

The dental labour force in Australia: the position and policy directions

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Abbreviations

ABS	Australian Bureau of Statistics
ADC	Australian Dental Council
AIHW	Australian Institute of Health and Welfare
ARCPOH	Australian Research Centre for Population Oral Health
DSRU	Dental Statistics and Research Unit

Place abbreviations

ACT	Australian Capital Territory
Aust	Australia
Eire	Ireland
NSW	New South Wales
NT	Northern Territory
NZ	New Zealand
Qld	Queensland
SA	South Australia
Tas	Tasmania
UK	United Kingdom
Vic	Victoria
WA	Western Australia

Symbols

..	not applicable
n.a.	not available
%	percentage
SE	standard error
-	zero or rounded to zero

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Editorial team

Several people have contributed to the editing of this publication. David Brennan and Lorna Lucas of DSRU and proofreader Jo Mason have all worked to improve the consistency, layout and readability of the text.

Summary

A reduction in dental graduate numbers in the early 1980s and an increase in need and demand for dental services are contributing to an emerging shortage in Australia's dental labour force.

The aims of this publication are to:

- inform the dental community about the findings of national data collections maintained by the Australian Institute of Health and Welfare's Dental Statistics and Research Unit at The University of Adelaide;
- inform the dental community about projects that have been conducted by research staff of the Australian Research Centre for Population Oral Health, The University of Adelaide; data collected is used to estimate and project the supply of and demand for dental services in Australia; and
- provide suggestions on policy directions which could be pursued. The intention is to provide a model and alternative policy directions to stimulate thinking and assist in the identification of preferred solutions.

Dental problems remain very common. There has been great improvement in the oral health of children, and both child numbers and their oral health have tended to stabilise. The percentage of adult patients aged 45–64 years and 65 years or more has increased, reflecting demographic trends towards increased population growth among adults and retention of teeth within these cohorts. Trends have shown that, with decreased levels of tooth loss, both the pool of teeth potentially at risk of oral diseases and the subsequent burden of disease have grown.

Low-level interventions such as diagnostic and preventive services have increased, related to the increased pool of teeth at risk of dental problems. High-level interventions such as endodontic and crown and bridge services have also increased, related to retention of more teeth among adult age cohorts. Overall, the service rate per visit has increased, reflecting growth in most service areas among adult patients, and a shift to adults for restorative services. Practice activity of dentists has shown stable hours per year devoted to work, but visits per year supplied by dentists have decreased over time.

The capacity of the Australian dental labour force to supply dental visits depends upon the numbers of practising dentists, therapists, hygienists and prosthetists (dentists make up 78% of practitioners). The number of visits they supply each year is influenced by age and sex distributions and varies for each type of practitioner. The number of dentists practising is expected to increase during 2000–2010 by 13.9% from 8,991 to 10,241. This will only marginally exceed population growth. However, dentists' capacity to supply dental visits is projected to increase by only 3.9% from 24.1 to 25.0 million visits. The number of hygienists is projected to increase, but numbers of therapists and prosthetists are projected to decrease, resulting in a marginal increase of only 1.5% in the capacity of the allied dental labour force to supply visits. In total, the capacity to supply dental visits is projected to be 29.4 million in 2010, an increase of 3.6% over the capacity to supply 28.4 million visits in 2000.

The capacity to supply visits is projected to fall well short of the Australian population's demand for dental visits. Demand reflects population size and distribution by age and oral health status. If trends in demand continue, even at half the pace observed during 1983–1998, Australians' demand for dental visits will increase from 23.8 million visits in 1995 to 33.2 million visits in 2010. The increase in demand is projected to be predominantly among middle-aged and older Australians, and for diagnostic, preventive, endodontic and crown and bridge services.

The aggregate projected shortage in supply in 2010 is about 3.8 million visits, which equates to approximately 1,500 dental providers.

For Australia to develop a sustainable self-sufficiency in its dental labour force, the number of dental graduates of Australian dental schools would need to increase by 120 each year. Given the existing dental graduate numbers of approximately 220 per year, each of the five existing dental schools should increase their numbers by an average of 24 graduates per year. This would be reduced, but not eliminated, by the establishment of new dental schools. One new clinical school of 50 dental graduates per year would reduce the average growth needed in existing schools to 14 graduates each year.

The number of dental therapists, hygienists and prosthetists educated should also increase by approximately 30 each year. The relative proportions of the four occupational groups among graduates can be altered. However, there is not a direct substitution of one for another, so the final numbers required may total more than 150 additional graduates each year.

The policy directions considered most useful include a short-term increase in recruitment from among overseas dental graduates, gradually reducing as the education of dentists, therapists and hygienists in Australian universities is able to satisfy the required growth in capacity of the dental labour force. An increase in dental graduates is required to supply 'the main street' (private general practice) dentistry, as well as 'off the main street' dental practice environments. An increase in dental therapy graduates is required to staff the school dental services. More may be required if there is a loss of dental therapists to the private sector to work under supervision in the provision of dental care to children outside the school dental services. An increase in dental hygienist graduates is already projected, but may need to be expanded further. If hygienists are to play a greater role in dental care, especially in non-traditional settings, higher graduation numbers will be required. Graduation numbers for prosthetists might be held stable while the pattern and appropriateness of full and partial denture work is further considered. Successful efforts to retain more of the dental labour force in the active practise of dentistry could decrease the number of additional recruits in any of these occupational groups each year.

The supply shortage is similar in each Australian State/Territory, but is probably greater in Tasmania and the Northern Territory. In all States and Territories it is more keenly felt in rural/remote areas and the public sector. While there is a strong case for a good proportion of the growth in supply to be for 'the main street', effort is required to recruit and retain dental practitioners in rural and public sector practice. This could involve scholarships, placements and establishing support for establishment of practices in under-served areas.

There is ample published evidence that the supply maldistribution is associated with reduced access to dental care, and with patterns of service provision that are less beneficial to improving oral health or quality of life, in such subgroups of the Australian population.

Both the aggregate shortage and maldistribution of the dental labour force create a substantial impediment to the improvement of oral health and dental care in Australia. The National Advisory Committee on Oral Health should determine its preferred policy directions and move them forward as the core of a national dental labour force plan.

Recommendations

This report recommends that:

1. In order to develop a self-sufficiency in generation of the dentist labour force, the graduation of Australian dentists from Australian universities be increased from its current level of 220 per year to 340 per year.
2. In the short-term (up to 6 years), the recruitment of overseas dental graduates be stimulated by: preferential points scoring; removal for a defined period of the age limit of 45 years for dentists migrating to Australia under an employment nomination; and the granting of limited registrations to overseas dental graduates who pass the English competency and clinical knowledge components of the ADC assessment so that they might practise in defined shortage areas as part of their preparation for the final clinical practice component of the ADC examination (which should be held in more locations and at a greater frequency).
3. Retraining/re-entry programs be established so that dentists currently not practising can be assisted back into practice; and that research be carried out into wastage within the dentist labour force to identify potential points of intervention in order to reduce career breaks and pursuit of alternative careers.
4. Success in attracting dentists back into practice be factored into the estimated number of additional dental graduates required per year.
5. Numbers of dental therapists per 100,000 population be maintained by increasing the number of graduates by approximately 17 per year, to protect the capacity to meet demand in the school dental services. This may need to be adjusted upwards if dental therapists are recruited into private dental practices.
6. Numbers of dental prosthetists completing training each year be maintained until there is firmer evidence of a decrease in demand for both full and partial prostheses.
7. Highly skilled advanced dental laboratory technicians be recognised and parallel training programs established.
8. Education programs for dental hygienists be extended across Australia and opportunities expanded. While the additional number required to match projected supply in proportion to their current activity is low (only an extra 6 per year), their numbers might be increased if it is thought desirable to extend their complementary role in prevention, especially in non-traditional practice settings.
9. In recognition that both the aggregate shortage and maldistribution of the dental labour force create a substantial impediment to the improvement of oral health and dental care in Australia, the National Advisory Committee on Oral Health determine its preferred policy directions and move them forward as the core of a national dental labour force plan.

1 Introduction

1.1 Background

The nature and size of the dental labour force have become increasingly vexed issues for dentistry in Australia. There is considerable opinion expressed about the relative roles of different occupational groups and, more recently, the adequacy of the total aggregate supply of dental professionals.

To many this will be somewhat surprising. Firstly, it was only 20 years ago that there was a perceived excess or over-supply of dentists, leading to cuts in intakes into university dental degrees. Secondly, many would imagine that the two major improvements in oral health over the last two decades, i.e. decreases in dental caries in children and decreases in tooth loss in adults, would have led to a reduction in need and demand for dental services. This has not been the outcome.

“Past improvements in oral health have not translated into reduced need for dental services. Improvements in oral health and ageing of the population both contribute to a greater need for dental services. Lower caries experience among children has been more than matched by increased awareness of the expectations for maintaining improved oral health. A lower rate of tooth loss in middle-aged and older Australians illustrates ‘the paradox of success’ when it leads to an increased burden of disease and need for treatment” (AHMAC 2001, vii–viii).

Collectively these two events, a reduction in dental undergraduate numbers in Australian universities and the paradoxical increase in need and demand for dental services, are shaping the emerging shortage in the dental labour force. Such a shortage appears earliest in those sectors and situations which traditionally have been less attractive locations for dental practice. Hence, shortage emerges initially in rural/remote areas, public dental services and areas of lower socioeconomic status in capital cities. Reports on the dental labour force in Victoria and New South Wales indicate that this has indeed occurred (AIHW DSRU 2002, unpublished). It is therefore timely to consider the dental labour force in Australia.

The aims of this publication are to:

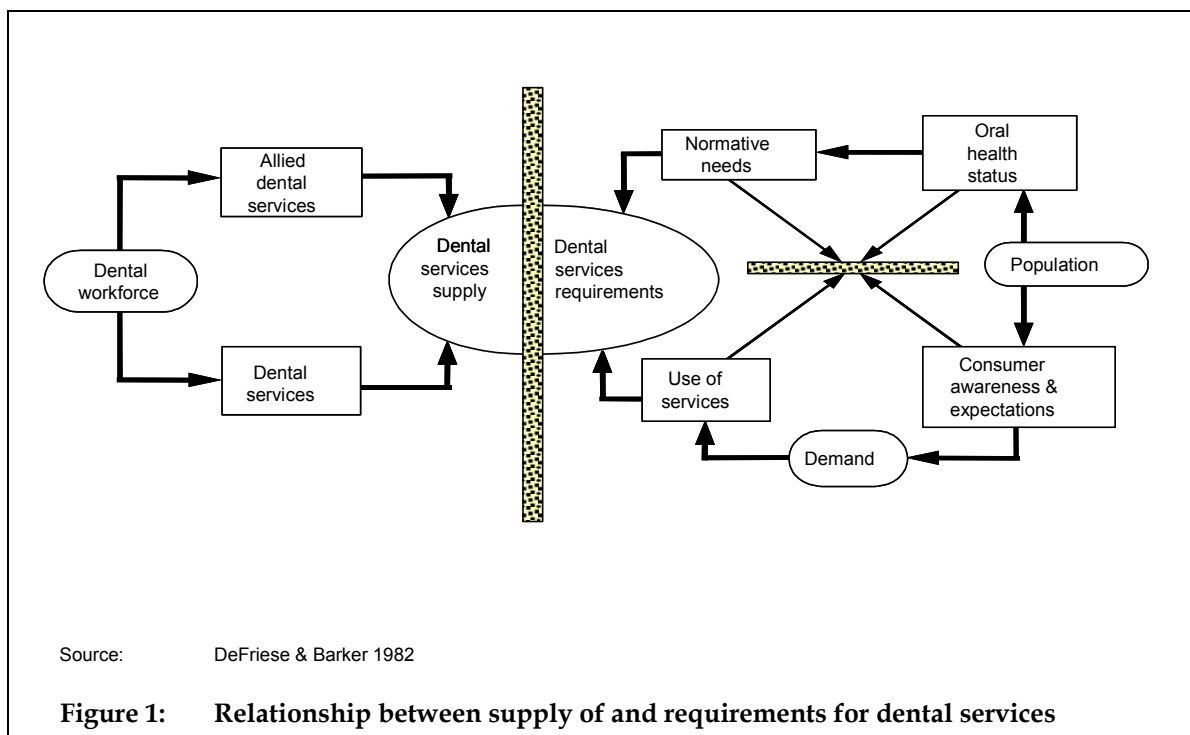
- inform the dental community about the findings of national data collections maintained by the Australian Institute of Health and Welfare’s Dental Statistics and Research Unit (AIHW DSRU) at The University of Adelaide;
- inform the dental community about projects that have been conducted by research staff of the Australian Research Centre for Population Oral Health (ARCPOH), The University of Adelaide. ARCPOH use data to estimate and project the supply of and demand for dental services in Australia;
- encourage discussion on the quality, analytic approaches, assumptions and interpretation of the data; and

- provide suggestions on policy directions which could be pursued. The intention is to provide a model and alternative policy directions to stimulate thinking and assist in the identification of preferred solutions.

1.2 Outline

A useful basic plan to relate supply of and requirements for dental services and, subsequently, the dental labour force is a model adapted from that proposed by DeFriese & Barker (1982). The model, presented in Figure 1, begins at the periphery with head counts of the dental labour force and the population, but endeavours to work toward common units of capacity to supply and requirement for dental services. The model illustrates:

- the complexity on the supply side introduced by multiple levels of qualification among personnel and the consequent matching within individual dental practices of personnel to services supplied;
- the complexity on the requirement side of reconciling the interaction between needs and demand for dental services; and
- the interface between supply and requirement, where decisions on the appropriateness of the balance reflect social, economic and political interests and drive policy directions.



The plan also introduces the organisation of this manuscript, consisting of five sections:

- an introductory description of key changes occurring in dental practice in Australia;

- the estimation and projection of dental labour force numbers and the capacity to supply dental services;
- the estimation and projection of the demand for dental services;
- a reconciliation of supply and demand; and
- a discussion of policy directions.

Only essential information on data sources, estimates and projections are presented. Reference is made to primary sources, where more detailed information is available.

2 Changing dental practice

Dental practice is likely to be influenced by a range of factors such as oral health and population demographics. This section looks at changes in dental practice over recent decades in order to identify trends that are likely to be relevant to the dental labour force, both now and in the future. Information is provided on dental visits and types of dental services that can be directly applied to projections of the supply of dental visits and demand for dental services presented in Sections 3 and 4.

2.1 Background

Dental problems remain very common. For example, dental caries has been reported as the most widespread health condition in the population (AIHW 2000). Use of dental services is increasing among adults. For example, the percentage making a dental visit in the last 12 months for the 65 years or more age group increased from 21% in 1979 (ABS 1979) to 61% in 1999 (AIHW DSRU: Carter et al. 2001). Furthermore, tooth loss has declined. The percentage of edentulism (the loss of all natural teeth) among persons aged 65 years or more has dropped from 66% in 1979 (ABS 1979) to 33% in 1999 (AIHW DSRU: Carter et al. 2001).

While there are relatively stable numbers of children and young adults, population growth is projected as a result of substantially higher numbers of middle-aged and older adults, with consistent increases over time in the age groups 35–44 years to 65 years or more (ABS 1990). In addition to increase in the number of adults in the population, increase in the number of teeth requiring treatment is also expected as tooth loss declines (Spencer & Lewis 1988).

The trends in use of services, oral health and population demographics indicate a shift in emphasis towards adult patients. The oral health trends indicate an increase in the pool of teeth at risk of oral disease. The increased number of adults retaining their teeth is likely to have an impact on dental practice. This leads to the question: 'What do we know about recent changes in dental practice that indicate trends relevant to the dental labour force in the future?' This question will be answered in the following sections, which deal with the age distribution of dental patients; service trends by main areas of service and total numbers of services per visit, and by age of patients; and productivity of dentists in terms of time and visit trends.

2.2 Dental patients: age distribution

Demographic changes were evident from the population data and are a factor that is influencing dental practice. Examination of the proportion of patients treated by age of patient over four time periods spanning the early 1980s to late 1990s (AIHW DSRU: Brennan & Spencer 2002) showed that the highest proportion of patients comprised adults aged 25–44 years. The proportion of patients declined for children aged 5–11 years through to adults aged 25–44 years. However, the proportion of patients aged 45–64 years and 65 years or more increased over time.

2.3 Service trends: main areas of service

If dental problems are changing to reflect changes in oral health and demography, it is likely that service patterns will reflect these changes. Trends over time in the main areas of service at the same four time periods during the early 1980s to late 1990s (AIHW DSRU: Brennan & Spencer 2002) are shown in Table 1.

Table 1: Services per visit: main areas by time of study

	Time of study			
	1983–84	1988–89	1993–94	1998–99
Main area of service	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Restorative*	0.639 (.021)	0.625 (.016)	0.660 (.022)	0.633 (.018)
Diagnostic**	0.499 (.015)	0.495 (.013)	0.610 (.015)	0.638 (.018)
Preventive**	0.282 (.016)	0.310 (.013)	0.351 (.014)	0.372 (.017)
Prosthodontic*	0.109 (.007)	0.092 (.006)	0.109 (.009)	0.109 (.011)
Extraction	0.095 (.009)	0.090 (.006)	0.091 (.006)	0.086 (.008)
Endodontic**	0.059 (.005)	0.069 (.004)	0.118 (.007)	0.148 (.010)
Crown & bridge**	0.038 (.004)	0.073 (.007)	0.077 (.008)	0.081 (.008)
General/misc.*	0.038 (.004)	0.045 (.004)	0.048 (.004)	0.044 (.004)
Periodontic	0.017 (.005)	0.021 (.003)	0.022 (.004)	0.020 (.003)
Orthodontic**	0.009 (.002)	0.020 (.004)	0.013 (.002)	0.012 (.003)

* (P<0.05)

** (P<0.01) Poisson regression

Note: SE denotes standard error.

The highest rates of services were observed in the diagnostic, restorative and preventive areas. Restorative services primarily comprise the provision of various types of fillings such as amalgams, composite resins and glass ionomer cements. Diagnostic services mainly comprise services such as examinations and radiographs. Preventive services mainly comprise prophylaxis services such as removal of calculus and plaque, and topical fluoride treatment involving the application of a fluoride solution or gel to the surfaces of the teeth. Restorative services per visit showed no clear trend over time, while both diagnostic and preventive services increased over the study period.

Endodontic or root canal services are used to treat cases of pulpal infection. Crowns made of materials such as composite resin or porcelain are used to cover and restore crown surfaces of damaged or fractured teeth, while bridges of materials such as metal or porcelain may be fixed between abutment or adjacent teeth to replace missing teeth. Endodontic services increased mainly over the second half of the study, while crown and bridge services increased mainly over the first two time periods. Neither denture nor extraction services showed any clear trends over time. General/miscellaneous, periodontic and orthodontic services comprised a small component of overall services.

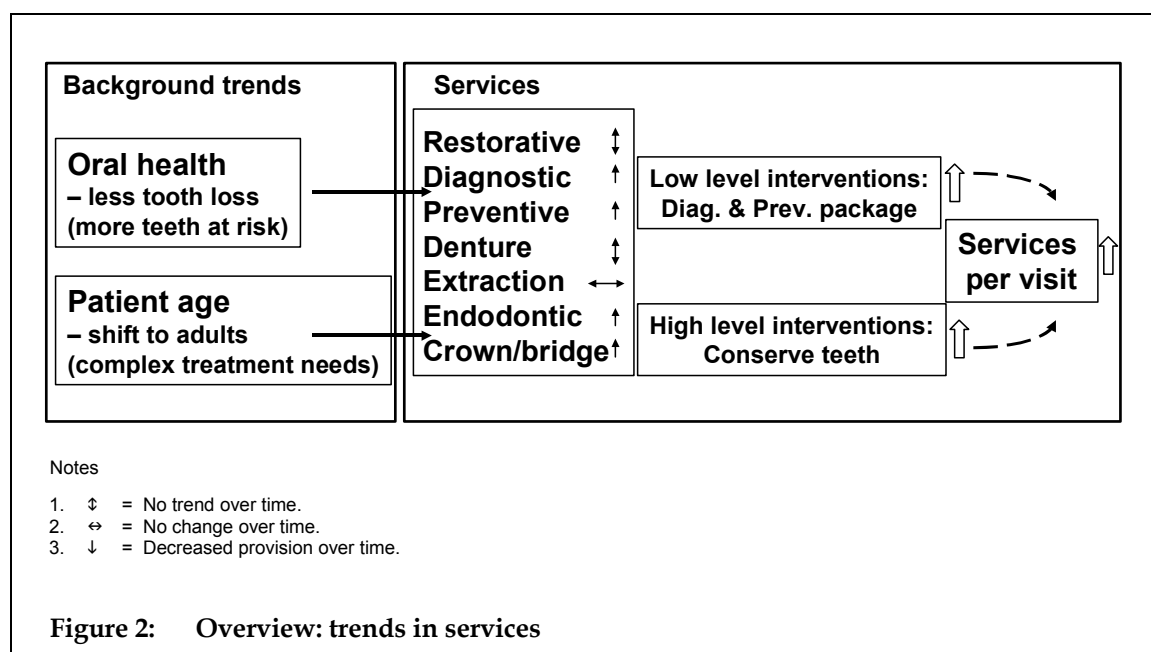
Information on rates of services provided per visit for the 10 main areas of service is applied in Section 4, where future demand for dental services is modelled by multiplying the rates of services per visit by the projected demand for dental visits.

2.4 Service trends: total number of services per visit

The aggregate number of services per visit for the combined main areas of service, by sex and age of dentist, and by time of study, are discussed in AIHW DSRU: Brennan & Spencer (2002). Female dentists provided a higher rate of services per visit than male dentists. The rate of provision of services per visit was relatively stable across the three youngest age groups of dentists (20–29, 30–39 and 40–49 years) before declining in the 50–59 years and 60 years or older age groups. The rate of services per visit increased across the four time periods of the study (1983–84, 1988–89, 1993–94 and 1998–99).

2.5 Overview: service trends

In Figure 2 an overview is provided of both component main areas of service and aggregate measures of total services per visit. Background trends in oral health towards decreased tooth loss may be linked to an increased pool of teeth at risk of oral diseases. Demographic trends towards increased proportions of adults in the population has led to a shift toward more adult patients, possibly with more complex treatment needs as a result of retaining teeth with a previous history of oral disease and dental treatment.

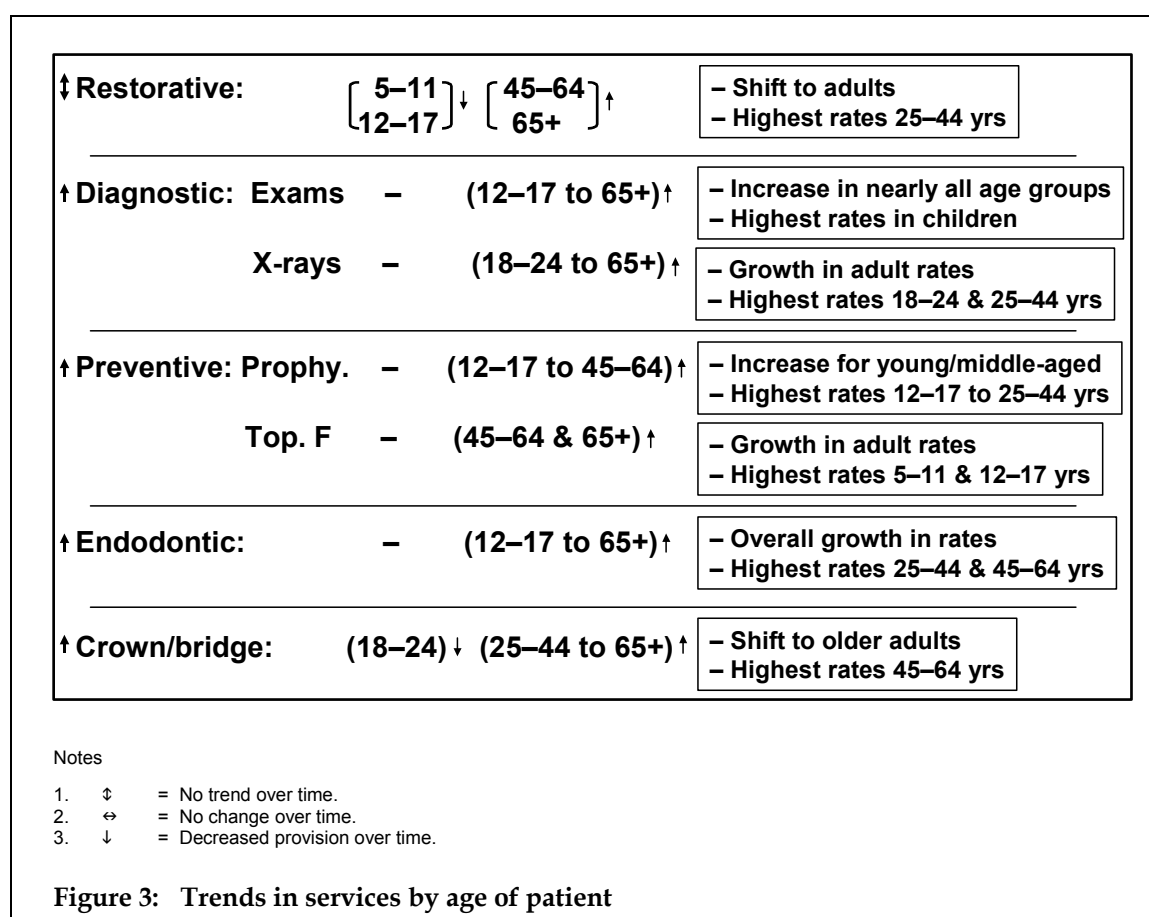


These background trends are linked to service trends such as increased rates of provision of both low-level interventions (e.g. diagnostic and preventive services) and high-level interventions (e.g. endodontic and crown and bridge services). These increases, together with relatively stable rates in other main areas of service, combine to produce an increased rate of total services per visit.

2.6 Service trends: age of patients

Dental problems often vary between different age groups of patients. Hence, to more fully understand trends in services it is useful to examine service provision by age of patients. This is particularly important given the changes in demographics that are occurring in the population.

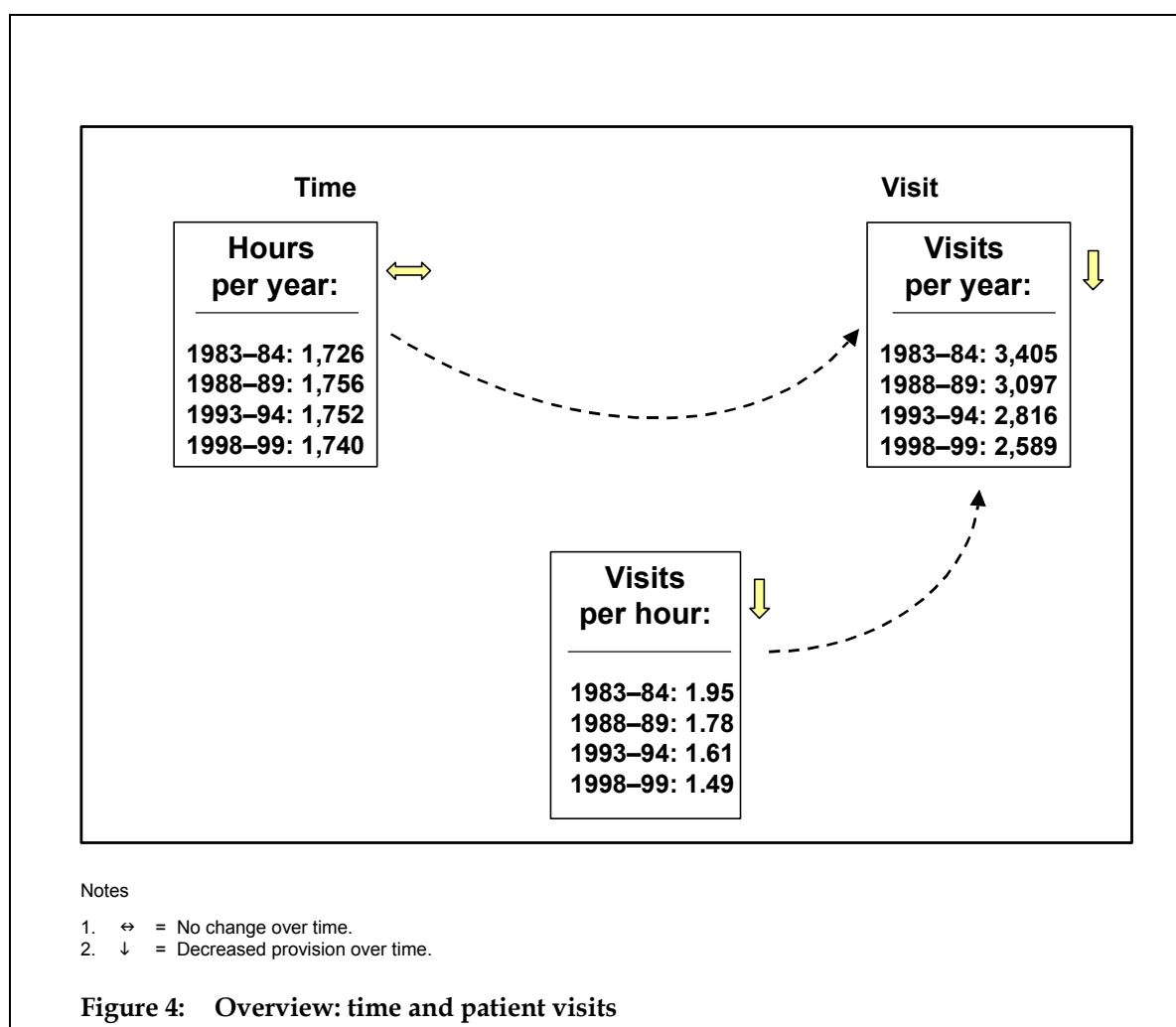
Restorative services, while stable overall, showed a shift to adults, with decreased rates for children and adolescents and increased rates for middle-aged and older adults (Figure 3). Diagnostic rates increased overall, reflecting increased rates of both examinations, in nearly all age groups, and radiographs, in adults. Preventive services also increased overall, as a result of increased rates of prophylaxis services in young to middle-aged patients, and of topical fluoride in middle-aged and older adults. Endodontic service rates increased overall, reflecting increased rates over time primarily among patients aged 25–44 and 45–64 years. Crown and bridge services increased overall, showing a shift towards older adults, with decreased rates among the 18–24 years age group but increased rates among patients aged 25–44 years and older. Age-specific rates of service per visit are used in Section 4 to model future demand for dental services.



2.7 Time and visit trends

Trends in hours worked and patient visits at the four time periods from the early 1980s to late 1990s are also discussed in AIHW DSRU: Brennan & Spencer (2002). The data showed that male dentists worked more hours per year, on average, than female dentists. The number of hours worked per year declined across the two oldest age groups of dentists (50–59 years and 60 years or older). There was no significant difference in hours worked per year across the early 1980s to late 1990s. The average number of visits per hour supplied by dentists was higher for male than for female dentists. Visits per hour peaked in the 50–59 years age group before declining in the 60 years or older age group. The number of visits per hour supplied by dentists declined across the four time periods (1983–84, 1988–89, 1993–94, 1998–99). The average number of visits per year supplied was higher for male dentists than for female dentists. Visits per year were highest in the 30–39 to 50–59 years age groups, and declined in the 60 years or older age group. The number of visits per year supplied by dentists declined across time.

Figure 4 summarises the practice activity trends for the time and patient visit data. Hours per year worked by dentists were stable over the study period. Visits per hour declined over the four time periods, resulting in a decline in the number of visits per year supplied by dentists over the 15-year period of observation.



In Section 3 information on provision of dental visits per year by dentists is applied, in conjunction with projected numbers of dentists, to calculate the capacity to supply dental visits in the period 2000–2010. This information is used later in Section 4 in conjunction with projections of demand in order to reconcile supply and demand of dental visits.

2.8 Summary

Oral health trends have shown that levels of tooth loss have decreased, and as a result the pool of teeth potentially at risk of oral diseases has grown. The percentage of adult patients aged 45–64 years and 65 years or more has increased, reflecting demographic trends towards increased population growth among adults and retention of teeth within these cohorts.

Low-level interventions such as diagnostic and preventive services have increased, related to the increased pool of teeth at risk of dental problems. High-level interventions such as endodontic and crown and bridge services have also increased, related to retention of teeth among adult age cohorts. Overall, the service rate per visit has increased, reflecting growth in most service areas among adult patients, and a shift to adults for restorative services. Age-specific rates of service provision for the 10 main areas of service are applied in Section 4, in conjunction with estimates of demand for dental visits, to model the future demand for dental services.

Practice activity of dentists showed that hours per year devoted to work were stable, but visits per year supplied by dentists have decreased over time. The number of visits per year is used in Section 3, in conjunction with projected numbers of dentists, to calculate the capacity to supply services in the period 2000–2010.

3 Dental labour force and capacity to supply dental visits

3.1 Background

In Australia the dental labour force continues to be dominated by dentists. The allied dental practitioners labour force, which includes dental therapists, dental prosthetists and dental hygienists, comprises only 22% of the total dental labour force. This occupational distribution reflects the longstanding registration and education of dentists in Australia.

Not only are there large differences in the comparative size of these four occupational groups, but there is little uniformity in the projected future growth of the groups. The following examination of supply will present the estimated numbers practising in each of these occupational groups, and projections of the estimated numbers practising to the year 2010. A brief description of the projection model will be followed by discussion of the recruitment and wastage which influences those projections.

The projected capacity to supply dental visits is calculated by multiplying the estimated numbers practising by annual productivity. Annual productivity is the product of total hours worked per year multiplied by the rate of dental visits per hour. Annual productivity measured in number of visits supplied each year is an alternative expression of full-time equivalence, i.e. the amount of work characteristically performed by different age and sex groups.

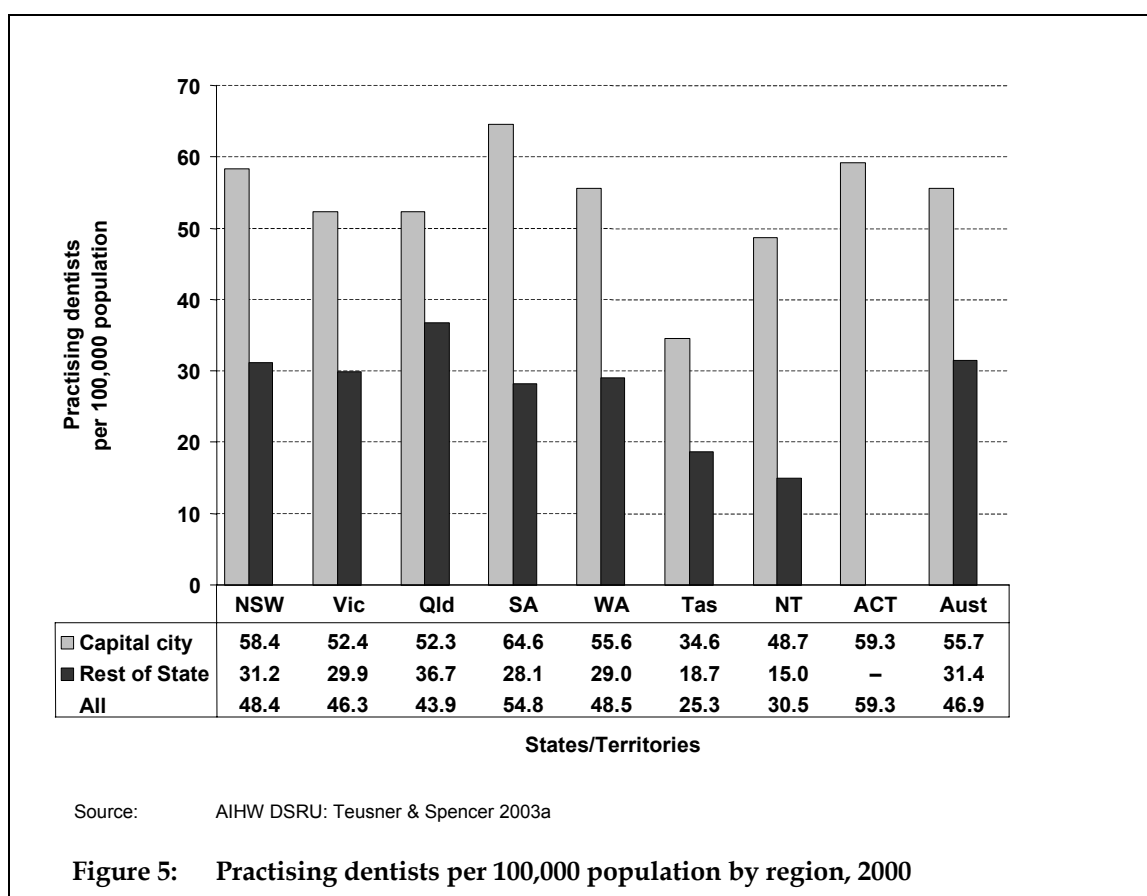
It should be noted that the services provided by the four different occupational groups are largely complementary and only sometimes involve substitution of one occupational provider for another. Interaction between the dental professions is difficult to examine and quantify. It has been speculated that greater provision of services by one practitioner group can create greater demand for the services of another, as opposed to relieving pressure for services. Consequently, when attempting to understand capacity to supply dental visits, it must be emphasised that dental visits are not necessarily equivalent, interchangeable units. Therefore, in an attempt to quantify supply by the total dental labour force, dental visits supplied by different practitioner groups are totalled for the purposes of reconciling supply with demand.

Capacity to supply visits varies substantially by occupational group, sex and age. Consequently, changes in both occupational and demographic distribution can have significant impacts on future capacity to supply. For example, two key demographic changes that effectively limit future growth in capacity to supply dental visits by dentists are the ageing of the dentist labour force and the increasing percentage of female dentists.

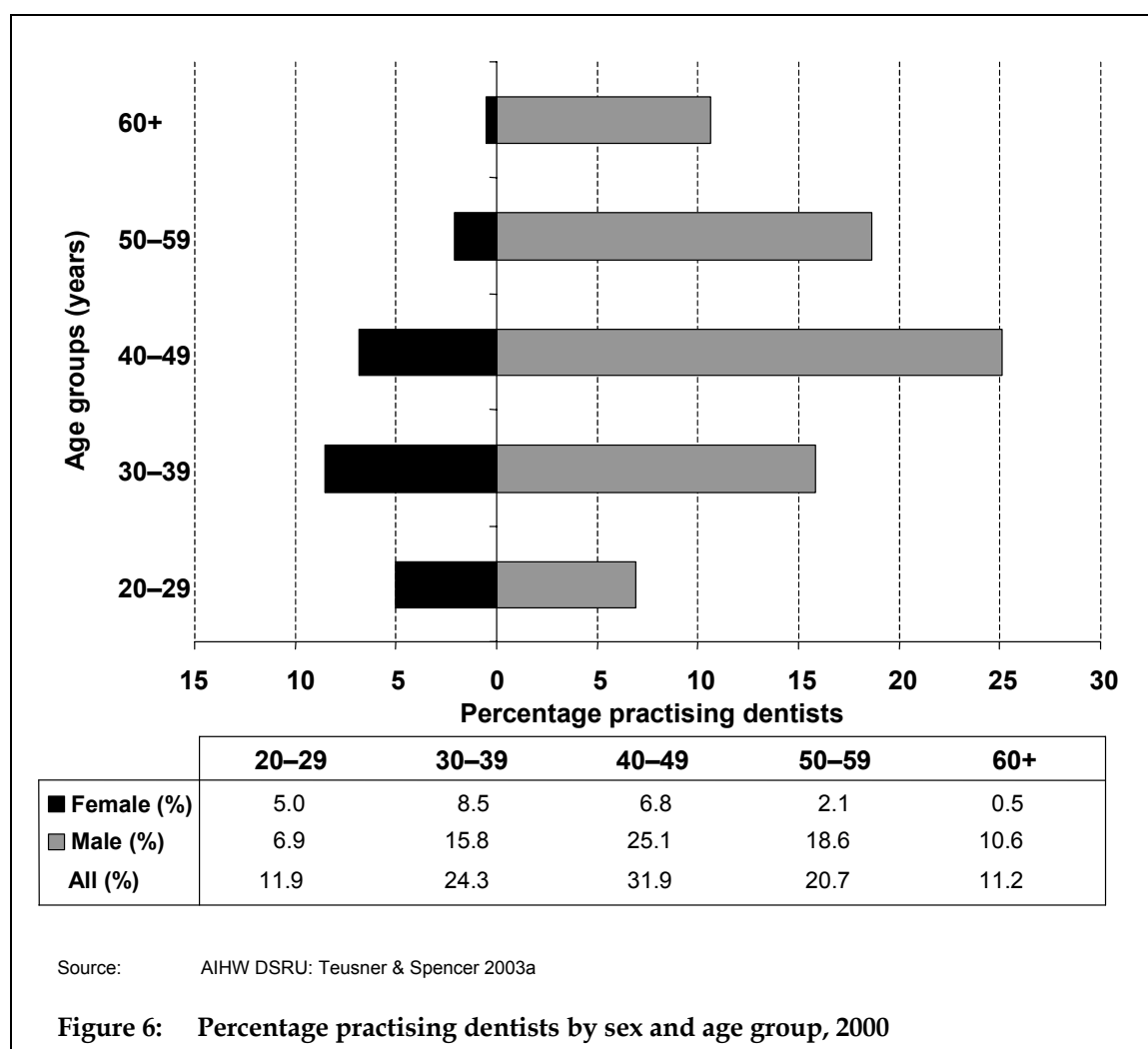
However, despite the effect of demographic and occupation distributional shifts, the primary determinants in future capacity to supply dental visits are the actual numbers practising and their annual productivity.

3.2 Dentist labour force

In 2000 there were an estimated 8,991 dentists practising in Australia; the practising rate per 100,000 population was 46.9 dentists. One of the main features of the dentist labour force was the substantial difference between the States and Territories in the rate of supply of dental practitioners. Practising rates of dentists per 100,000 population ranged from 25.3 in Tasmania, to 59.3 in the Australian Capital Territory (Figure 5). The uneven distribution of dentists between capital cities and other regions in the States/Territories was also a significant feature of the labour force, with practising rates for capital cities averaging 55.7 dentists per 100,000 population compared with 31.4 for other areas within the States/Territories (Figure 5).



Only 22.9% of dental practitioners were female and nearly one-third of all dentists were aged 50 years or older. The age distribution of dentists varied according to sex; 37.8% of male dentists were over 50 years of age, compared with only 11.6% of female dentists (Figure 6).



Most dentists (85.1%) worked in general practice, 11.5% were in specialist practice and the remainder worked in non-clinical roles such as administration and research/education. An estimated 82.6% of dentists worked in private practice, 16.2% in the public sector and the remainder worked in industry or other types of practice. Female practitioners were more highly represented in public sector practice; 35.6% of dentists working in the public sector were female practitioners compared with 20% in the private sector.

There have been marked differences in the practice activity of dentists by sex and age. On average, the usual number of hours worked by female dental practitioners was 33.7 hours per week, which was substantially less than male practitioners at an average of 41.1 hours per week. The most productive age groups, in terms of hours usually worked per week were the 35-44 age group for male dentists (43.8 hours) and the 20-29 age group for female dentists (37.4 hours). Hours worked declined markedly for male and female dentists aged 55 years or older (35.3 hours per week).

3.3 Allied dental practitioner labour force

Table 2 shows some of the main features of the allied dental practitioner labour force. One of the key features of these groups is that they are each predominantly of one sex; hence, marked differences in hours usually worked are a function of both sex and occupational characteristics of the practitioners. Other key differences are the comparative sizes of these occupational groups and the public/private sector representation. While the hygienists and prosthetists are largely employed in the private sector, the therapist labour force is largely employed in the public sector. However, it should be noted that several States are introducing changes in legislation and regulations relevant to dental practice, and it is expected that the public/private distribution of dental therapists will change in the next decade.

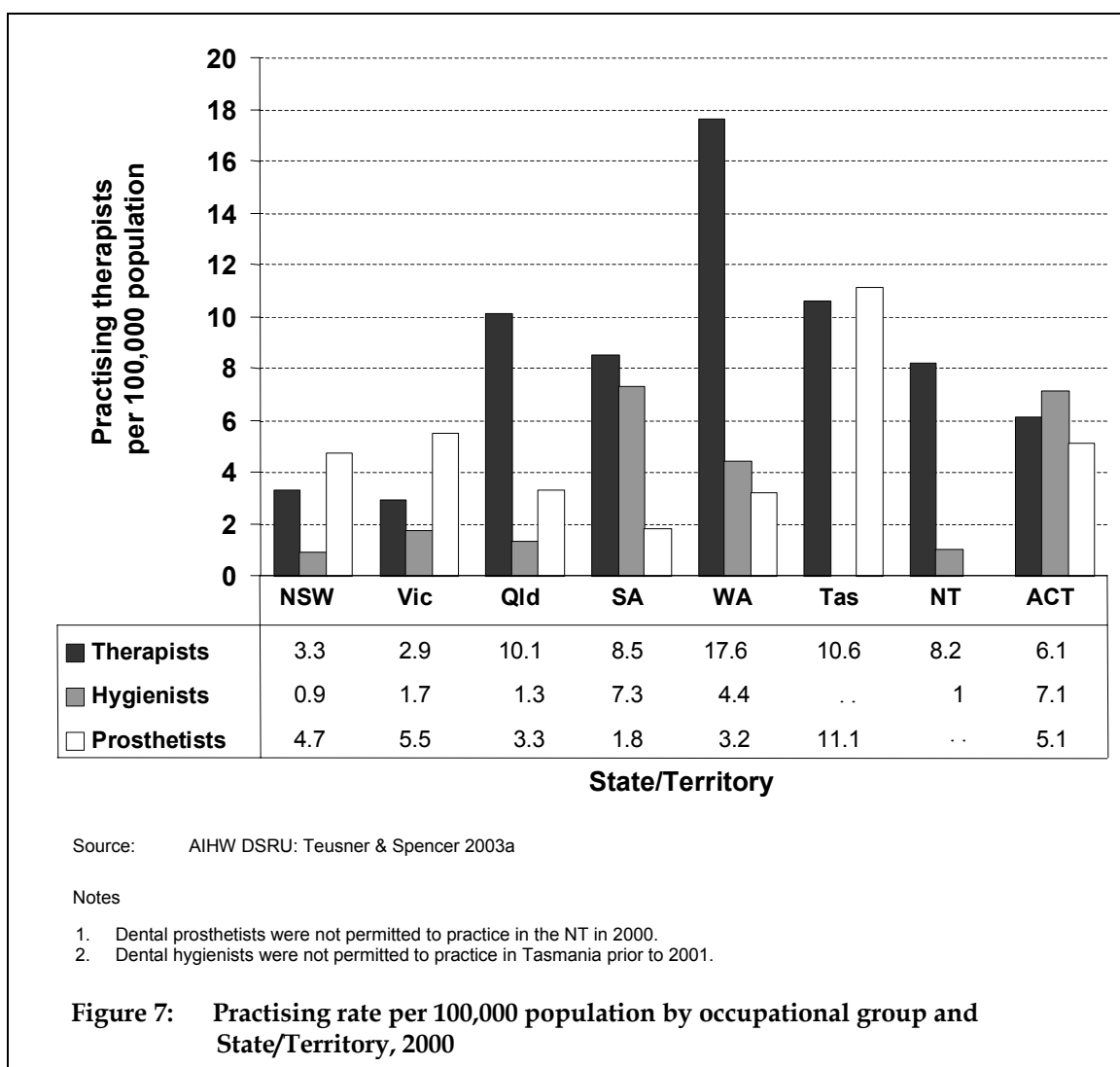
Table 2: Allied dental practitioner labour force, 2000

Occupational group	Therapists	Hygienists ^(a)	Prosthetists
Estimated number practising	1,260	398	836
Practising rate per 100,000 population	6.6	2.1	4.4
Capital cities—practising rate per 100,000 population	7.3	..	4.0
Rest of State—practising rate per 100,000 population	8.5	..	4.2
Percentage female	97.6%	99.0%	8.6%
Mean age (years)	37.9	35.3	47.4
Average hours usually worked per week	28.8	30.0	43.6
Percentage working in public sector practice	86.6%	5.0%	8.9%

(a) There were insufficient data to determine capital city and regional practising rates for dental hygienists. Very few dental hygienists are practising in regional areas.

Source: AIHW DSRU: Teusner & Spencer 2003a

Figure 7 shows the practising rate by State/Territory of each of the allied dental practitioner groups in 2000. There were substantial differences between the State/Territory practising rates per 100,000 population for all three occupational groups. Numerous factors can explain the emergence of such differences, including availability of education and training, structure of State/Territory dental services, legislative boundaries of practice activity and availability of comparative dental services provided by dentists.



3.4 Dentist labour force projections and capacity to supply dental visits

3.4.1 Projection model

Projections for each of the occupational groups were calculated for the period 2000–2010. A thorough explanation of the projection model employed, details of all inputs and outputs are available in the ARCPOH working paper ‘Projections of the Australian dental labour force’ (AIHW DSRU: Teusner and Spencer 2003b).

In summary, in order to calculate the future stock of dental practitioners, estimated inflows and outflows from the stock were entered into a basic Markov chain model.

Movement into the stock of dentists and allied dental practitioners (recruitment) is made up of those who are educated in Australian educational institutions, those who migrate into Australia and those who return to practice after a period of cessation from practice. Movement out of the stock (wastage) is associated with migration out of

Australia, retirement, death, and cessation of practice, either permanently (to pursue another career) or medium term (i.e. prolonged parental leave, study leave).

3.4.2 Recruitment and wastage of dentists

For the dentist projections, the total recruitment and wastage for each year altered as the age/sex distribution of practitioners changed over the period of the projection.

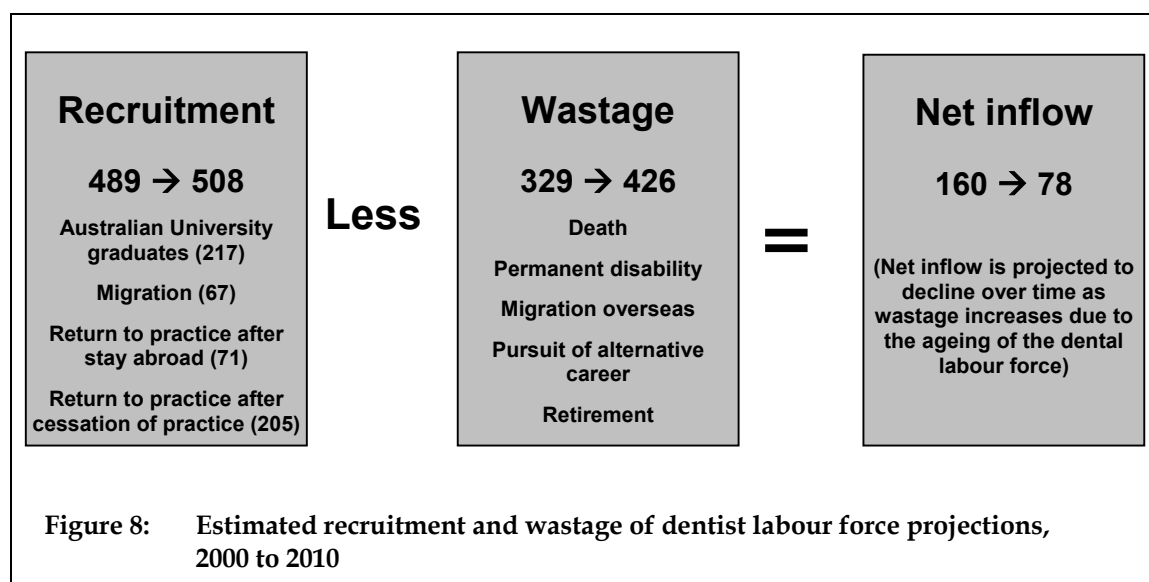


Figure 8 shows that the estimated recruitment in the first year of the projection totalled 489 dentists. The two largest components were Australian university graduates and practitioners who return to practice after temporary cessation of practice. Recruitment was expected to increase only marginally over the course of the projection, with an expected total recruitment of 508 dentists in the year 2010.

Age/sex specific wastage rates were determined by examining dental labour force collection data for changes in practice status. The overall average wastage rate for female dentists was higher than for male dentists, 4.7% and 3.5% respectively. For the first year of the projection there was an estimated outflow of 329 dentists, increasing to a total expected wastage of 426 dentists in the year 2010. This substantial increase in wastage is primarily due to the ageing of the labour force; attrition increases as the number of dentists shift into older age groups with higher rates of wastage.

The difference between recruitment and wastage is the net inflow. In the 2000 to 2001 period the net inflow was 160 dentists. However, the net inflow diminishes to 78 dentists by the end of the projection period.

It has been speculated that the wastage rates of older practitioners may decrease in the future. Improving health and increased longevity coupled with economic conditions may increase the participation of older dentists in the labour force. However, based on the projected age distribution, it is unlikely that decreased wastage rates will have a substantial impact on supply until after 2010, and hence they were not included in the current model.

3.4.3 Dentist projections

In order to test the sensitivity of the model to variation in recruitment and wastage rates, a series of projections were calculated. These projections are available in the ARCPOH working paper 'Projections of the Australian Dental Labour Force' (AIHW DSRU: Teusner & Spencer 2003b). Summarised in Table 3 is the projection based on the medium rate of wastage. It is projected that by 2010 there will be a 13.9% increase in the number of practising dentists. It is calculated that this increase will only slightly out pace population growth, as the practising rate per 100,000 population is expected to increase by only 3.4%.

Table 3: Projections of the dentist labour force, 2000 to 2010

	Male	Female	Total
Baseline—estimated number practising, 2000	6,932	2,059	8,991
Projected—estimated number practising, 2010	7,404	2,837	10,241
Per cent change	6.8%	37.8%	13.9%
Baseline—practising rate per 100,000 population			46.8
Projected—practising rate per 100,000 population			48.5
Per cent change			3.4%

Source: Estimated resident population projections Series 'Q', Australian Bureau of Statistics, Population projections, Australia 1999–2001. ABS Catalogue No. 3222.0.

Capacity to supply dental visits was calculated by multiplying projected numbers of dentists by age/sex specific rates of annual productivity. Initially the projected supply was calculated using a static matrix of age/sex rates. However, it is argued that this represents a 'best case scenario'. As discussed in the previous section, there has been substantial change observed over time in the average number of dental visits supplied per year for all dentists, declining from 3,405 visits in 1983–84 to 2,589 in 1998–99 (AIHW DSRU: Brennan & Spencer 2002).

Taking into account this significant trend, it is unlikely that annual productivity, in terms of the number of visits provided, is going to stabilise and remain static across the projection period. Hence, it is argued that future projections of supply need to take account of the outcomes of any continued historical trends in annual productivity.

Based on this premise, a range of supply projections were calculated:

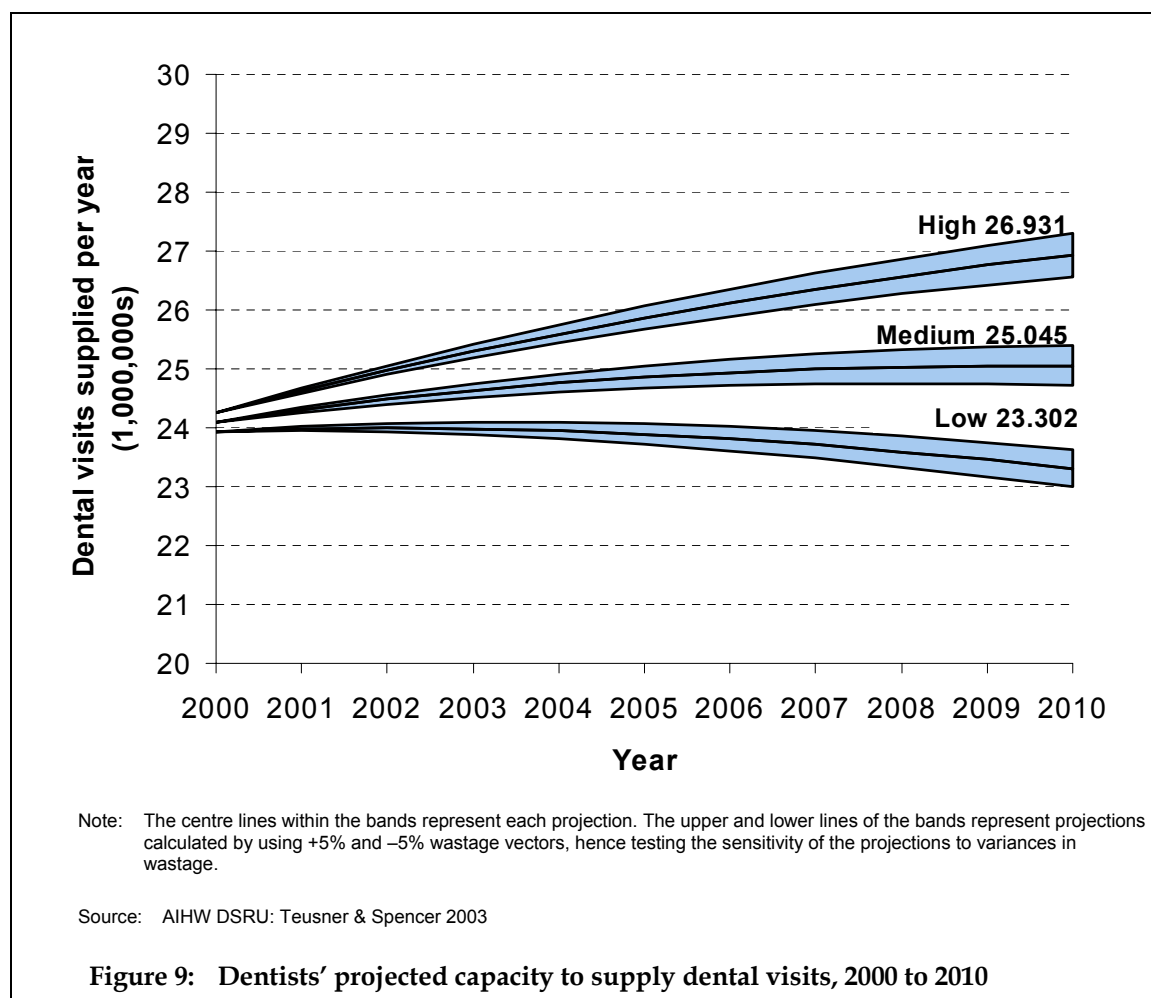
- The high projection calculates the future capacity of the dentist labour force by multiplying projected numbers of practising dentists by the average number of visits supplied in 1998–99, thereby assuming that the number of dental visits supplied per annum will remain static and ignoring historic decline.
- The medium projection assumes that annual productivity will continue to decline at half the rate of decline observed between 1983 and 1998.
- The low projection assumes that annual productivity will continue to decline at the same rate observed between 1983 and 1998.

It is suspected that both the high and low scenarios are unlikely to occur; however, they serve to illustrate the breadth of potential outcomes.

The three supply projections are represented in Figure 9. Under the high scenario there is a projected 11% increase in visits supplied. The growth in actual visits supplied does not parallel the projected growth in numbers of practising dentists (13.9%, Table 3), due to the effects of demographic changes within the dentist labour force. It is projected that the percentage of female dentists will increase by nearly 5% to 27.7%, and that the percentage of male dentists over 60 years of age will increase from 13.8% to 18.3%. As these subgroups provide, on average, substantially fewer dental visits per year, these changes have a combined effect of limiting the growth in visits supplied.

Under the medium scenario there is a projected 3.9% increase, and under the low scenario a projected 2.7% decrease, in total dental visits supplied per year.

Under the high supply projection, the rate of dental visits per capita supplied by dentists is projected to marginally increase from 1.26 to 1.28. In comparison, the medium and low supply projections both result in a decline in the number of visits per capita, to 1.20 and 1.10 respectively. Consequently, any future decline in dentists' annual productivity will mean that the capacity to supply visits by dentists is unlikely to keep pace with projected growth in the population alone.



3.5 Allied dental practitioner labour force projections and capacity to supply dental visits

3.5.1 Recruitment and wastage of allied dental practitioners

For the allied dental practitioner projections, developing recruitment vectors was a more uncertain process than for dentists. Education and registration of allied dental practitioners is currently undergoing a period of change. Some of the changes in recent years include moratoriums on courses, significant changes to State Dental Acts regarding practice activity and, for therapists and hygienists, the development of new hybrid university based courses. Also contributing to a lack of understanding of recruitment and wastage are the existing inconsistencies between the State/Territory registration boards with regard to formal registration of allied dental practitioners. Consequently, for the purposes of calculating projections, constant recruitment vectors were applied. For dental therapists the recruitment vector totalled 75 per year, for dental hygienists 45 per year and for prosthetists 20 per year.

Due to limited availability of data, occupation specific wastage rates for the allied dental practitioners could not be calculated, so proxy wastage rates were applied. For dental prosthetists, male dentist wastage rates were applied; for dental hygienists and dental therapists, female dentist wastage rates weighted up by 50% were applied.

3.5.2 Allied dental practitioner projections

A series of projections similar to those for dentists were calculated for allied dental practitioners in order to test the sensitivity of the model to varying recruitment levels and wastage rates. Table 4 summarises the results of what was conceived to be the probable outcomes based on the recruitment levels cited in the previous section. Only dental hygienists are expected to experience future labour force growth; both the therapist and prosthetist labour forces are projected to experience a decline in the numbers practising. The projected number of dental visits supplied was calculated by multiplying the projected number of practitioners by occupation specific annual productivity estimates. As there were no age/sex specific estimates in productivity for the allied practitioners, the impact on supply of projected demographic shifts within the allied dental labour force could not be assessed.

Table 4: Projections of the allied dental practitioner labour force and capacity to supply dental visits, 2000 and 2010

Occupational group	Therapists	Hygienists	Prosthetists
Baseline—estimated number practising, 2000	1,260	398	836
Projected—estimated number practising, 2010	1,196 ^(a)	522 ^(b)	790 ^(c)
Per cent change	-5.1%	28.9%	-5.5%
Baseline—practising rate per 100,000 population	6.6	2.1	4.4
Projected—practising rate per 100,000 population	5.7	2.5	3.8
Per cent change	-13.9%	16.9%	-14.0%
Baseline supply of dental visits (1,000,000s)^(d)	2.360	0.852	1.108
Projected supply of dental visits (1,000,000s)^(d)	2.240	1.098	1.046
Per cent change	-5.1%	28.9%	-5.5%

- (a) Projection based on constant recruitment vector totalling 75 and female dentist medium wastage vector (weighted up by 50%).
 (b) Projection based on constant recruitment vector totalling 45 and female dentist medium wastage vector (weighted up by 50%).
 (c) Projection based on constant recruitment vector totalling 20 and male dentist medium wastage vector.
 (d) For occupation specific supply rates used in the calculation of dental visits supplied, see Teusner & Spencer 2003.

3.6 Summary

Future growth in numbers of practising dentists will keep pace with growth in the population; however, due to changes in the demographic distribution of the labour force, the growth in capacity to supply will not match growth in the numbers practising.

In addition to demographic changes limiting growth of supply, any continuation of the previously observed trend in declining annual productivity will mean that any growth in supply capacity, at best, is likely to be marginal. Hence, while practising numbers may keep pace with population increases, it is unlikely that the capacity to supply dental visits will also keep pace.

While future trends in dentists' annual productivity are unknown, it is suspected that the high and low dentist supply projections are unlikely outcomes. A more probable outcome is that the number of visits supplied by dentists will fall somewhere near the medium projection.

It can be seen that the overall projected increase in number of visits supplied by the combined allied dental practitioner labour force will be negligible. Furthermore, due to the relative size of this labour force, it is evident that even large increases in supply would have minimal impact on overall supply of dental visits.

In summary, Table 5 shows the total capacity of the dental labour force to supply dental visits in 2010, under the medium dentist supply projection, to be 29.43 million visits. This represents an increase of 3.6% in the capacity of the dental labour force to supply visits.

Table 5: Projections of the dental labour force's capacity to supply dental visits (1,000,000s), 2000 and 2010

	Visits supplied		
	Dentists (medium supply projection)	Allied dental practitioners	Total dental labour force
2000—baseline	24.100	4319.15	28.419
2010—projected	25.045	4384.72	29.430
Per cent change	3.9%	1.5%	3.6%

Source: Teusner & Spencer 2003

4 Demand for dental care

4.1 Background

There are numerous ways in which the concept of demand is referred to and defined. For the purposes of this working paper, the word 'demand' will be used synonymously with reported usage. That is, historical dental care usage will be used to determine past demand in the population, which will then be projected to provide estimates of future demand for dental care. Future demand is meant to provide an estimate of the quantity of dental care that people are likely to be able to consume. This definition of demand probably leads to an underestimate of actual demand since it does not include any occasions on which people may have sought dental care but were unable to access it. Further details on demand for dental care are available from the AIHW publication 'Demand for dental care' (AIHW DSRU 2003).

In dentistry the first point of demand is for a dental visit. A person may have a problem they are aware of and seek to make an appointment, or they may just decide that now is the time to have a dental check-up. In this working paper the majority of the results are directed towards the demand for dental visits. Obviously, within each dental visit, services are then supplied; therefore, the future demand for dental services has also been modelled and analysed across the main service areas.

There are at least four main reasons that would lead to an increase in total demand for dental care.

1. Increasing population

As the total number of people in Australia increases, it follows – all other things being equal – that the total number of people demanding dental care will also increase. Essentially, if there were twice as many people, you would expect total demand to double.

2. Decreasing edentulism rates

Edentulous persons (those with no natural teeth remaining) demand dental care at a far lower rate than dentate persons (those who still have some teeth remaining). Historically, the percentage of the population that is edentulous has been declining, resulting in a greater percentage who are dentate. Thus, for a population of fixed number, a decline in edentulism equates to an increase in the dentate population and therefore results in an increase in total demand.

3. Demographic changes in the population that may lead to increased total demand

Not all age groups demand the same amount of dental care. If the population age distribution shifts in such a way that a greater proportion of people are in age groups that demand greater dental care, total demand will increase.

4. Increasing per capita demand

If per capita demand (the average number of dental visits per person) increases then total demand for visits must also increase. Historically, there is evidence that per capita demand for dental visits in Australia has been increasing over time.

4.2 Population change

The total population of Australia is increasing; Table 6 summarises its changes from 1980 to 2020. However, while the total population continues to grow, the rate of that growth is declining both in terms of net population increase and also in terms of relative percentage increase. The projected increase of 1.6 million people from 2010 to 2020 is two-thirds of the increase (2.4 million people) observed from 1980 to 1990. The projected percentage increase for 2010 to 2020 is less than half the percentage increase from 1980 to 1990.

Table 6: Australian population, 1980 to 2020

Year	Millions	Net increase (millions)	Per cent increase
1980	14.7		
1990	17.1	2.4	16.2%
2000	19.1	2.0	12.1%
2010	20.9	1.8	9.4%
2020	22.5	1.6	7.4%

Source: ABS Australian demographic statistics. ABS Catalogue No. 3101.0, ABS n.d.

4.3 Demographic change

From 2000 to 2020 there is a projected marginal decline in the total number of persons aged 17 years or less, and a marginal increase in the total number of persons aged 18–44 years. The total number of persons aged 45–64 years is projected to increase from 4.3 million in 2000 to 5.5 million by 2010 (a 28% increase) and then to 6.1 million by 2020. The total number of persons aged 65 years or more is projected to increase from 2.4 million in 2000 to 3.0 million by 2010 (a 25% increase) and then to 4.1 million by 2020, a further increase of 37%. By 2014 it is projected that there will be, for the first time in Australia, a greater number of people aged 65 years or more than people aged 5–17 years; notionally, more people of retirement age than of school age (ABS n.d.).

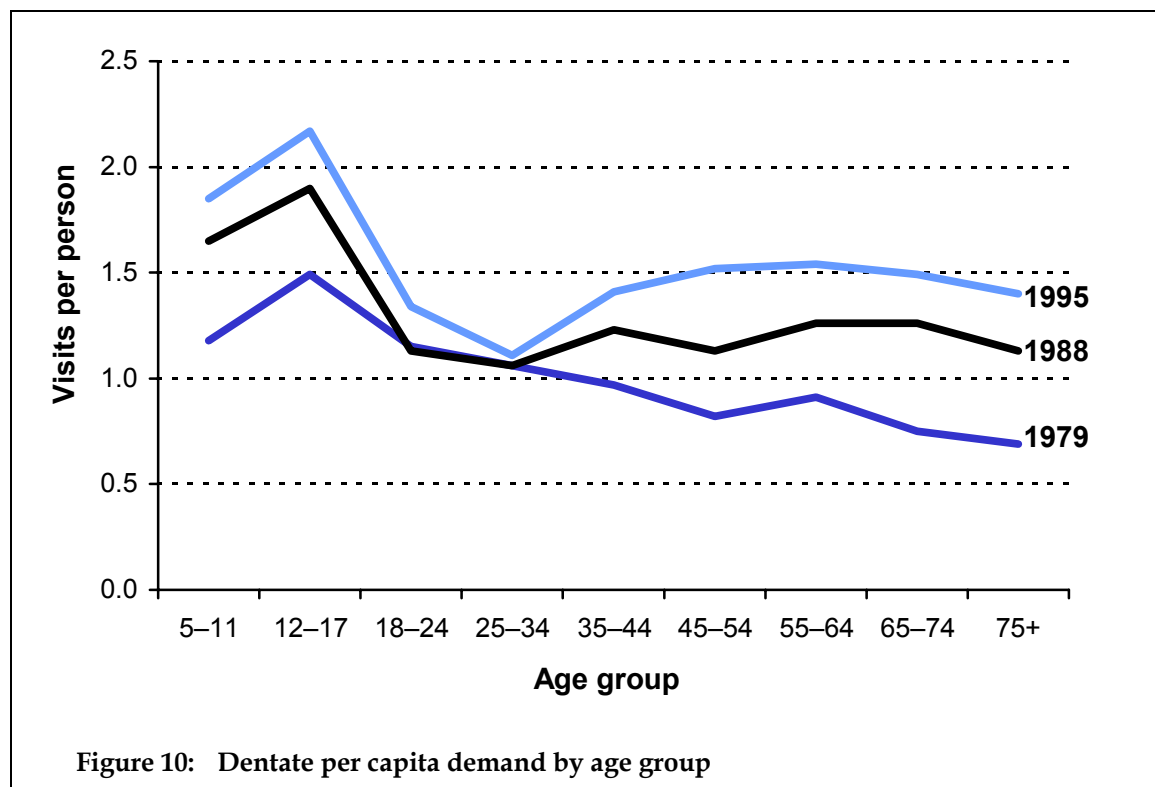
4.4 Edentulism change

Over the past 20 years there have been dramatic changes documented in the occurrence of edentulism in Australia; the percentage of persons who are edentulous has been declining at a rapid rate. Among those aged 75 years or more, 79% were edentulous in 1979; this figure is projected to plummet to 23% by 2019. Over the same time period, edentulism among those aged 65–74 years is projected to decline from 60% to 12%. The rate will drop from 40% to 5% among people aged 55–64 years and from 27% to 2% among those aged 45–54 years.

In 1979 there was an estimated 2.2 million edentulous persons in Australia. This had dropped to 1.3 million people by 2002, and is projected to decline to 0.8 million people by 2019. As reported above, from 2000 to 2010 the population of Australia is projected to increase by 1.8 million people (9.4%) from 19.1 to 20.9 million people. Over this same time period the dentate population will increase by 2.2 million people (11.9%) from 17.7 to 19.9 million people. Therefore, the dentate population (those who are most likely to use dental services) will be increasing at a rate greater than the population as a whole.

4.5 Per capita demand change

Figure 10 presents per capita demand as measured by the average number of dental visits per dentate person per year at specific times, 1979, 1988 and 1995. This figure has been restricted to dentate persons only since per capita demand among edentulous persons is much lower than that for dentate persons. If per capita demand were shown for all persons, any changes observed would be confounded with changes in edentulism, making it difficult to determine if the change was real or just an artefact of changing edentulism rates. Total per capita demand for the dentate population was 1.00 visits per person in 1979, increasing to 1.32 visits in 1988 and reaching 1.50 visits by 1995. With the exception of the 18–24 and 25–34 years age groups, all other age groups have experienced substantial increases over time in dentate per capita demand. It has doubled from 1979 to 1995 among the 65–74 years and the 75 years or more age groups.



Given the historic increases that have been observed in dentate per capita demand, in order to produce projections of future total demand, three different models were examined.

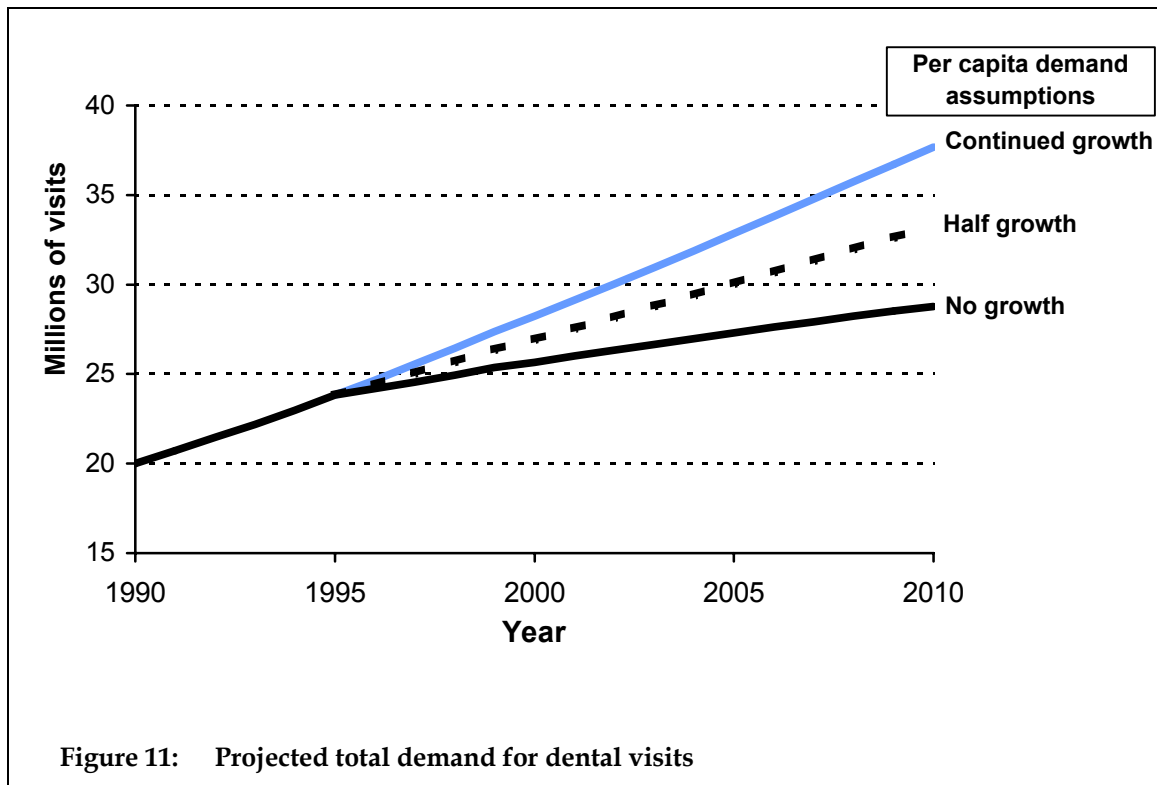
Under the first model, referred to as 'continued growth', future per capita demand was projected on the basis of linear extrapolation of past trends for each age group. For example, among the 34–44 years age group, dentate per capita demand was 0.97 visits per person in 1979, increasing to 1.23 visits by 1988 and to 1.41 visits by 1995. The linear extrapolation of this trend to 2010 results in a projected dentate per capita demand of 1.83 visits per person among this age group.

For the second model, referred to as 'no growth', dentate per capita demand was assumed to remain at the rate observed in 1995. Under this model the projection of dentate per capita demand in 2010 would be 1.41 visits per person for the example outlined above.

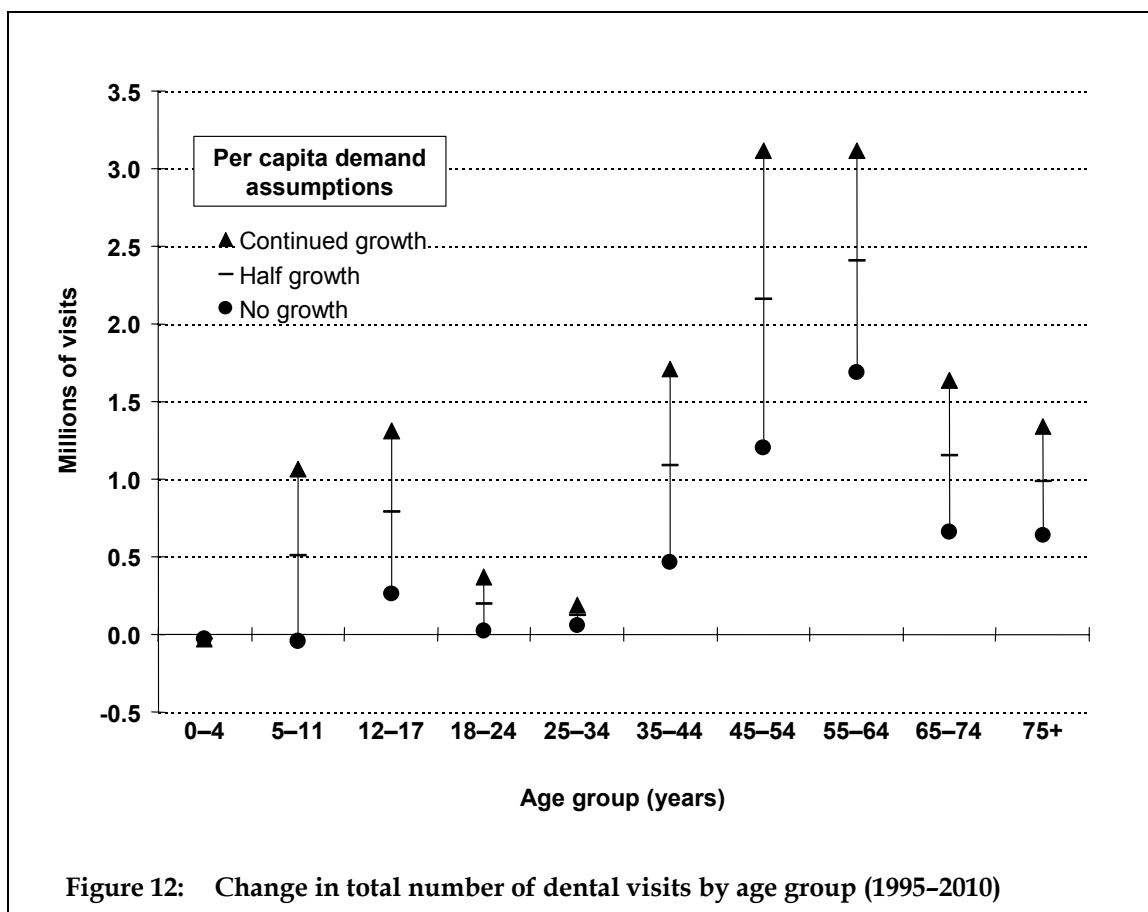
The third model, referred to as 'half growth', assumes that the trend in per capita demand will not continue at the rate observed historically, but at half that rate. This results in a projection midway between the no growth and continued growth model.

4.6 Projected total demand for dental visits

Figure 11 shows the projected total demand for dental visits in Australia under the three different per capita demand projection models. In 1995 an estimated 23.8 million dental visits were made in Australia to dental professionals. Under the no growth model, this is projected to increase to a total of 28.8 million dental visits by 2010. The no growth model keeps age-specific per capita demand constant, and therefore represents a natural increase due solely to population increase, and changes in edentulism rates and demographic distribution. If the historic increases in per capita demand persist at the same rate into the future (i.e. the continued growth model), the projected total demand is estimated to be 37.7 million dental visits, an increase of 32.7%. The half growth model projects 33.2 million dental visits by 2010, a 16.9% increase.

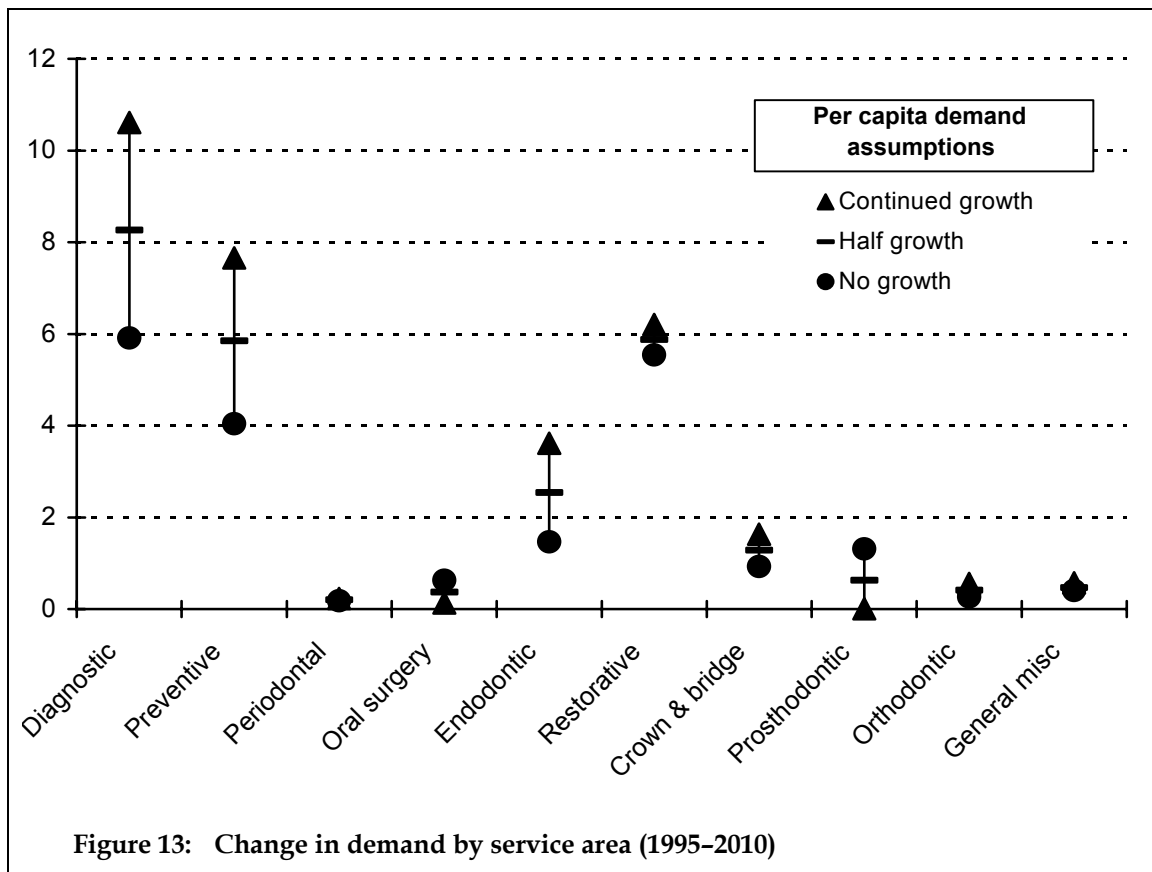


The projected increases in total demand for dental visits are not distributed equally across age groups. The impact of each of the driving factors for total demand is different for each age group. Figure 12 illustrates the age distribution of the increase in total demand from 1995 to 2010 by age group for the three per capita demand models. The age groups projected to experience the greatest growth (in terms of total additional dental visits) are the 45–54 years and 55–64 years age groups. Under the half growth model it is estimated that these two age groups will experience an increase of 2.2 and 2.4 million visits respectively. The half growth model projects increases of around 1 million visits for each of the 35–44 years, 65–74 years and 75 years or more age groups. Increases for children were more moderate: 0.5 million extra visits for the 5–11 years age group, and 0.8 million extra visits among those aged 12–17 years. Very little change was projected for age groups between 18 and 34 years. The majority of future increases in demand are projected to be among the older working age and pre-retirement population and those of retirement age (AIHW DSRU 2003).



4.7 Projected total demand for dental services

Modelling was also undertaken of future demand for dental services, using the half growth model to provide underlying projections. For each of the 10 service areas the average number of dental services by age group was projected using data from the *Longitudinal Study of Dentist Practice Activity* (AIHW DSRU: Brennan & Spencer 2002). The total number of services estimated to have been provided in 2000 was 56 million. Under the no growth model (holding service rates constant) the future increase in services from 2000 to 2010 is estimated to be 22.6%. Under the continued growth model the increase is estimated to be 41.4%, while the half growth model produces an increase of 32.0%. Future increase in services is not equal across service areas; Figure 13 illustrates the service areas projected to experience the greatest increase (in terms of total additional services). The majority of the increase is projected to be in diagnostic services, followed by preventive and restorative services. Endodontic services are projected to also experience some increase, as are crown and bridge services and possibly prosthodontic services (AIHW DSRU 2003).



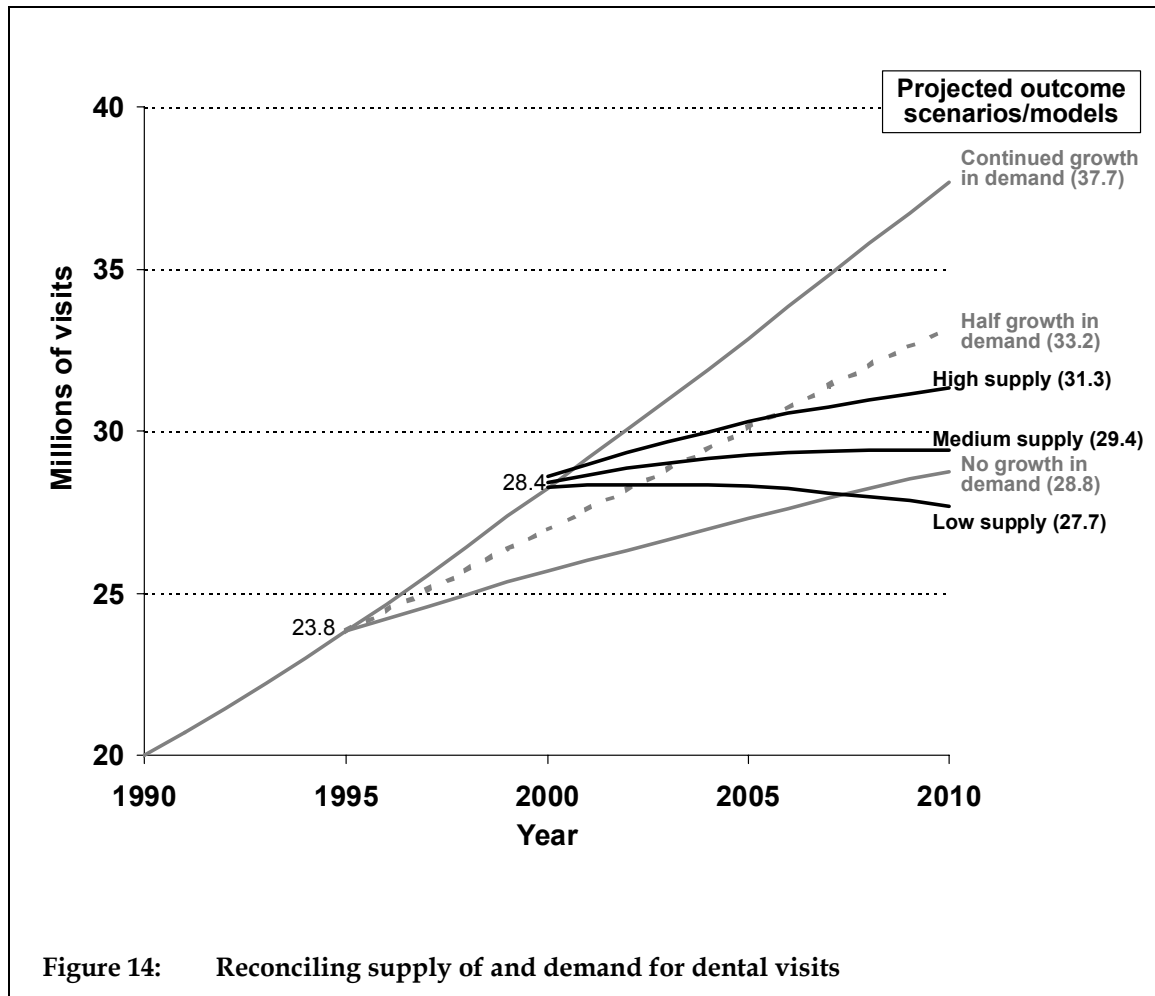
4.8 Reconciling supply of and demand for dental visits

One interpretation of the demand and supply estimates and projections presented is that, despite their different origins, these projections are in reasonable agreement. In 2000 the supply side estimate of the total number of dental visits was approximately 28.4 million. This sits very comfortably with the range of demand projections, which are similar to the year 2000 projections under the assumption of continued full growth. However, there are a number of issues that indicate a need for caution in that interpretation.

Firstly, more recent data on demand from the same time series from which the projections were made are not available. Such data will be available from the 2002 National Dental Telephone Interview Survey. Secondly, variation exists in demand estimates derived from different sources and with different reference periods for reported use of dental services. This variation needs further investigation. Thirdly, as for the demand projections, there are no recent labour force data available against which to assess the baseline estimate and assumptions used in the supply projections.

While limitations in the data available urge caution in a literal interpretation, there are also other reasons to expect agreement between the supply and demand estimates and projections than the findings implied. For example, historically, demand estimates tend to be less than supply estimates. This may be due to double counting of the supply of visits from teams of dentist and hygienist, or dentist and therapist, but the reporting of

only a single dental visit by users of those dental services. For these reasons a good deal of emphasis is more appropriately placed on trends.



It is clear from Figure 14 (and data already presented) that the demand for dental visits is expected to increase under all three projections, based on past trends in per capita demand. In contrast, the supply of dental visits is projected to be reasonably constant, or even decrease toward the end of the decade.

In order to give an indication of the gap that could exist between demand and supply, the half growth model in per capita demand and the medium scenario in supply are compared. This reconciliation is put forward as a cautious, maybe conservative, interpretation.

The gap between the half growth demand estimate of 33.2 million visits and the medium supply estimate of 29.4 million visits is 3.8 million visits. Under the current distribution of the dental labour force and their respective productivity rates, approximately 1,500 additional dental providers could supply a shortfall of 3.8 million dental visits.

Another concern that emerges surrounding reconciliation between demand and supply is the potential for program activity that directly stimulates demand among one or more disadvantaged groups of adults eligible to use public dental services. A new program with funding of \$200 million a year to target disadvantaged Australians and bring them

into contact with either public dental services or private dentists for general dental care would provide a maximum of 533,000 courses of care at \$375.00 per course (Spencer 2001). However, that would probably be reduced to less than 50% of those courses of care because not all unmet need would be converted to new demand. This would result from eligible adults who are existing demanders of privately provided dental care exercising the option of seeking publicly subsidised care, and from some of the funds being used to convert past emergency care demanders to general care demanders. This is not a one-for-one conversion because the average course of general dental care requires 2.1 dental visits compared with 1 dental visit for an emergency course of dental care. While the transfer to public subsidy and conversion of type of care are tangible improvements in fair access to more comprehensive care, they are not associated with additional new courses of care for eligible adults. Hence, it is estimated that such a public dental care program would boost demand by approximately 567,000 visits, which would be additional to the estimated demand of 33.2 million visits, i.e. a total of 33.8 million visits. The gap between demand and supply would widen to 4.4 million visits.

5 Policy directions

5.1 Background

The previous sections have provided information on changes occurring within dental practice, i.e. demand for and supply of dental services. There is a definite picture of two emerging dental labour force problems: an aggregate supply shortage, and a maldistribution of supply. While the maldistribution of supply could exist even if an aggregate shortage of supply did not exist, it is accentuated by the aggregate shortage.

The aggregate shortage exists as a result of past trends in demand for dental services that are projected to continue across the period 2001 to 2010 and beyond. Projected increases in demand are driven by population growth, the even faster growth in numbers of dentate adults, and underlying increases each year in individuals' demand for dental visits and services.

The aggregate capacity to supply dental visits has shown limited growth in the last decade and is projected to change little over the period 2001 to 2010. Capacity to supply visits is dominated by dentists, especially private general practitioners. While dentist numbers are projected to increase a little between 2001 and 2010, a combination of ageing, an increasing percentage of women in the labour force, and a trend for decreasing annual productivity measured by visits supplied per year yields very little growth in dental visits.

The allied dental practitioner labour force supplies a small proportion of all dental visits made by Australians. Dental therapists provide most (in the school dental services) followed by prosthetists and then hygienists, reflecting the relative numbers of practitioners in each allied dental field. Past trends indicate only limited growth in the projected number of visits supplied by the allied labour force.

There are several levels at which the consequences of this supply shortage can be considered. At a macro-level a supply shortage will diminish the dental labour force's contribution to improving oral health and particularly oral health related quality of life. While the dental labour force plays only a marginal role in the oral health gains of the population, it plays a substantial role in ameliorating pain and infection, and in diagnosing diseases and disorders and controlling or treating them so that individuals can fulfill their expectations of productive and rewarding roles in society.

At a micro-level the supply shortage will have an impact upon dental practice. Scarcity of supply will lead to increases in the fees of private dental care, contributing to increasing costs to patients and increasing incomes for private dental practitioners. The differential or gap in incomes between private and public dental practitioners will subsequently increase, which will encourage public dental practitioners to move from the public to the private sector. However, the increase in fees and costs to patients will decrease the affordability of private dental care. As a result, adults eligible for public dental care who had sustained their own access to private dental care will move from the private to the public dental sector (Grytten & Lund 1999). The maldistribution of demand and resources between the private and public sectors will be accentuated.

It is imperative that Australia responds to this developing scenario. There is a need for a national dental labour force policy directed at resolving these problems.

Dental labour force policy is presently decentralised, voluntary and uncoordinated. What policy exists is administered at a State and Territory level. For example, Victoria has conducted an oral health services labour force project which culminated in an action plan (Victorian Department of Human Services 2002). However, there are limits to what a State or Territory can achieve on its own. Many aspects of labour force planning operate at a national level, including the tertiary education of the dental labour force, migration of dental personnel to Australia, recognition of overseas qualifications for dental personnel, trans-Tasman movement, and government subsidies for private dental insurance. There is a need for a national dental labour force policy that recognises the complexity of labour force planning but seeks to coordinate a comprehensive package of policy responses. Without such policy development Australia will see continued:

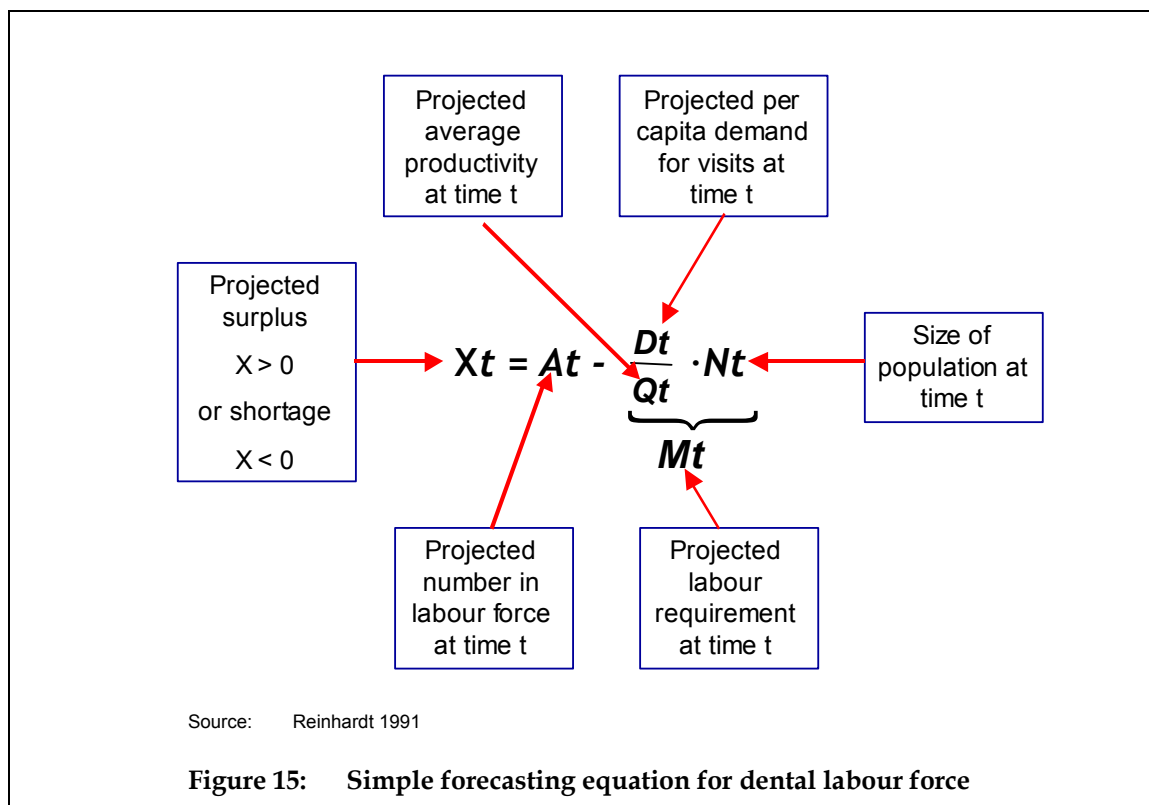
- reduction in access to dental care for vulnerable subpopulations; and
- pressure for the escalation of overall dental care costs (Noren 1997).

Further neglect of policy development will see the escalation of ad hoc initiatives across sectors, leading to contradictory decision making and maintenance of underlying problems.

In its efforts to improve oral health and provide better dental care, Australia needs a set of national dental labour force policies directed at sustainable self-sufficiency. Providing better dental care needs to be guided by the principles of effectiveness and efficiency as well as adequacy and appropriateness.

5.2 A model for considering policy

A pragmatic and simplified model for examining the dental labour force is presented in Figure 15. It is based on a model discussed by Reinhardt (1991).



Whether or not there is a projected surplus or shortage (X) at time t is determined by the projected number in the labour force (A) at time t minus the projected labour required (M) at time t . The projected labour requirement is itself the product of the size of the population (N) at time t multiplied by the ratio of the projected per capita demand for dental services (D) at time t divided by the projected average dental productivity (Q), defined as the projected average output of dental services per full-time-equivalent at time t .

This model illustrates, in a straightforward manner, that the policy directions that can be pursued to bring a projected dental shortage back toward equilibrium include:

- increasing dental productivity
- decreasing per capita demand
- increasing labour force numbers.

5.3 Dental productivity

While increasing productivity has been pursued across the Australian economy for some two decades, gains in a human service delivery area like dental services seem elusive.

Gains could be achieved by the substitution of capital for human labour and improvements in technology such as materials and instruments. Examples include glass ionomer cements for some restorations where ideal conditions for other materials are difficult to meet, or mechanical preparation of root canals in endodontic treatment. If science and technology had an impact on dental service production in only these ways, then productivity gains would be expected.

However, as already seen, both the long-term and medium-term trends have indicated a decreasing number of visits provided per hour by dentists (AIHW DSRU: Brennan & Spencer 2002). Science and technology, rather than increasing productivity in terms of visits supplied per hour, are contributing to increased complexity and intensity of services provided, resulting in longer visits and decreasing productivity. Examples include infection control issues and the shift away from tooth extraction toward tooth retention and maintenance. This conclusion is dependent on the unit of measure of productivity, i.e. visits per hour. It is possible that productivity measured by services per hour, work units per hour or constant dollars generated per hour has not decreased. However, using such alternative measures also requires that demand be similarly expressed. Demand for services is considerably greater and increasing faster than demand for visits. This maintains the unfavourable D_t/Q_t ratio in projections of labour force requirements. These productivity trends are also driven by population and patient demography, increased tooth retention and increased consumer awareness and expectations.

The second possibility for increased productivity lies with the configuration of the dental team. Historically, the team has consisted of dentist and chairside dental assistant. Increases in productivity (visits per hour) can be achieved by the substitution of allied dental labour personnel for a dentist. This has been most clearly established for dental hygienists in North American research. Increases in productivity may be more readily achieved in larger dental practices where there are favorable circumstances for expansion, and economies of scale that are likely to optimise the input of new team members. However, the assumption is that the increased dental team produces more of the same 'visits and services'. Further, in terms of the labour force model, there is no change in per capita demand.

While research on the impact of an expanded dental team is limited, it is most likely that any expansion of the dental team is a mix of 'more of the same', a substitution effect; and 'additional new services', a complementary effect. For example, a dental practice that adds a dental hygienist to the team is likely to produce not only the previous preventive and periodontal services (substitution) but also additional preventive and conservative periodontal services provided by the dental hygienist (complementarity), and possibly additional complex services provided by the dentist in the time freed from previously provided preventive and periodontal services. However, the nature of the dental service provided by the practice has changed and per capita demand from among its old patient pool or a new pool of patients may also increase. This may be generated

by the practice (demand creation) because the opportunity to service new demand exists or because of increased patient awareness and expectations.

If the ratio of per capita demand to average productivity does not decrease, the expansion of the dental team will not necessarily contribute to reducing the labour force shortage. Dental programs for school children, unemployed adults and older adults in residential care can be considered in a similar fashion to a dental practice.

Questions surrounding the impact of dental therapists, hygienists and prosthetists on projected shortages depend on the degree of substitution versus complementarity and the population per capita demand changes that may follow. The benefits associated with implementing an expanded dental team will reflect the value placed on:

- reduction in the dental labour force shortage
- new additional services and to whom they are provided
- development of dental team approaches.

What seems clear is that productivity gains are not easily achieved and expansion of the dental team may not contribute, *per se*, to reductions in the dental labour force shortage.

5.4 Per capita demand

Another policy direction to pursue to reduce the dental labour force shortage is demand modification. This could involve two separate activities: a reduction in the rate of increase in per capita demand and alteration of the distribution of demand in the population.

It would seem possible, theoretically, to pursue a series of policies aimed at slowing or stopping the growth in per capita demand. Earlier it was seen that a continuation of past trends in per capita demand led to projections of demand in 2010 well in excess of capacity to supply dental services. Even the more cautious approach of assuming a halving of the future rate of growth in per capita demand could not avoid a severe dental labour force shortage. If growth in per capita demand could be halted, there would still be a gap between the population's demand for dental services and the capacity of the labour force to supply the dental services, but it would be smaller and more readily covered by other policies under consideration.

Demand growth could be diminished by increasing the cost of dental services to the population, which could take the form of removing public subsidy for private dental insurance or reducing the rebate paid on many individual dental services under private insurance. Both actions would exploit the price elasticity of dental demand.

However, such policies are blunt instruments. They would affect many Australians on low and middle incomes, including some eligible for public dental care who have covered their own dental costs and not drawn on the public sector. There has been little research on the economics of dental services in Australia, and the consequences of these actions are uncertain.

A variant of price elasticity in the private sector is the use of co-payments in the public sector. This is a misnomer because co-payments have traditionally been a percentage of the fee charged, with varying percentages across dental service areas. Instead, public dental services have raised a charge for a visit, with differentials for emergency and general dental services, and a ceiling on the total charge. This is more akin to a deductible, a front end charge of a set amount. 'Co-payments' in the public dental services have depressed demand. However, they raise equity concerns given that eligibility for public dental care is already restricted to those with 'means-tested' low incomes. A further limitation is their relevance to less than 5% of the population who are eligible and use public dental care.

An alternative policy direction is to explore a range of managed dental care approaches. It may be possible to develop guidelines for appropriate dental care around frequency of courses of care and certain dental services, and adjust eligibility for insurance rebates to create incentives for adherence to those guidelines. Such approaches hold considerable theoretical appeal as they link dental labour force policy to improvements in the effectiveness and efficiency of service delivery.

How ready dentistry in Australia is to grapple with the substantial issues of managing demand through clinical guidelines and insurance rebate incentives is an unanswered question. Recently, international discussion on health labour force issues has given considerable space to the strengthening of the regulatory hand, especially given the failure of the invisible hand in a competitive market for health care. Grumbach (2002) emphasised the heavy hand or 'firm regulatory grasp' which would be required in a different health care market. Others are curious as to what a firm regulatory grasp on labour force policy would entail and how it could be made compatible with an unregulated demand side of the health care market. Reinhardt (2002) stated "Simply to wish away that chaotic demand side ... in favour of a comprehensively planned health care system as a platform for ... [labour force] planning is just to continue the health planners' century-old dream".

5.5 Labour force numbers

The alternative to either of the highly problematic policy directions of influencing productivity or demand is to consider increasing labour force numbers.

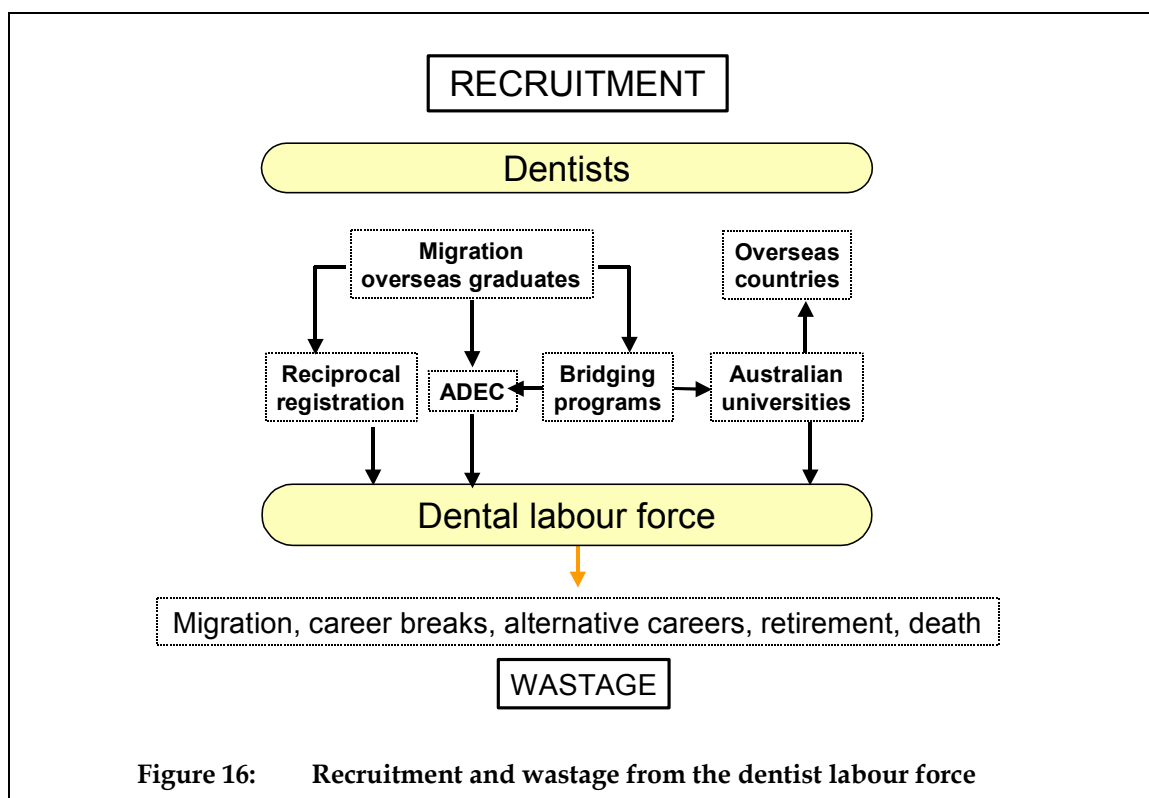


Figure 16 summarises recruitment and wastage from the dentist labour force. Dentists are recruited predominantly from the five Australian dental schools (Universities of Sydney, Melbourne, Queensland, Adelaide and Western Australia). As indicated earlier, recruitment of dental graduates who are Australian citizens or permanent residents is approximately 217 per year. A limited number (6) of these graduates are previous overseas dental graduates who have chosen to obtain Australian qualifications through bridging programs. A further 20+ graduates per year are international students who return to their country of origin upon completion of their degree.

The other source of recruitment is migration of overseas dental graduates into Australia. The flow of overseas dental graduates is strongly influenced by circumstances in both Australia and the countries of origin, but is estimated to be approximately 67 per year.

A number of issues drive the acceptance of basic qualifications of overseas dental graduates, including reciprocal registration arrangements. Approximately half of the overseas dental graduates are from the United Kingdom, Ireland and New Zealand, where the basic qualification is accepted for registration with the Australian State/Territory dental boards. Overseas dental graduates from all other countries, regardless of their further qualifications and/or experience, are required to pass the Australian Dental Council's (ADC) three stage examination. Historically, success rates have been low, but have greatly increased recently. This may in large part be due to preparatory 'bridging programs' for overseas dental graduates wishing to take the

examination, especially the knowledge and clinical components. Greater assistance in preparing for the examinations, a greater number of locations where they can be taken and a higher frequency at which they are offered might reduce current barriers to success in the examination process.

Policies to increase the dentist labour force can be grouped according to their contribution to increased recruitment or reduced wastage. While many wastage factors cannot be influenced by policy, consideration should be given to decreasing career breaks and pursuit of alternative careers. One specific proposal in this area is retraining for re-entry into the active labour force, especially for women, after a career break.

The range of policy options is presented in Table 7.

Table 7: Policy options for increasing the number of dentists in the labour force

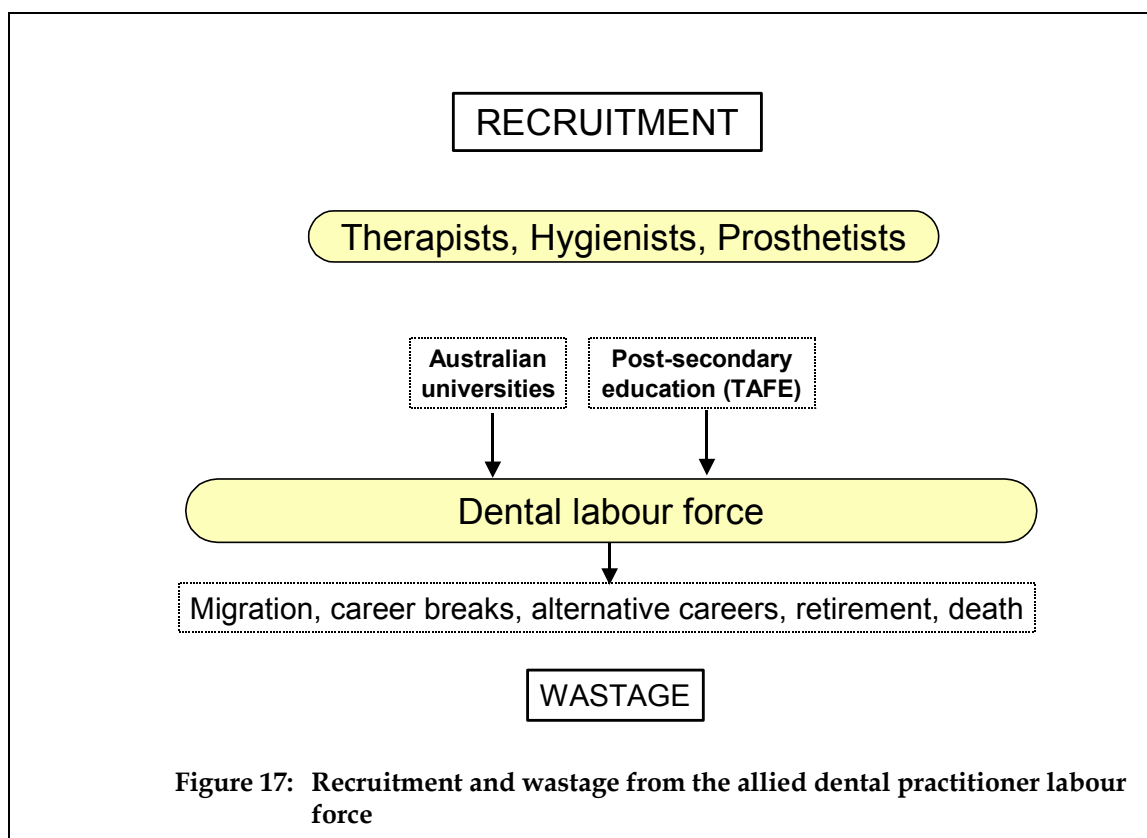
Recruitment or wastage vector	Policy options
Recruitment	
Australian universities	Expand output of the existing dental schools Add new dental schools or clinical schools, especially in regions without education programs, e.g. Tas, NT, ACT
Migration of overseas dental graduates	Remove barriers to migration, e.g. maximum age Increase basic qualifications accepted for registration or create limited registration options linked to work in under-supplied areas Increase bridging programs both within universities and for the ADC examination held at more locations and with greater frequency
Retention in dentist labour force	Increase support for dentists in under-supplied areas Provide retraining/re-entry programs for those who take a career break Increase sessional/locum opportunities to delay retirement from practice or pursuit of alternative careers

Consideration of these policy options should give emphasis to developing, in the longer term, a self-sustaining approach to the dentist labour force. This would focus attention on retention of dentists and recruitment from Australian universities. However, some assistance could be obtained in the short term, up to five years, from policies directed at migration of overseas dental graduates.

Earlier data have indicated that the dentist labour force shortage (made up of an increase in practising rate per 100,000 population but a decrease in annual productivity) needs an increase in recruitment of dentists of 25% per year from 2001 to 2010 to meet their current proportion of the increase in demand under the medium supply projection. As increased recruitment from Australian universities cannot contribute before 2007 at the earliest (predominantly 2008), some of the short-term shortfall must be met by policies directed at migration of overseas graduates.

5.6 Allied dental practitioner labour force

Recruitment of therapists, hygienists and prosthetists is predominantly from education programs at Australian universities and the post-secondary education sector (TAFE) (see Figure 17).



Projections for the allied dental practitioner labour force indicated shrinking rates per 100,000 population for dental therapists and prosthetists, with only limited growth for hygienists. The policy options for increasing numbers of practitioners in the allied dental practitioner labour force are outlined in Table 8.

Table 8: Policy options for increasing the numbers of practitioners in the allied dental practitioner labour force

Practitioners	Policy options
Therapists	Expand output of existing programs
Prosthetists	Stabilise recruitment while further consideration is given to the need and appropriateness of partial dentures Establish high technology dental laboratory training
Hygienists	Expand output of existing programs
Therapists/Hygienists	Position education within universities and integrate into a combined degree

Given the regulatory changes surrounding dental therapists, it seems highly likely that the decreasing rate of supply to their traditional sector, i.e. school children enrolled in

the school dental services, is likely to be accentuated. Some increase in the allied dental personnel able to work as dental therapists in the school dental services seems highly desirable.

Dental prosthetists practise removable prosthetics, the supply and fitting of full and partial dentures. Underlying patterns of tooth loss are having an impact on demand for removable prostheses. As edentulism decreases, the need for initial and replacement full prostheses also decreases, although there will still be a considerable ongoing demand for these services. The decrease in demand for full prostheses has been buffered by an increase in partial denture services. Two aspects of this work deserve attention. Firstly, is this a transition period between edentulism and no need for removable partial prostheses because tooth loss will continue to diminish? Secondly, removable partial dentures attract some criticism for supplier induced demand and over-servicing (as reflected in the proportion not being worn one year later), and iatrogenic oral disease such as increased periodontal tissue destruction and possibly caries increment.

In contrast to these uncertainties about dental prosthetists, there is increasing demand for high technology dental laboratory work involving porcelain bonded to metal, precious metals, ceramics, orthodontic appliances and implants. For some time dental prosthetists have been the only dental technicians recognised for their higher skills. There is a clear need to establish advanced dental laboratory training programs and recognition in parallel with dental prosthetists.

The remaining allied dental personnel are dental hygienists. While the dental labour force projections indicated a likely increase in their rate of supply, this is from an extremely low base. Dental hygienists offer the potential of shifting the service mix and thereby influencing oral health outcomes, especially in private dental practice where they are predominantly employed. They could also make a substantial contribution to the provision of preventive and oral health promotion services in non-traditional settings, such as residential care facilities. While many of these activities represent complementary roles to existing dentist provided services, and therefore only a marginal substitution effect and reduction in the supply shortage, the value of the complementary services provided supports an increased recruitment of dental hygienists.

A number of education programs for dental therapists and hygienists have been established at universities and integrated into a combined degree, a Bachelor of Oral Health. Such programs allow for integrated learning and subsequent articulation between these complementary allied dental professions. Because they offer a number of advantages, integrated programs should be encouraged. They offer to the dental industry the conceptual creation of a dental team; to universities the optimisation of resource use for education; and to students a more interesting and broader education as well as the occupational flexibility achieved in an uncertain allied dental practitioner labour force market.

5.7 Maldistribution of supply

Maldistribution of the dental labour force can exist at several different distribution levels: specialty, sector, occupational, and geographic.

In Australia some 12% of dental practitioners are specialists, predominantly orthodontists and oral and maxillofacial surgeons. Specialists exist to provide exceptional services to 'special' patients. However, they also serve as a focal point for raising the quality of dental care, innovation and adoption of new procedures, clinical research and continuing education of general dental practitioners. Little attention has been paid to questions of the supply of dental specialists or their distribution across disciplines. Consideration should be given to a proactive policy of specialty recognition so as to contribute to professional leadership and exceptional service in new, emerging disciplines.

Of much more immediate concern are the areas of sector and geographic distribution. Fundamentally these concerns are embodied in the question 'Where will additional dentists practise?'

A paradox exists that an increase in new dentists recruited to the labour force is likely to see many of these recruits choose to practice in 'the main street' (Davis 1983). The main street symbolises those areas where there is already sufficient supply of dentists and where the community already has access to an increasing level of dental care. Given the freedom of practice location choice, many new recruits will choose to practise in the private sector in affluent areas with high social capital, where they will also live. Vulnerable groups who face access barriers to basic dental care (including those in rural/remote areas, eligible for public dental care, homebound or in residential care) are less likely to be able to recruit new dentists to serve their needs unless policies to increase recruitment take the opportunity to link at least a portion of that recruitment to practising in under-serviced areas.

Mertz and O'Neil (2002) allude to this issue in a recent commentary on the US situation.

"The standard response to the lack of dental services is to suggest increasing the number of dentists. Some increase may be warranted, and perhaps inevitable, but it may be more useful to understand this problem less as a problem of supply of practitioners and more as a poor fit between part of the current practice model, the patterns of disease, and the people needing care."

A number of policy options are readily identified which might be considered for their contribution to both increasing supply and addressing sector and geographic maldistribution issues. These are listed in the Table 9.

Table 9: Policy options influencing maldistribution of the dental labour force

	Policy options
Recruitment	
Australian universities	Preferential selection/quotas for rural/remote students linked to scholarships
Recruitment of overseas dental graduates	Limited registration for practices in under-serviced areas
Practice location decision making	
	Undergraduate placements in under-serviced areas
	Residencies/internships in under-serviced areas
	Targeted recruitment of graduates to under-serviced areas

Each of these policy options requires appropriate incentives and support for both institutions and students or practitioners. Failure to provide adequate support may

simply reinforce the relative disadvantage that works against establishing practices in under-serviced areas.

The opportunity to link dental labour force policy to other issues in oral health and dental care should be explored. Concern exists that the projection approaches used in this report accept existing inequalities in access to dental care.

Bringing vulnerable groups into programs that promote access to an acceptable minimum standard of dental care is a substantial challenge for dental policy. Cross-linkage to dental labour force policy, as outlined for sector and geographic distribution issues, is essential. It is necessary to consider the position of vulnerable groups in the overall context of dental labour force policy.

Firstly, the vast majority of dental services provision and of the current labour force is centred around private dental practice. In order to minimise the consequences of a dentist labour force shortage, there is a high priority to continue to recruit most dentists to private practice. Similar logic dictates a similar attitude for dental hygienists and prosthetists with regard to private practice. Further, there is a need to ensure recruitment of most dental therapists into the school dental services for the provision of dental care to approximately half of all Australian school children.

Secondly, programs to improve the oral health and dental care available to special vulnerable groups in the Australian population must recognise that, while such groups present substantial service difficulties, their numbers are generally quite low. For example, there are approximately 140,000 older adults in residential care in Australia. Programs which might establish assessment and oral care plans for these adults and allow access to required dental treatment need limited additional dental labour force numbers (over that now involved in such care) when compared to the servicing of demand from 9–10 million Australians visiting private practices each year. Further, such programs create new demand beyond that in the demand projections in this report. The additional dental labour force numbers required to service that demand, while extremely valuable per se, do not contribute to resolving the dental labour force shortage. Hence, policy to convert unmet need among vulnerable groups in the population into effective demand for dental care requires further dental labour force growth.

The dental labour force shortage and the policy needed to address it highlight links to many other policy issues, and reveal a complexity that contrasts with the presently decentralised voluntary, uncoordinated responses by the dental profession and others. It is unrealistic to delay assessment of policy until such time as all the data and inter-relationships are known and verified. There is an imperative to begin, to 'muddle through inelegantly'.

"In a pluralistic society such as ... [Australia], which does not have a national system of [dental] health care, it may be futile to pose the question whether the nation will have too many, too few, or just the right number of ... [dental providers] a decade or two in the future. All we can hope to do is to address selected facets of the supply problem as they force themselves onto the nation's agenda. To do more is likely to lead to frustration: to do less is to stockpile problems for the future" (Ginzberg 1989).

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