

Toothbrushing In Primary Schools

Project Statement

The Bayside District Toothbrushing Program was designed to increase toothbrushing episodes, and application of low levels of fluoride into the mouths of children, in order to decrease the incidence of dental caries. It also promoted toothbrushing as a daily habit for life.

Relevant Outcome/ Partnership Area/s

Oral Health

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- Birkdale Primary State School
- Birkdale South Primary State School
- Cleveland Primary State School
- Coolnwynpin Primary State School
- Hemmant Primary State School
- Mary Mackillop Catholic Primary School
- Mt Cotton Primary State School
- Mt Petrie Primary State School
- Ormiston Primary State School
- Redland Bay Primary State School
- St Lukes Catholic Primary School
- Thornlands Primary State School
- Vienna Woods Primary State School
- Capalaba Primary State School (pilot).

Without the support and commitment of the teachers, parents and students of these schools the project could not have been undertaken.

In addition, our thanks go to those schools that had volunteered to participate in the study but were not selected in the random allocation process.

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Background

Poor oral health contributes to difficulty in eating and speaking, pain and discomfort, poor self-esteem and the economic consequences that result from lost productivity and decreases in quality of life. It is a documented fact that dental caries remains a significant problem for children from disadvantaged areas of the population.^{1,2} Improvements in oral health of children over the last twenty years have been attributed to universal access to fluoridated toothpaste and fluoridated water supplies. While Queenslanders have been able to access fluoridated toothpaste at the same rate as other Australians they have had limited access to fluoridated water supplies. Toothpaste exposure requires individual behaviour and access to sufficient income to purchase this preventive product.

The TIPS project addressed anomalies in previous toothbrushing programs. The project sought to overcome some of the problems identified in other studies by using a classification of carious lesions at both the D1-2 level and at the D3 level as described by Pitts.³ The TIPS toothbrushing program also used low dose fluoride toothpaste to ensure that children would not be consuming excess toothpaste and a routine for daily school toothbrushing that is sustainable within a classroom setting was established.

The Bayside District Program aimed to improve upon earlier studies in two significant approaches. Firstly, the program used low dose fluoride toothpaste and included teacher training in toothbrushing routine. Daily teacher supervision of brushing ensured the children would be exposed to minimum toothpaste consumption. Secondly the program considered white spot lesions (reversible stage of tooth decay) as these lesions were most likely to be affected by exposure to fluoride toothpaste. The recruitment of a study group of over 800 children with schools randomly allocated to control or intervention groups was undertaken to minimise study group bias.

Inter-examiner variability is a major concern for the reliability of the current Child Dental Health Survey Data and had the potential to bias the results of the TIPS study. This project therefore utilised one examiner for all of the survey population to increase the reliability of data collection. Another operator was trained in evaluation as a backup. Centralised training was undertaken to ensure that both operators would score in a standardised way, and regular reliability checks were incorporated into the study protocol. Screening protocols were developed and utilised to increase standardisation of practice over time. These protocols were based on the World Health Organisation (1987) oral health survey manual for caries studies. The program used the same operator for all subsequent surveys over the longitudinal survey period of 3 years.

The TIPS project was initially implemented with Year One students in intervention schools and these students continued with toothbrushing daily for three years. Strategies were undertaken to reduce the loss to follow up of participants in the program as they progress through primary school by using Education Queensland unique personal identifiers where possible.

Overview of project

The primary objective of the TIPS project was to establish the effectiveness of a sustainable daily toothbrushing program at school on reducing dental caries.

¹ Brown LP, Mulqueen TF and Storey E, 1990. The effect of fluoride consumption and social class on dental caries in 8yr old children. *Australian Dental Journal*; 35:61-68.

² Australian Institute of Health and Welfare, 1992. *Australia's Health 1992 – The Third Biennial Report of the Australian Institute of Health and Welfare*. AGPS, Canberra.

³ Pitts NB. Risk assessment and caries prediction. *Journal of Dental Education* 1998; 62(10):762-768.

Project Success

Goal

To reduce by 3% (absolute) the incidence (net D1 caries increment) of smooth surface caries for children in year one in pilot schools conducting the Toothbrushing Program in the Bayside Health Service District by December, 2003.

Performance Indicator

Reporting against the original performance indicator - (absolute) reduction in the incidence (net D1 caries increment) of smooth surface caries for children in the intervention schools compared to the control schools was found to be an inappropriate measure for reporting on outcomes for this project.

More informative measures of outcomes related to this intervention were considered to be caries prevalence and caries incidence. Caries prevalence is the number of decayed, missing and filled deciduous and permanent tooth surfaces per child. Each child's caries prevalence score is categorised into one of the following three categories: caries free (0 surfaces), 1-4 d_3mf/D_3MF surfaces, 5 or more d_3mf/D_3MF surfaces. Caries incidence is that portion of change that measures new caries (sound to caries) on the caries progression calculator (Attachment 9). For the purpose of this study teeth sites that were identified at baseline as unerupted or partially erupted are considered to be sound at baseline.

Burden of Disease

Burden of disease (d_3mfs/D_3MFS) was defined to include surfaces decayed into dentine, gross decay (open cavity), filled with decay, filled with no decay, or where the surface was from a tooth missing as a result of caries. The baseline report only expressed burden of disease in terms of child rates rather than surface rates because of the combination of surface- and missing-tooth-specific components to the definition of this outcome. Overall, the child-specific prevalence at baseline of *burden of disease* was 46% at baseline, involving 1 to 42 surfaces per child.

The analysis of surface-specific rates of *burden of disease* increased significantly in 2003 relative to 2001 (

Table 1). The relative odds of *burden of disease* in 2003 compared to 2001 were 1.17-fold (95%CI 0.1.02-1.34).

This pattern of reducing *burden of disease* rate from 2001 to 2003 screening was statistically similar in the toothbrushing intervention group as it was in the control group (interaction $\chi^2_2 = 4.65$, $p = 0.098$). The greatest difference between intervention and control groups with respect to *burden of disease* rates was at baseline in 2001. At that time, relative to the control group, the toothbrushing intervention group had 1.24 (95% CI 0.91-1.69) times the *burden of disease* before the intervention even commenced. By 2002, and maintained in 2003, the *burden of disease* in the toothbrushing intervention group had been reduced to similar levels of that in the control group (Odds ratio 1.01 for 2002, and 0.95 for 2003).

Over the whole study period, the best overall estimate of the effect of the toothbrushing intervention is that it resulted in a five percent increase in *burden of disease* compared to the control condition (odds ratio 1.05, 95% CI 0.82-1.35). The 95% confidence interval is wide, suggesting an uninformative result, with both relative reductions in *irreversible decay* as high as 18 percent or relative increases in *burden of disease* as high as 35 percent being plausible with these data.

Table 1 The effectiveness of the TIPS toothbrushing intervention in reducing *burden of disease*^a between 2001 and 2003 in the Bayside Health Service District. **Relative odds of *burden of disease* (i) over years compared to baseline year 2001, and (ii) in intervention group compared to control group.**

		INTERVENTION GROUP		
		Odds ratio	95% Confidence Interval	Statistical Significance
YEAR				
	2001	1.00	Referent	0.025
	2002	0.99	(0.88, 1.11)	
	2003	1.17	(1.02, 1.34)	
INTERVENTION				
	Control	1.00	Referent	
	Intervention	1.05	(0.82, 1.35)	0.687

^a*Burden of disease* is defined to include a surface with decay into dentine, gross decay (open cavity) or filled surfaces with decay, filled with no decay, or with tooth missing as a result of caries

^b*Adjusted for father's education and frequency of adult brushing*

Caries free

Table 2 shows the varying level of disease within the two study groups at both baseline and post intervention. There was very little difference in the distribution of caries between the groups. However, there was a large reduction in the proportion of children who were caries free by 2003 in both groups. Additional information related to the analysis of oral health screening and comparisons to parent survey data is provided in Attachment 5.

Table 2 Proportion of children experiencing nil, moderate and high levels of dental disease at baseline and post intervention.

Number of d ₃ mf/D ₃ MF surfaces	2001 (n=803)			2003 (n=594)		
	Caries free	1-4	5 or more	Caries free	1-4	5 or more
Intervention	53%	19%	28%	32%	30%	38%
Control	54%	21%	25%	34%	29%	36%
Total	54%	19%	27%	33%	30%	37%

In the control group (n=309) at post intervention, 34% of children were caries free, 29% experienced moderate caries (1-4 surfaces) and 36% experienced high caries (5 or more surfaces). In the intervention group (n=285) at post intervention, 32% of children were caries free, 30% experienced moderate caries (1-4 surfaces) and 38% experienced high caries (5 or more surfaces). There was no clinical or statistically significant difference in caries prevalence at post intervention between the two groups ($\chi^2_2=0.3$, n=594, p=0.871).

Caries Incidence

Caries incidences were seen in over 250 children in each group between 2001 and 2003. For the control group, caries incidence ranged from -5 to 20 surfaces with a median of 1 (mean 2.18) (Figure 1). In permanent teeth, 27 (10%) children in the control group (n=267) experienced new caries on a total of 42 sites. A negative caries incidence is achieved when false positive changes occur when pre and post data is matched, for example a filled surface at baseline is recorded as sound at post.

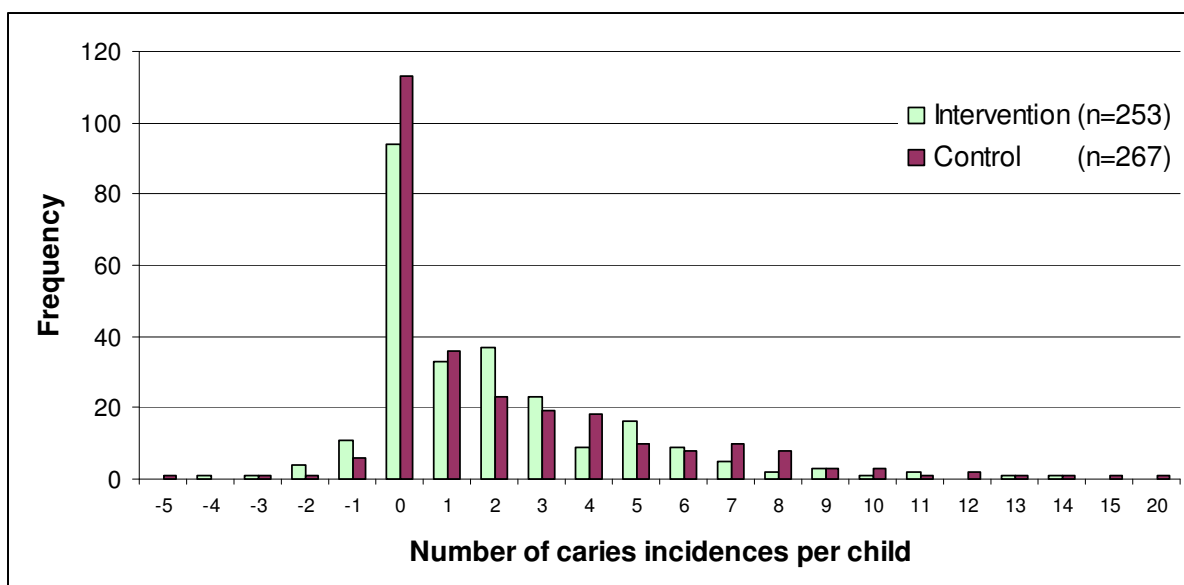


Figure 1 Proportion of children in each study group by caries increment in 2003.

A similar caries incidence was seen in the intervention group with a range of -4 to 14 new carious surfaces and the median caries incidence was 1 (mean 1.81). In permanent teeth in the intervention group (n=253), 18 (7%) children experienced new caries on a total of 32 sites. This suggests a lower proportion of children experienced new decay in permanent teeth in the intervention group than children in the control group. The low numbers experiencing disease in permanent teeth makes it difficult to identify either a clinical or a statistical significance ($z=-1.1$, $n=594$, $p=0.256$).

While the mean number of sites with new disease at the child level over the 32 month study period was 2.00 (SD 3.0), there was no statistically significant difference ($Z=-0.575$, $n=520$, $p=0.565$) between the intervention group (1.81 SD=2.7) and the control group (2.18 SD=3.3).

Inequities

Due to the inequitable distribution of dental caries and the high burden of disease experienced by the most disadvantaged additional investigations were undertaken to identify the impact of the intervention for the most disadvantaged. In order to achieve this individual caries increment scores for the TIPS study group were categorised (-6 to -1=false positives, 0=no caries increments, 1 to 4=1-4 caries increments and 5 to 39=5 or more caries increments). These categories of caries increment were then compared between children of families with and without health care card (HCC) access.

Children from families with HCC access were more likely to have a total of 5 or more caries incidences in both the intervention and control groups. Figure 2 shows that 40% (95% CI 30%, 50%) of disadvantaged children (HCC holders) in the intervention group and 34% (95% CI 23%, 45%) of disadvantaged children (HCC holders) in the control group experienced a total of 5 or more caries incidences over the three years of the TIPS study. The wide confidence intervals suggest relative caries incidence of disadvantaged children in the intervention group was not different to the relative caries incidence of disadvantaged children in the control group and the difference was not statistically significant ($\chi^2_3=3.720$, $n=148$, $p=0.293$).

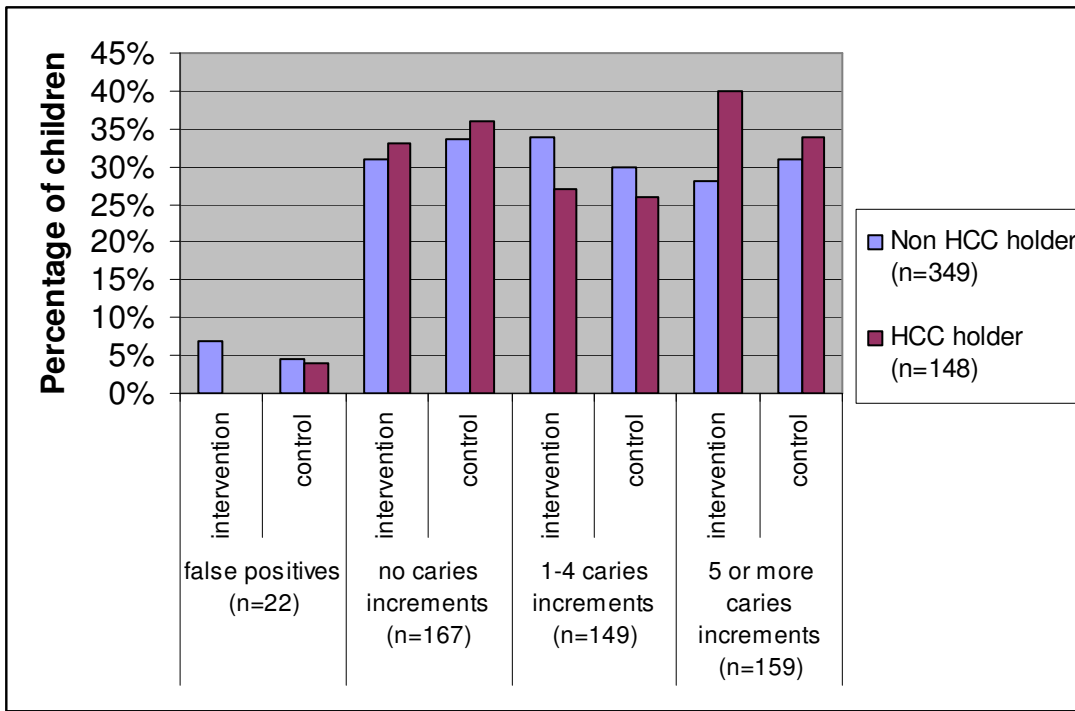


Figure 2 Comparison of caries increment categories by Health Care Card access and intervention group.

A comprehensive overview of additional data analysis completed by Dr Battistutta (QUT) for the TIPS study is presented in Attachment 4.

Objectives and related strategies

Objective 1: To gain optimal participation to the project by all major stakeholders, including control schools by March 2001.

Performance indicators (target):

Seventeen schools agreed to involvement in the random pool for allocation to study groups. Random allocation of schools to study groups was undertaken to ensure sufficient numbers of students for study power and representativeness of schools within study groups. A school retention rate of 100% was achieved for the entire study period 2001/03 although one small intervention school (30608) ceased to provide the intervention (daily toothbrushing) for the second and third year of the study. This school continued participation in all other aspects of the study. In 2003, the proportion of participants screened at both 2001 and 2003 was 75%.

The stakeholder groups represented on project reference group are as follows:

- State School Administration
- State School Teacher
- School Nurse
- Dietitian
- Marketing & Communication
- Epidemiologist
- Association of Independent School
- Catholic Education (non attendance)
- Biostatistician
- Zonal Oral Health Promotion Coordinator
- Dental Specialist
- Infection Control Officer
- Bayside District Coordinator of Education

Eighty four percent of parents consented to their year one pilot school child's participation in the project.

Strategies

1. The project reference group was formed and representative of most stakeholders. Although it did not have a parent representative or representative from Catholic Education, Oral health staff who had children in local schools did agree to provide parent input into the project.
2. Commitment to the project from Education Queensland (EQ) and school administration was obtained through letters to schools and district offices as well as research project presentations to all schools in the Bayside Area.
3. Permission to use EQ identifiers was given by EQ. Schools interested in participating in the project then self nominated to the random selection pool. (Attachment 7)
4. Support for the project was sought from Community Health (Child Health). Child Health nurses provided additional advocacy at local schools re the importance of oral health.
5. The toothbrushing project implementation protocol was distributed to relevant stakeholders to ensure acceptance and suitability. These stakeholders included University of Queensland Dental School, QEII HSD infection control officer, Bayside HSD ethics committee, Media and Communications, school teachers.

6. A representative cross section of schools in the Bayside Health Services was achieved and guidance provided by the Biostatistician assisted in allocation of schools based on Redlands Local Area Statistics and school data.
7. The QUT Biostatistician randomly allocated schools to control and intervention groups using a blind draw from the self selected school pool.
8. In order to get support from schools, presentations were made by oral health project team to school staff outlining the project aims. Consent for school participation varied between schools, with some schools allowing teachers to vote on involvement and others making a school decision.
9. Informed consent/medical history for research participation and screening was collected from the parents of all study participants at every screening timepoint. Informed parental consent to participate in toothbrushing was collected from all parents of intervention children at the beginning of the study. (Attachment 6)
10. Annual written project updates were provided to parents. Teachers were also updated annually via project team presentations. Teachers were acknowledged for their support of the project with a new year TIPS calendar each Christmas. Attachment 8

Objective 2: To collaborate with dental experts to develop and implement appropriate tools to measure dental caries and plaque presence at more sensitive levels than currently employed.

Performance indicator (target):

A dental caries screening sheet was developed based on the AIHW surface data record sheet (Attachment 3). This tool was piloted with a convenience sample of 20 students to validate its use. The dental therapist and dentist repeated measures showed a Chronbach Alpha reliability ratio .90. The Silness and Loe validated gingival measure was used for oral hygiene data collection.

This screening chart's utilisation throughout study was found to be valuable. Amendments to the original form to include options for recording the mixed dentition are essential. Some notation for known pathology such as hypoplasia should be included in the screening chart. It was considered by the screener that demineralisation scores are an overestimation of demineralisation as hypoplasia was included. As there was only one record made at each designated site for the plaque-gingival score it was not possible to include both plaque and gingival notations. Plaque presence was noted first, if no plaque present then the gingival condition was recorded. There should have been an option to record both plaque and gingival health.

Strategies

1. The TIPS study protocol outlining the caries measurement levels and screening protocol is provided as Attachment 2.
2. The screening tool is provided as Attachment 3.
3. Testing and validating of measurement tools was undertaken with pilot group.
4. Screening was undertaken at baseline, post 2002 and final post 2003.

Objective 3: To conduct a daily toothbrushing program in a classroom setting for all consenting year one students through to year 3 in intervention schools.

Performance indicator (target):

Four hundred and sixty children in intervention schools participated in daily toothbrushing. Only 4 parents did not consent to their child participating in daily toothbrushing but did consent to screening participation. A further 18 parents did not consent to their child participating in the screening. Pre and post screenings were conducted for 54% of the total study group as defined by class role term 1, 2001. A limitation of using term 1 class lists for Year 1 students to define the study group was that almost 10% of the students on these class lists were not still attending the school by the time the initial consent to participation forms were distributed.

Strategies

1. Oral health staff involved in the TIPS project were provided with training related to the toothbrushing program protocol to ensure consistency in implementation and communication. A manual was developed for teachers to guide consistent toothbrushing protocol in the classroom (Attachment 10). The toothbrushing coordinators (dental assistants) assisted teachers with the implementation of toothbrushing in each classroom to ensure standardised procedures were adhered to.
2. All year one students were provided with an initial oral health lesson (Dental Therapist) including demonstration and practice of toothbrushing technique. Intervention children were also shown how to complete toothbrushing at school using the standardised toothbrushing protocol. Toothbrushing coordinators reinforced toothbrushing skills at weekly visits in the first term, and fortnightly visits in the second term.
3. Parents were informed about the toothbrushing protocol at school and encouraged to ensure children continue to spit out toothpaste when brushing at home.
4. All participating classrooms implemented the toothbrushing program in term 3 2001. This ensured that no child's baseline oral health screening data was biased by the initiation of the toothbrushing program.
5. Infection control was a major component of the TIPS program as this was considered essential for program sustainability. Classrooms were provided with soap (bar) and children were required to wash their hands before brushing. Some teachers provided their own liquid soap. In the first few weeks of the program the toothbrushing coordinators checked storage of toothbrushes and paste, shaking off excess water and cleaning of sinks after rinsing brushes. The infection control protocols were reinforced through posters in classrooms and the Teachers Manual (Attachment 10).

Milton's cleaning of toothbrush cases was initially carried out by placing a measure of diluted Milton's water mixture into the case and soaking for 5 minutes and then wiping out the case with a disposable cloth and then drying. This was extremely time consuming and was taking over an hour per classroom. Some toothbrushes were presenting with mould and needed to be soaked in Milton's or replaced. Autoclaving of toothbrush cases was also trialled but found to be at least as time consuming as Milton's soaking.

Permanent markers used to identify toothbrushes and toothpaste tubes were not effective as the names were easily removed with regular rinsing and handling. Oil based paint pens overcame this problem (uni Paint marker, Marvy Uchida Calligraphy pen).

Each classroom was then provided with cloth wipes with detergent/water mix (DuPont Sontara medical cleanup wipe). Children were given a cloth wipe which they used to clean the case themselves each week. Children were not cleaning the cases very effectively and

mould continued to be an issue even though the cases were being left open on a window sill in the sun wherever possible. This increased storage problems within many classrooms.

The mould issue became a major barrier to infection control and needed to be addressed. A brainstorming session led to the development of a cloth bag prototype which allowed brush and paste storage with continuous airflow. The cloth bag was sent to the infection control advisor to identify if there would be any potential concerns related to cross infection. The team was advised that there was no concern as bags were double thickness and would continue to be personal items. A supplier for the cloth bags was sought. Colgate offered to pay for the costs of producing the bags for the trial. This offer was gratefully accepted.

Two cloth bags were provided for each child and named accordingly. Each child stored their toothbrush and paste in the bag for 4-6 weeks and then transferred these items to the second bag to enable laundering of the dirty bag. The bags were sent to the hospital linen service for laundering and drying. The time taken to implement toothbrush bag change over was 20-30 minutes per classroom. This changeover was carried out 3 times per term. Laundering of bags was conducted by the Mater hospital laundry service. This was found to be an efficient mechanism given the large quantity of bags. The only drawback to this process was the collection of wet bags that required oral health staff to facilitate drying and folding of bags ready for redistribution. Once this routine was established it became less cumbersome.

One drawback to the cloth bag was that children could easily squeeze the bags. If the toothpaste lid (flip top) was not closed properly toothpaste exuded into the bag. It became evident after a short time that younger children found it difficult to properly close the flip top lids once toothpaste built up around the opening. To overcome this problem, the protocol was changed to eliminate the use of the flip top. All children were encouraged to screw the lid off and on the toothpaste tube.

Objective 4: To measure plaque scores, caries levels and gingival condition for all children in pilot study in 2001, 2002 and 2003.

Performance indicator (target):

The percentage of students involved in control and intervention groups that were screened for dental caries and plaque indicators at each screening timepoint are shown below. _____

Table 3 Proportion of children that participated in TIPS screenings in 2001, 2002 and 2003.

Study Group	School code	Total 2001	Match 2002		Match 2003	
		N	N	%	N	%
C	30022	82	66	80%	53	65%
C	30023	43	30	70%	29	67%
C	30030	8	5	63%	8	100%
C	30284	34	29	85%	22	65%
C	31915	108	82	76%	70	65%
C	31927	86	68	79%	54	63%
C	35601	47	43	91%	31	66%
Total matched		408	317	78%	318	78%
I	30229	73	57	78%	46	63%
I	30405	50	39	78%	31	62%
I	30596	73	66	90%	60	82%
I	30608*	14	8	57%	7	50%
I	31240	57	38	67%	35	61%
I	31545	73	56	77%	45	62%
I	31936	55	39	71%	29	53%
Total matched		395	298	75%	279	71%

*school discontinued intervention after 12 months participation.

Strategies

1. To maximise collection of completed medical history and consent to screening forms (Attachment 11) from parents the following processes were undertaken:
 - In 2001 all consent/medical history forms were individually hand written with name, school and class details.
 - In 2002 all consent/medical history forms were individually labelled with name, school and class details using mailing labels printed from excel class lists.
 - In 2003 all consent/medical history forms were individually printed with name, school and class details.
 - Forms were provided to teachers in an envelope that had a cover sheet listing all children for whom forms needed to be collected and a collection date was arranged for oral health staff to collect returned forms. All teachers were asked to mark off the child's name as forms were returned and to encourage children whose forms were not returned to do so up to the date of collection.
 - If the screening team was at a screening school for more than one day, children who had not returned consent/medical history forms were given another copy of the form and asked to return it the following day.
 - Notification slips for individual children with urgent dental care requirements (abscess or pain) were issued in a sealed envelope. The notification advised parents that there was an urgent dental concern and provided contact details for their local school dental facility.
 - The dental drover was used as a standardised screening environment throughout the study. A number of issues arose from the use of the drover and the screening protocol. These are discussed by year:

At the screening, children attended on their own without their parent. For the first year this was problematic as many of the children had not yet experienced a dental appointment. This impacted substantially on the amount of time taken to conduct the screening as the dental operator had to be aware of individual student needs in relation to orientation to dental care. Three children were not able to be examined due to their inability to cope with the new experience. Major problems were encountered with the use of the diagnodent recorder and the time required to collect each diagnodent reading was higher than expected. Other issues associated with the utilisation of the diagnodent included the high battery usage and infection control requirements (sleeves for light probe).

Drover problems were initiated when it was suggested that a truck license was required (not required in the end). The garaging of the drover was a major drawback to effective time utilisation in the early stages as the Drover needed to be returned to the Wynnum Hospital every night. Long leads had to be connected each night to recharge the power supply. Pickup of the drover and clinic setup took between 1 and 2 hours depending on travel requirements. Packup time was similar. This usually did not impact on the available screening time as screening could only take place during school hours (9am-3pm). Unforeseen problems arose with the drover as the TIPS team were the first to utilise the facility for a continuous period of time. A number of maintenance and equipment problems presented with the generator, hydraulics, compressor, fridge and power connections.

Wet weather also created difficulties with parking the Drover. A mud slide at Mary Mackillop College tested the drivers' ability and induced an elevated fear factor to parking in wet conditions.

Due to unavailability of a power outlet and a generator failure at Cleveland State Primary School children were examined in the fixed dental clinic at this school.

2002

Additional time was allowed for the screening process in 2002 given the problems encountered in 2001. Screening was much quicker in 2002 as the children were familiar with the process and the dental operators. The combined experience of the screener and recorder further enabled processes to operate smoothly. Permanent premolars had not been expected to be as prevalent as was found. This presented a problem as the screening chart had not had a notation for recording tooth type for these teeth. A change to the form to enable collection of this data was implemented to ensure tooth type was able to be accurately recorded for data entry.

The diagnodent failed to function and had to be repaired half way through the screening process. As the exact timing of when the diagnodent failure occurred could not be determined, the previous school diagnodent was re-screened until re-screening and original screening diagnodent scores could be matched. Changes had been made to modify the drover and faulty equipment from the 2001 experience and few, if any, problems were incurred.

Intention to carry out the screening for Cleveland State Primary School children in the fixed clinic again in 2003 (maintain consistency) were foiled as the fixed dental clinic was burnt down in the interim. A power connection had to be installed and children were screened in the Drover for subsequent years.

2003

Screening was extremely efficient as the children were more mature and accustomed to the process and the operators. Both operators were very experienced with the drover, collection tools and charting measures. The drover was efficiently utilised.

Objective 5: To investigate fluoride consumption and frequency of brushing by December 2002.

Performance indicator (target):

The mono-fluoro phosphate content of Colgate Junior Toothpaste was calculated at .04% of tube (.4mg F- per 1g toothpaste) through consultation with the Colgate toothpaste manufacturing team at their Gold Coast production facility. Safe levels of ingestion of fluoride for this age group in a non-fluoridated community were considered to be those under 0.5mg as this was the current supplement rate for the same age group. The mean daily toothpaste usage (g) was calculated by dividing the total grams of toothpaste removed from the tube during the investigation period divided by the total number of recorded brushing episodes. As children were not actively encouraged to expel toothpaste after brushing in the TIPS program the total amount of toothpaste removed from the tube was calculated as potential daily fluoride intake (PDFI). The PDFI (milligrams) was calculated as the mean daily usage (grams) multiplied by 0.4 as shown for each child in Figure 3. Mean PDFI for those children sampled was found to be 0.26 mg per day. This is well below the recommended supplement level of 0.5mg per day for this age group.

The limitations identified with this investigation of PDFI were that classes that did not submit brushing records for more than one month were not included in Potential Daily Fluoride Intake (PDFI); some records included in data analysis for PDFI did not accurately reflect all brushing episodes and toothpaste wastage due to mishaps or accidents was not recorded. The first limitation presents an unknown bias to these results and the other two limitations are likely to have produced an overestimation in the PDFI.

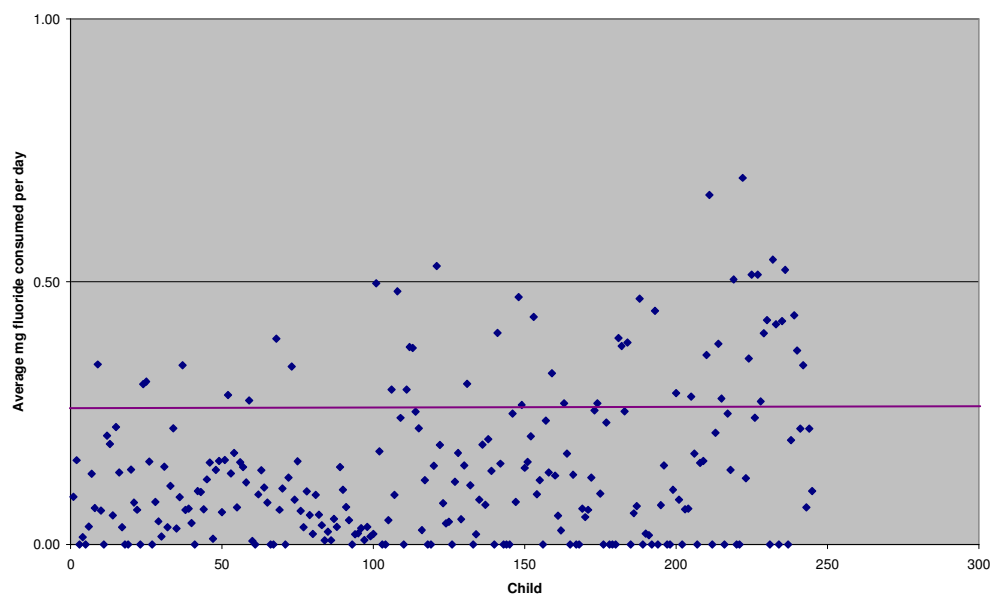


Figure 3 Plot of individual potential daily fluoride intake through TIPS program term 3, 2001.

Strategies

1. In term 3, 2001 toothbrushing classes were asked to monitor and record fluoride toothpaste use on a daily basis. Toothpaste contents were measured at baseline and at the end of the school term using a Sartorius Basic (GMBH Göttingen Type B310P) weight measurer and weights were recorded prior to distribution to children.
2. Each class teacher was provided with a term toothbrushing chart to record every child's participation in toothbrushing on a daily basis. Teachers stamped the chart for each child that brushed on a given day.
3. At the end of term all toothpaste tubes were collected and reweighed and recorded.

4. The number of brushing episodes per child and the pre and post toothpaste tube weight were entered into Excel to calculate the potential daily fluoride intake.

Objective 6: To build on existing intersectoral collaboration between education, child health, oral health and tertiary institutions to enhance communication of the project.

Performance indicator (target):

There was 100% agreement from teachers who returned the post implementation survey to implement the tooth brushing program if it was evaluated as effective in reducing dental caries.

Communication of the project to date has included:

- Poster presentation at Qld Child Health Conference.
- Science in Parliament participation.
- International Union of Health Promotion and Health Education Conference presentation.
- Queensland Dental and Oral Health Therapist Association conference presentation.
- Brussels Longitudinal study presentation.
- Queensland Health Medical and Scientific Meeting presentation.

A strong learning environment was established within the oral health team.

Communication improved with the University of Queensland Dental School. This was evidenced by the invitation to present the TIPS study to 4th year dental students.

Strategies

1. A communication plan was developed in consultation with the district communications officer.
2. Representatives from all key stakeholder groups were invited by letter to participate in the reference group.
3. In the presentations to schools, teachers were encouraged to incorporate oral health into the Health and Physical Education Curriculum for each class.
4. Teachers were provided with instructions and a resource book for the toothbrushing program protocol and routine. All participating schools were provided with a health resource package that included oral health story books, puppet, Colgate Bright Smiles, Bright Futures package. The schools were also advised of other health programs (eg; Germ Busters, Food for Smiles). School health nurse also advocated in the schools other health opportunities. The toothbrushing coordinators also provided regular support to teachers in the classroom.
5. The TIPS team developed a strong environment that encouraged learning and skill development in project management and research.

Results of post implementation teacher survey:

In early 2004, the TIPS team visited each participating school (intervention and control) to feedback on the early results of the project to school staff. At this meeting teachers from the intervention school were invited to feedback their reflections on the toothbrushing project.

A total of 10 teachers completed and returned the "TIPS feedback on project outcomes" survey. Of these 8 were teachers who had taught in a toothbrushing classroom, one was a teacher's aide and one was a teacher not involved with the toothbrushing program.

Overall, teachers indicated that the project had been a worthwhile. *"Even if the only benefit was showing the children that brushing should be a daily routine then that is worthwhile"*. Teachers also

indicated that there were flow on effects in that *“parents saw the advantage of brushing at school”* and children *“developed an awareness in children for personal dental care”*.

“The children involved really enjoyed the project” and *“thought it was fun”*. In fact, the children often instigated the brushing especially when their regular teacher was absent. *“Children loved cleaning their teeth at school and eagerly participated and reminded me if I didn’t do the brushing on time”*. The program may have been *“inconvenient at times, especially by Year 3 as the children were ‘over it’”*.

Even though teachers *“fully supported the TIPS project they were concerned that another health/personal development area is being put on to school responsibility”* and while it was *“probably a worthwhile trial, ...the whole thing was just another task for me to do each day”*. *“Getting children into routine took up part their teaching time”* and teachers suggested that *“the programming into an everyday timetable needs some more consideration”*.

The initial introduction of the program in Year 1 was problematic as children did not know the routine or in some cases have the fine motor skills to complete set tasks. *“My experience with 30 Year Ones, started off rocky but eventually we got into the swing of things”*. *“From a teacher’s point of view, it was difficult to begin with (Yr 1)”* and *“the toothbrushing in the classroom did cause some difficulties with the young children”*. This was particularly evident for a preschool- Year 1 combined class. *“Preschoolers needed teacher and aide support because they could not independently dispense a small amount of toothpaste and also constantly wanted to rinse. We found the preschoolers fine motor skills were not developed enough to put such a small amount of toothpaste on the brush”*.

Some teachers identified particular concerns about the project implementation in that *“dental nurses gave no prior warning about their visits and it was usually during our lunch breaks”* or *“lack of promised support made the whole thing a ‘chore’”*. Other teachers noted that *“the support from the project team was very helpful”* and wished *“many thanks for great support personnel”*.

“Hygiene was an issue in the early stages” and teachers indicated that *“there were concerns with hygiene- keeping brushes dry yet protecting from creepy crawlies was difficult”*. All of these concerns were from teachers in relation to the storage of toothbrushes in the plastic cases. No concerns were raised with regard to toothbrush storage once the toothbrush bags were introduced.

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Project Management Processes

Gantt chart

2001	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Bayside OHS	school recruitment	consent	parent survey + pre screening started	screening		picked up missed screening at fixed clinics	brushing commenced					recruitment of yr 2 teachers
QUT								data entry			baseline report	
2002	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Bayside OHS		upskilling for yr 2 teachers	brushing commenced with bags	post 1 screening	post 1 screening							recruitment of yr 3 teachers
QUT						financial report due.	data entry	analysis	draft 1st post report			
2003	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Bayside OHS	upskilling yr 3 teachers	commence brushing	Status report				Status report	Collect class lists	Arrange screening timetable	post parent survey	post 2 screening	Status report
QUT						financial report due.						
2004	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Bayside OHS		Status report	Feedback to parents on completion of project	IUHPE poster	DOHTAQ presentation		Feedback to schools and stakeholders	Completion report due.				
QUT	data entry	data entry	data cleaning/analysis	data analysis	data analysis	data analysis	Final report!!!!	Final financial report due				

Cost

While there was limited ability to monitor budget at the local level due to varying levels of accountability this project has shown exceptional reporting of both human and physical resource expenditure. This accountability of investment was considered essential if there was to be any consideration of further investments in this area in the future.

	October 2000 - December 2001	January 2002 - December 2002	January 2003 - December 2003	January 2004 – June 2004	
Source 1; HPP Approved funding	\$20,000				
Source 1; HPP Approved funding		\$14,257			
Source 1; HPP Approved funding			\$18,209		
TOTAL HPP Approved funding					52,466.00

ITEM	No. OF UNITS	COST PER UNIT	TOTAL COST	No.OF UNITS	COST PER UNIT	TOTAL COST	No.OF UNITS	COST PER UNIT	TOTAL COST	No.OF UNITS	COST PER UNIT	TOTAL COST	TOTAL BALANCE
Backfill for D.A.(002.4@7.6hrs/day for 60days@\$14.02/hour)	456 hrs	\$14.02 /hr	\$6,393	638 hrs	\$15.15 /hr	\$9,666	638 hrs	\$17.94 /hr	\$11,446				27,505.00
Dianna Battistutta			\$10,790			\$3,500			\$2,428				16,718.00
Printing of Surveys			\$663						\$669.00				1,332.00
Graphic Artist/Printing			\$692						\$25.00				717.00
Stationery (including marking pens)			\$92			\$26			\$16.00				134.35
Batteries			\$17			\$25							41.90
Sundries			\$17										17.00
Toothbrushes and Toothpastes													0.00
Travelette Cases	500	\$0.75	\$375						\$2,678				3,053.00
				2	\$11	\$22			\$663.00				685.00
Courier			\$37			\$9			\$17.00				63.35
Stamps				30	\$0.45	\$14							14.00
Books	14	\$13.45	\$188										188.30
				5	\$12	\$60							60.00
Paper towels			\$97										97.00
Hand Soap			\$20										20.00
Buckets			\$38										38.00
Miltons			\$125										125.00
Laundry bags				4	\$2	\$8	8	\$15	\$120.00				128.00
Storage bin				1	\$13	\$13							13.00
Tap Fitting				1	\$3	\$3	1	\$4	\$4.00				7.00
Labels						\$22							22.00

Frames				14	\$10.10	\$141.00					141.00	
Phone Card				1	30	\$30.00					30.00	
Lunch Bags				2	1	\$2.00					2.00	
Parking							\$17				17.00	
Detergent		\$21									21.00	
Gloves		\$183									183.00	
SUB TOTALS		\$19,749				\$13,393					18,239	51,380.90

Source 2: Bayside Health Service District
Staffing: Implementation Team as follows

Senior SDT (TO4.3)	342 hrs (1) /hr	\$26.35	\$9,012	377 hrs (1) /hr	\$26.35	\$9,934	352hrs (1) /hr	\$26.35	\$9,275	39hrs (1) /hr	\$26.35	\$1,028	29,248.65
SDT TO2.6)	366 hrs (4) /hr	\$20.45	\$7,485	108 hrs (2) /hr	\$20.45	\$2,209	52hrs (1) /hr	\$20.45	\$1,063	26hrs (1) /hr	\$20.01	\$520	11,277.26
OHT (PO2.4)				117 hrs (2) /hr	\$21.41	\$2,505	122hrs (3) /hr	\$21.41	\$2,612	18hrs (2) /hr	\$20.45	\$164	5,280.60
DA (002.4)	87.5 hrs (1) /hr	\$15.10	\$1,321	93.8 hrs (1) /hr	\$15.10	\$1,416	91hrs (1) /hr	\$15.10	\$1,374	36hrs (2) /hr	\$21.41	\$726	4,836.66
Printing & laminating of Infection Control Protocol		\$0	\$0		\$0	\$0		\$0	\$0	18hrs (1) /hr	\$15.10	\$272	271.80
Printing & binding of Teachers' Handbook		\$0	\$0		\$0	\$0		\$0	\$0	60 eet	12c/sh	\$7	7.20
Printing of handouts				1000	\$0.12	\$120	1800	\$0.12	\$216				336.00
SUB TOTAL		\$17,818				\$16,184			\$14,540			\$2,716	51,258.17

Source 3: SPHUN (Helen Clifford)
AO5 OHP coordinator -support and sponsor

Toothbrushes and paste	400hrs	\$27.40	\$10,960	180hrs	\$27.40	\$4,932	280hrs	\$28.50	\$7,980	350hrs	\$29.60	\$10,360	34,232.00
Puppets	14	\$35	\$490										4,758.00
Printing and photocopying	1000	\$0.12	\$120	1000	\$0.12	\$120	2000	\$0.12	\$240	1000	\$0.12	\$120	490.00
SUB TOTAL			\$16,328			\$5,052			\$8,220			\$10,480	40,080.00

Source 4: Colgate

Colgate Oral Health Kits	12		0										
Colgate Toothbrush storage bags				850	\$1.25	\$1,063	500	\$1.25	\$625				1,687.50
SUB TOTAL			0			1062.5			625			0	1,687.50

BALANCE		\$53,895				\$35,692			\$41,624			\$13,196	\$144,406
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Expenditure	144,406.57
Project Funding	52,466.00
Difference	91,940.57

Cost (continued)

This project has gone to great lengths to capture the true costs of undertaking this type of research. It is essential that any comparison of costs between projects is only undertaken when a comparative project also includes full costs for implementation. Since true costing is rarely captured the costs presented here may seem high, but in fact provide for more accurate and accountable cost considerations.

It is estimated that implementation of a toothbrushing program following the TIPS protocols would cost approximately \$380 per child class per year or \$14 per child per year. The cost of implementing the toothbrushing project in the 7 intervention schools would therefore have been approximately \$6460 (17 x \$380). These calculations are shown in Table 4.

Table 4 Toothbrushing program projected costs based on TIPS cost analysis.

Requirements per classroom	approx 27 children/class	Number of units	Item cost	Total cost
toothbrush and paste	4/child/year	108	1.70	\$183.60
bag	2 per child	54	1.25	\$67.50
DA	3x30 mins per term	6hrs	21.40/hr	\$128.40
				<hr/>
				\$379.50

Quality

A series of quality processes were undertaken in this project. The project plan, project protocols documentation, teacher's handbook etc were key quality strategies to limit research biases and ensure quality project implementation.

The interviewing of key project personnel in regards to implications associated with project involvement (3 year requirement) led to a low turnover of project team members and provided significant benefits in relation to reducing data biases.

Project reporting on time, cost and quality was extremely well executed by the project coordinator. The project team managed all project risks as they arose or were identified in a very effective manner thereby reducing the impact of such risks on the projects implementation. The project was carried out within the proposed timelines and all allocated funding was expended on specific project costs as per proposed budgets. Commitment to quality has been verified by problem solving strategies throughout the project (eg: toothbrush storage containers), the true capturing of cost and rigorous etc study design in a school environment.

Lessons Learnt

Project Team Reflections

The following discussion pertains to the project team's reflections on lessons learnt during the TIPS project.

PROJECT PLANNING

Although at the beginning of the project many team members expressed frustration with "all the planning", by project end, the team commented that "all this planning allowed us to nail our presentations to the schools to seek participation". The team's new commitment to project management was apparent when team members remarked that "with hindsight, *they could* see the many, many benefits of taking the time to plan well" and that they would "really encourage anyone doing a project to really look at getting the planning down pat before starting".

PARTNERSHIPS

The establishment of new partnerships with the Biostatistician and the Oral Health Promotion Coordinator was valued by team members and the close working relationship with schools and children was cherished.

The utilisation of Education Queensland personal identifiers provided valuable research rigour for tracking study participants in this longitudinal study.

PARTNER ENGAGEMENT

The importance of partner insight into dental disease issues and the potential impact on engagement was highlighted at project end. The team identified that the "schools needed guidance and assistance from us to understand the dental disease problems that this research aimed to address". Team members had responded to this by developing skills in producing succinct professional power-point presentations. This process "successfully achieved commitment and support from more schools than was required" to undertake the research.

A commitment throughout this project to feed back to schools ensured that key stakeholders were involved in all aspects of the project lifecycle. Being honest at the outset about the gap in the knowledge base and subsequent honesty about lack of health outcomes has been a challenge for all. A key learning from this project is that this project achieved positive results in that it filled the gap in the evidence base. Partnering with schools allowed for a collaboration in future disinvestment in this area.

HUMAN RESOURCE MANAGEMENT

The pressure placed on team members as they continued to perform their primary roles and responsibilities without any backfilling was sometimes overwhelming. This influenced the team's sense of support from management during their involvement in the TIPS project. Despite this, the project team focused on sharing the workload as "many hands made light work". Lack of budget tracking support and numerous sign off points for budget items also increased the time taken for the project coordinator to complete project status and completion reporting.

ENHANCED SKILLS

Involvement in the project over the 3 year period enabled team members to steadily develop group skills. Team members remarked that they were increasingly "confident in *their* abilities to contribute" and comfortable with having their "opinions and ideas heard". Team members noted the "sense of cohesion and support for each other" that had developed. Project involvement also provided team members with an opportunity to enhance "team problem solving skills". Project involvement required a significant commitment from team members and it was a "big ask of the staff members who undertook all the screening". Despite the fact that for a number of reasons, not all team members were able to provide the same level of commitment to the project, "team meetings proved very successful as what seemed to be huge problems were nipped out very easily".

In addition to group skills, other personal development attributed to project involvement was noted by team members. These new skills include, public speaking, project management, familiarity with power-point presentation, research data collection, ethics applications as well as an increased understanding of basic statistics and research methodologies. Team members noted that being involved in the project enhanced existing skills and “made us grow into a group that could take the TIPS presentation to universities, consultative forums and biennial conferences”.

COMMUNICATION

Working in the dental drover was somewhat problematic. Issues arose when the screening team felt that they were being blamed for faults with the drover that were beyond their control. Poor communication, in this instance left the screening team feeling very unsupported when they had taken every action possible to ensure they managed the drover and its malfunctions as professionally as possible.

GOVERNANCE

A key learning from this project is that future projects need to ensure that there is a strong commitment from management and that better team / management communication processes must be established early on so that project team members feel supported in taking on additional project work.

It is also important that we truly capture the cost of health promotion and research. Without true costings it will be difficult for decision makers to truly identify cost effective investments for the future.

Communication and dissemination

To date the following communication of the project processes has been achieved:

- Key stakeholders
- Qld Child Health Conference
- Science in Parliament
- International Union of Health Promotion and Health Education Conference
- Queensland Dental and Oral Health Therapist Association conference
- Brussels Longitudinal study conference
- Queensland Health Medical and Scientific Meeting
- Oral Health Directors Forum

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Project outcomes dissemination:

To date:

Key stakeholders

Bayside HSD ethics committee

Oral Health Unit

Suggested for future:

- Australian Dental Therapist Journal (Conducting research programs)
- Australian Dental Association Journal (Caries Outcomes)
- Public Health Association Australia Journal (Nutrition implications for oral health)
- Australian Health Promotion Association Journal (School based oral health intervention)
- Community Dental Health (parental attitudes and oral health)

Hand-over overview and outcomes

Post-implementation review

Methodology

A post implementation review will be undertaken with a broad range of stakeholders in order to identify implications of this research for education and health. It will be essential to involve key health and education representatives in this process. Additional research questions that may be able to be explored within the TIPS data set need to be identified and options for addressing these considered.

Timeframe

This review should be undertaken by February 2005.

Governance

Post implementation governance should be handed over to:

Sponsor: State Manager for Oral Health Services Queensland Health

Project Coordinator: SPHUN Oral Health Promotion Coordinator

Costs

There are no direct costs expected to be associated with this post implementation review. Potential costs may be incurred if further analysis of the TIPS data is to be undertaken.

Estimated margin of error

As no direct costs the estimated margin for error is expected to be small. Analysis costs can be quoted once key research questions have been identified.

Recommendations and conclusions

Toothbrushing in schools, as per the TIPS project, has not shown a significant reduction in dental caries incidence in the intervention group compared to the control group. While there was a small difference between the groups, the difference was neither clinically or statistically significant. Given the cost associated with implementing a toothbrushing program under the TIPS protocol, the project team recommends that this type of intervention does not produce a benefit that is commensurate with the costs incurred.

The TIPS research data holds valuable oral health information beyond the evaluation of the TIPS project. This data should be explored for further insight into effectiveness of school based service delivery.

This research questions the effectiveness of low dose fluoride toothpaste in the prevention of dental caries. There is minimal evidence in the literature to support its use in non-fluoridated areas and this study appears to raise concerns about the promotion of these toothpastes to children at 5 years of age.

The findings in this study support the need for water fluoridation to help reduce the burden of dental disease in Queensland. This alternative method of fluoride exposure was unable to provide a similar protection for tooth enamel as that shown by water fluoridation studies.

Further information

Recommendations and decisions

Cleared by	
Name: Helen Clifford Position: SPHUN Oral Health Promotion Coordinator	Signed: Date:
Name: Elizabeth Holder Position: Principal Dentist, Bayside Health Service District	Signed: Date:
Name: Andrew McAullife Position: A/Director, Oral Health Unit	Signed: Date:
Name: Peter McKeown Position: A/Manager HPS, Southern Public Health Unit Network	Signed: Date:
Comments:	
Higher authority decision	
<p>Next Steps:</p> <p><input type="checkbox"/> Project completion report accepted, indicating project closure</p> <p><input type="checkbox"/> Revise report and present again</p> <p>Comments:</p>	<p>Resources for post-implementation review approved?</p> <p><input type="checkbox"/> Yes Amount approved - \$</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> NA (if no post-implementation review is to be undertaken)</p>
	<p>Name:</p> <p>Position: State Manager, Oral Health Services</p> <p>Signed:</p> <p>Date</p>

- Attachment 1: Project Plan
- Attachment 2: TIPS study protocol
- Attachment 3: Screening Tool
- Attachment 4: QUT statistical report
- Attachment 5: Masters of Public Health Thesis by H. Clifford
- Attachment 6: Consent to participation
- Attachment 7: Letters to schools
- Attachment 8: Feedback to schools and parents
- Attachment 9: Baseline Report
- Attachment 10: Teachers Manual
- Attachment 11: Screening and consent forms