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Introduction

Shifts in service provision over time can reflect changes in demography, oral health and expectations, as well as new technology and provider preferences. Trends towards improved oral health have been observed in the Australian population over recent decades. Reductions in caries experience have occurred among children, although recent data have shown an upward trend in caries, and decreased levels of tooth loss have been reported among adults. The pool of middle to older aged adults at risk of oral disease is increasing, driving increases in services to restore tooth function. New materials and techniques have made many interventions both more efficacious and efficient, and the preference of many patients.

Methods

(a) Sample and response

A longitudinal design involving a sample of 10 per cent of male dentists and 40 per cent of female dentists was randomly drawn from the dental registers for each State or Territory in Australia in 1983. The higher sampling rate for female dentists was designed to provide sufficient numbers for comparisons by gender of dentist, as females comprise a lower percentage of registered dentists than males. Sample supplementation at each successive wave of the study based on 10 per cent of male and 40 per cent of female dentists who were newly registered since the previous wave ensured representative cross-sectional estimates. In 1983, 1988, 1993 and 1998 these samples were surveyed by mailed questionnaire, providing response rates of 73, 75, 74 and 71 per cent.

The data were weighted using the estimated number of practising private general practice dentists at December 1983 and 1988, with the age and gender distribution of dentists from the 1981 and 1986 population censuses of Australia, and dental board registration statistics from 1992 and 1994. Therefore the estimates of practice activity are representative of the age and gender distribution of Australian private practice dentists at each time.

(b) Service provision data

Practitioners recorded the types of services provided over one to two self-selected typical days of practice. The number of patients sampled by each dentist varied according to their typical level of activity. Dentists were free to choose which days to include in their service log. Only sampled dentists within any group practice provided data. Dentists were instructed to record for each patient treated on their selected typical days the services provided regardless of whether or how they were charged to the patient. A patient may receive a number of services per visit across the range of 10 main areas of service. For most analyses services were classified into main areas of service following the Australian Dental Association’s Schedule of Dental Services. Extraction services reported in this paper correspond to the area listed as oral surgery in the Schedule. Further analyses focus on groups of services within a main area of service.

Figure 1 provides a schematic outline of the data collection and derivation of the service provision measures.

Results

(a) Practice activity measures by gender and age of dentist and time of study

Table 1 presents measures of service provision by gender and age of dentist and time of study. Male dentists had a lower rate of services per visit, but higher rates of patient visits supplied per year and annual services provided per dentist. Significant variation occurred by age of dentist, with...
high rates of service provision per visit and annual services per dentist among dentists aged 40-49 years, and high rates of patient visits supplied per year for 40-49 and 50-59 year-old dentists. Services per visit increased from 1.78 to 2.14 over the study period, while the number of patient visits supplied per year decreased. However, the number of annual services supplied per dentist remained stable over the period.

(b) Main areas of service by time of study

Annual services provided per dentist (see Fig 2) decreased over the time of the study for restorative services, but remained stable for diagnostic and preventive services. Endodontic and crown and bridge services both increased over time (see Fig 3), while rates of extraction and denture services decreased. No changes over time were observed for periodontic, orthodontic, or general/miscellaneous services (Fig 4).

(c) Restorative services

Annual numbers of restorative services provided per dentist is presented in Fig 5 broken down into amalgam, composite resin and glass ionomer services. The number of amalgams decreased consistently across all four points in time. Composite resin services, while provided at stable rates between 1983 and 1993, increased in 1998. Glass ionomer services increased initially in 1988 and 1993, before decreasing in 1998.

(d) Denture services

Annual numbers of denture services are presented in Fig 6 broken down into full and partial dentures. The provision of full upper and lower dentures decreased across all four points in time between 1983 and 1998, as did the provision of full upper dentures. There was no statistically significant change

Table 1. Mean practice activity measures by gender and age of dentist and time of study

<table>
<thead>
<tr>
<th>Gender of dentist</th>
<th>³Services per visit</th>
<th>³Patient visits per year</th>
<th>³Annual services per dentist</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (S.E.)</td>
<td>Mean (S.E.)</td>
<td>Mean (S.E.)</td>
</tr>
<tr>
<td>Male</td>
<td>1.97 (0.02)</td>
<td>3091 (42)</td>
<td>5862 (84)</td>
</tr>
<tr>
<td>Female</td>
<td>2.05 (0.03)</td>
<td>2181 (49)</td>
<td>4477 (114)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age of dentist</th>
<th>³Services per visit</th>
<th>³Patient visits per year</th>
<th>³Annual services per dentist</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29 yrs</td>
<td>1.98 (0.03)</td>
<td>2695 (61)</td>
<td>5209 (134)</td>
</tr>
<tr>
<td>30-39 yrs</td>
<td>2.03 (0.02)</td>
<td>3048 (59)</td>
<td>5982 (118)</td>
</tr>
<tr>
<td>40-49 yrs</td>
<td>2.01 (0.03)</td>
<td>3160 (67)</td>
<td>6105 (142)</td>
</tr>
<tr>
<td>50-59 yrs</td>
<td>1.87 (0.04)</td>
<td>3163 (97)</td>
<td>5794 (188)</td>
</tr>
<tr>
<td>60+ yrs</td>
<td>1.92 (0.08)</td>
<td>2333 (121)</td>
<td>4240 (230)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time of study</th>
<th>³Services per visit</th>
<th>³Patient visits per year</th>
<th>³Annual services per dentist</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983-84</td>
<td>1.78 (0.03)</td>
<td>3405 (82)</td>
<td>5832 (147)</td>
</tr>
<tr>
<td>1988-89</td>
<td>1.84 (0.02)</td>
<td>3097 (65)</td>
<td>5607 (123)</td>
</tr>
<tr>
<td>1993-94</td>
<td>2.10 (0.03)</td>
<td>2816 (61)</td>
<td>5766 (134)</td>
</tr>
<tr>
<td>1998-99</td>
<td>2.14 (0.03)</td>
<td>2589 (58)</td>
<td>5463 (145)</td>
</tr>
</tbody>
</table>

(a): Poisson regression
(b): OLS regression
*(P<0.05), **(P<0.01), NS (Not statistically significant)
in the provision of full lower dentures, but there was a non-significant trend towards lower provision of these services. Partial upper dentures showed a significant decrease between 1983 and 1998, while the provision of partial lower dentures increased in 1998.

Discussion
(a) Aggregate trends
Different patterns over time were observed among the two measures of service provision. Services per visit increased over time, but annual services per dentist were not statistically different over time. The trend towards an increased number of services per visit over time may be related to the observed decrease in the number of patient visits supplied by dentists over this time period. Factors related to the declining supply of visits by dentists per year such as the retention of teeth and a shift towards adults with complex treatment needs as well as the operation of infection control procedures may explain the observed trends in service provision measures.

The stability in annual services per dentist reflects a counterbalancing of increased rates of service per visit by declining numbers of visits being supplied by dentists per annum. While, on average, there appears to have been no change in the aggregate provision of services per year by dentists, this masks the shift in the way there are providing services. The trend is to supply fewer visits but to provide more services at each visit.

(b) Component trends
While endodontic services increased as a component of the annual services provided per dentist, there were no changes over time in annual numbers of either diagnostic or preventive services per dentist. Annual numbers of restorative services per dentist decreased over time. These trends in component services reflect the operation of rates of component services per visit and the annual number of visits supplied by a dentist. When broken down into sub-categories of restorative services it was evident that much of the decline in restorative services reflected lower rates of provision of amalgam restorations while other types of restorations such as composite resins and glass ionomers increased. Denture services decreased over time, lead by the steep fall in full denture work. While upper partial dentures decreased, lower partial dentures increased, despite reports of low ongoing wearing of lower partial dentures.

Rates of service provision have followed the trends which were evident from previous reports as interventions consistent with the maintenance of a functional dentition such as endodontic and crown and bridge services. However, this increase in the annual workload of dentists was balanced by decreases in restorative services, and reductions in services associated with tooth loss and replacement, such as denture and extraction services.

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References

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