.

- Former West Germany: n=3374
- Former East Germany: n=3070

### Definitions

**SGA:** 10th percentile of BW from 24 – 43 weeks GA

**Education:**
- I: <8yrs East and West Germany
- II: 9 yrs West and 10 yrs East
- III: 10 yrs West and 12 yrs East
- IV: 13yrs West and Technical College East
- V: University East and West

### Data sources and analysis

Prospective survey of women seeing obstetricians in West Germany (591/1000 obstetricians agreed to participate in study) and 8 hospitals in East Germany.

Surveys returned by 3946 pregnant women in West Germany and 4043 in East Germany. Pregnancy outcome available for 3374 West German women and 3113 East German women.

### Maternal education outcomes

<table>
<thead>
<tr>
<th>Education</th>
<th>OR (95%CI) SGA by ME in former East and West Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>reference</td>
</tr>
<tr>
<td>IV</td>
<td>1.39 (0.73 to 2.65)</td>
</tr>
<tr>
<td>II</td>
<td>1.49 (0.85 to 2.61)</td>
</tr>
<tr>
<td>I</td>
<td>1.60 (0.92 to 2.78)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th>Adjusted OR (95%CI) SGA by ME in former East and West Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>reference</td>
</tr>
<tr>
<td>IV</td>
<td>1.28 (0.66 to 2.48)</td>
</tr>
<tr>
<td>II</td>
<td>1.35 (0.75 to 2.42)</td>
</tr>
<tr>
<td>I</td>
<td>2.02 (0.87 to 4.72)</td>
</tr>
</tbody>
</table>

### Study context and overall findings

Raum 2001 compared rates of SGA for women living in the former West and East Germany in order to compare the effect of ME on SGA in difference social and political systems. When the analysis was adjusted for BMI, smoking, marital status, mother’s age, parity and maternal height women with the lowest levels of education in East Germany were found to have twice the risk of SGA compared to women with a university level of education, but there were no other significant differences according to maternal education level in either East Germany or West German women.

**Reference rates:**
- SGA - East Germany 10.8%
- West Germany 9.5%

### Critical appraisal comments

- Method of selecting groups: well reported. Data obtained from surveys conducted by doctors agreeing to participate in the study – 60% of doctors participated. No information available about doctors or women not participating. Other information such as maternal height and smoking status also self-report. However, authors state no strong evidence of information or selection bias in sample.
- Adjustment made for confounding: age, parity, smoking, SES. Did not adjust for SES.
- Completeness of dataset: Unclear
- Risk of misclassification bias: Low

**Overall risk of bias:** Moderate
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandiford 1997</td>
<td>Infants of women aged 25-29 who had become literate through adult education during the Nicaraguan National Literacy Crusade in 1980, in Masaya Province, Nicaragua. Excluded women who: were less than 15 during the NLC (may have become literate as children); attended primary school and adult literacy classes; could read but not write. Matched each adult literacy woman with one illiterate woman and one woman who had become literate through formal schooling. n=1294 mothers and 7475 infants.</td>
<td>Literate: Able to read one simple sentence from a set of three and write another sentence from the same set of three. (e.g. fish live in water) IM: Death from 0-1 year of life. NM: Not reported PNM: Not reported</td>
<td>Structured questionnaires administered to study participants after literacy established by completing simple reading and writing test. Analysis: Logistic regression to determine unadjusted and adjusted odds ratios for infant mortality and maternal education. Adjusted for: family formation variables (age and birth order); water supply, ownership of toilet; ownership of fridge or car; aspects of house construction; literacy of woman’s mother; household structure (single or cohabiting and number of occupants per bedroom); woman’s height and calf circumference; urban/rural residence; employment status.</td>
<td>IM rate: (per 1000 live births) illiterate – 93 adult education – 67 p&lt;0.01 compared to illiterate formal schooling – 72 p&lt;0.05 compared to illiterate PNM rate: (per 1000 live births) illiterate – 66 adult education – 50 p&lt;0.05 compared to illiterate formal schooling – 57 NM rate: (per 1000 live births) illiterate – 29 adult education – 18 p&lt;0.05 compared to illiterate formal schooling – 17 p&lt;0.05 compared to illiterate OR (95%CI) for infant mortality by ME: illiterate vs adult education Crude Adj NM 1.33 (0.95 to 1.86) 1.27 (0.89 to 1.94) PNM 1.14 (0.90 to 1.46) 1.11 (0.87 to 1.42) IM 1.19 (0.98 to 1.46) 1.16 (0.94 to 1.42) Crude: only adjusted for age of mother, year of birth, sex of child, order of birth Adjusted: all socioeconomic variables OR (95%CI) for infant mortality by ME: formal schooling vs adult education Crude Adj NM 0.92 (0.74 to 1.10) 0.95 (0.60 to 1.50) PNM 1.08 (0.82 to 1.42) 1.07 (0.80 to 1.43) IM 1.03 (0.81 to 1.30) 1.03 (0.80 to 1.32) Crude: only adjusted for age of mother, year of birth, sex of child, order of birth Adjusted: all socioeconomic variables</td>
</tr>
</tbody>
</table>

Critical appraisal

Method of selecting groups: Well described but focused on adult literacy therefore may lack generalisability
Adjustment made for confounding (age, parity, smoking, SES): Did not adjust for smoking.
Completeness of dataset: Unclear
Risk of misclassification bias: Unclear
Overall risk of bias: Moderate

Study context and overall findings

Studied maternal intelligence, maternal literacy and child survival (including infant mortality) in Nicaragua. No significant difference in IM, PNM or NM was observed between women with no formal schooling who were illiterate and those who had gained literacy either through formal schooling or adult education.
Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

Reference
Schell 2007

Population
152 countries with data on infant mortality rate from the World Development Index 2003

Definitions
**IM**: Infant deaths before one year of age
**Young female illiteracy (YFI)**: Women aged 15-25 who were illiterate

Data sources and analysis
World Development Indicators 2003

**Analysis**: Pearson correlations of IMR against YFI and linear regression analysis to determine contribution of 5 variables (national income, young female illiteracy rate, Gini index of economic inequity, poverty rate, public spending on health) to IMR.

Maternal education outcomes
**Overall result**: 3 variables – GNI/capita, YFI rate and income distribution predicted 92% of variability in IMR at a country level

YFI most important predictor for low income countries and an important predictor in middle income countries. Public spending on health did not make a significant difference to IMR when adjusted for other variables.

Correlations of IMR and YFI rate
- **All countries**
  - univariate analysis – Pearson correlation – 0.82 p<0.001 n=137
  - multivariate – correlation – 0.46 p<0.001 n=105
- **Low income countries**
  - univariate – correlation – 0.65 p<0.001 n=51
  - multivariate – correlation – 0.55 p<0.001 n=50
- **Middle income countries**
  - univariate – correlation – 0.65 p<0.001 n=58
  - multivariate – correlation – 0.36 p=0.018 n=44
- **High income countries** – NA

Study context and overall findings
Studied predictors of IMR at a country level in 152 countries. Overall gross national income per capita, young female illiteracy and income equality predicted 92% of the variance in national infant mortality rates. In low income countries female illiteracy was a more important predictor than income.

Critical appraisal comments
Method of selecting groups: Well reported and representative
Adjustment made for confounding (age, parity, smoking, SES): Did not adjust for smoking, age or parity but analysis at a country not individual level
Completeness of dataset: Good
Risk of misclassification bias: Low
Overall risk of bias: Low
Singh 1995 studied infant mortality trends and projections in the US from 1950 to 2010. Over the period 1950 to 1991 IM rates in the US declined significantly, however, the disparity between white and African American IM rates increased (as the rate of decline for African American IM rate was lower than for whites). An inverse relationship between maternal education and infant mortality rates was demonstrated for both white and African American women. However, the effect appeared to be larger for white women compared with African American women. The ratio of white to African American infant mortality increased for increasing levels of maternal education suggesting a widening disparity in infant mortality as educational attainment increased.

Reference rates: (per 1000 live births) 1985-1987

<table>
<thead>
<tr>
<th></th>
<th>NMR</th>
<th>PNMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>5.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Black</td>
<td>12.0</td>
<td>6.2</td>
</tr>
<tr>
<td>American Indian</td>
<td>6.1</td>
<td>7.2</td>
</tr>
</tbody>
</table>

**Study context and overall findings**

Singh 1995 studied infant mortality trends and projections in the US from 1950 to 2010. Over the period 1950 to 1991 IM rates in the US declined significantly, however, the disparity between white and African American IM rates increased (as the rate of decline for African American IM rate was lower than for whites). An inverse relationship between maternal education and infant mortality rates was demonstrated for both white and African American women. However, the effect appeared to be larger for white women compared with African American women. The ratio of white to African American infant mortality increased for increasing levels of maternal education suggesting a widening disparity in infant mortality as educational attainment increased.
## Population

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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NM rates (per 1000 live births) by ME 2001 birth cohort education (yrs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PNM rates (per 1000 live births) by ME 2001 birth cohort education (yrs)</td>
</tr>
</tbody>
</table>

### Study context and overall findings

Singh 2007 studied infant mortality trends and in relation to socioeconomic deprivation in the US from 1969 to 2001. Over the period IM rates in the US declined significantly, however relative disparities in infant mortality increased. Relative risk of IM increased for the most deprived group between 1969 and 2001 compared with the least deprived. Education-specific risk of PNM and NM also increased between 1969 and 2001.

### Critical appraisal comments

Method of selecting groups: Population level study so included all live births and infant deaths. Adjustment made for confounding age, parity, smoking, SES.

Adjusted for all maternal age, parity and smoking. Measured individual level SES by level of maternal education.

Completeness of data set: Unclear but probably high Risk of misclassification bias: Unclear but probably Low Overall risk of bias: Low
<table>
<thead>
<tr>
<th>Education (yrs)</th>
<th>Unadjusted RR (95%CI) of PNM by ME 2001 birth cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>3.50 (3.25 to 3.75)</td>
</tr>
<tr>
<td>12</td>
<td>2.58 (2.40 to 2.77)</td>
</tr>
<tr>
<td>13-15</td>
<td>1.86 (1.72 to 2.01)</td>
</tr>
<tr>
<td>≥16</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education (yrs)</th>
<th>Adjusted RR (95%CI) of PNM by ME 2001 birth cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>2.42 (2.23 to 2.64)</td>
</tr>
<tr>
<td>12</td>
<td>1.92 (1.78 to 2.07)</td>
</tr>
<tr>
<td>13-15</td>
<td>1.57 (1.45 to 1.70)</td>
</tr>
<tr>
<td>≥16</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Maternal Education
## Reference

**Stoltenberg 1998**

**Location:** NORWAY  
**Dates:** 1967 to 1993

Children of both parents with either ethnic Pakistani origin or both Norwegian origin born in Norway during study period. Immigrants excluded. Also excluded infants with missing information about infant mortality at census date, parental consanguinity and parity

<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| Pakistani infants n=7274 (of 7494) | Stillbirth: Infant death with GA greater than 16 weeks  
IM: Death in first year of life  
Early mortality: Stillbirth + IM  
Parental relations: Non-consanguineous, first cousins or closer, other consanguineous relations (i.e. related more distantly than cousins) | Medical Registry of Norway for IM and other birth information  
Statistics Norway for linked data on education and parental country of origin – education obtained from 1990 census. | Stillbirths and IM by ME and race: (per 1000 live births)  
education | Stillbirths  
IM (years)  
Norwegian  
Pakistani  
>12  
2633/276136  
1878/276136  
1/357  
9.5 per 1000  
14 per 1000  
6.8 per 1000  
2.8 per 1000  
10 – 12  
8886/807246  
7210/807246  
11/860  
11 per 1000  
12 per 1000  
8.9 per 1000  
12 per 1000  
<10  
4440/313900  
3809/313900  
22/1467  
14.1 per 1000  
11.5  
12.1 per 1000  
15 per 1000  |
| Norwegian infants n=1431055 (of 1448766) | | |  
Adjusted OR (95%CI) for stillbirth by ME and race: education(years)  
Norwegian  
Pakistani  
>12  
1.0  
1.0  
10 – 12  
1.2 (1.2 to 1.3)  
0.9 (0.3 to 2.7)  
<10  
1.5 (1.4 to 1.6)  
0.8 (0.3 to 2.2)  |
| | | | Adjusted OR (95%CI) for IM by ME and race: education(years)  
Norwegian  
Pakistani  
>12  
1.0  
1.0  
10 – 12  
1.2 (1.2 to 1.3)  
0.6 (0.3 to 3.5)  
<10  
1.5 (1.4 to 1.6)  
4.5 (0.6 to 33.8)  |
| | | | Adjusted for consanguinity, ME, maternal age, parity and year of birth

## Critical appraisal comments

**Method of selecting groups:** Well reported and representative

**Adjustment made for confounding (age, parity, smoking, SES):** Did not adjust for smoking or SES

**Completeness of dataset:** Authors note that for Pakistani women in Norway educational attainment may not be an appropriate measure of SES, only a small proportion of Pakistani women had received higher education and there was a large proportion of missing data regarding educational attainment among Pakistani women.

**Risk of misclassification bias:** Moderate

**Overall risk of bias:** Moderate

## Study context and overall findings

Stoltenberg 1998 studied the influence of consanguinity and maternal education on risk of stillbirth and infant death in Norway comparing Norwegian born and Pakistani born mothers. Consanguinity was markedly higher among the Pakistani born (31% vs 0.1%). Overall, the Pakistani group had higher infant mortality compared to the Norwegian group (relative risk for stillbirth 1.3 and for IM 1.7) but differences between groups nonsignificant after adjusting for consanguinity and maternal education. There was a significant negative association between education level and stillbirth and IM for Norwegian group but not for the Pakistani group.

Reference rates: per 1000 live births (from 1967-1993)

**Norwegian**

Stillbirths – 16573/1431055 11.6 per 1000  
Infant deaths – 13367/1431055 9.3 per 1000

**Pakistani**

Stillbirths – 100/7274 13.7 per 1000  
Infant deaths – 92/7274 12.6 per 1000

Preventing infant deaths among Aboriginal and teenage women in South Australia, 2009

**Preventive and specific care for infant mortality**

**Preventive care**

- **Infant feeding:** Breastfeeding is protective against infant mortality. In 2007, 84% of infants 0–6 months old were breastfed, 6% were formula-fed, and 10% were mixed-fed.

- **Maternal nutrition:** Maternal nutrition and weight gain during pregnancy are important for preventing infant mortality. In 2007, 73% of women were in the recommended weight range for their age and height.

- **Antenatal care:**Antenatal care is essential for the health of both mother and baby. In 2007, 95% of pregnant women attended at least one antenatal visit.

- **Infectious disease control:** Vaccinations and disease control measures such as the control of childhood illnesses can help prevent infant mortality. In 2007, the childhood vaccination coverage rates were 95% for DTP (diphtheria, tetanus, and pertussis) and 90% for polio.

**Specific care**

- **Newborn care:** Early identification and treatment of newborn problems can help prevent infant mortality. In 2007, 99% of newborns received a first prenatal care visit within the first 2 weeks of life.

- **Newborn screening:** Newborn screening for disorders such as phenylketonuria and congenital hypothyroidism can help prevent infant mortality. In 2007, 100% of newborns underwent newborn screening.

- **Postnatal care:** Postnatal care is important for the health of both mother and baby. In 2007, 98% of mothers received postnatal care within 48 hours of delivery.

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- **Postnatal care:** Postnatal care is important for the health of both mother and baby. In 2007, 98% of mothers received postnatal care within 48 hours of delivery.
<table>
<thead>
<tr>
<th>Location: BRAZIL</th>
<th>Dates: Jan 1994 to Jun 1996</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants born in 140 municipalities in Ceara State, Brazil during study period.</td>
<td>IMR: Ratio of infant deaths to live births during study period.</td>
</tr>
<tr>
<td>1991 census for State of Ceara for maternal illiteracy rates Community Health Workers’ Program (PACS) for IM and other birth related information.</td>
<td>Analysis: Simple and multiple linear regression weighted by number of births. Analysis adjusted for: exclusive breastfeeding, prenatal care up to date, female illiteracy, household low income, households with inadequate water supply, urbanization, per capita gross municipality product (GMP) Ecological relative risk – RR comparing a child born in a community with 100% prevalence of the determinant of interest to a child born in a community with 0% of determinant of interest</td>
</tr>
<tr>
<td>Compared infant mortality rates across municipalities in one state in Brazil taking into consideration a range of proximate determinants (adequate weight gain and breast feeding), health service variables (adequate prenatal care, participation in growth monitoring, immunization, decentralisation of health services) and socioeconomic factors (female literacy rate, household income, adequate water supply, adequate sanitation, municipality income). In a logistic regression analysis, 41% of the variation in infant mortality by local municipalities was explained by a model which included breastfeeding, prenatal care, household income, female illiteracy rate, adequacy of water supply, urbanisation and per capital GMP. The ecological relative risk of infant mortality was 2.24 (p=0.00001) for female illiteracy.</td>
<td>Method of selecting groups: Well reported and representative. Adjustment made for confounding (age, parity, smoking, SES): Did not adjust for age, parity or smoking but an ecological analysis not a patient-based analysis Completeness of dataset: LBW likely to be underreported especially in low-income communities. Risk of misclassification bias: Low to moderate Overall risk of bias: Moderate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study context and overall findings</th>
<th>Critical appraisal comments</th>
</tr>
</thead>
</table>
| Regression model of determinants of variations in IM in 140 municipalities in State of Ceara Brazil Overall $R^2 = 40.9 \text{ p}<0.0001$ (i.e. model explains approximately 41% of variance in IM) correlations coefficients (SE) exclusive breastfeeding $-0.32 (0.15) \text{ p}<0.05$ prenatal care up to date $-0.49 (0.11) \text{ p}<0.0001$ female illiteracy rate $1.07 (0.25) \text{ p}<0.0001$ low income household $-0.61 (0.20) \text{ p}<0.0001$ inadequate water supply $0.20 (0.11) \text{ p}<0.10$ urbanization $0.21 (0.11) \text{ p}<0.10$ per capita GMP $-0.003 (0.002)\

Ecological relative risk of IM exclusive breastfeeding – RR 0.62 p=0.02 prenatal care up to date – RR 0.43 p=0.0001 female illiteracy – RR 2.24 p=0.0001 inadequate water supply – RR 1.25 p=0.06 urbanization – RR 1.23 p=0.05

Reference rate: IM per 1000 live births range 14 to 193

Risk of bias: Moderate
<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Definitions</th>
<th>Data sources and analysis</th>
<th>Maternal education outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tressarras 1992</td>
<td>Infants in 103 countries with available data on IM and adult illiteracy</td>
<td>IM: Not defined</td>
<td>UN State of the World’s Children Report 1982 for IM and adult illiteracy.</td>
<td>Ecological RR (95%CI) for IM by female illiteracy: 5.82 (5.16 to 10.71)</td>
</tr>
<tr>
<td></td>
<td>Ecological study so no individual level data given n=103 countries</td>
<td>Adult illiteracy: Not defined</td>
<td>Analysis: Ecological relative risk calculated using logistic regression.</td>
<td>Correlation between IM and female illiteracy:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Each country weighted according to number of births estimated from total population and crude birth rate (adjusted prevented small or large countries from dominating in the analysis).</td>
<td>r=0.855, p&lt;0.05</td>
</tr>
</tbody>
</table>

**Study context and overall findings**

- Studied infant mortality, per capita income and adult illiteracy in 103 countries. Correlation between IM and per capita income was statistically significant (-0.73) as was correlation between IM and female illiteracy (0.86) (p<0.05).

**Critical appraisal comments**

- Method of selecting groups: Not well reported but 103 countries represented 90% of world population at time of study.
- Adjustment made for confounding (age, parity, smoking, SES): Not applicable as an ecological study.
- Completeness of dataset: Unclear
- Risk of misclassification bias: Unclear
- Overall risk of bias: Moderate

2.4 Community Resilience: Does community resilience have a significant bearing on infant mortality rates?

What is community resilience?

Resilience refers to the ability to react and adapt positively when faced with hardship, challenges and difficult conditions. In physics, resilience can be defined as the capacity of a material to bend and bounce back, rather than break, when stressed. It is a term widely used within areas such as child psychology, social policy, ecology and disaster planning. It can apply to both individuals and systems (families, groups and communities), although the distinctions between individual and community resilience are not always clear. The literature on individual resilience is considerably more developed than that on community resilience. In the context of disaster readiness, Norris 2007 notes that a collection of resilient individuals does not guarantee a resilient community.

Authors may use a range of terms for concepts of – or having some similarities to – community resilience. These include terms such as cohesion, social capital, social engagement, adaptability, empowerment, collective capacity, and strength. A useful perspective is that of ‘community wellbeing’ which depends on the following attributes of resources (Norris 2007; Hampshire 2005):

- Robustness – withstanding stress without suffering degradation (but fragile if the resource works only under a small number of possible scenarios);
- Redundancy or resource diversity – for example having larger social networks or by having more than one way to solve a problem;
- Rapidity – resources can be quickly accessed and used.

When resources are not sufficiently robust, redundant or rapid enough to create resilience, long-term or permanent dysfunction may manifest in the form of substance use, smoking, family violence or unsafe sexual activity.

Community resilience is therefore highly dependent on extensive and successful networks and the ways in which community decisions are made or influenced. In 2000, the Canadian Centre for Community Enterprise defined a resilient community as one that:

“...takes intentional action to enhance the personal and collective capacity of its citizens and institutions to respond to and influence the course of social and economic change”

(In Hampshire 2005).

The UCL Department of Epidemiology and Public Health publication, ‘Capability and resilience: Beating the Odds’ (UCL 2006) aimed to identify the components which contribute to community resilience:

- **Creation of opportunities and choices**: For example improvements in public infrastructure (such as education, training and transport) can raise well-being without necessarily any change to individual incomes.

- **Strong relationships**: School and neighbourhood life, as well as positive parent relationships and supportive family environments, are important. Social policy can foster relationships through community-led activities and integrated health and social service delivery, involving young people, their families, peers and the wider community.

- **Education**: It is widely accepted that education, at all stages of life, is a key tool in enabling people to overcome adversity, as it increases an individual’s ability to make choices. The UCL report suggests that quality education can overcome individual risks of factors such as unsupportive home lives and poor relationships. It also notes that early individual ability (without educational and other support) may not be sufficient to overcome future adversity, such as socioeconomic disadvantage in later childhood.
Area deprivation: Some economically deprived areas have better health (including mortality rates), compared to other areas, which the UCL report attributes to having social cohesion through common identities, history, cultures or religions as positive influences.

Service provision: The UCL reports highlights the need for respectful, non-judgemental services which recognise capability and build confidence. Much of poorer people’s time is spent on surviving, coping, ‘just getting by,’ rather than participating in extra activities. It describes the concept of a growing ‘surveillance’ culture which they suggest induces a feeling of being judged. This may have implications for service uptake and involvement, with facilities in deprived areas perceived as sometimes conveying messages of mistrust and not valuing their clients.

Deficit models vs asset models: The UCL report draws attention to the historical approach of service provision being based on a ‘deficit model,’ defining communities and individuals in negative terms. This approach focuses on the ‘identification of problems and needs of populations that require professional resources and high levels of dependence on hospital welfare services.’ What is positive and works well within that particular population may be disregarded. It also creates pressure on disadvantaged communities to prove that they are worse off than others to justify expenditure of resources, thus decreasing community self-esteem. This is in contrast to an ‘asset model’ that ‘accentuates positive capability to identify problems and activate solutions, which promotes the self-esteem of individuals and communities, leading to less reliance on professional services.’

The LINC Community Resilience model assumes that “individuals, families and communities are inherently competent and resilient, and that with appropriate support and encouragement, they can access individual and collective strengths that will allow them to transcend their loss.” This model emphasises social support networks with outside workers helping communities to access the resilience of their ancestors without the outside workers intruding or become embedded in the community; and involves engaging respected community members to act as natural agents for change. The community links initiate, maintain and sustain change long after the outside workers have departed. Part of the LINC model includes working with community members to develop and prioritise a list of important goals, with community leaders nominated to lead the process of achieving those goals (Landau 2007).

Community resilience and Aboriginal and Torres Strait Islander people

The Social Emotional Wellbeing program of the Cooperative Research Centre for Aboriginal Health aims to strengthen resilient relationships in Aboriginal and Torres Strait Islander families and communities through appropriate interventions and by building on existing community networks. Empowerment programs, parenting programs and the role of Aboriginal community-controlled health services in developing community capacity are some of the current projects (CRCAH annual reports 2006-07 & 2007-08).

The Family Wellbeing Empowerment Program was developed by a group of stolen generation Aboriginal and Torres Strait Islander people to address not only the hurt and pain of the past, but also the day-to-day challenges of being relatively marginalised minority peoples in an affluent society. Participants in the program reported that they believed they would be able to improve their social environment and there was also some evidence of increased capacity to address structural issues within the wider community, as well positive changes in how individuals viewed themselves, their loved ones and their community (Tsey 2007; McEwan 2008).

The recent Beyond Bandaids report (CRCAH 2007) highlights the importance of relationships and family bonds in the foundations of resilience, with the need to continually adapt in the face of colonisation and marginalisation, including forced removal of children. Community functioning has been undermined by imbalanced power relations, intergenerational trauma, limited access to services, discrimination and racism. This may manifest as individuals feeling that meaning and control over their lives is lacking, and is
exacerbated by presenting health and other statistics in a way that portrays the situation as hopeless and that efforts for change are futile.

The report notes many programs are not specific to Aboriginal and Torres Strait Islander people and/or have not been designed to transcend cultural differences. This is important since many of the resilience strategies used by Aboriginal and Torres Strait Islander people include ‘caring for country’ and similar strategies embedded in culture. The report gives an example from First Nation peoples in Canada where cultural continuity and local community control are linked to low rates of youth suicide (CRCAH 2007).

The Aboriginal and Torres Strait Islander Health Performance Framework report (Australian Health Ministers Advisory Committee 2008) outlines the concept of ‘community functioning’ which is defined there as “the ability and freedom of community members to determine the context of their lives (e.g. social, cultural, spiritual, organisational) and to translate their capability (knowledge, skills, understanding) into action (to make things happen and achieve a life they value).” Community functioning is seen to relate to concepts of wellbeing, capability and human functioning in the context of the economic, political and social infrastructure; and so appears to share many of the attributes of community resilience, as described above. A national workshop has identified the following components of community functioning (Australian Health Ministers Advisory Committee 2008):

- power to control choices and options
- connectedness to family land and history
- health, chronic disease and substance use
- culture
- identity
- continuing employment
- education
- infrastructure and community
- coping within the internal world and external world
- structure and routine
- income.

These components were constructed to form a community functioning score and applied to data from the 2002 National Aboriginal and Torres Strait Islander Social Survey (NATSISS). With a possible top score of 100, most Aboriginal and Torres Strait Islander people 15 years and older (82%) had a community functioning score between 33 and 67 (Australian Health Ministers Advisory Committee 2008).

The Overcoming Indigenous Disadvantage report (Productivity Commission 2007) has suggested a similar, but not identical, set of indicators of community resilience to those outlined in the Framework. The OID indicators are:

- disability and chronic disease
- year 10 and 12 retention and attainment
- labour force participation and unemployment
- income
- suicide and self-harm
- substantiated child abuse and neglect
- family and community violence
- imprisonment and juvenile detention rates.

Characteristics of functional and resilient families and communities may include a caring, protective and supportive environment, positive health outcomes, and cultural awareness.

Walker 2008 observes that the OID indicators focus more on outcomes of poor family functioning than measuring how well families function; and that further development should focus on Aboriginal family strengths and protective factors. However it is important to be aware of the enormous stresses faced by
many Aboriginal and Torres Strait Islander families. For example, in WA in 2001-02, over one in five Aboriginal children aged 0-17 years were living in families where seven to 14 major life stress events, such as death, incarceration, violence and severe hardship, had occurred in the 12 months prior to the survey (Silburn 2006 in Productivity Commission 2007).

Caring for country and its relationship to the health and wellbeing of Aboriginal and Torres Strait Islander people in Victoria is explored in a qualitative study involving members of the Yorta Yorta Nation and the Boonwurrung and Bangerang Tribes. Caring for country (defined as having knowledge, sense of responsibility and inherent right to be involved in the management of traditional lands) is seen to offer great benefits such as building self-esteem, fostering self-identity, maintaining cultural connection and enabling relaxation and enjoyment through contact with the natural environment. Study participants noted that self-esteem increases in Aboriginal people who become involved in land management (Kingsley 2009).

Nunyara is a newly established Aboriginal health and wellbeing centre in Whyalla, which illustrates the complexity of Aboriginal kinship networks. Most communication happens within the 10 or so language/family groups, and not between groups, which both limits community-level participation and also helps to keep individual family group cultures alive. Successful health planning will require a detailed understanding of these kinship issues (Champion 2008).

Other indigenous populations

In the Canadian First Nations context, Tait (2002) talks about the importance of building healthy social networks, such as offering a safe place for women and their children where meals can be cooked together and shared as an alternative structured programs for ‘high risk’ women. Many of these women do not have a place to go where relaxation with other people is not combined automatically with alcohol or drug abuse.

In smaller communities, Tait believes that outreach services may have more success if they avoid attaching problems such as fetal alcohol syndrome, addiction and alcohol abuse to their services. Instead prevention could build on the strengths and priorities of the community, e.g. healing circles, community suppers, sewing groups. Space shortages leading to co-location of services can cause problems. For example, women in a remote community in Canada avoided a fetal alcohol syndrome prevention program because it was offered in the same building as child and family services, because women were afraid that their social worker would find out about their alcohol use during pregnancy and then apprehend their children or their baby at birth.

According to Inuit traditional health, wellbeing is dependent on community involvement, so the health of a pregnant woman is tied to communal health. However Douglas 2006 notes that medical intervention and loss of choice to birth locally has severely eroded community self-confidence.

Community resilience and overall mortality

In a group of British areas subjected to prolonged economic adversity, Tunstall 2007 has shown that some of the areas had much lower mortality rates, but further investigation of the reasons for the differing mortality rates in these areas have so far failed to find the ‘recipe for resilience’. This body of research is funded by the UK Economic and Social Research Council as part of the Research Priority Network on ‘Human capability and resilience’ (Mitchell 2009).

It seems the UCL report statement that “very deprived areas that show strong evidence of resilience had a lower risk of death than in other similarly disadvantaged places” (UCL 2006) may be a little premature although certainly plausible and worthy of further investigation, especially the significance of the social environment in influencing mortality (Mitchell 2009).
Community resilience and infant mortality – direct links

We located only one study that provides a direct link between community resilience and birth outcomes. This study showed that low birthweight rates for low income Latino mothers in the US are similar to the overall US rates (about 6-7%) in contrast to rates of about 13% among African Americans (McGlade 2004).

Birth outcomes for Latina mothers in the US are better than might be expected for women with this level of socioeconomic disadvantage. This ‘Latina paradox’ is attributed to social and cultural factors maintained by community networks. These informal systems of antenatal and postnatal care are composed of family, friends, community members and lay health workers and they confer protective factors which encourage healthy birthing behaviours; and result in low birthweight and mortality rates that are lower than national US averages.

Some of this protective effect may be due to the ‘healthy migrant’ phenomenon, but is also thought to be due to strong cultural support for maternity, healthy traditional dietary practices and ‘marianismo’, the selfless devotion to the maternal role. This helps immigrant mothers to resist adopting the negative risk behaviours of the new host society, particularly those related to smoking, alcohol abuse and diet.

Informal systems of antenatal care are likely to:
- have a strong tradition of intergenerational knowledge transfer through which healthy behaviours are passed down from one generation of mothers to the next
- have many mothers benefiting from the support of other family members, particularly sisters
- have women taking responsibility for the health needs of those beyond their nuclear households.

Mexican fathers also play a positive role in perinatal care, as do friends and neighbours, as well as parteras (lay midwives). Though it is not clear how family and social is linked to improved birth outcomes in deprived areas, pooling of resources may mitigate the effects of poverty.

The protective effect appears to erode in subsequent generations. For example in a study of births to low income Mexican women in the US, mothers who were themselves born in the US had low birthweight rates of 14% compared with 3% for babies of Mexican-born women. While maternal smoking and poorer nutrition explained some part of the poorer birth outcomes, acculturation to the norms of mainstream American society remained predictive poor birth outcomes after controlling for diet and smoking.

Integration and support of these informal systems of care with other antenatal services through expanding the use of lay health practitioners is suggested as a way to improve future birth outcomes.

In Victoria, Dardee Boorai, a charter of safety and wellbeing for Aboriginal children and young people was launched in late 2008. This statement of a shared commitment between community and government “affirms the strength and resilience of Victoria’s Aboriginal culture, communities and families”. The Charter notes that Aboriginal culture is already rich in the protective factors that promote resilience such as connection with family, social networks and participation in community activities and these will be promoted and supported while trying to minimise risk factors such as low birthweight and socioeconomic disadvantage. A Charter implementation strategy will be developed, and reflected in the 10 year plan for Victoria’s Aboriginal children and young people which will be developed in 2009 (Victorian Department of Education and Early Childhood Development 2008).

In Hackney, in the UK, a program using local area agreements is aiming to use a community empowerment and neighbourhood approach to reducing infant mortality; and to use more supportive and targeted ways of working with women at greater risk of experiencing infant mortality. Findings so far are that engaging all the key agencies encourages them to commit to infant mortality targets by developing joint strategies, and aligning plans, targets and budgets; and facilitates joint commissioning of services such as developing maternity services in children’s centres (UK Department of Health 2007b).
Community resilience and infant mortality – indirect links

Although not directly reporting on infant mortality or other infant and baby outcomes, a number of authors have described the impact of community resilience on factors likely to be linked to infant mortality in some way.

Aboriginal children living in remote communities in WA had better mental health than Aboriginal children living in Perth, suggesting that traditional culture and ways of life may enhance emotional wellbeing (Zubrick 2005 in Productivity Commission 2007).

An earlier comparison of health outcomes for Aboriginal adults living in their homelands showed lower mortality, hospitalisation, diabetes and injury than those living in centralised communities in central Australia. Returning to traditional country may provide a safer and healthier lifestyle, free of the social stresses, alcohol and drug use, and family violence of some of the larger communities (McDermott 1998).

A community renewal program in Lake Tyers, East Gippsland, one of the most disadvantaged Aboriginal communities in Victoria, is showing positive effects on levels of family violence and feelings of personal and community safety. The program has also led to improved community infrastructure such as housing and sewerage upgrades and improved educational participation and performance (Productivity Commission 2007).

In the WA Aboriginal Child Health Survey, the following 10 factors were found to be associated with family functioning:
- family financial wellbeing
- quality of children’s diet
- level of educational attainment of the primary carer
- importance of religion/spirituality
- whether overuse of alcohol caused problems in the household
- parenting quality
- whether children were at high risk of clinically significant emotional or behavioural difficulties
- age of the primary carer
- whether the primary carer had been forcibly separated from their natural family
- whether the carer had a limiting medical condition.

Families that do not experience alcohol problems in the house, and where children have healthy diets, and carers have reasonable parenting skills or hold strong spiritual/religious beliefs are more likely to have very good family functioning (Walker 2008).

One of the intended outcomes of the Victorian In-Home Support program is to build social connections through communities that enable parents, children and young people to build connections and draw on informal assistance (Victorian Department of Education and Early Childhood Development 2007). Indicators will be:
- increased proportion of children with parents who can turn to someone for advice when having problems
- increased proportion of children from households where the respondent is able to get support in time of crisis from persons living outside the household.

Each region in Victoria has funds to allow local Aboriginal Community Controlled Organisations to appoint community convenors as part of the Aboriginal and Torres Strait Islander Family Decision Making Program. This program enables extended family and respected Elders to participate in decision making and case planning about the safety, stability and development of Aboriginal children within the child protection system.
The Victorian Aboriginal Services Plan (Victorian Department of Human Services 2008) has a specific target to emphasise the achievements of Aboriginal people, for example through the publication of ‘Reconciliation News’.

The Mullum Mullum Indigenous Gathering Place in Melbourne is a culturally appropriate community centre for the Aboriginal community that offers a range of social and cultural support (Victorian Department of Human Services 2008).

An innovative community arts project in NSW, Mubali, has increased young Aboriginal women’s participation and engagement in antenatal care. Part of this program involved young women making plaster casts of their pregnant bellies which helped introduce them to antenatal services (www.beyondempathy.org.au).

The Coalition for Research to Improve Aboriginal Health (CRIAH) is a partnership between the SAX Institute and the Aboriginal and Health and Medical Research Council of NSW that brings Aboriginal communities and researchers together to improve Aboriginal health in NSW. CRIAH has identified lupus, diabetes and child health as early research priorities. The Study of Environment of Aboriginal Resilience and Child Health (SEARCH) is following around 2000 urban Aboriginal children from 800 families who attend Aboriginal Medical Services in NSW to explore the determinants of health and to trial strategies to improve health outcomes. The feasibility of conducting research to prevent type 2 diabetes in Aboriginal and Torres Strait Islander adults is also underway. Initially SEARCH will address the role of the environment, including the effects of housing and resilience on health, in particular ear health, (www.saxinstitute.org.au/researchassetsprograms/improvingaboriginalhealththroughresearch/SEARCH.cfm?objid=410 - accessed 30 January 2009).

In Canada, Community Holistic Circle Healing has had effects on the community as well as on individuals. Improved p’madaziwin (spiritual, emotional, physical and mental wellbeing) has been reflected in better parenting, empowerment of women, respect, harm reduction and control of violence (Ross 2006).

For adolescents, protective factors against risky behaviour (such as substance use) include participation in community activities, academic achievement, family connectedness, parental support and parental monitoring (Fergus 2005). This is a specific aim of the Australian Core of Life program for teenagers – see ‘Models’ section of the report.

Discussion

Although there is very little direct evidence of links between community resilience and birth outcomes, it is plausible that ways to strengthen the resilience of families and communities may result in improved outcomes for babies and infants.

Even though the context is very different from Aboriginal and Torres Strait Islander and teenage women in Australia, the protective effect of strong social networks seen for Latina mothers in the US (McGlade 2004) may transcend these differences. The emphasis on social support and engagement in resilient communities is likely to improve attendance and involvement in antenatal care, to improve maternal mental health and to reduce levels of unhealthy behaviours such as substance use and high alcohol use. The evidence outlined elsewhere in this report indicates that these changes have the potential to improve birth outcomes.

For every Aboriginal and Torres Strait Islander child there is only one adult (compared with over three for other Australian children), with many primary carers being unwell or otherwise unable to fully carry out their parenting duties. Combined with lower life expectancies, this means that many children do not have their parents and grandparents to guide them into adulthood (Stanley 2008). Due to this depleted level of capacity, maintaining and building social support networks for parents and children is a particular challenge.
for many Aboriginal and Torres Strait Islander people. The common practice of extended family members looking after children helps to overcome this challenge.

As Mitchell 2009 points out, it is difficult for policy makers to quickly support the social cohesion necessary to make communities more resilient. Weakening the very strong links between poverty and mortality, for instance, will require sustained investment. Though talking in a broader context than community resilience, Fiona Stanley in her 2008 Hawke lecture advocated the rapid enhancement of the capacities of Indigenous organisations and communities, and developing effective partnerships with government and non-government organisations (Stanley 2008) which could take the form of the sustainable partnership models described by LINC (Landau 2007).

Some recent developments in Aboriginal and Torres Strait Islander communities are likely to bolster community resilience and this may in turn be reflected in better general health outcomes and better birth and infant outcomes, as well as addressing some of the intergenerational issues. Initiatives include integrating antenatal care provision with early childhood services and making these integrated or standalone services flexible and welcoming as well as encouraging women and families to drop in informally or for social interaction.

An emphasis on educational attainment and achievement is important given the link between maternal education and infant mortality and other birth outcomes. A detailed coverage of this is given elsewhere in the report (see section on 'Maternal Level of Education and Infant Mortality'; Question 4). Many of the principles of community development such as community ownership, leadership and control are also highly relevant to community resilience and along with local decision-making, choice and fostering hope for the future should build stronger communities able to counteract the negative influences of the past. However the size and complexity of the initiatives, supports and resources required should not be underestimated – nor should the time required to do so.

While community resilience may indeed make a positive contribution to maternal, infant and family health, the components and packages of various models of community resilience and functioning need to be evaluated, and changes and refinements made accordingly. In addition, more understanding of which components of community resilience make the greatest contribution to improving short and long-term health outcomes, the pathways involved, and under which circumstances, will inform the design of targeted programs and ways to prevent or manage particular conditions.

**Future action and research**

There is a need to prospectively test the degree and nature of the theoretically derived community resilience components in communities generally, but particularly in various Aboriginal and Torres Strait Islander communities.

Any links between the components of community resilience and outcomes (particularly health outcomes) need to be investigated.

The effects of educational attainment and achievement, with and without supportive social networks, need to be investigated.

There is a need to introduce programs likely to enhance community resilience and evaluate the impacts of these programs.

The results of the UK research program on community resilience need to be monitored and community plans need to be evaluated to see if the goals of the plans are being achieved.
References


2.5 Unintended Pregnancies (addressing Question 6)

Question 6: Unplanned Teenage Pregnancy
What are the factors that impact on unplanned pregnancies among teenage women? Do these factors have an impact or correlate with the infant mortality rate of this pregnant population? What strategies have been successful in reducing the number of unplanned pregnancies among the teenagers?

Definitions: Unplanned or unintended pregnancies can be thought of as being in three categories: unwanted, mistimed, or pregnancies that the women feels ambivalent about (Mohllajee 2007).

1. Demographic factors and trends

South Australia
Births
In 2007, 900 teenage women gave birth in South Australia, which represents 4.6% of all births in SA. Eight of these births were to teens aged under 15 years – two to Aboriginal and Torres Strait Islander mothers and six to non-Indigenous mothers (Chan 2008b).

Teenage pregnancy rates vary considerably between different parts of the metropolitan area, with more disadvantaged areas showing higher rates of pregnancy (Slowinski 2001).

Pregnancies
The 2007 teenage pregnancy rate of 35.0 per 1000 women in SA was the lowest recorded since 1970. The actual teenage birth rate is about half this (largely due to terminations of pregnancy – see below) (Chan 2008b), suggesting that about 2000 teenage women become pregnant each year in SA.

Australia
Australia’s teenage fertility (birth) rate of 15 per 1000 women aged 15-19 is about midrange of western countries, with USA highest of these at 40 per 1000 women (WHO Global Health Indicators 2008 cited in French 2009). The adolescent conception rate in Australia is estimated to be around 45 per 1000, with the difference between this and the fertility rate being accounted for by terminations (Taft 2007).

In a 1996 survey of Australian women, 7% of the 3,822 women aged less than 20 years had been pregnant and 56% of these women reported having terminations; compared with 30% and 37% respectively for women aged 22 to 27 in the 2000 survey (Taft 2007).

In Australia the median age of first sexual intercourse is 16 and decreasing (Williams 2004). Thirty-five percent of a sample of 2,388 Australian year 10 and year 12 students reported having experienced sexual intercourse. Of these 35%, 4.1% of males and 7.8% of females reported that they had experienced sex that resulted in pregnancy, and a further 7.5% were unsure. Most sexually active students used some form of contraception the last time that they had sex:

- Condoms 65%
- The pill 37%
- Withdrawal 12%
- Emergency contraception 4%
- Rhythm method 1%
- IUD/diaphragm 1%
- None 9%

Only 17% of students used both the pill and a condom at their last sexual encounter (Agius 2006).
Aboriginal and Torres Strait Islander teenagers

Aboriginal and Torres Strait Islander women tend to have their children at a younger age than non-Indigenous women. In 2005, teenagers who gave birth in Australia were five times more likely to be Aboriginal and Torres Strait Islander women than other women – 21.7% versus 3.7% of all women under 20 years (Australian Health Ministers’ Advisory Committee 2008).

The corresponding percentages for SA in 2007 were 18.8% and 4.1%, about a 4.5 fold difference. There were 107 births to Aboriginal and Torres Strait Islander teenage women and 790 births to non-Indigenous teenage women (Chan 2008b). In the 1995 to 1999 period in SA, the teenage pregnancy rate for Aboriginal and Torres Strait Islander women was more than twice as high, and their teenage birth rate more than four times as high as non-Indigenous women (Westenberg 2002), the latter similar to the 2007 birth rates.

In Victoria, the number of Aboriginal and Torres Strait Islander women under 20 years giving birth increased from 1999 to 2005. For example in 2005, 20.6% of Aboriginal and Torres Strait Islander women gave birth compared with 2.6% for non-Indigenous women under 20 years (about an eightfold difference). Some of the increase is the result of better identification of women as Aboriginal and Torres Strait Islander persons. It is unclear to what extent these differences relate to differing cultural practices and to the desire of Aboriginal and Torres Strait Islander women to have their babies at an earlier age or to what extent they relate to poverty or a lack of access to contraceptive advice or termination services (Victorian Dept of Human Services 2007).

In a 2004 Queensland study, nearly half the teenagers had experienced sexual intercourse. Aboriginal and Torres Strait Islander students in years 9 to 11 (n=171), and 15 residents of a homeless youth shelter in Townsville, Queensland, 46% (84) reported past sexual intercourse (Larkins 2007).

Repeat pregnancies

In the US, the rate for teenagers having a repeat pregnancy is about 20%, with about half of these pregnancies ending in abortion (Madden 2009). About one-third of rapid repeat pregnancies among US adolescent women are reported to be intended (Boardman 2006).

In the UK, repeat teenage pregnancies are increasing, with a 42% increase in abortions subsequent to a previous birth and a 68% increase in abortions subsequent to a previous abortion (Collier 2009).

Planning and attitudes

When interviewed at 20 weeks gestation, 71% of 537 pregnant Australian teenagers aged 12 to 17 years said that they had planned or semi-planned to become pregnant (Quinlivan 2001). In a WA qualitative study, Aboriginal teenage women expressed higher intent to become pregnant than their non-Indigenous counterparts ( Skinner 2009).

In the US, nearly 40% of adolescent pregnancies were reported to be intended, with similar proportions for those in early-middle adolescence (13 to 16 years) or those in late adolescence (high school graduates aged 17 or 18). However a greater proportion of the younger group indicated that they wanted to be pregnant for reasons other than the desire to raise a child (78% v 59%). There were some substantial differences between the age groups (considering both intended and unintended pregnancies). The early-middle adolescent group was significantly less likely to attend antenatal care in the first trimester and to gain an appropriate amount of weight while pregnant, and more likely to have STIs and preterm births than the well educated older adolescent group (Sheeder 2008b).

Between a third and a quarter of male and female Australian teenagers are likely to underestimate the negative aspects of parenthood and to overestimate the positive aspects ( Condon 2000).

International

A general decline in teenage pregnancy rates in Europe has been attributed to improved knowledge and access to contraception as well as more educational and employment opportunities.
In a survey of the US Pregnancy Risk Assessment Monitoring System from 1996 to 1999, 53.2% of women reported unintended pregnancies – 10.6% were unwanted; 30.2% were mistimed and 6.0% of women were ambivalent about their pregnancy (Mohllajee 2007).

2. What are the links between teenage behaviour and other factors, and unplanned pregnancies?

Risk factors for teen childbearing include poorer school performance, lower maternal education, parents not married, greater number of children in the household, dating in early adolescence, and less enriching environments (Meade 2008).

Not using contraception
The main reason young people give for not using contraception is that they are not currently in a sexual relationship (French 2009). However in a study of 289 adolescent women in the US, those women committed to not getting pregnant engaged in unprotected sex about half the time (Bartz 2007).

Early age at first intercourse (before the age of 16 years) is associated with increased risk of STIs, being paid for sex, engaging in unsafe sex, reduced contraceptive use and increased regret (Williams 2004) and, of course, the risk of an unintended pregnancy (French 2009).

Experiencing adversity
The odds of becoming pregnant as a teenager if the person had experienced all of the following eight adverse events (emotional, physical and sexual abuse, witnessing partner abuse, household member in prison, alcohol or drug abuse, someone with a mental illness in the house, loss of a biological parent during childhood) were six times greater than a teenager who had experienced none of the adverse events (Palfrey 2005).

Social capital
In a study from the US, teen pregnancy rates were inversely and significantly correlated with social capital (i.e. social capital was protective). Social capital was measured with Putnam’s Social Capital Index which consists of 14 variables spanning the domains of community organisational life, involvement in public affairs, volunteerism, informal sociability and social trust. Teen pregnancy rates were also significantly associated with poverty and income inequality, but these associations were not as strong as the one with social capital which the authors believe is operating independently to poverty and income equality (Crosby 2006).

Family violence
Women experiencing violence and abuse can be subject to coercive and unprotected sex, leading to additional unplanned and, perhaps unwanted pregnancies (Bacchus 2001). In a 1996 Australian survey, recent partner violence was significantly associated with the likelihood of a teenage women terminating her pregnancy (OR 3.11 95% CI 1.76 to 5.49) (Taft 2007).

A systematic review of 51 studies shows clear links between women’s sexual health and physical violence. Four of these studies were exclusively in adolescent women (a total of about 13,000 teenagers). In particular, physical violence is associated with increased risks of unwanted pregnancy and induced abortions; and also with sexual risk-taking behaviours such as inconsistent condom use and partner not being monogamous (Coker 2007).

Social and emotional wellbeing
An association between depressive symptoms in adolescent mothers and rapid subsequent pregnancies has been seen in a US study, consistent with observed links between depressive symptoms and high-risk sexual behaviour. These findings indicate that improved recognition and treatment of depression in adolescent mothers may reduce the risk of rapid repeat pregnancy (Barnet 2008).
In a 1996 Australian survey, low education levels (none/year 10) were significantly associated with the likelihood that a teenage woman will terminate her pregnancy (OR 2.32 95% CI 1.44 to 3.74) (Taft 2007).

Intergenerational teenage pregnancy
Daughters of teenage mothers have an increased risk of teenage childbearing, perpetuating intergenerational cycles in some cases. Follow up from the US National Longitudinal Survey of Youth 1997 showed that daughters of teenage mothers were 66% more likely to become teenage mothers, after accounting for other risks. However it is important to note that the majority of daughters of teenage mothers do not become teenage mothers themselves. Particular risks for teenage motherhood were peer norms that were risky and not ‘enriching’, low parental monitoring and poverty. Poverty was an especially strong predictor which may operate by young women having limited life opportunities and a role model supportive of early childbearing (Meade 2008).

3. What are the links (direct and indirect) between these factors and other characteristics of teen pregnancies and infant mortality?

In a survey of births to SA teenagers from 1995 to 1999, teenagers were more likely to have preterm, small-for-gestational-age and low birthweight babies and neonatal deaths (van der Klis 2002). Rates of these adverse birth outcomes in 2007 were much lower than for the earlier period and were similar to outcomes for older mothers (Chan 2008b) – see Introduction for detailed statistics. The one exception may be a higher rate of postneonatal deaths to infants of teenage mothers in 2007; however this is based on small numbers and may not be a reliable interpretation.

From 1995 to 1999 in SA, Aboriginal and Torres Strait Islander teenage mothers had significantly more medical conditions (including STIs and anaemia) than non-Indigenous teenagers. Rates of preterm birth, low birthweight and congenital abnormalities were nearly twice as high for Aboriginal and Torres Strait Islander teen mothers compared with non-Indigenous teen mothers in SA during this period (Westenberg 2002).

In UK from 2002-04 the infant mortality rate for mothers younger than 20 years (7.9 per 1000 live births) was 63% higher than for older mothers aged 20-39. The main contributory factors are thought to be that young mothers are more likely to attend late for antenatal care; are more likely to smoke during pregnancy; less likely to breastfeed, and to have poorer diets during pregnancy (UK Department of Health 2007b).

Young maternal age
Healthy infants born to young adolescent mothers (15 years and younger) are at increased risk of postnatal death. In a survey of the entire US 1996-97 birth cohort, infants born to mothers in early adolescence had a three-fold higher risk of postnatal death compared with adult mothers, after adjusting for ethnicity, antenatal care use and marital status. Risk of postneonatal death was also elevated for infants born to 16-17 year old mothers; 18-19 year mothers; and 20-22 year old mothers compared with mothers aged 23 to 29, but the highest risk was seen for the youngest mothers. For the mothers who were 15 and under, approximately 52% of postneonatal deaths of infants born healthy could be due to possible neglect or abuse. Over a third (36%) of postneonatal deaths were attributed to SIDS, a much higher level than for older mothers (Phipps 2002).

Unwanted pregnancies
Compared with intended and mistimed pregnancies, women with unwanted pregnancies are less likely to have appropriate antenatal care; less likely to have adequate nutrition; and more likely to consume alcohol, tobacco and illicit substances (Sheeder 2008b). In an analysis of the US Pregnancy Risk Assessment Monitoring System, women with unwanted pregnancies had an increased likelihood of preterm birth (adjusted OR 1.16 95% CI 1.01 to 1.33) compared with women with intended pregnancies. Women who were ambivalent towards their pregnancy were more likely to have a low birthweight baby (adjusted OR
In contrast to women with mistimed pregnancies who had a lower likelihood of low birthweight – compared to women with intended pregnancies (Mohllajee 2007).

Infants who are mistimed by more than two years and those who are unwanted by both parents are more likely to be small at birth and to die than infants who are less seriously mistimed or unwanted by only one parent. Women with unintended pregnancies are less likely to breastfeed and more likely to have attachment problems with their infant. Unintended children are more likely to suffer behavioural or social problems and to have less educational success (Sheeder 2008b).

**Infection**

Changes in adolescent sexual behaviour, such as increased number of sexual partners, is consistent with a rise in STIs (French 2009).

**Smoking, alcohol and substance use**

Most pregnant teenagers (65%) in a WA study of implanton use after birth smoked prior to pregnancy, and most (74%) used alcohol before becoming pregnant, with 61% consuming more than four drinks on each occasion. Most (70%) also used marijuana before pregnancy with 42% using it once a week or more (Skinner 2007).

### 4. Evidence for interventions

#### 4.1. Combined and/or mixed interventions

A wide-ranging research synthesis from the UK concluded that there are strong grounds for investing in early childhood and youth development programs to reduce unintended teenage pregnancy rates. The review also found that happiness, enjoyment of school and ambition can all help to delay early parenthood. The available research evidence also points both to child care and to education and career development programs as promising ways of supporting young parents (Harden 2006).

In this review, six studies of early childhood interventions consisting of preschool education, parenting support, and social skills development; and youth development programs combining community service and student learning, or providing a program of academic and social development showed a 39% reduction in the number of young women reporting teenage pregnancy (relative risk 0.61, 95% CI 0.48 to 0.77) with positive effects also on employment and economic status. The qualitative research revealed three recurrent themes in the experiences of young people becoming pregnant or at risk of doing so: dislike of school; poor material circumstances and unhappy childhoods; and low expectations for the future (Harden 2006).

Studies of educational and career development interventions tripled the number of young parents in education or training in the short-term (relative risk = 3.13 95% CI 1.49 to 6.56). Day care and welfare sanction/bonuses programs also had positive short-term effects. None of these types of interventions showed any long-term effects. The most promising approach for reducing repeat pregnancy appears to be the provision of child care. The qualitative research included in the in-depth review of parenting support highlights the diversity of needs and preferences within this group; struggles against negative stereotypes of teenage parenthood; heavy reliance on family support; the continuation of problems existing before parenthood; and the wider costs and benefits of education and employment (Harden 2006).

Although sex education is an important part of young people’s preparation for adulthood, the evidence is that it is not, on its own, an effective strategy for encouraging teenagers to defer parenthood (Harden 2006). In a systematic review of 26 RCTs, strategies to reduce unintended pregnancies among adolescents were not shown to delay the initiation of sexual intercourse, improve the use of birth control among young men and women, or reduce the number of pregnancies in young women (DiCenso 2002).
4.2 Social Support

In a Cochrane review of programs offering additional social support, at-risk pregnant women were more likely to choose to terminate the pregnancy (Hodnett 2003).

4.3 Delaying or preventing subsequent pregnancies/births

An RCT among 181 low-income African-American adolescent women in the US aimed to assess whether a fortnightly home-based intervention was effective in preventing second births within two years of an adolescent mother’s first birth. The curriculum focused on interpersonal negotiation skills, adolescent development and parenting and was delivered by ‘big sister’ mentors. Women in the intervention group were less likely to have a second infant within two years; for example only one of the mothers who completed six or more visits had a second baby. However not all of previous studies in this area have shown an effect on delaying second births; and it is important to note that rapid second births may be regarded as desirable by some adolescent women (Black 2006).

In a systematic review, prevention programs (involving an array of services such as case management and referral; education about pregnancy, birth, contraception and infant health; and individual counselling) were effective in reducing numbers of subsequent teenage pregnancies (for at least 19 months) although few differences were seen in the impact of comprehensive programs compared with more targeted interventions (Corcoran 2007).

In the Nurse Family Partnership RCTs teenage mothers who were visited by nurses were about one-third less likely to give birth within two years than those teenagers who were not visited; although one in four of the visited teenagers did give birth with the first years postpartum (often while using some form of contraception). In a secondary analysis of teenage data from these trials, nurses had rarely documented trying to help postpone a second pregnancy, helping teens achieve long-term goals or involving male partners in decision making, despite the attribution of preventing rapid repeat pregnancies to the attention and support given by the nurses. It seems they may have been unaware of the lapses in contraceptive use that must have occurred (Gray 2006).

In an historical cohort study from the US, administration of long-acting contraception at the time of abortion showed a decrease in repeat pregnancy (Madden 2009).

4.4 Preventing alcohol-exposed pregnancies

Ineffective contraceptive use and risky drinking were both targeted in a recent US RCT, Project CHOICES. Women at risk for an alcohol-exposed pregnancy were randomised to either motivational interviewing and contraceptive counselling or information only, with outcome data available for 593 women. Numbers of alcohol-exposed pregnancies, instances of risky drinking and ineffective contraception use were all significantly reduced with the brief motivational intervention compared with the information only group (whether unadjusted or adjusted for confounders). At nine months, 56% of women in the intervention group were using effective contraception compared with 39% in the information only group (Floyd 2007).

Another US RCT involved a single session of motivational interviewing in college women at risk for an alcohol-exposed pregnancy. This trial showed similar effects on increasing these women’s effective use of contraceptives (Ingersoll 2005).

4.5 Sex education in schools

According to Ollis 1996 quality sexual health education programs in schools:

- Take a whole school approach and develop partnerships;
- Acknowledge that young people are sexual beings;
- Acknowledge and cater for the diversity of students;
Provide an appropriate and comprehensive curriculum context;
Acknowledges the professional development and training needs of the school community.

SHARE
In SA, SHine has developed a sexual health education program for schools called share. SHine SA is the predominant South Australian agency in the field of sexual health in service provision, advocacy, research, community development, resources and policy development (SHine annual report 2007-08).

The goal of the share program is to improve the sexual health, safety and well-being of young South Australians. The objectives focused on four domains:

For young people to:
- have increased knowledge and understanding about relationships, sex and sexual health;
- have increased understanding of, and the ability to practice safety in all aspects of sexual relationships with confidence;
- know about and feel comfortable accessing a range of services and people for support;
- have increased skills to enable them to establish and maintain respectful positive relationships;
- develop positive attitudes and behaviour relating to sexual health, and relationships (including sexual, cultural and physical diversity).

For parents and families to:
- have increased knowledge and understanding concerning relationships, sex and sexual health;
- increase communication about sexual health issues between young people and their families.

For school staff to:
- have increased knowledge and understanding about young people’s relationships, sex and sexual health;
- have increased competence and confidence to deliver the share program;
- develop partnerships with the community in order to improve links with, and access for young people to youth health and general health services;
- develop positive attitudes and behaviour relating to sexual health, relationships.

School Environment
- To ensure that schools have a commitment to addressing relationships and sexual health issues in the whole school environment;
- To develop positive attitudes and behaviours that are inclusive and respectful of diversity (Dyson 2006).

According to Johnson 2006, the main share curriculum resource document Teach it like it is:
- Is based on international research on sexual health education;
- Is well organised and integrated within the overall school curriculum;
- Acknowledges diversity;
- Relies on teachers’ professional judgement;
- Uses a variety of learning methods, with an emphasis on interactive and sociable learning tasks.

A qualitative evaluation was carried out in 2005-06, three years after the pilot share program had been trialled in 15 SA schools. Teachers were overwhelmingly positive about the quality and utility of the program materials they also highly rated the 15 hours of training from SHine. Some difficulties in implementation were experienced by teachers who were reluctant to teach the program and in some classes of ‘immature’ boys. Due to some parents’ opposition to the program, 2-5% of students did not take part in the program and other students did not participate as it was not compulsory; and due to timetabling clashes. The parental opposition was reflective of a wider view of some groups and individuals that share promoted homosexuality, was too explicit about human sexuality, and did not promote sexual abstinence or the institution of marriage (Johnson 2006).
In another evaluation of the share program by La Trobe University, students were able to name correctly a greater range of STIs and showed a slight improvement in confidence that they would not be infected with an STI. They appeared overall to have a slightly improved understanding of STI prevention and to be slightly more confident that they could say no to unwanted sex. There was no change in the small number of students who were the ‘risk takers’ having casual sex, often under the influence of drugs and alcohol. While most students use their peers as a common source of sexual health information, well over half the students nominated school programs as having value in this area. A clear finding from the results of the surveys is that the predictions of those who opposed the implementation of the program have not been borne out. Those who felt that exposure to an intervention such as the share program would lead to greater sexual activity, less responsible behaviour and taking sexual matters out of the hands of parents were proven wrong (Dyson 2006).

Systematic review of RCTs
Bennett 2005 included 16 RCTs in their systematic review. They concluded that some abstinence-only (three RCTs reviewed) and abstinence-plus programs can change teens’ sexual behaviours, although the effects are relatively modest and may only last for a short period. Students’ knowledge and use of contraception were significantly influenced by programs offering contraceptive education.

RIPPLE RCT
RIPPLE was a cluster randomised trial of a peer-led sex education program in 27 English schools, with seven year follow up of over 9000 pupils. Peer educators, aged 16 to 17 years were trained to deliver three one hour classroom sessions to 13 to 14 year old pupils from the same schools. Compared with women who had received the standard sex education program at school, significantly fewer women self-reported a pregnancy by age 18 (adjusted OR 0.62 95% CI 0.41 to 0.91; 7.2% v 11.2%) although no change in the teenage abortion rate was shown (Stephenson 2008).

4.6 Abstinence
Promotion of abstinence-only programs has had little impact on adolescent pregnancy rates (French 2009).

4.7 Termination of pregnancy

South Australia
In 2007 in SA, about 50% of known teenage pregnancies were terminated. The abortion rate was 14.5 abortions per 1,000 women aged 14 to 44 years (a total of 4,884 terminations of pregnancy). This rate has been stable for the last three years. The abortion rate in 2007 was 17.6 per 1,000 women aged 15 to 19 years (1,766 abortions), which represents a decrease from 2006. Teenagers accounted for 18.6% of the abortions and 4.6% of the live births in SA in 2007 (Chan 2008).

Overall, 37.0% of women (1,808) had had a previous termination – among teenagers this proportion was 16.4% (Chan 2008). In 1999, 85% of the pregnancies among 13 and 14 year old adolescents were terminated (Slowinski 2001).

The majority of terminations were performed within 14 weeks of pregnancy (91.1%); 74.6% by medical practitioners in family advisory clinics and 90.0% used vacuum aspiration (Chan 2008).

The SA Social Health Atlas indicates that termination of pregnancy is strongly associated with low socioeconomic status. In metropolitan areas of SA, high rates of termination of pregnancy were correlated with areas housing high levels of people receiving unemployment benefits or disability support pensions, jobless families, low income families, children in welfare-dependent families and community mental health clients. In country areas of SA, the correlations were with areas which had high levels of people receiving a disability support pension, jobless families and Child and Adolescent Mental Health Service clients (Glover 2006).
Australia has one of the world’s highest teenage abortion rates – the ratio of about one abortion for every two pregnancies has remained stable since 1999 (Skinner 2009).

In SA, termination of pregnancies was less common for Aboriginal and Torres Strait Islander teenagers than for non-Indigenous teenagers from 1995-99 (Westenberg 2002).

### 4.8 Types of contraceptives and evidence of their effectiveness in teenagers

In the US (as in many other developed countries), the primary determinant of declining teen pregnancy rates is improved contraceptive use (Santelli 2007).

With the exception of male or female sterilisation, no contraceptive methods are contra-indicated solely on the grounds of age (French 2009).

**Condoms**

Condoms are popular because they are widely and easily available, but are disliked by some teenagers because of interrupted spontaneity of sex, and difficulty in using properly. Condoms have the advantage of protection from STIs but are less effective than hormonal methods and IUDs in preventing pregnancy (French 2009).

**The Pill**

Hormonal combined oral contraceptives give highly effective protection against pregnancy when used consistently and correctly, but offer no protection against STIs. Women need to obtain the pill from a clinical service and need to be able to make taking the pill part of their daily routine (French 2009).

**The mini-Pill**

The progestogen-only pill (POPs) is also a highly effective way to prevent pregnancy but it does not protect against STIs. Like the combined pill, it needs to be obtained from a clinical service and must be taken daily. Its lack of oestrogen reduces some of the risks associated with the combined pill (French 2009).

**Injectables**

Injectables give highly effective protection against pregnancy but offer no protection against STIs. The longer period of protection makes compliance easier. Some women, particularly if they are obese, gain weight with this method. Return to fertility is delayed (four to six months) compared with other methods (French 2009).

**Implants**

Subdermal implants also give highly effective protection against pregnancy but offer no protection against STIs. An invasive procedure is required and implants may not readily available. However they give extended pregnancy protection (for about three years) and help with compliance (French 2009).

An ongoing study in WA is looking at whether Implanon is acceptable to a group of teenagers attending the King Edward Memorial Hospital Adolescent Clinic, and whether it can reduce repeat unwanted pregnancy. At baseline 75% of women reported that they had not intended to become pregnant, although almost all reported not using contraception, or not using it consistently. Nearly half (46%) of the teenagers have elected to use Implanon; but by 12 months contraceptive use had fallen with 22% of participants who had reached 12 months postpartum follow-up experiencing a rapid repeat pregnancy (Skinner 2007).

**Intrauterine systems and devices (IUS/IUDs)**

The benefits of IUS/IUDs usually outweigh the risks for teenagers, although they offer no protection against STIs (French 2009). A systematic review shows pregnancy rates for IUDs and combined oral contraceptives to be similar at two years for teenage women, with IUDs having similar or better continuation rates (Deans 2009).
Emergency contraception
A Cochrane review shows that the chance of pregnancy is similar whether or not women have emergency contraception on hand before unprotected sex, although women who had emergency contraception in advance were more likely to use it, and to use it sooner after sex (Polis 2007). A later RCT confirmed the findings of higher use and sooner use of emergency contraception, noting that having emergency contraception on hand means that teenagers, in particular, have access to effective contraception at weekends instead of waiting until clinics open (Ekstrand 2008).

Young women who have frequent unprotected sex may underestimate their risk of becoming pregnant and often do not use emergency contraception even if they have easy access to it (Williamson 2009).

In SA, emergency contraception is available over-the-counter to women over 16, and many public hospitals and SHine clinics provide it free.

Choosing a contraceptive method
A Cochrane review indicates limited evidence of what works to help people choose an appropriate contraceptive method, although categories were more clearly understood than numbers and audiovisual aids worked better than usual oral presentations from health practitioners (Lopez 2008).

In a US RCT of 542 women at risk of unintended pregnancies and STIs (29% under 20 years), the group receiving computer-based tailored feedback were significantly more likely to use dual contraceptive methods (contraceptive and condom) than the group receiving standard contraceptive information. However no differences were seen between the two groups for rates of STI or unintended pregnancies (Peipert 2008).

Effective sex education programs address self-esteem and acknowledge social norms and the teenagers’ cultural, peer and family context as well as including the WHO key life skills of being able to make decisions about relationships and sexual intercourse, being able to defend these decisions, being able to deal with pressures for unwanted sex or drug use, and being able to recognise a situation which may turn risky or violent (Williams 2004).

Programs
South Australia
The Second Story (TSS) is the Youth Division of CYWH and utilises a primary health care approach to improving the health and preventing ill health of young people in South Australia.

TSS provides free and confidential health services for young people from 12 years to the age of 25. Priority health issues are those related to mental health, sexual health and substance abuse. Other important concerns are the effects of violence, lifestyle issues, homelessness and unemployment. Priority populations include socially disadvantaged young people, young parents, Indigenous youth, same sex attracted young people, early school leavers and young people in Secure Care Centres.

The service aims to provide an integrated and coordinated service so there is cross referral between medical and counselling services and group programs. Liaison with other services to promote appropriate and ‘youth-friendly’ services is fundamental. Attendance is voluntary and preferably at the instigation of the young person concerned.

Australian Capital Territory (Mikhailovich 2005)
The Indigenous Peer Education Project (IPEP) was developed and implemented by Sexual Health and Family Planning ACT with funds provided through the National Indigenous Sexual Health Strategy 2002-04. The program was developed in consultation with stakeholders.
The three aims of IPEP were to:

- Engage recruit, train and support marginalised and disadvantaged young people to become sexual health peer educators;
- Develop partnerships and build capacity to support a local network of young peer educators;
- Work with a range of service providers to improve access to services.

The initiative comprised peer education training, capacity building and the development and dissemination of sexual health educational materials through an arts-based strategy.

The program trained 22 young Aboriginal and Torres Strait Islander peer educators and training consisted of a residential program of five days; five days of organisation-based training and follow-up training for two days a week for six to nine weeks. An Indigenous arts officer worked with young people using drama and role plays, stories, drawing, painting and cartooning to develop a range of materials, such as comic books, posters and stickers that communicated sexual health messages in a format and language accessible to young marginalised Aboriginal and Torres Strait Islander people. A peer education training manual was developed and 200 copies were distributed to a range of youth and health services.

Resources were developed on building healthy relationships, proper condom use, contraception, HIV/AIDS and other STIs, drugs, alcohol and sexual assault and more than 2600 sets of sexual health resources were disseminated to young Aboriginal and Torres Strait Islander people and their community.

Program evaluation involved a retrospective qualitative methodology, including document analysis, interviews and focus groups. Participants demonstrated increased knowledge of sexual health issues, and skills as peer educators. It was not possible to assess long-term effects for participants, service providers or the community. Areas for program improvement and challenges for proper sustainability were identified. The program was well supported within the local community. Five of the 22 peer educators participated in interviews and five in focus groups. Four of the five service providers participated in telephone interviews.

A formal ongoing network of Aboriginal and Torres Strait Islander sexual health peer educators did not develop from the project and while young people who participated in the program increased their use of sexual health services, there was no evidence that this continued beyond the end of the program or changed organisational practices of service providers participating in the program. Two factors were associated with the failure to establish an ongoing peer education network. The high support needs of the young people participating in the program presented challenges to the sustainability of a peer education network – many required emotional support, practical assistance with transport, income and liaison with schools, workplaces or parents. Difficulties were also encountered in gaining a commitment from some service providers to support peer educators. One of the original objectives of the project was that service providers would offer paid work opportunities for peer education within the organisation. Participants had been paid for their training involvement and wished to work for pay rather than on a voluntary basis in the organisations.

Mainstream services did not have the organisational readiness, resources or capacity to integrate the peer education model or young Aboriginal and Torres Strait Islander people into their services. Organisations needed extensive preparation and capacity building prior to the introduction of the peer education programs. The authors concluded that the project needed a better employment strategy.

**United Kingdom**

**New Deal for Communities**

A teenage pregnancy initiative was developed in 2002 in North Huyton, England in line with New Deal for Communities principles of participation and consultation with the local community and engagement between local agencies. Teenage pregnancy rates in this area were more than double the national average, and reduced by up to 32% by 2006. Program components included self-esteem, outreach, emergency contraception and peer-led education. Another program in Wigan is aiming to reduce repeat pregnancies in teenagers (UK Department of Health 2007b).
Native Teen Voices (Garwick 2007)
Native Teen Voices was a community-based participatory action research involving 148 young people who had never been involved in a pregnancy. In focus groups they expressed the view that access to comprehensive pregnancy prevention education, community-based programs and contraceptives was limited. Programs need to involve knowledgeable, trusted Native family and community leaders because they understand the life experiences and cultural background of Native teens. This could take the form of a pregnancy prevention intervention using a traditional Talking Circle format.

Young Parent Program (Omar 2008)
The Young Parent Program (YPP) is a comprehensive program for pregnant teenagers, teenage mothers and their babies of antenatal and postnatal care, continuity of care and extensive contraceptive care. The program offers flexible hours, reminder systems and financial incentives (e.g. free contraceptives). Less than one percent (11) of the 1386 mothers in this program had a repeat pregnancy within three years. Seven of the 11 women used condoms, two used oral contraceptives and two did not use contraceptives; and no repeat pregnancies were reported for those using long-acting hormonal contraception.

6. Ongoing projects/programs

Healthy lives, brighter futures (United Kingdom)
The UK Teenage Pregnancy Strategy aims to halve the under-18 conception rate by 2010. One of the elements of the strategy is a campaign to increase young people’s knowledge of effective contraceptive methods, including long acting reversible methods of contraception (LARC), backed by an increased investment of around 27 million pounds a year from 2008-09 to improve access to contraception. Part of this funding will be used to provide greater incentives to GPs to provide advice on contraception, particularly long acting methods (UK Department of Health 2009).

You’re Welcome (United Kingdom)
The UK Department of Health has developed a set of principles and criteria for young people accessing mainstream health services called ‘You’re Welcome Quality Criteria: Making Health Services Teenage Friendly (UK Department of Health 2009).

Developing a Healthy Further Education Programme (United Kingdom)
Part of this program involves investing 6 million pounds to improve information and advice on contraception to young people in further education. Around three-quarters of further education colleges have now developed on-site health advice services, including advice and support on contraception and sexual health (UK Department of Health 2009).

Evaluation of Adolescent Pregnancy Prevention Approaches (USA)
The Adolescent Pregnancy Prevention Approaches Evaluation aims to reduce teen sexual activity and its consequences. Promising approaches will be tested in up to eight sites and the evaluation is scheduled to run from 2008 to 2013; (www.acf.hhs.gov/programs/opre/strengthen/preg_prevention/ [accessed 11 June 2009]).

Baby-Think-It-Over (USA)
The Baby-Think-It-Over infant surrogate program which involves a life-like infant with computerised crying (de Anda 2006) was not regarded as an effective deterrent to adolescent pregnancy by a group of US teenage mothers (Lemay 2007).

The following Cochrane review is in preparation:

- Interventions for preventing unintended pregnancies among adolescents (Ehiri 2005).
7. Barriers

Long-acting reversible methods
Internationally, use of highly effective long-acting reversible contraceptive methods, such as subdermal implants, has been low but is now increasing. There is a need to challenge the perception that the pill and condoms, the most commonly used contraceptive methods, are always the most suitable methods for young people (French 2009). In some Aboriginal and Torres Strait Islander communities, contraceptive implants are common and acceptable. However they must be inserted and removed by a doctor and communications between health staff and young women need to be clear and effective (Lockyer 2007).

Terminations
Some young women from remote Aboriginal communities may have pregnancy terminations and while this may be an informed decision which is not regretted, in some cases lack of confidentiality, experiences at the clinic and community attitudes opposed to terminations may cause difficulties for a young woman (Lockyer 2007).

Condoms
In a qualitative study in young WA women, condom use was regarded as a hassle and something that interrupts sex; or they reported that they were too affected by alcohol to use a condom (Skinner 2009).

Giving out free condoms and providing information have often had disappointing results, even where awareness of safe sex is high (Marston 2006). In a systematic review of qualitative studies addressing the sexual behaviours of young people, risk that a partner or potential partner was free of disease was made on subjective grounds such as how well they knew their partner socially and on their appearance. Conversely asking a partner to use a condom can be interpreted as a lack of trust that the partner is disease-free (Marston 2006). For some young Australian women, the incentive to use condoms lessened as relationships strengthened or knowing or trusting that their partner was ‘clean’ (Skinner 2009).

The Pill
Reliable use of the pill can problematic for some teenage women (Skinner 2007).

Although women are generally expected to be responsible for pregnancy prevention, they may be stigmatised for carrying condoms or using other forms of contraception (Marston 2006).

Degree of motivation to avoid pregnancy
Some teenagers (such as established adolescent couples) may feel that the opportunity costs of pregnancy are low and the benefits are high, thus generating little motivation to avoid pregnancy. This may also be the case if they perceive that their future educational and/or career goals are compatible with having a child in their teens (Sheeder 2008a).

Encouraging contraceptive use
Young teenage mothers in the US have suggested that the following would encourage use of contraception among sexually active adolescents (Lemay 2007):

- Young mothers outreaching to teenagers;
- Health care providers to provide more information (on a confidential basis), to raise the topic of contraception earlier in adolescence, and to not talk ‘down’ to teenagers;
- Parents should be more involved in talking to their teenagers about contraception;
- Media and commercials should portray contraception use as ‘cool’.
8. Interpretation/comments

The gap between sexual and social maturity is widening, with age at first intercourse decreasing, and age of financial independence (for example) increasing (French 2009) meaning that unplanned or unwanted teen pregnancies increasingly occur in the context of economic marginalisation.

Interventions need to address both pregnancy prevention and preventing STIs, and the implementation of these interventions needs to be improved (French 2009).

An emphasis on barriers to contraceptive use fails to consider that many female teenagers may view immediate pregnancy and parenthood positively and want to get pregnant or ‘wouldn’t mind’ getting pregnant. Idealisation of pregnancy and parenthood may also extend to deciding not to terminate a pregnancy. Subsequent disillusionment can contribute to postnatal depression, anger, resentment, violence, child abuse or neglect (Condon 2000).

9. Further action/research

Research gaps include the development and evaluation of policies to promote young people’s involvement in schooling, further education and training, and to support families experiencing problems linked with social disadvantage (Harden 2006).

Interventions to prevent teenage pregnancies need to start before adolescence. Universal access to comprehensive sexual health and relationships education needs to commence in primary school, as high school is too late for some teenagers.

Enriching activities (such as sports, music, dance, drama) and access to educational programs and resources may help prevent pregnancies in line with ecological systems theory (Meade 2008).

Motivational interviewing to delay sexual initiation and broad youth programs, as well as structural interventions to provide opportunities for educational and occupational success to disadvantaged youth are also required (Meade 2008).

Avoiding a repeat teenage pregnancy is particularly important since the second, rather than the first, teenage pregnancy is more likely to be the one that commits a teenager to poverty and failing to return to education (Quinlivan 2004a). Access to appropriate and supportive models of care for teen pregnancy is poor. Effective models have the potential to reduce or delay subsequent teen pregnancies for the same young mother, as well as support good parenting.

The quality of contraceptive services in remote Aboriginal and Torres Strait Islander communities, including services and counselling, needs to be reviewed (Lockyer 2007).

Skinner et al 2009 suggest that “greater insight into the specific cultural experiences of Aboriginal teenagers and their attitudes around pregnancy, parenthood, contraception and abortion is needed.”

Although family violence screening is recommended by a number of groups, large controlled trials are needed to establish if screening improves women’s health outcomes and quality of life. More work is needed on how to prevent family violence, particular among younger women and men (Coker 2007). Screening without proven effective intervention and support can be merely stigmatising.
References


Preventing infant deaths among Aboriginal and teenage women in South Australia


