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Projected demand and supply for dental visits in Australia: analysis of the impact of changes in key inputs

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Contents

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
ASGC	Australian Standard Geographical Classification
BDS	Bachelor of Dental Surgery
BOH	Bachelor of Oral Health
DEST	Department of Education Science and Training
DIMA	Department of Immigration and Multicultural Affairs
DIMIA	Department of Immigration and Multicultural and Indigenous Affairs
DSRU	Dental Statistics and Research Unit
ERP	estimated resident population
LSDPA	Longitudinal Survey of Dentists' Practice Activity
NACHO	National Advisory Committee on Oral Health
NDTIS	National Dental Telephone Interview Surveys
NOHSA	National Oral Health Survey of Australia
PCD	per capita demand
RTP	return to practice

Place abbreviations

ACT	Australian Capital Territory
Aust	Australia
NSW	New South Wales
NT	Northern Territory
Qld	Queensland
SA	South Australia
Tas	Tasmania
Vic	Victoria
WA	Western Australia

Symbols

n.a.	not available
. .	not applicable
%	percentage
–	zero or rounded to zero

Acknowledgments

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Editorial team

Several people have contributed to the editing of this publication. The AIHW publishing unit, Dr David Brennan, Alison McLean and Lorna Lucas of ARCPOH and proofreader Jo Mason have worked to improve the consistency, layout and readability of the text.

Summary

In the early part of the current decade an emerging shortage of dental practitioners was widely recognised by the dental profession and key stakeholders. At this time, the Australian Research Centre for Population Oral Health (ARCPOH) published several reports projecting and examining supply and demand of dental visits in Australia. Since the publication of those projections in 2003, many factors influencing the supply and demand of dental visits in Australia have changed.

Revised baseline projections from the year 2003 are presented. These projections were based on the known circumstances at the time of report writing and hence the revised supply projection does not include new regional dental schools announced at the end of 2007. The sensitivity of these baseline projections are assessed by examining the impact of changes in key inputs or assumptions. The alternative scenarios examined broadly relate to dental labour force policy directions and thereby provide an analysis of their potential impact.

Revised supply projections

- The number of dentists is projected to increase by 33%, from 10,104 dentists in 2005 to 13,465 dentists in 2020.
- Numbers of dental prosthetists and dental therapists are projected to decline slightly by 2020, while numbers of hygienists are projected to increase by 138% of a low base number.
- The total aggregate supply of dental visits is projected to increase by 17% from 28.9 million visits in 2005 to 33.7 million visits in 2020.

Revised demand projections

- Under the 'no PCD growth' projection, demand for dental visits is projected to increase from 28.2 million visits in 2005 to 33.6 million visits in 2020 (an increase of 19%). Under the 'half PCD growth' and 'continued PCD growth' projections, demand in 2020 is projected to be 38.8 and 44.0 million visits respectively.

Supply projections: changes in key inputs

- Supply projections were most sensitive to differing productivity (visits supplied per year) assumptions and changes in levels of dentist recruitment from Australian universities or through migration. They were less sensitive to changes in attrition rates and increases in allied dental recruitment levels.

Demand projections: changes in key inputs

- Demand projections were very sensitive to differing assumptions of future per capita demand (PCD) growth. Conservative and potentially likely increases in percentage accessing care in a 12-month period resulted in substantial increases in projected demand. Demand projections were not very sensitive to changes in insurance coverage or changes in patterns of access by regional dwellers.

Conclusion

Of the various scenarios examined, it was contended that the 'most likely' supply scenario was that of 140 additional dentist graduates (from 2013 onwards). This scenario projected that supply in 2020 would be approximately 36.0 million visits. The most likely demand projection was argued to be that of half growth in PCD, which projected that demand would be 38.8 million visits by 2020. These 'most likely' supply and demand projections result in an estimated supply shortfall of 2.8 million dental visits. This equates to an undersupply of 1,000 to 1,100 dental practitioners (on the basis of current productivity levels).

1 Introduction

1.1 Purpose of this report

This report is intended to inform policy makers and service provision planning by providing current estimates and projections of demand and supply of dental visits in Australia. It also assesses and revises earlier projections of demand and supply for dental visits published by ARCPOH in Population Oral Health Series No. 2. The revised supply projection was based on known circumstances at the time of report writing and therefore does not include the new regional dental schools announced at the end of 2007.

In addition, this report attempts to assess the impact on supply and demand of various policy directions or changes in existing social and professional trends. This is achieved by altering key inputs and assumptions in projections and producing a range of 'what if' scenarios. The supply projection scenarios assessed were selected on the basis of their plausibility as a policy direction that would aim to narrow the gap between supply and demand. Those demand projection scenarios selected aim to assess potential shifts in patterns of accessing dental care as a result of policy initiatives aimed at improving access to dental care.

The projections of demand and supply of dental visits presented in this publication treat demand and supply as separate models; however, it must be acknowledged that a dynamic relationship exists between supply and demand.

For example, there is anecdotal evidence of supplier-induced demand, where actual supply is extended by dentists, increasing consumption beyond what the community might normally want or desire in order to meet various practice goals. Alternatively, insufficient capacity to supply could potentially cap growth in demand; hence, the level of demand would be influenced by supply.

While each model employs different methods and draws on different data sets, they project in a common unit—dental visits—thus allowing reconciliation of supply and demand. Reconciliation of the two projection models is useful in this context as a means to understanding trends and assessing the impact of various policies to close the projected future gap between supply and demand.

The focus of this publication is policy analysis, hence data sources and detailed methodology are provided in the appendices.

1.2 Overview of previous supply and demand projections

ARCPOH has previously published supply and demand projections from 2000 to 2010 (Spencer et al. 2003; Teusner & Spencer 2003). These publications indicated that a gap could exist between demand and supply that was conservatively estimated to be 3.8 million visits in 2010. This was approximated to be a shortfall of 1,500 dental providers.

This publication tracks the course of those original projections against actual estimates and examines the inputs used in those models against updated data. This process of revisiting the previous projection provided directions for refinement of the projections. These refinements, along with updated inputs, were applied to the supply and demand projections for the years 2003 to 2020.

1.3 Policy directions or shift in trends

In order to assess the impact of various policy directions, the sensitivity of the supply and demand projections to changes in their underlying assumptions and inputs was examined. Identifying those inputs and assumptions that have the greatest impact on the supply and demand projections can indicate what type of policy initiatives will have the greatest potential influence on dental supply and demand in Australia.

The sensitivity of the supply model was examined according to:

- increases in the numbers of Australian university graduates, dentists or allied dental practitioners
- increases/decreases in the number of migrant and ADC certified dentists
- variations in existing productivity trends
- alterations in wastage/attrition rates of dentists.

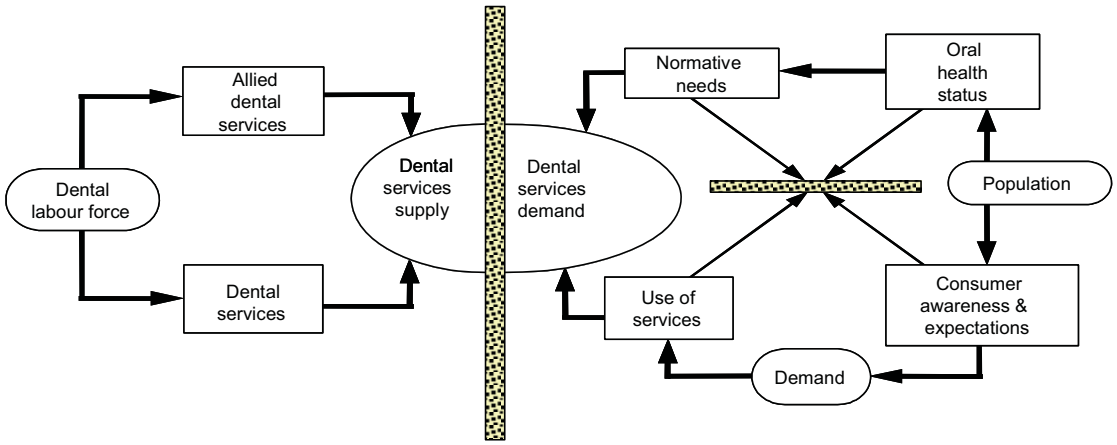
The sensitivity of the demand model was examined according to:

- alterations in patterns of accessing dental care
- increases/decreases in health insurance policy coverage.

2 Overview of supply and demand models

A useful basic plan for the relationship between supply of and demand 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 and endeavours to work towards common units to quantify both the capacity to supply dental services and the demand for dental services. The model illustrates:

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



Source: Adapted from DeFriese & Barker 1982.

Figure 1: Relationship between supply of and demand for dental services

2.1 Supply model

Projections of the dental labour force are based on entering inflows and outflows from a stock of dental personnel into a modified Markov chain model (see Appendix B for detailed description). As seen in Figure 2, inflows to the stock of dentists comprise Australian university graduates, migrants to Australia, and those who return to practice after a length of absence. Movement out of the stock, or wastage, is associated with migration out of Australia, retirement, death and cessation of practice, either permanently to pursue another career or for an extended term, e.g. study or parental leave.

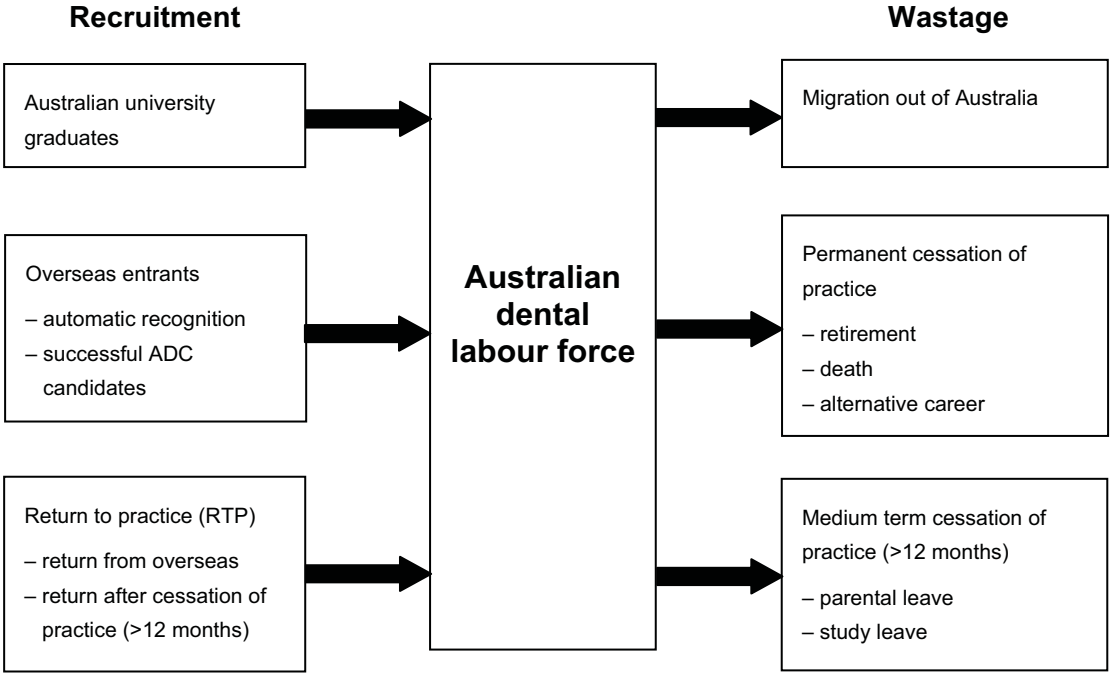


Figure 2: Schematic model of dental recruitment and wastage

Projections of dental visits supplied are calculated by multiplying the projected numbers of practising dentists and allied practitioners by sex-and age-specific estimates of visits supplied per annum. The principal data sources are the National Dental Labour Force Data Collections (NLFDC) and the Longitudinal Survey of Dentists' Practice Activity (LSDPA).

2.2 Demand model

For the purposes of this publication the word 'demand' is used synonymously with usage of dental care—in other words, expressed demand. Historical patterns of usage are examined and used to estimate future demand for dental care. Projections of demand presented in this publication are an estimate of the quantity of dental visits that people are likely to consume based on previous consumption. This definition of demand does not directly relate to need for dental care and does not include the occurrence of people wanting or seeking care but unable to access care.

In simple terms the demand projection model multiplies the age specific PCD rates for dentate and edentulous persons by the numbers of people that are predicted to be in those groups in the future (Figure 3).

There are four key factors that influence and impact on demand for dental visits:

- **Increases in the population**
  As the total number of people in Australia increases, it follows—all other things being equal—that the total number of visits demanded will also increase.

- **Demographic changes in the population**
  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.

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

- **Changes in per capita demand**
  If per capita demand (PCD—the average number of dental visits per person) changes, then total demand for visits must also change. Historically, there is evidence that PCD for dental visits in Australia has been increasing over time.

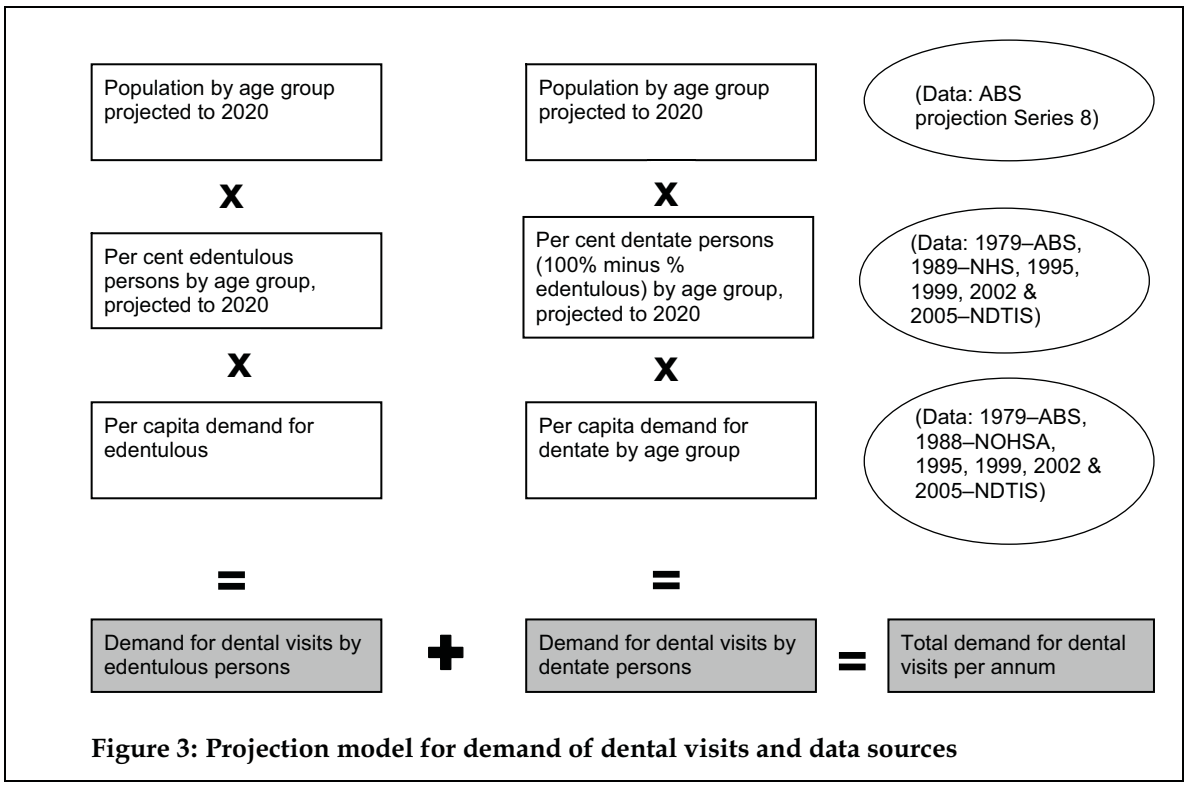


Figure 3: Projection model for demand of dental visits and data sources

3 Supply of dental visits

This section estimates the supply of dental visits by the dental labour force, which comprises four key occupational groups that provide clinical services. In terms of numbers dentists dominate the dental labour force. Allied dental practitioners, which include prosthetists, dental therapists and dental hygienists, comprise approximately 22% of the dental labour force.

First, the primary characteristics and most recent estimates of numbers of practitioners practising in each of these occupational groups are presented. Second, the capacity of each of these groups to supply visits is estimated. Third, previous projections are briefly reviewed and the components that comprise the projection model are examined and refined. Finally, revised projections are presented, both of the number of practitioners and of visits supplied by the total dental labour force to the year 2020.

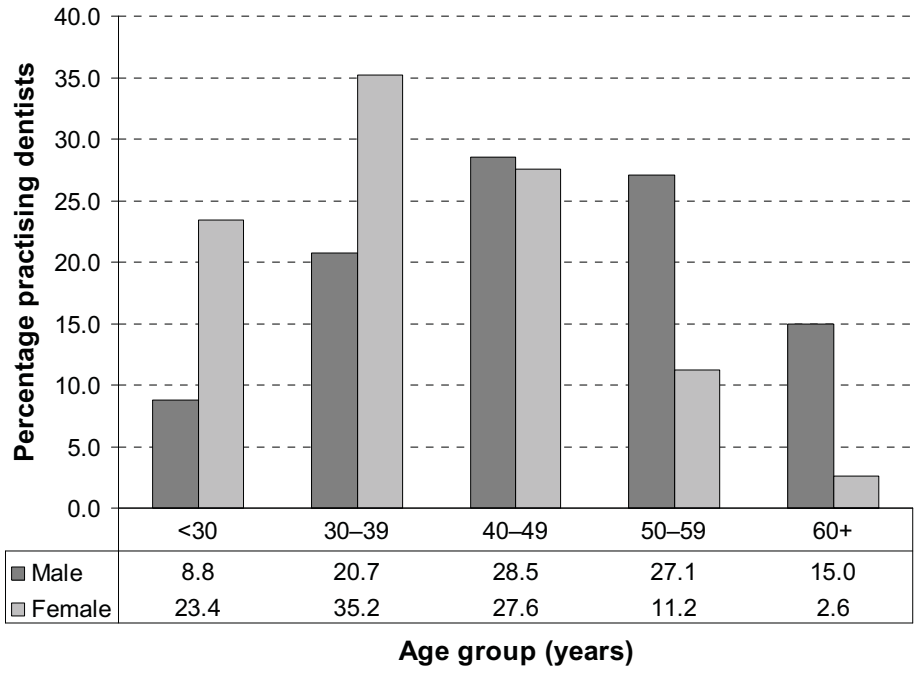
3.1 Dentist labour force

In 2003 there were 11,404 dentists registered with a state/territory Dental Board in Australia, of whom 482 were multiple registrations (registered in more than one jurisdiction), leaving a potential stock of 10,922 dentists. Of these, 9,678 (88.6%) were actively practising in dentistry, giving a practising rate of 48.7 dentists per 100,000 population (Table A.1).

In 2003 the percentage of employed dentists (practising) was 84.9% of all registrations. As expected the employment rate declines with increasing age, dropping from 88.1% for the under 35 years age group to 68.7% in the over 65 years age group. There were minor differences between males and females in terms of employment rate. The exception was the 55–64 years age group, where only 75.1 % of female registrants were employed compared with 84.9% for male registrants (Table A.1).

Demographics

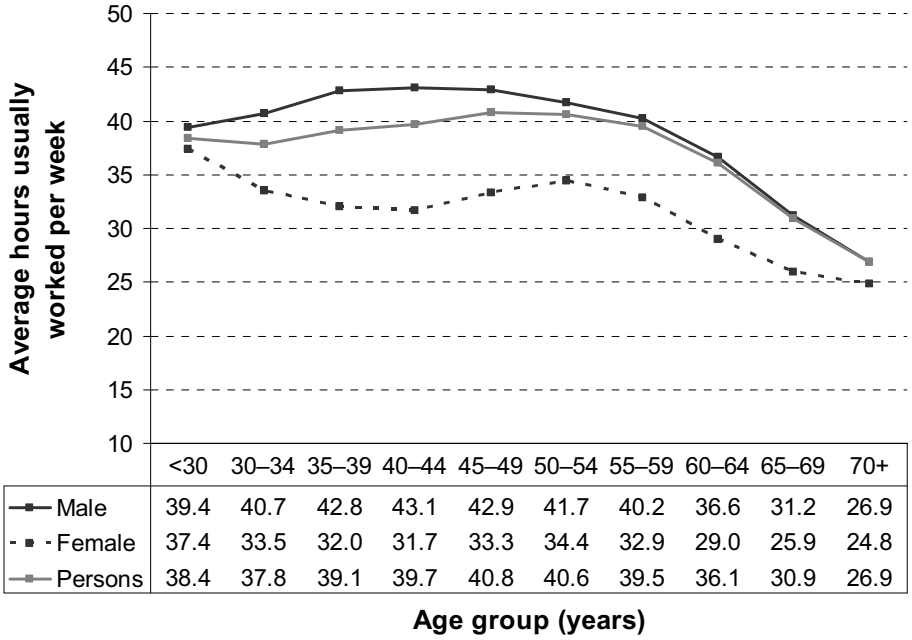
In 2003 nearly three-quarters (73.7%) of all practising dentists were male with an average age of 46.9 years. Female dentists were on average much younger than their male colleagues, with an average age of 38.1 years (Table A.2). Just over half (58.6%) of all female dentists were aged less than 40 years of age compared to less than one-third (29.5%) of male dentists. In contrast, approximately 42% of male dentists were aged over 50 years compared to 13.8% for females (Figure 4).



Source: Teusner et al. 2007.

Figure 4: Percentage of practising dentists by sex and age group, 2003

Total average hours worked per week varied by age and sex. Female dentists on average worked fewer hours than their male counterparts in all age groups. Of female dentists, those less than 30 years of age worked the longest week (37.4 hours) whereas male dentists in the 40 to 44 years age group worked the longest week (43.1 hours) (Figure 5).



	<30	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70+
Male	39.4	40.7	42.8	43.1	42.9	41.7	40.2	36.6	31.2	26.9
Female	37.4	33.5	32.0	31.7	33.3	34.4	32.9	29.0	25.9	24.8
Persons	38.4	37.8	39.1	39.7	40.8	40.6	39.5	36.1	30.9	26.9

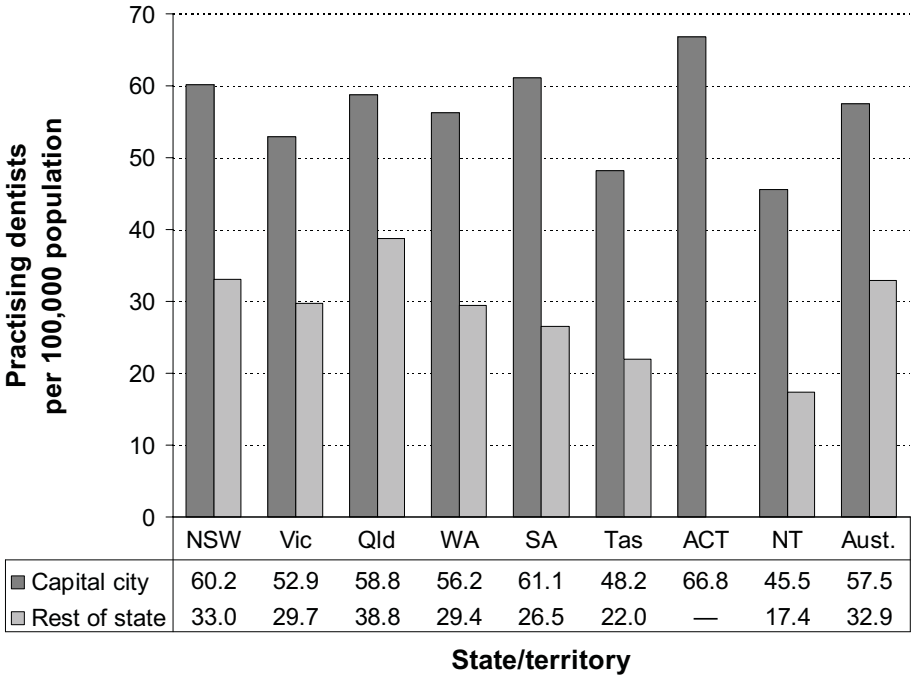
Source: Teusner et al. 2007.

Figure 5: Practising dentists by average hours usually worked per week, age group and sex, 2003

Most dentists (84.7%) worked in general practice, 11.7% worked in specialist practice and the remainder worked in non-clinical areas such as administration and research/education (Table A.3). The majority (81.6%) of practising dentists worked in the private sector, 15.5% worked in the public sector and the remaining dentists worked in industry or other sectors.

Geographic distribution

In 2003 the overall practising rate of dentists was 48.7 dentists per 100,000 population. Practising rates across jurisdictions varied widely, ranging from 32.7 in the Northern Territory to 66.8 dentists per 100,000 population in the Australian Capital Territory (Table A.2). Furthermore, within jurisdictions the distribution of dentists was uneven relative to the population. Capital cities averaged 57.5 dentists per 100,000 population while other regions (rest of state) averaged 32.9 dentists (Figure 6).



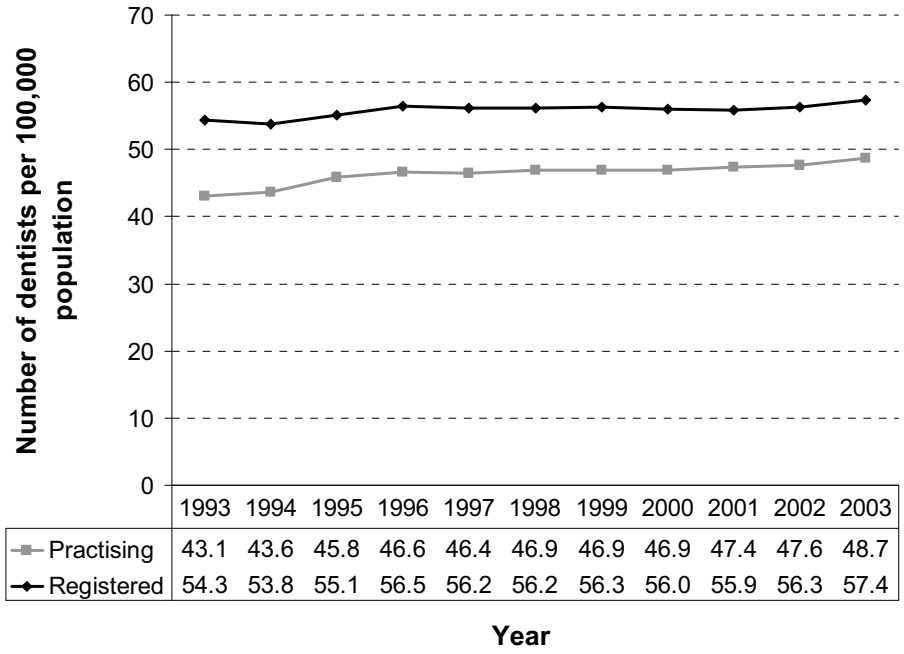
Source: Teusner et al. 2007.

Figure 6: Employed dentists per 100,000 population by state and region, 2003

Previous growth in dentist labour force

Over the decade to 2003 the total number of dentist registrations increased from 9,592 in 1993 to 11,404 in 2003, an overall increase of 18.9%. Allowing for multiple registrations and those not employed in the labour force, the estimated number of employed practising dentists increased from 7,618 in 1993 to 9,678 in 2003, an overall increase of 27.0% over the 10-year period.

The number of dentists per 100,000 population provides a more relevant estimate of change in the supply of dentists because increases in the population are taken into account. The number of dentist registrations increased from 54.3 to 57.4 dentists per 100,000 population between 1993 and 2003, a 5.7% increase. Numbers of employed dentists increased from 43.1 in 1993 to 48.7 dentists per 100,000 population in 2003, an increase of 12.9% (Figure 7).



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Practising	43.1	43.6	45.8	46.6	46.4	46.9	46.9	46.9	47.4	47.6	48.7
Registered	54.3	53.8	55.1	56.5	56.2	56.2	56.3	56.0	55.9	56.3	57.4

Source: Teusner et al. 2007.

Figure 7: Registered and practising dentists per 100,000 population, 1993 to 2003

Dentists' capacity to supply dental visits

The capacity to supply dental visits is estimated by multiplying the sex-and age-specific average number of visits supplied per annum by the number of employed dentists working principally in clinical practice (96.4% of all employed dentists). Estimates of average number of dental visits supplied per annum are sourced from the Longitudinal Study of Dentists' Practice Activity 2003–04 (LSDPA) and are calculated by multiplying the number of hours worked per year by the average number of visits supplied per hour.

The average number of dental visits supplied by dentists vary by age and sex. In 2003–04 male dentists on average supplied 2,898 visits per year while female dentists supplied substantially fewer (2,307) visits per year. For males, dentists in the 50 to 59 years age group provided the highest number of visits (3,454 visits per year) while those aged over 60 years provided the least (1,861 visits per year). For females, those aged less than 30 years and over 60 years provided the highest number of visits (2,537 and 2,520 visits per year, respectively) while those in the 50 to 59 year age group supplied the least (2,082) visits per year (Table 1).

For the past 40 years the average length of a dental visit has been increasing, as has the number of services provided per visit, while the average hours worked per week has remained stable (Spencer & Lewis 1986). Consequently the number of visits supplied per year has been steadily declining over that period (Table 1). The trend towards declining productivity (in terms of dental visits supplied) was evident across all age groups with the exception of females aged over 60 years where the number of visits fluctuated during the 20-year period (primarily due to small numbers of respondents in this age group).

Table 1: Average number of dentist visits supplied per year by sex and age, 1983–84 to 2003–04

Age group (years)	1983–84	1988–89	1993–94	1998–99	2003–04	Per cent change 1983–84 to 2003–04
			Male			
20–29	3,195	2,828	2,959	2,248	2,601	–18.6
30–39	3,964	3,707	3,081	2,883	2,780	–29.9
40–49	3,897	3,753	3,723	3,396	3,081	–20.9
50–59	3,614	3,972	3,083	3,083	3,454	–4.4
60+	3,003	2,744	2,413	2,339	1,861	–38.0
			Female			
20–29	2,611	2,638	2,724	2,393	2,537	–2.8
30–39	2,530	2,303	2,413	2,163	2,158	–14.7
40–49	2,876	2,444	2,691	2,085	2,377	–17.4
50–59	2,704	2,036	3,091	2,367	2,082	–23.0
60+	2,000	2,427	2,160	n.a.	2,520	26.0

Sources: LSDPA, General and specialist dentists; D Brennan and AJ Spencer, unpublished data.

3.2 Allied dental labour force

In 2003 there were 2,687 employed practitioners in the allied dental labour force, comprising 1,242 dental therapists, 878 dental prosthetists and 577 dental hygienists. Dental prosthetists tended to be older, with an average age of 48.7 years and approximately 83% aged over 40 years. In contrast, dental hygienists were the youngest group, aged 36.5 years on average with approximately 37% aged over 40 years (Table 2).

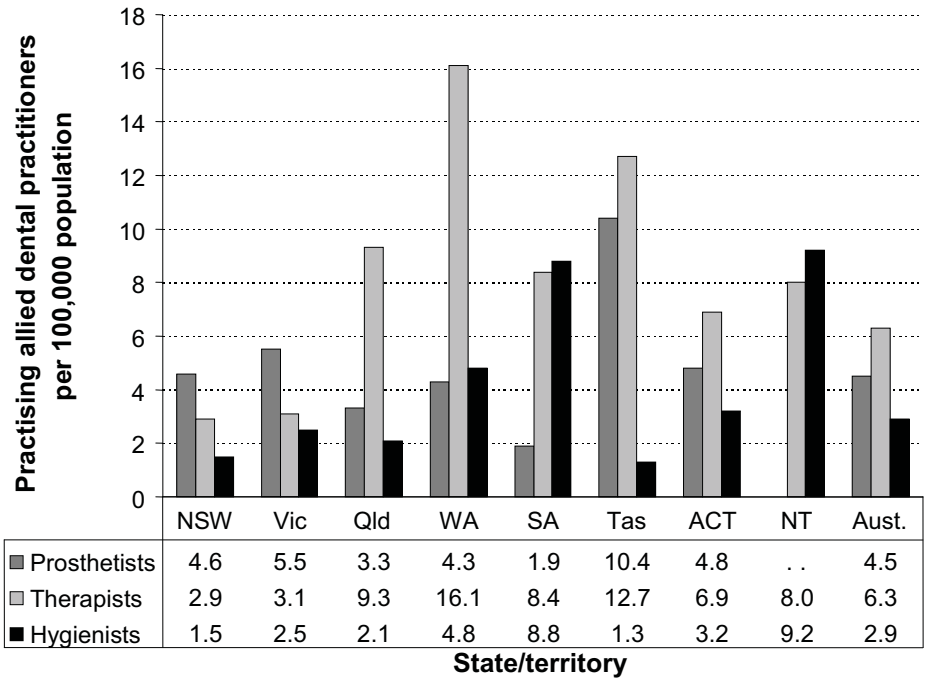
Dental prosthetists were predominantly male (90.8%), worked on average the longest working week (43.0 hours per week) and had the lowest rate of part-time workers (19.8%). Both dental hygienists and dental therapists were predominantly female and on average worked a similar working week (29.4 hrs and 29.5 hrs per week, respectively). The defining features between these two groups were that therapists worked predominantly in the public sector and were on average older than hygienists (40.3 years and 36.5 years, respectively) (Table 2).

Table 2: Allied dental labour force: selected characteristics, Australia, 2003

	Dental prosthetists	Dental therapists	Dental hygienists
Estimated number practising	878	1,242	577
Practising rate per 100,000 population	4.5	6.3	2.9
– capital cities	4.5	5.6	3.8
– rest of state	4.5	7.5	1.2
Percentage female	9.2	98.6	97.1
Average age	48.7	40.3	36.5
Percentage aged 40 years and over	82.4	62.7	36.5
Average hours usually worked per week	43.0	29.4	29.5
Percentage working part-time (<35 hrs per week)	19.8	56.3	63.3
Percentage working in the public sector	6.4	87.0	7.4

Sources: Tables A.5, A.6, A.7; Teusner et al. 2007.

Allied dental practising rates per 100,000 population varied greatly across jurisdictions. This variation can be accounted for by numerous factors including differences in scope of practice, availability of education and training, and differences in state and territory dental health policy (Figure 8).



	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust.
Prosthetists	4.6	5.5	3.3	4.3	1.9	10.4	4.8	. .	4.5
Therapists	2.9	3.1	9.3	16.1	8.4	12.7	6.9	8.0	6.3
Hygienists	1.5	2.5	2.1	4.8	8.8	1.3	3.2	9.2	2.9

Sources: Tables A.5, A.6, A.7; Teusner et al. 2007.

Figure 8: Practising allied dental practitioners per 100,000 population by state and territory, 2003

There have been only marginal changes in the numbers of practicing dental prosthetists and dental therapists in recent years. For dental prosthetists, the numbers have remained stable since 2000, with the number practising per 100,000 population decreasing marginally from 4.6 prosthetists in 2000 to 4.5 in 2003. For dental therapists, the numbers employed have declined by 5.7% since 2000, with a corresponding decline in the numbers practising per 100,000, from 6.9 therapists in 2000 to 6.3 in 2003. In contrast, the dental hygienist labour force has increased since 2000, with numbers employed increasing by 38.7% and the number practising per 100,000 population increasing from 2.2 hygienists in 2000 to 2.9 in 2003.

Allied dental practitioners' capacity to supply dental visits

As there is no practice activity data available for estimation of the number of dental visits supplied by allied dental practitioners, capacity to supply is calculated by adjusting estimates derived from the dental labour force data collection and dentists' practice activity data (LSDPA). The data used and estimates of annual supply rates for allied dental practitioners are shown in Table 3. Total allied dental supply is calculated by multiplying the number of practising practitioners by the percentage working in clinical practice and the estimated annual supply.

Table 3: Estimated number of dental visits supplied per annum per allied dental practitioner

	Dental therapists	Dental hygienists	Dental prosthetists
Hours per week[(a)]	29.40	29.50	43.00
Weeks per year[(b)]	43.26	43.26	44.60
Hours per year[(c)]	1,271.84	1,276.17	1,917.80
Patient visits per hour[(d)]	1.71	1.71	1.73
Patient visits per year[(e)]	2,174.85	2,182.25	3,317.79
Percentage in clinical practice[(f)]	96.2	96.8	41.5
Estimated number of employed practitioners, 2003[(a)]	1,242	577	878
Estimated supply of dental visits, 2003 (millions)[(g)]	2.60	1.22	1.21

(a) 2003 dental labour force data collection.
(b) 1998–99 LSDPA data, female dentists worked 43.26 weeks per year and male dentists worked 44.60.
(c) [Hours per week] x [weeks per year].
(d) 2003–04 LSDPA data, female dentists provided 1.71 visits per hour and male dentists provided 1.73.
(e) [Hours per year] x [patient visits per hour].
(f) 2003 dental labour force data collection.
(g) [Patient visits per year] x [percentage in clinical practice] x [no. employed].

The contribution of the allied dental labour force to total labour force supply was adjusted in order that their contribution to aggregate supply reflected the proportion of dental visits that they supplied independently of a visit to the dentist. This allowed reconciliation of aggregate supply estimates with demand estimates, as demand side data records a simultaneous visit to a dentist and a hygienist, or a therapist and a dentist, as one dental visit. For estimation of therapy visits supplied, total supply by therapists was reduced by 50% of the estimated supply by school dental service dentists. For hygienists, it was anecdotally reported that 1 in 5 patients visited a hygienist without receiving a consult from the dentist; hence, 20% of their total supply was counted towards aggregated supply. There was no discount applied to clinical visits supplied by prosthetists.

3.3 Review of previous dental labour force projections, 2000 to 2010

Dental labour force projections were previously published by ARCPOH (Teusner & Spencer 2003). These projections were calculated using 2000 dental labour force survey estimates as the baseline and a recruitment vector totalling 489 dentists at baseline. Components of the recruitment vector comprised Australian university graduates (217), migration (67), return from abroad (71) and return to practice after cessation of practice (205).

This projection estimated that by 2010 the total number of dental practitioners would increase to 12,749 (including allied dental practitioners) with an estimated capacity to supply 29.4 million visits (Table 4). When reconciled against the demand projections published at that time, it was concluded that capacity to supply would fail to meet potential demand for dental visits by an estimated 3.8 million visits (Teusner & Spencer 2003).

Table 4: Previous baseline and projected number of practitioners and visits, 2000 and 2010

	Number of practitioners		Number of visits (million)	
	2000	2010[(a)]	2000	2010[(a)]
Dentists	8,991	10,241	24.10	25.05
Dental therapists	1,260	1,196	2.36	2.24
Dental hygienists	398	522	0.85	1.10
Dental prosthetists	836	790	1.11	1.05
Total	**11,485**	**12,749**	**28.42**	**29.43**

(a) Medium supply projection, based on assumption that dentist productivity will continue to decline at 50% the rate of decline observed in the period 1983–84 to 1998–99.

Source: Teusner & Spencer 2003.

Dentists

The projected number of dentists compared with the actual estimates for 2003 are shown in Table 5. The previously published projection predicted a 5.0% increase in numbers of dentists, with male dentists projected to increase by 2.7% and females to increase by 12.9%. When compared to estimates from the 2003 Dental Labour Force Survey (Teusner et al. 2007), it was evident that the previous projections underestimated the growth in dentist numbers by almost 3 percentage points.

Table 5: Baseline data for the dentist labour force in 2000 and comparison of previous projections with actual practising dentists by sex, 2003

	2000 baseline data	2003 projection[(a)]	2003 actual[(b)]	Projected per cent change	Actual per cent change
Males	6,932	7,120	7,132	2.7	2.9
Females	2,059	2,325	2,546	12.9	23.7
Persons	**8,991**	**9,445**	**9,678**	**5.0**	**7.6**

Sources: (a) Teusner & Spencer 2003; (b) Teusner et al. 2007.

To understand the difference between the projected number and the actual number of dentists in 2003, all components and inputs of the model were examined.

A summary of the components of the recruitment vector for the original projection (Teusner & Spencer 2003) and actual numbers of those components (averaged for the years 2000 to 2003) are provided in Table 6.

An increase in number of recruits was observed across all components during the period 2000 to 2003, with recruitment on average totalling 613 dentists per annum, 25% more than the recruitment vector applied in the previous projection. The most notable change was the increase in the number of dentists returning from an extended stay abroad. Previous projections were based on an estimated 71 entrants per year whereas during 2000 to 2003, this figure had increased to an average of 110 per year.

In addition to greater numbers of entrants there was also a difference in the proportion of female to male graduates. Between 2000 and 2003 females represented 50% of all students completing a Bachelor of Dentistry, whereas the original projection assumed a continuation of the trend observed in the late 1990s, when female graduates comprised 40% of all graduates. A similar scenario occurred with overseas dentists migrating to Australia from countries where a recognition of qualifications policy exists (United Kingdom, Ireland and New Zealand); and in successful ADC candidates between 2000 and 2003 females were in the majority.

Table 6: Expected and observed estimates for recruitment vectors

	Recruitment vector (2000 baseline)			Average recruitment (2000–03)		
	Males	Females	Persons	Males	Females	Persons
Australian graduates	131	86	217	117	120	237
Migration	19	12	31	39	25	64
ADC	20	16	36	17	30	47
Return from abroad	44	27	71	68	42	110
Return to practice	86	48	134	85	70	155
Total recruitment	**300**	**189**	**489**	**326**	**288**	**613**

Comprehensive examination of the actual attrition rates was not possible as many state/territory datasets can not be linked from year to year. However, there appeared to be no evidence that the pattern or rate of attrition had altered from the rates used in the previous model.

In addition to the underestimation of total recruitment, the difference between the projected number of dentists and the observed number can also be partly accounted for by an underestimation of the Queensland dental labour force in 2000. Revised estimates indicated that the previous baseline was underestimated by approximately 80 dentists.

To cross-validate with the model previously used (Teusner & Spencer 2003), the updated recruitment vector for 2000 to 2003 was entered into the original projection model. The revised recruitment estimates accounted for the difference between the projected number of dentists and the actual number as presented in Table 5, thus providing a validation of the appropriateness of the attrition rates employed in the original model.

Allied dental practitioners

Previously published projections of allied dental practitioners appear to be in line with 2003 actual numbers with the exception of dental hygienists. Growth in the number of dental hygienists exceeded previous projections; actual recruitment levels were higher than previously estimated due of the establishment of new training courses.

Table 7: Baseline data for the allied dental labour force in 2000 and comparison of previous projections with actual employed allied dental practitioners, 2003

	2000 baseline data[(a)]	2003 projection	2003 actual	Projected per cent change	Actual per cent change
Dental therapists	1,260	1,248	1,242	–1.0	–1.4
Dental hygienists	405	450	578	11.1	42.7
Dental prosthetists	836	819	879	–2.0	5.1
Total	**2,501**	**2,517**	**2,699**	**0.6**	**7.9**

(a) *Source:* Teusner & Spencer 2003.

3.4 Refinement of supply projections

This section provides a summary of the revisions applied to the supply projection model. Greater detail of all assumptions and inputs is provided in Appendix B.

Dentists

Recruitment vector

A summary of the revised estimates that comprise the recruitment vector is provided in Table 8. Total recruitment per annum is estimated to be 642 dentists which is 31% more than the annual recruitment estimates applied in the previous model.

The estimates for migration and return from abroad were derived from the average arrival numbers from 2000 to 2006 Department of Immigration and Multicultural Affairs(DIMIA, analysed by the ABS) multiplied by the dental labour force employment rate for 2003 (84.9%). For the years 2003 to 2006 the actual numbers of successful ADC candidates were known and these were included in the recruitment vector, but for subsequent years a figure of 100 was assumed for ADC recruitment. This arbitrary number reflects the substantially higher number of candidates passing ADC exams in recent years but does not assume that these high (158 candidates in 2006) levels will continue. The Australian university graduate component for the first 5 years of the projection was based on the average number of completions between 2000 and 2004. From 2009 an additional 70 graduates were included to account for the first year of graduates from Griffith University (approximately 50 students commenced in 2004) and some incremental increase in the graduate numbers from the 5 dental schools established prior to 2004.

International graduates are not included as a component in the recruitment vector despite the fact that it is anecdotally known that many gain residency to live and practice in Australia post-graduation. They are excluded for two reasons. Firstly, the number of graduates falling into this category is unknown and secondly, it is believed that many would be included in the 'return from abroad' component of the recruitment vector.

In addition to updating recruitment figures, the return to practice (RTP) component (the percentage returning after cessation of practice for a period of 12 months or more) was recalculated using more recent data. Estimated RTP numbers alter each year as they are calculated by multiplying the RTP% by the number of dentists practising in the previous year of the projection (see Appendix B).

Table 8: Revised recruitment vector for dentist projections by sex

	Males	Females	Persons
Australian graduates (237 in 2003 to 2008, 307 in 2009 to 2020)	117	120	237
Automatic recognition (UK/NZ/Eire citizens)	29	28	57
ADC	50	50	100
Return from abroad	57	36	93
Return to practice (2003)	85	70	155
Total recruitment per annum	**338**	**304**	**642**

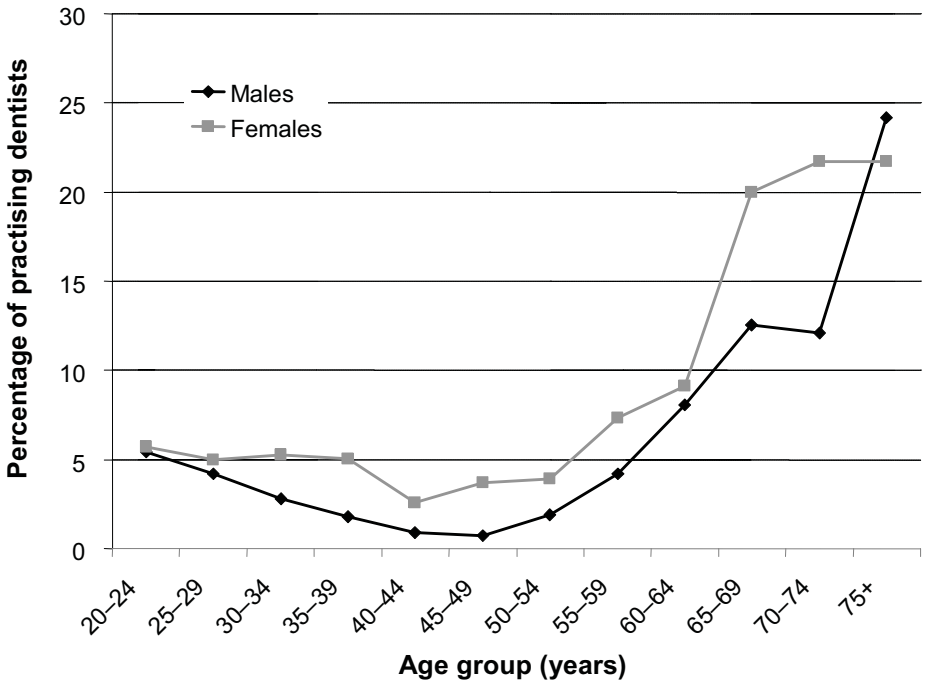
Notes

1. RTP estimates are a function of the number of dentists practising per year (see Appendix B). RTP numbers in this table are for 2003 and would increase through the course of the projection.
2. Automatic recognition and return from abroad (expatriate) components are estimated by averaging arrivals data over the period 2000 to 2006 and multiplying by the 2003 employment rate (84.9%).
3. For 2003 to 2006, the ADC component of the recruitment vector used the actual numbers of ADC candidates in those years.

Wastage vector

Attrition (wastage) rates were estimated for each sex and 5-year age group and used to develop a matrix of transitional probabilities. This matrix represents the probability that in the next year of the projection a dentist will stay in the same age group, move into the next age group or exit the stock of dentists. Female attrition rates were higher than those for males. For male dentists less than 30 years of age, attrition rates average approximately 5%. Rates continue to decline until age 45 to 49 years and then steadily increase as male dentists move towards retirement. For female dentists, attrition rates remain around 5% until 40 years of age, decline slightly and then increase in the 50 to 54 years age group and older (Figure 9).

Although the revised projections use the same wastage rates as previous projections (Teusner & Spencer 2003), the matrix of transitional probabilities has been recalculated using slightly adjusted assumptions relating to the movement between age groups (see Appendix B for more detail).



Source: Teusner & Spencer 2003.

Figure 9: Practising dentists, estimated attrition rates by age and sex

For the first year of the revised supply projection (2003), overall attrition rate is 4.8% of employed female dentists. This rate increases marginally to 5.2% by 2017 and then remains stable to 2020. For male dentists, the attrition rate is 3.6% at baseline, increases to 4.3% in 2014 and then remains stable to 2020.

Allied dental practitioners

Recruitment vector

A revised recruitment vector was developed for dental therapists and dental hygienists based on updated information on actual enrolments in courses (Table 9). Most training courses produce dual-qualified graduates but it is uncertain what proportion will practise in dental hygiene versus dental therapy. Hence an arbitrary assumption was made that 50% of graduates from dual-qualified courses would practise as hygienists and 50% as therapists. An RTP component was included in the recruitment vector for hygienists and therapists.

Table 9: Revised recruitment vector for allied dental practitioners (baseline 2003)

	Dental hygiene	Dental therapy	Dental prosthetics
Australian graduates	164	74	30
Return to practice (baseline)	8	16	–
Total recruitment per annum	172	90	30

Note: RTP estimates are a function of the number of practitioners practising per year (see Appendix B). RTP numbers in this table are for 2003 and would increase through the course of the projection. For hygienists and therapists the RTP rate was set at 50% of the rate for female dentists (2.6%).

Wastage vector

Although the revised projections use the same attrition rates as the original projections, the matrix of transitional probabilities has been recalculated using standardised assumptions of the movement between age groups (see Appendix B for more detail).

The dental hygiene and dental therapy projections used the same attrition rates that were applied to female dentists but with a 50% loading. The dental prosthetist projection used the same attrition rates that were applied to male dentists.

3.4 Revised supply projections, 2003 to 2020

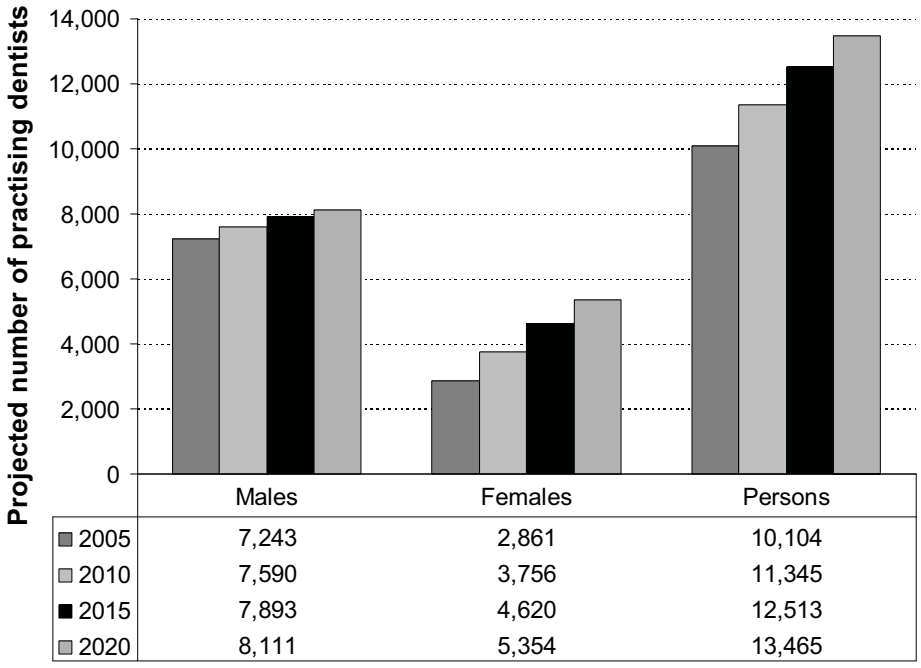
The number of practitioners in each occupational group was projected to the year 2020. Between 2005 and 2020 the number of dentists is projected to increase by 33.3%, from an estimated 10,104 dentists in 2005 to 13,465 in 2020. The projected increases vary across the allied dental groups from a 137.8% increase for dental hygienists to a 5.3% decrease for dental therapists and an 8.7% decrease for dental prosthetists (Table 10). The decreases in these two occupational groups are related to the predicted increase in the number of practitioners retiring or ceasing practice over the next decade.

Table 10: Projected number of practitioners by occupational group, 2005, 2010, 2015 and 2020

	Projected number of employed practitioners				Per cent increase
Occupational group	2005	2010	2015	2020	2005 to 2020
Dentists	10,104	11,345	12,513	13,465	33.3
Dental therapists	1,271	1,300	1,261	1,204	–5.3
Dental hygienists	831	1,339	1,705	1,977	137.8
Dental prosthetists	860	841	816	786	–8.7
Total	**13,067**	**14,825**	**16,296**	**17,431**	**33.4**
	Projected number of employed practitioners per 100,000 population				
Dentists	49.5	52.7	55.2	56.6	14.3
Dental therapists	6.2	6.0	5.6	5.1	–18.8
Dental hygienists	4.1	6.2	7.5	8.3	3.9
Dental prosthetists	4.2	3.9	3.6	3.3	–21.7

Sources: Tables D.3 and D.4.

The projected growth of the dentist labour force by sex is shown in Figure 10. The number of practising female dentists is projected to more than double by 2020, increasing from 2,861 in 2005 to a projected 5,354 in 2020. In contrast, the number of male dentists is projected to increase by 12%, from 7,243 in 2005 to 8,111 in 2020. The difference in growth rates is mainly due to the differences in age distribution of male and female dentists. Although recruitment of females and males is expected to be relatively similar over the course of the projection, the projected numbers of dentists ceasing practice is substantially higher for male dentists.

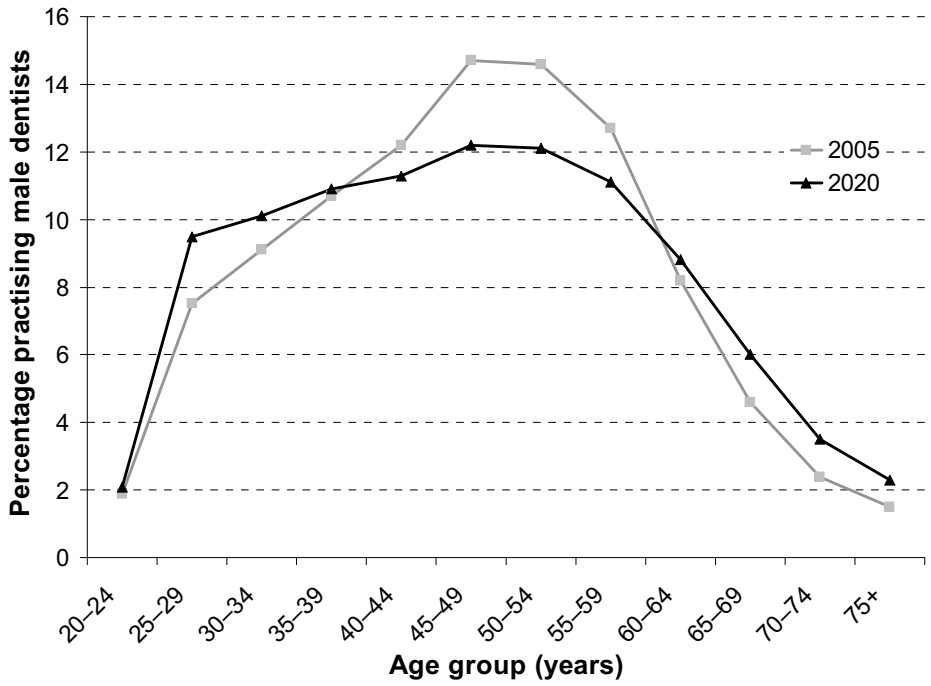


	Males	Females	Persons
2005	7,243	2,861	10,104
2010	7,590	3,756	11,345
2015	7,893	4,620	12,513
2020	8,111	5,354	13,465

Source: Appendix D.

Figure 10: Projected number of dentists by sex and year

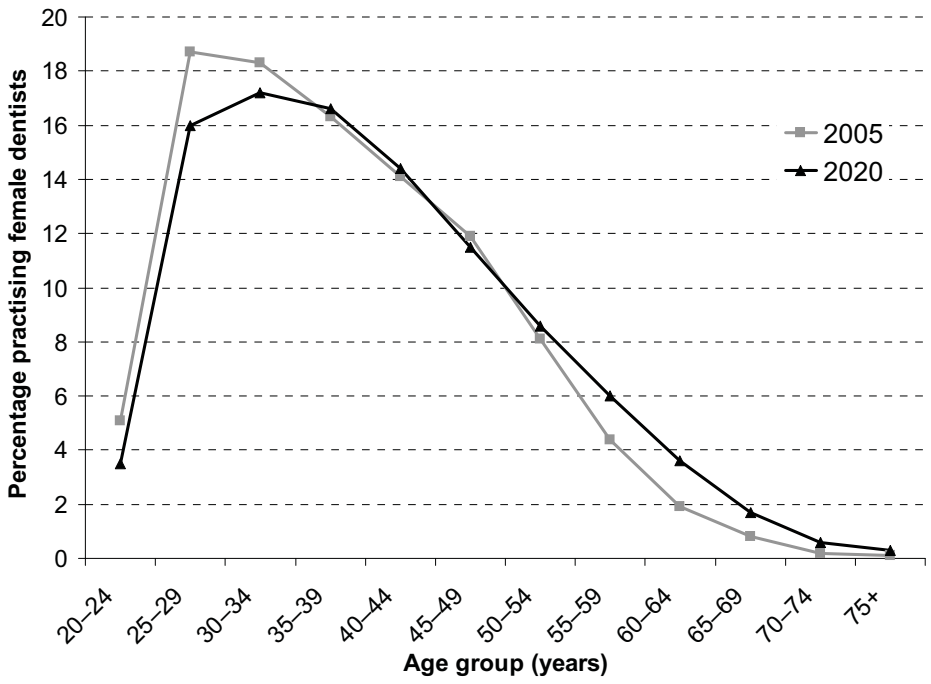
For male dentists the shape of the age distribution is projected to flatten slightly by 2020, with the percentage aged between 40 and 60 years dropping from 54.2% in 2005 to 46.7% in 2020 (Figure 11).



Source: Appendix D.

Figure 11: Percentage male dentists by age group, 2005 and 2020

The age distribution of female dentists is expected to alter slightly, with the percentage of females under the age of 35 years expected to decrease from 42.1% to 36.7% while those aged 50 years and over are expected to increase from 15.5% in 2005 to 20.8% by 2020 (Figure 12).



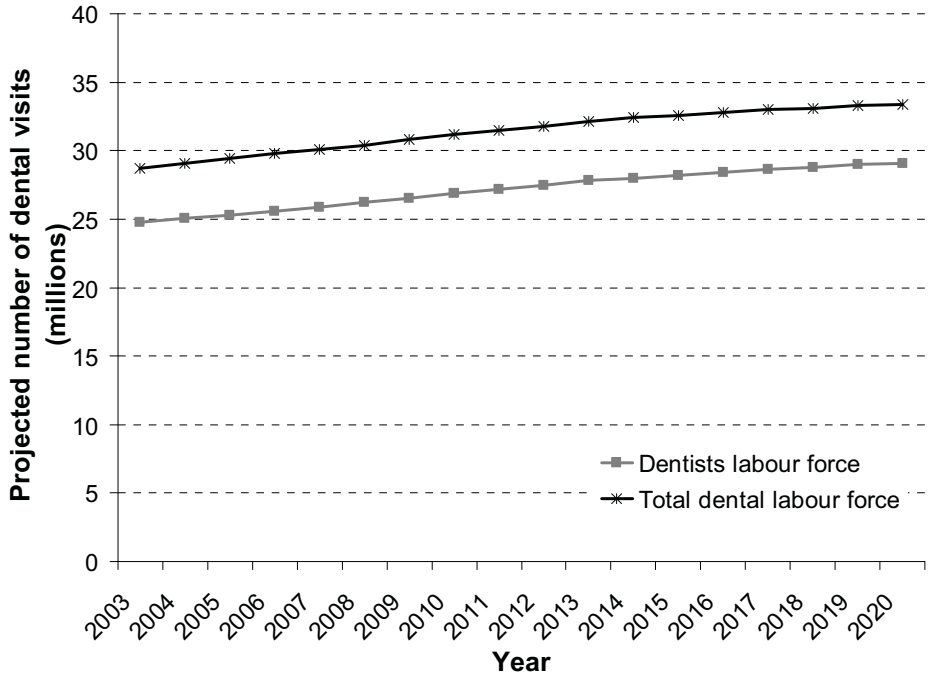
Source: Appendix D.

Figure 12: Percentage female dentists by age group, 2005 and 2020

To estimate the projected supply of dental visits by dentists in 2020 the numbers of practising dentists were multiplied by age and sex specific supply rates (Table D.2). Over the past 40 years the length of a visit has been increasing as has the number of services supplied at a visit. As the number of hours worked per week has remained stable, the number of visits supplied has therefore declined substantially over that period (Brennan & Spencer 2006). It is unlikely that this decline in productivity, in terms of visits supplied per annum, will suddenly discontinue; however it is also uncertain whether it can continue at the previous rate. Hence it is assumed that the number of visits supplied per annum per dentist will continue to decline at half the rate was observed over the period 1983–84 to 2003–04 (see Appendix B).

To estimate the projected supply of dental visits by allied dental practitioners, the numbers of practising allied dental practitioners were multiplied by the occupation-specific supply rates (Table 3).

Total projected supply of dental visits is expected to increase from approximately 29.5 million visits in 2005 to 33.7 million visits in 2020. Visits provided by dentists are the greatest component, increasing from 25.5 million to 29.4 million visits over the same period. Allied dental practitioners provided approximately 4.1 million visits in 2005 and are projected to increase to 4.3 million visits by 2020 (Figure 13). This revised projection is referred to as the 'standard supply projection' in the following sections of this report.



Notes

1. Only allied visits supplied independent of a dentist visit are included in aggregated total dental labour force supply (see Appendix B). In terms of all visits supplied by allied dental practitioners, the allied dental labour force is projected to supply 7.8 million visits by 2020 (see Table D.4).
2. In the following sections of this report, the 'Total dental labour force' projection is referred to as the 'standard supply' projection.
3. The 'dentists labour force' projection assumes that supply rates will continue to decline at half the rate of decline observed in the period 1983–84 to 2003–04.

Figure 13: Projected number of dental visits supplied, 2003 to 2020

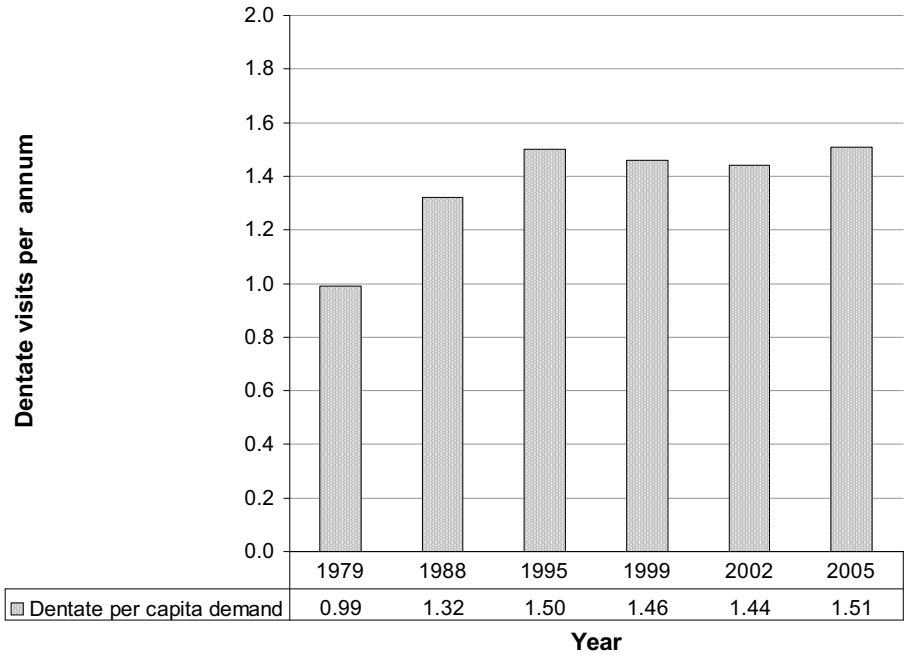
4 Demand for dental visits

This section estimates the demand for dental visits in Australia. Previous projections are briefly reviewed and the components that comprise the projection model are examined and refined, followed by revised demand projections for dental visits from 2005 to 2020. For the purposes of this report, the word 'demand' is used synonymously with reported use. For an outline of the demand projection model see Section 2.2 and for greater detail on methods and inputs into the demand model see Appendix D.

4.1 Demand for dental care

Per capita demand is represented by the average number of dental visits per person per year. It is estimated independently for dentate and edentulous persons as demand among edentulous persons is substantially lower than that for dentate. If PCD were shown for all persons (dentate and edentulous), changes observed over time would be confounded with changes in the rate of edentulism, which has declined dramatically for at least the last three decades (Carter & Stewart 2003).

Total PCD for dentate persons increased substantially between 1979 and 1995, from 0.99 to 1.50 dental visits per year, declined slightly in 1999 and 2002, and increased in 2005 (Figure 14). Demand for dental visits by edentulous persons has also increased over this period, from 0.30 visits per edentulous person in 1979 to 0.67 in 2005; however, growth has not been linear.



Sources: 1979 (ABS), 1988 (NOHSA), 1995–2005 (NDTIS).

Figure 14: Per capita demand, dentate persons by year

The historical growth in demand for dental visits is also evidenced by data from the ABS National Health Survey. The percentage of people reporting that they received a dental consult in the 2 weeks prior to being surveyed has increased. In 1989–90 an estimated 51.6 persons per 1000 population made a dental consultation increasing to 58.8 persons per 1000 population in 2004–05 (ABS 1996, 2006).

Increases in demand for dental visits by dentate persons varied by age group. For the youngest age groups, (aged 5–11 and 12–17 years), PCD increased substantially between 1979 and 1995 and then remained stable. There has been little change in demand since 1979 by younger adults (aged 18–24 and 25–34 years); however, in the 45 years and older age groups, there have continued to be marginal increases in demand (Table 11).

Table 11: Dentate per capita demand by age group and year, 1979 to 2005

	Age groups (years)									
Year	5–11	12–17	18–24	25–34	35–44	45–54	55–64	65–74	75+	Total
1979	1.18	1.49	1.15	1.06	0.97	0.82	0.91	0.75	0.69	0.99
1988	1.65	1.90	1.13	1.06	1.23	1.13	1.26	1.26	1.13	1.32
1995	1.85	2.17	1.34	1.11	1.41	1.52	1.54	1.49	1.40	1.50
1999	1.56	2.40	1.09	1.15	1.40	1.47	1.53	1.44	1.35	1.46
2002	1.63	2.14	1.14	1.08	1.33	1.44	1.68	1.39	1.51	1.44
2005	1.64	2.17	1.27	1.14	1.33	1.55	1.71	1.63	1.53	1.51

Note: This table presents PCD for dentate persons only. Demand among edentulous persons is substantially lower than that for dentate persons. If PCD were shown for all persons (dentate and edentulous), changes observed would be confounded with changes in the rate of edentulism.

Reasons for the recent plateau in growth in PCD are not fully understood. However, it is unlikely that improvements in oral health are related to this effect as there were substantial gains in oral health status during past decades where strong growth in use was also observed. One potential explanation may be that the capacity to supply visits by the labour force is capping growth in demand, in effect a supply infrastructure 'bottle neck'. Alternatively, limited growth in demand could be related to accessibility issues, for example affordability and regional misdistribution of service providers.

Review of previous demand projections for dental visits, 2000 to 2010

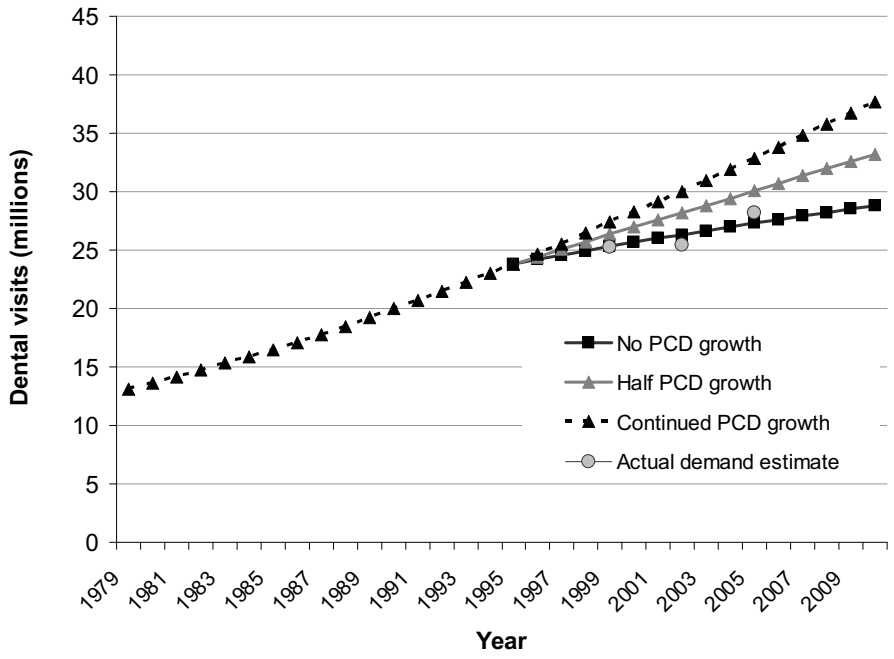
Previously published projections of demand for dental visits (Spencer et al. 2003) were calculated from a 1995 baseline to 2010. Per capita demand at baseline was estimated from 1995 NDTIS data and the projection used ABS population projections series K.

Historical increases in PCD were analysed and three projections of age-specific PCD rates were calculated. These rates were used to produce three projections of demand for dental visits— 'no PCD growth', 'half PCD growth' and 'continued PCD growth'.

Under the 'no PCD growth' projection, increase in demand was solely due to population increases, demographic change and changes in rates of edentulism. Age-specific PCD rates were held constant; hence, there was an assumption that previously observed growth in PCD rates would not continue. In 1995 there was an estimated 23.8 million dental visits made to dental professionals. The 'no PCD growth' projection estimated that demand would increase to 28.8 million visits by 2010, a 21% increase. Under the 'continued PCD growth' projection the previously observed increases in demand per capita were assumed to continue at the same rate into the future. This projection

estimated that total demand in 2010 would be 37.7 million, a 32.7% increase. The 'half PCD growth' projection, which assumed that demand would continue to increase at 50% the rate of previously observed growth, estimated that demand would be 33.2 million dental visits by 2010, a 16.9% increase.

Using recent NDTIS data published since the previous projections, the number of dental visits made in 1999, 2002 and 2005 were estimated. The 1999 and 2002 estimates were 24.7 million and 25.5 million visits respectively. These estimates fell slightly below the 'no PCD growth' projection. The estimate for 2005, 28.2 million visits, was slightly above the 'no PCD growth' projection, but well below the 'half PCD growth' projection (Figure 15).



Source: Spencer et al. 2003.

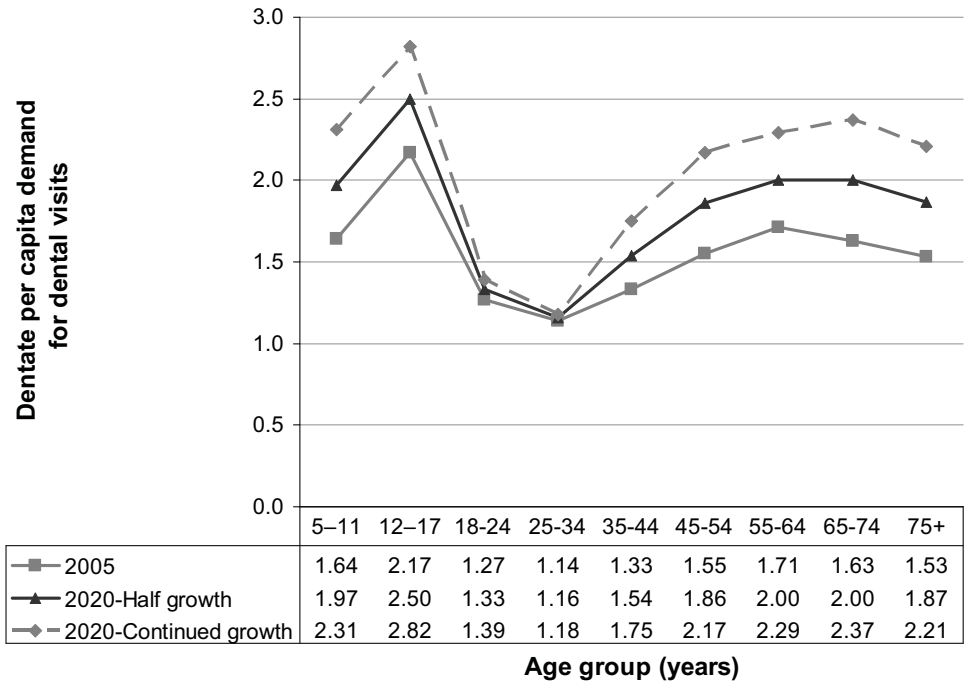
Figure 15: Demand estimates, 1979 to 1995, 1999, 2002 and 2005, and previous demand projections for dental visits, 1995 to 2010

Revised demand projections, 2005 to 2020

Revised demand projections were calculated from a 2005 baseline to 2020. The revised projections are based on three different projections of growth in PCD. The 'no PCD growth' projection assumes no growth in demand, while the 'continued PCD growth' assumes that the rate of growth observed between 1979 and 1995 will continue from 2005. Similarly the 'half PCD growth' projection assumes that demand will continue at half the rate observed in the same period.

As the projected growth in PCD is based on previously observed growth, the percentage growth varies by dentate status and age group. The projected demand for dentate persons under the 'half PCD growth' and 'continued PCD growth' scenarios is shown in Figure 16. Under the 'continued PCD growth' scenario, the largest increases in dentate demand occur in the two age groups 65–74 years and 75 years and older (both increase by 45% by 2020). In contrast, there is only a 3% increase in demand in the 25–34 years age group by 2020.

For edentulous persons, demand increases from 0.67 to 0.83 visits under the 'half PCD growth' scenario and to 0.96 visits under the 'continued PCD growth' scenario.

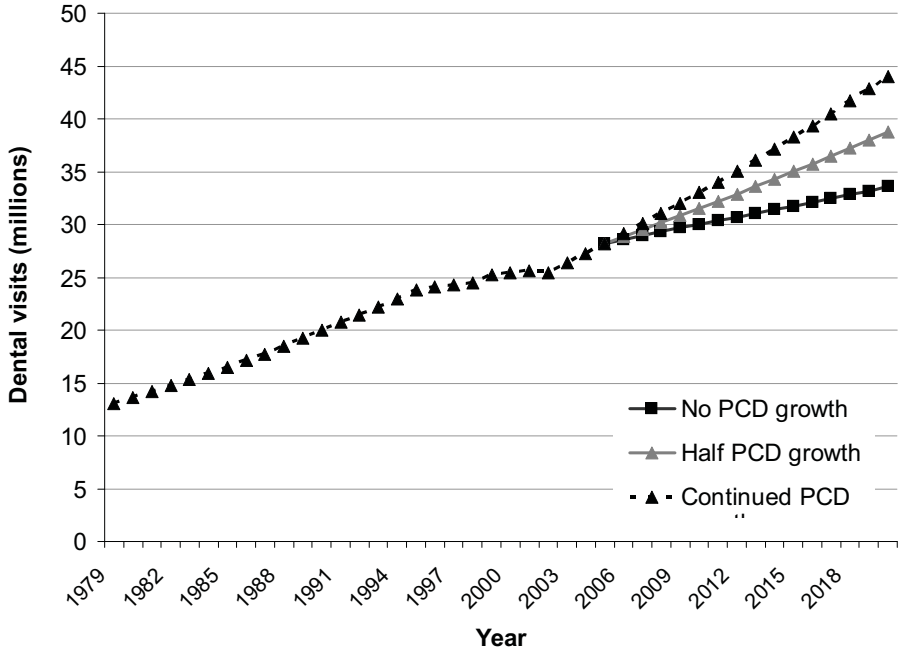


	5–11	12–17	18-24	25-34	35-44	45-54	55-64	65-74	75+
2005	1.64	2.17	1.27	1.14	1.33	1.55	1.71	1.63	1.53
2020-Half growth	1.97	2.50	1.33	1.16	1.54	1.86	2.00	2.00	1.87
2020-Continued growth	2.31	2.82	1.39	1.18	1.75	2.17	2.29	2.37	2.21

Figure 16: Dentate per capita demand for dental visits, 2005, and projected demand, 2020, by age group

There are two key revisions to the demand projection—both effectively result in creating a 'no PCD growth' projection that is approximately 1 million visits greater than the original 'no PCD growth' projection. First, the revised demand model, using an updated projection of rates of edentulism based on more recent data, estimates slightly lower rates of edentulism in 2010 and 2020 than rates applied in the previous demand model. Second, population projections updated to the most current projections available at the time of publication (ABS 2003 population projections series 8) predict approximately 1 million more persons in Australia by 2020 than the population projections applied in the previous model (see Appendix D for full details of demand projection inputs and assumptions).

Under the 'no PCD growth' projection, demand for dental visits is projected to increase from 28.2 million visits in 2005 to 33.6 million in 2020 (an increase of 19%). Under the 'half PCD growth' and 'continued PCD growth' projections, demand in 2020 is projected to be 38.8 million and 44.0 million visits respectively (Figure 17).



Note: The 'no PCD growth' model keeps age-specific demand for dental visits constant and therefore represents the increase due solely to population and demographic changes, and changes in the rate of edentulism. 'Continued PCD growth' assumes that demand increases at the same rate as the increase observed between 1979 and 1995.

Source: Spencer et al. 2003.

Figure 17: Demand for dental visits, 1979 to 2005, and revised demand projections, 2005 to 2020

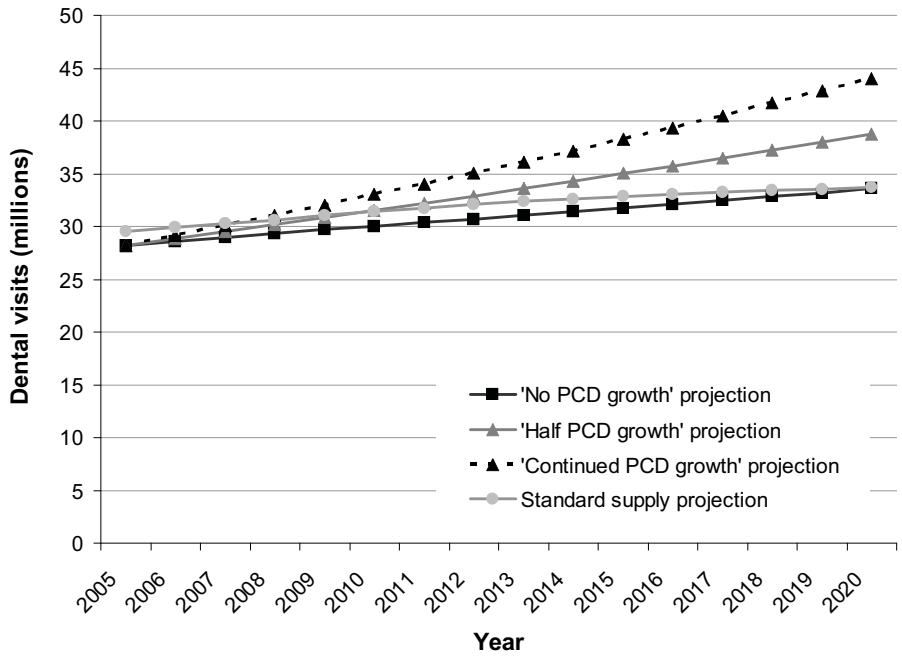
The 'no PCD growth' projection keeps age-specific demand for dental visits constant and therefore represents the increase due solely to changes in population, demographic changes and changes in the rate of edentulism. Under the 'no PCD growth' projection population growth is the most substantial driver of increase in demand. Declining edentulism increases demand but to a much lesser extent than population change. Changing the demographic profile or the ageing of the population, due to lower PCD of older Australians, makes a negligible contribution to the projected growth in demand. If all other factors were held constant, but the population continued to age, demand for dental visits would effectively not change (marginal increase of 0.1%) between 2005 and 2020.

5 Reconciling supply and demand

Supply of and demand for dental visits are estimated via very different methods using different datasets and different time periods for establishing trends. Therefore it is unlikely that the estimates would be the same for a given point in time. The estimate of supply for 2005 (29.5 million visits), from a data baseline of 2003, was slightly higher than the demand estimate for the same year (28.2 million visits). It is not expected that such estimates would be similar because each is surrounded by a notional 'confidence interval' or level of uncertainty. Further, the projection inputs reflect the average annual inputs over the course of the projection and will not always match the actual inputs for each year of the projection. Hence, the projections illustrate trends over time and are not intended to forecast precise levels of supply or demand at given point in time.

The standard supply projection estimates that the number of visits supplied by the dental labour force will increase to 33.7 million by 2020. This is marginally higher than the estimated demand for dental visits under the 'no PCD growth' projection (33.6 million visits) but falls well short of the 'half PCD growth' projection which estimates demand increasing to 38.8 million visits by 2020. The gap between the standard supply projection and the 'half PCD growth' projection equates to an approximate shortfall of 1,800 dental providers in 2020 (based on current rates of supply) (Figure 18).

However, the standard supply projection can be conceived of as a very conservative projection which does not reflect the impact on supply if new schools are established or current high levels of successful ADC candidates were to continue. The impacts of these potential events are assessed in the following section (Section 6).



Notes

1. The 'no PCD growth' model keeps age-specific demand for dental visits constant and therefore represent the increase due solely to changes in population, demographic changes and changes in the rate of edentulism. 'Continued PCD growth' assumes that demand increases at the same rate as the increase observed between 1979 and 1995.
2. For details of the inputs and assumptions of the standard supply projection see Section 3.4 and Appendix B.
3. The number of visits supplied by therapists and hygienists has been discounted so that their contribution to total labour force supply reflects the number of visits they most likely supply independent of a dentist visit.

Figure 18: Reconciliation of revised demand and supply projections for dental visits, 2005 to 2020

6 Capacity to supply dental visits: impact of changes in key inputs

This section investigates the potential outcomes of various policy directions by assessing the impact of changes in key inputs or existing trends on supply projections of dental visits. The sensitivity of supply projections to various changes is assessed by comparing alternative scenarios against what is referred to as the standard projection. The standard projection and its inputs are described in Section 3.4.

6.1 Impact of increased numbers of dental graduates

Increasing numbers of dentist graduates

In 2003 there were five Australian dental schools; Griffith University commenced an undergraduate course in 2004. Under the standard supply projection the number of graduates entering the labour force was 237 per year until 2008, increasing to 307 per year from 2009. Taking into account the 5-year lag between commencement and completion of a dentistry course, the earliest possible time that changes in the numbers of dentistry places would be evident in the labour force (at time of publication) is 2013.

To explore the impact of increasing graduate numbers on the supply of dental visits, three scenarios were modelled—increases in graduate completions of 70, 140 and 210 in 2013. Increments of 70 were chosen as an approximation of an additional dental school plus incremental increases in current dental school numbers. Hence, the first scenario (+70) would approximately simulate the impact on supply of opening an additional dental school in 2008, while the second scenario (+140) simulates 2 additional dental schools in 2008 and so forth.

The standard projection results in a 33.3% increase in numbers of dentists, from 10,104 in 2005 to 13,465 in 2020. Increasing the number of graduates by 70 in 2013, increases the projected number of dentists to 13,995 in 2020, 3.9% more dentists than the standard projection. The capacity to supply dental visits under this scenario projected to be 34.8 million visits in 2020, 3.3% more visits than the standard projection (33.7 million visits). The second scenario, a 140 increase in graduate completions in 2013, results in a projected 7.9% more dentists than the standard projection and a corresponding increase in supply of 6.7%, while the third scenario, an additional 210 graduates, results in 11.8% more dentists than the standard and 10.0% additional dental visits supplied in 2020 (Table 12).

Table 12: The impact of increases in numbers of dentistry course completions, projected number of dentists, dentists per 100,000 population and total dental visits supplied, 2005, 2010, 2015 and 2020

Scenario[a]	2005	2010	2015	2020	Per cent increase, 2005 to 2020	Per cent increase over standard projection
Number of employed dentists						
Standard projection	10,104	11,345	12,513	13,465	33.3	. .
+70 graduates	10,104	11,345	12,720	13,995	38.5	3.9
+140 graduates	10,104	11,345	12,926	14,524	43.7	7.9
+210 graduates	10,104	11,345	13,133	15,054	49.0	11.8
Employed dentists per 100,000 population						
Standard projection	49.5	52.7	55.2	56.6	14.3	. .
+70 graduates	49.5	52.7	56.1	58.8	18.8	4.0
+140 graduates	49.5	52.7	57.0	61.1	23.2	7.9
+210 graduates	49.5	52.7	58.0	63.3	27.7	11.8
Total dental labour force supply, number of visits[b] (millions)						
Standard projection	29.52	31.41	32.84	33.70	14.1	. .
+70 graduates	29.52	31.41	33.30	34.82	18.0	3.3
+140 graduates	29.52	31.41	33.76	35.95	21.8	6.7
+210 graduates	29.52	31.41	34.23	37.07	25.6	10.0

(a) The standard projection has no additional graduates in 2013 and is based on 237 graduates for 2003 to 2008 and 307 graduates for 2009 to 2020. The +70 scenario has an additional 70 graduates per year from 2013 (a total of 377), the +140 scenario has an additional 140 graduates per year from 2013 (a total of 447), and the +210 scenario has an additional 210 graduates per year from 2013 (a total 517 graduates).

(b) Includes visits provided by allied dental practitioners. Only unique visits, i.e. visits supplied independent of a visit of a dentist, are counted towards total labour force supply.

Increasing numbers of allied dental practitioner graduates

In recent years there has been the emergence of a new university-based qualification, the Bachelor of Oral Health (BOH). Graduates of this course can practice either as a dental hygienist or dental therapist. In 2003 the number of graduates from these courses was relatively small but numbers of dual-qualified hygienists and therapists are expected to grow rapidly throughout the current decade. The work patterns of these dual-qualified allied dental professionals is currently uncertain and, at the time of publication, there appeared to be no indication in the labour force data of the future work patterns of BOH graduates. Graduates may not be evenly split across the two professions, may favour (or employers may favour) movement into one occupational area over the other; alternatively, they may practise in both simultaneously. While there is considerable uncertainty about the future roles and practice of these two groups, several hygiene (non dual qualified) courses still operate; hence, separate projections of the dental therapist and hygienist labour force were conducted.

When projecting the number of dental visits supplied by therapists and hygienists, the numbers were discounted such that only visits supplied independently of a visit to a dentist were counted towards the estimate of supply by the entire labour force (see Appendix B). This allows reconciliation of supply estimates with demand estimates, as demand side data records a simultaneous visit to a dentist and hygienist, or a therapist and dentist, as one dental visit.

Dental hygienists were discounted to a greater degree than therapists as they provide fewer unique visits. Consequently, assumptions about the movement of BOH graduates into one profession versus the other have implications for the projected overall supply of dental visits.

Several scenarios with differing assumptions about the future occupational role of BOH graduates were assessed (in each of these scenarios recruitment for dental prosthetists was not altered). The first scenario assumes that 50% of BOH graduates will practise principally as therapists and 50% principally as hygienists (standard projection, 50/50 split). The second scenario was based on a ratio of hygienists to therapist of 30/70 and the third scenario was the converse of the second (70/30). Under the 30/70 split scenario, where more BOH graduates practise as therapists than hygienists, allied supply was projected to be 12.1% more than that projected under the standard projection (50/50 scenario, 4.82 million visits). In contrast, under the 70/30 split scenario, it was projected that supply of allied dental visits would be 12.8% less than the standard projection (3.75 million visits) (Table 13). The impact on total dental labour force supply is negligible as the contribution of allied supply is relatively small compared to that of dentists.

Table 13: The impact of changes in the hygienist to therapist graduate ratio on the projected numbers of therapists and hygienists and contribution of total allied dental visits to total dental supply, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase over standard projection
	Number of employed allied dental practitioners				
Standard projection, 50/50 split					
Therapists	1,271	1,300	1,261	1,204	. .
Hygienists	831	1,339	1,705	1,977	. .
Hygienist/therapist split, 30/70					
Therapists	1,327	1,468	1,513	1,520	26.2
Hygienists	773	1,165	1,445	1,651	–16.5
Hygienist/therapist split, 70/30					
Therapists	1,213	1,126	1,000	877	–27.2
Hygienists	887	1,507	1,957	2,292	15.9
	Total allied labour force supply, number of visits[(a)] (millions)				
Standard projection (50/50 split)	4.06	4.31	4.35	4.30	. .
30/70 split	4.15	4.59	4.77	4.82	12.1
70/30 split	3.96	4.01	3.91	3.75	–12.8
	Total dental labour force supply, number of visits[(a)] (millions)				
Standard projection (50/50 split)	29.52	31.41	32.84	33.70	. .
30/70 split	29.61	31.69	33.26	34.21	1.5
70/30 split	29.42	31.11	32.40	33.14	–2.0

(a) Includes visits provided by allied dental practitioners. Only unique visits, visits supplied independent of a visit to a dentist, are counted towards total labour force supply.

Note: Assumptions of standard projection: the dental hygienist projection was based on annual recruitment of 172 per year (including RTP) and a discounted supply rate of 20% of 2,182.25 per clinically practising hygienist. The dental therapist projection was based on annual recruitment of 90 (including RTP) and a supply rate of 2,174.85 per clinically practising therapist discounted by approx 50% of the estimated supply of school dental dentists. The dental prosthetist projection was based on annual recruitment of 30 and a supply rate of 3,317.79 per clinically practising prosthetist.

The following scenario investigates the impact on allied dental supply and the total dental labour force supply if numbers of hygienist and therapist graduates were to increase. The additional graduates are assumed to be evenly split across the two professions. The earliest that an increase in commencements could be realised is 2008; hence, increases in the stock of allied dental practitioners would be evident from 2010. Under this scenario, the additional contribution of allied dental visits to overall supply would be 1 million visits, 23.7% more than under the standard projection (Table 14). Aggregate supply for the total dental labour force would increase by 3.0% to 34.7 million visits.

Table 14: The impact of increasing therapist/hygienist graduate numbers from 2010 on the projected contribution of allied dental visits to total dental supply, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase over standard projection
Number of employed allied dental practitioners					
Standard projection					
Therapists	1,271	1,300	1,261	1,204	. .
Hygienists	831	1339	1705	1977	. .
+100 per year					
Therapists	1,271	1,350	1,517	1,613	34.0
Hygienists	831	1,339	1,925	2,358	19.3
Total allied labour force supply, number of visits (millions)					
Standard projection	4.06	4.31	4.35	4.30	. .
+100 per year	4.06	4.41	4.98	5.32	23.7
Total dental labour force supply, number of visits[(a)] (millions)					
Standard projection	29.52	31.41	32.84	33.70	. .
+100 per year	29.52	31.51	33.47	34.71	3.0

(a) Includes visits provided by allied dental practitioners. Only unique visits, i.e. visits supplied independently of a visit to a dentist, are counted towards total labour force supply.

Note Assumptions of standard projection: the dental hygienist projection was based on annual recruitment of 172 per year (including RTP) and a discounted supply rate of 20% of 2,182.25 per clinically practising hygienist. The dental therapist projection was based on annual recruitment of 90 (including RTP) and a supply rate of 2,174.85 per clinically practising therapist discounted by approx 50% of the estimated supply of school dental dentists. The dental prosthetist projection was based on annual recruitment of 30 and a supply rate of 3,317.79 per clinically practising prosthetist.

6.2 Changes in numbers of successful ADC candidates

Policies directed at increasing graduate numbers provide a reliable and long term supply outcome; however, the lead time is at least 5 years. In comparison, migration of overseas-trained dentists into Australia provides a solution with a shorter lead time.

Currently there are two pathways for overseas-trained dentists to gain registration in Australia. Dentists who gained their qualifications in the United Kingdom, Ireland or New Zealand are automatically recognised by state and territory registration boards. Entrants from other countries are required to pass the ADC's three-stage examination process taking approximately 2–4 years. Numbers of successful ADC candidates have increased markedly in recent years from 37 in 2002 to 158 in 2006. This is largely due to the following factors: there have been substantial increases in the numbers applying, dentist migration is encouraged, and they are able to apply to migrate via the professionals and other skilled migrant program as dentists have been included on DIMIA's 'Australia's skilled occupation list'. There have also been new preparatory programs developed to assist overseas graduates in successfully passing ADC exams, an increase in the number of locations where the examinations can be taken, and a higher frequency at which the examinations are offered.

In the future, the numbers of overseas-trained dentists may be influenced by migration policies and by world events, which may alter the attractiveness of Australia as a migration destination.

To explore the possible impact of changing numbers of ADC candidates, three scenarios were modelled: the standard projection assuming 100 ADC candidates per year, the second scenario assuming 50 candidates per year and the third scenario assuming 150 per year. The second scenario projects 4.8% less dentists than the standard projection, and 4.3% less visits supplied in 2020, or approximately 1.4 million visits. The third scenario projects that by 2020 there will be 4.3% more visits supplied than the standard projection (Table 15).

Table 15: The impact of changes in the numbers of ADC candidates, projected number of dentists and dental visits supplied, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase over standard projection
			Number of employed dentists		
Standard projection (100 per year)	10,104	11,345	12,513	13,465	. .
50 per year	10,104	11,149	12,048	12,821	–4.8
150 per year	10,104	11,542	12,942	14,108	4.8
			Total dental labour force supply, number of visits[(a)] (millions)		
Standard projection (100 per year)	29.52	31.41	32.84	33.70	. .
50 per year	29.52	30.95	31.87	32.27	–4.3
150 per year	29.52	31.86	33.82	35.12	4.2

(a) Includes visits provided by allied dental practitioners. Only unique visits, i.e. visits supplied independently of a visit to a dentist, are counted towards total labour force supply.

6.3 Changes in dentists' attrition and retention rates

Research on dentists' job satisfaction has found that, while dentists are generally satisfied, there are areas of concern (Luzzi et al. 2005). Issues such as 'burn out', lack of autonomy and musculoskeletal complaints are perceived to be related to retention. Hence, it is not inconceivable that policies addressing these issues may influence the levels of attrition, either for the labour force overall or for specific age and sex subgroups.

Lengthening the working life of dentists

Dentist attrition rates are at their lowest for dentists in their forties and increase as they age (Figure 9), attrition of male dentists increasing from less than 1% in the 45–49 years age group to approximately 8% in the 60–64 years age group. Policies aimed at lengthening the working life of dentists until the age of 65 years may influence the relatively higher attrition rates observed in this age group.

To explore the effect of changes in the attrition rates for dentists aged 50–64 years of age, two scenarios were projected. In each scenario the attrition rates were incrementally adjusted over the period of the projection in order to simulate the gradual change that a policy initiative directed at influencing retention would incur.

The first scenario, low attrition, assumes that current attrition rates will incrementally decline and be 30% lower by 2020. The second scenario examines the impact if attrition was to increase by 30%.

Compared to the standard projection, the low attrition scenario would result in an estimated 1.6% increase in the total number of dental visits supplied (or 0.47 million visits). In contrast, the high attrition condition would result in an estimated 1.5% decrease in the number of visits supplied (or 0.50 million visits) (Table 16).

Table 16: The impact of changes in attrition rates of dentists aged 50 to 64 years, projected numbers of dentists and visits supplied, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase over standard projection
			Number of employed dentists		
Standard supply projection (observed attrition rates)	10,104	11,345	12,513	13,465	. .
Low attrition (–30%)	10,110	11,398	12,658	13,736	2.0
High attrition (+30%)	10,099	11,293	12,375	13,215	–1.9
			Total dental labour force supply, number of visits[(a)] (millions)		
Standard supply projection (current attrition rates)	29.52	31.41	32.84	33.70	. .
Low attrition (–30%)	29.53	31.52	33.14	34.23	1.6
High attrition (+30%)	29.51	31.29	32.56	33.20	–1.5

(a) Includes visits provided by allied dental practitioners. Only unique visits, i.e. visits supplied independently of a visit to a dentist, are counted towards total labour force supply.

Decreasing attrition of female dentists

Currently the overall attrition rates for female dentists are on average higher than those for male dentists (estimated to be 4.8% for females and 3.6% for males). There is evidence in the wider workforce that female participation in the labour force is increasing. Women's participation in the Australian labour force is projected to increase in all age groups except the 15 to 19 years and 65 years or older groups. The largest increase in participation rates is expected to occur in the 55–59 years age group (ABS 1999). Therefore, it seems logical to expect that the same social and economic pressures shaping these trends in the wider workforce may also impact on female dentists, ultimately leading to increases in their participation rates. Alternatively policies may be implemented that specifically address retention of female dentists.

To explore the impact on supply if female dentist attrition rates were to decline, two scenarios were assessed. The first scenario assumes that the overall female attrition rate will become similar to male attrition by 2020. Hence, female attrition rates were reduced by 20% in each age group. In the second, more conservative scenario, female dentist attrition was reduced by 10% by 2020. In each scenario the attrition rates were incrementally adjusted over the period of the projection in order to simulate the gradual change that would likely occur.

Under the first scenario (20% decline) projected supply by 2020 would be 1.8% more than estimated by the standard projection and under the second scenario (10% decline) projected supply would total 0.9% more then the standard projection (Table 17).

Table 17: The impact of declining female attrition rates, projected number of dentists and dental visits supplied, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase over standard projection
			Number of employed dentists		
Standard supply projection (observed attrition rates)	10,104	11,345	12,513	13,465	. .
Decline in attrition rates (–20% by 2020)	10,108	11,388	12,649	13,763	2.2
Decline in attrition rates (–10% by 2020)	10,106	11,366	12,581	13,611	1.1
			Total dental labour force supply, number of visits[(a)] (millions)		
Standard projection (observed attrition rates)	29.52	31.41	32.84	33.70	. .
Decline in attrition rates (–20% by 2020)	29.53	31.50	33.13	34.31	1.8
Decline in attrition rates (–10% by 2020)	29.52	31.45	32.98	34.00	0.9

(a) Includes visits provided by allied dental practitioners. Only unique visits, i.e. visits supplied independently of a visit to a dentist, are counted towards total labour force supply.

6.4 Shifts in productivity trends

For the purposes of the supply projections, productivity is assessed in terms of visits supplied per dentist per annum. The average number of dentist visits supplied per year has been declining for the last four decades. The number of services per visit and the average length of a visit increased between 1983–84 and 2003–04, while the average hours worked per week remained stable (Table 1). It is considered unlikely that this trend will suddenly stabilise; however, the number of visits supplied cannot continue to decline indefinitely, and at some stage this trend should slow and stabilise. The standard supply projection assumes that visits supplied per annum will continue to decline at half the rate that was observed from 1983–84 to 2003–04, and this was considered a conservative scenario.

In order to show the impact of changes in productivity, two scenarios were produced. The high supply scenario assumes that the number of visits will remain static at the 2003–04 supply rate and therefore ignores the observed historical decline in productivity. The low supply scenario assumes that the number of visits will continue to decline at the same rate observed between 1983–84 and 2003–04, and the 'standard' supply projection assumes that decline will continue at half this rate. The high supply scenario predicts that there will be an additional 10.7% visits supplied in 2020 above the standard projection, an increase of 3.6 million visits (Table 18).

Table 18: The impact of changes in productivity and projected number of visits supplied, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase standard over projection
			Number of employed dentists[(a)]		
Standard supply projection	10,104	11,345	12,513	13,465	. .
			Total dental labour force supply, number of visits[(b)] (millions)		
High supply projection (no decline in productivity, supply rates remain static)	29.86	32.70	35.24	37.30	10.7
Standard projection (productivity declining at 50% observed rate)	29.52	31.41	32.84	33.70	. .
Low supply projection (productivity declining at 100% observed rate)	29.18	30.11	30.44	30.09	–10.7

(a) Projected number of employed dentists is as per the standard projection under all productivity scenarios. Productivity scenarios vary the levels of visits supplied per dentists but there are no changes in the projected number of practitioners.

(b) Includes visits provided by allied dental practitioners. Only unique visits, i.e. visits supplied independently of a visit to a dentist, are counted towards total labour force supply.

Note: The number of projected dentists does not alter under these scenarios as only the rates of supply are altered, (see Appendix B).

6.5 Summary

The projected supply for dental visits in 2020 is compared in Figure 19 according to the various scenarios presented in the previous sections against the 'no PCD growth' and 'half PCD growth' projections. All supply scenarios assessed except the 'continued decline in productivity' scenario exceeded the 'no PCD growth' projection (33.6 million visits) but none exceeded the 'half PCD growth 'projection (38.8 million visits) (Figure 19).

In summary, the standard supply projection was the most sensitive to differing productivity assumptions. The standard supply projection assumes that productivity will continue to decline but only at half the rate of decline observed in the previous two decades. The two productivity scenarios, that is 'no decline' and 'continuation of decline', serve to illustrate the extremes. The absolute difference between these scenarios and the standard projection is approximately 3.6 million visits by 2020, equates to approximately 1,300 dental providers (based on current productivity levels).

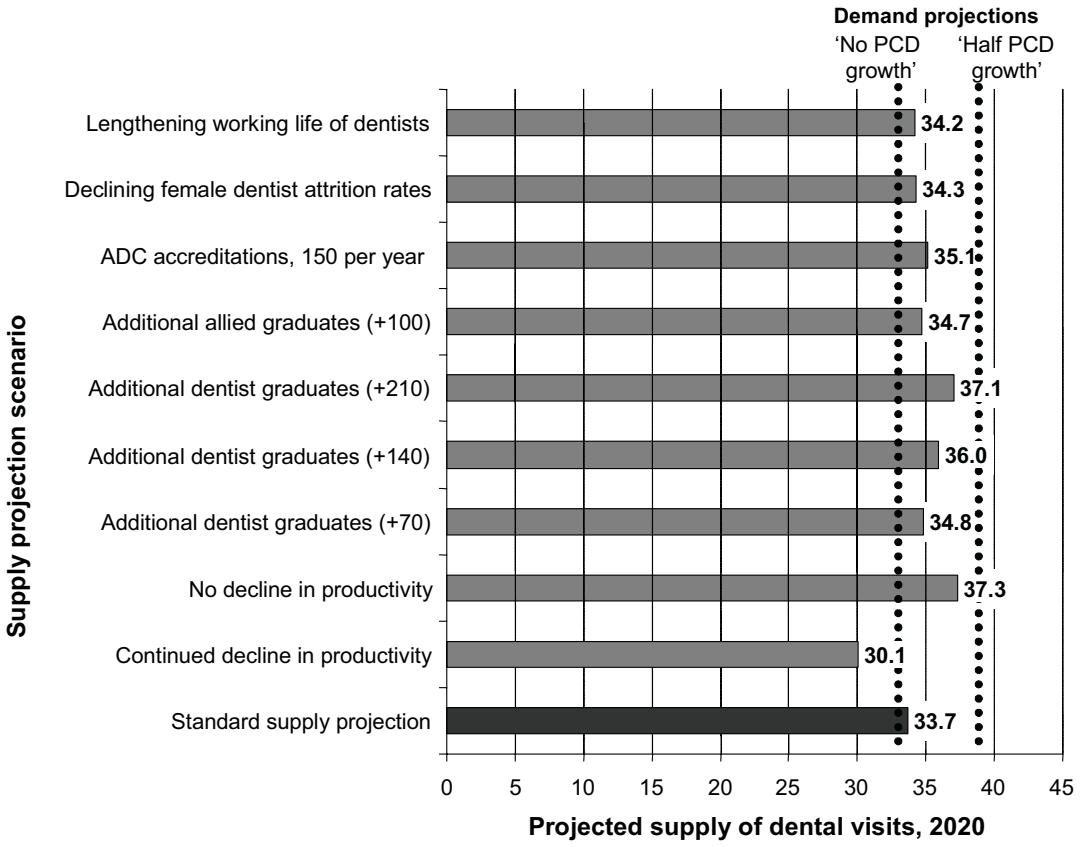
Increases in dentist recruitment beyond the standard projection recruitment levels (307 graduates per year) also resulted in substantial increases in supply above the 'no PCD growth' projection. If dentist graduates were to increase by 140 (totalling 447 graduates per year from 2013), excess supply above the 'no PCD growth' projection, would be 2.2 million visits by 2020. There would be approximately an additional 800 dental providers in comparison to the standard supply projection.

Changes in the numbers of successful ADC candidates have an immediate impact on supply relative to changes in domestic graduate numbers. Changes in ADC numbers can be increased without the lead-time associated with training dentists. However, projections based on 150 ADC candidates per year would only increase supply capacity by 1.4 million visits by 2020.

The standard projection model appeared least sensitive to changes in attrition rates. The scenarios examined were relatively conservative, with small changes being incrementally implemented to reflect the gradual impact of any attrition/retention-related policy initiative. Hence, if these changes in attrition did occur, they would have a greater impact on a supply projection that progressed for another decade, i.e. to 2030. Attrition may also be influenced by changes in social trends and expectations, or changes in macro-economic conditions. For example, it has been well documented that one of the key determinants of retirement intentions is the expected level of post-retirement income; consequently, if superannuation fund growth were to decline or shift negative, as it did in the early 1990s, retirement rates may be affected.

Increases in numbers of allied dental practitioners did not have as great an impact as similar increases in dentist graduates. Allied dental practitioners do not have the same level of productivity as dentists (in terms of visits supplied per annum). However, the limited impact of allied dental practitioner increases is largely an artefact of the discounting of allied dental visits so that their contribution to total aggregate supply reflects only the number of unique visits supplied by allied dental practitioners.

It is unlikely that these scenarios will occur in isolation as represented in the preceding sections. For the impact on supply if one or more scenarios simultaneously occur, refer to Appendix H.



Notes

1. 'No PCD growth' projection estimates demand for dental visits to be 33.6 million visits by 2020. See section 3.4 for assumptions of 'half PCD growth' projection.
2. 'Half PCD growth' projection estimates demand for dental visits to be 38.8 million by 2020. See section 3.4 for assumptions of 'half PCD growth' projection.
3. Total dental labour force supply includes visits supplied by allied dental practitioners. Only allied visits supplied independently of a visit to a dentist are counted towards the total labour force supply.

Figure 19: Projected total number of dental visits supplied by various scenarios, 2020

7 Demand for dental visits: impact of changes in key inputs

This section investigates the potential outcome of various policy directions by examining the impact of changes in key inputs or shifts in existing trends on demand projections for dental visits. Per capita demand (PCD) is the product of the percentage accessing dental care in the previous 12 months and the mean number of visits made by those accessing. The various scenarios presented in the following sections assess the impact if either or both of these factors were to alter. The sensitivity of demand projections to various changes is assessed by comparing alternative scenarios against what is referred to as the 'no PCD growth' projection. The 'no PCD growth' projection and its inputs are described in section 4.1.

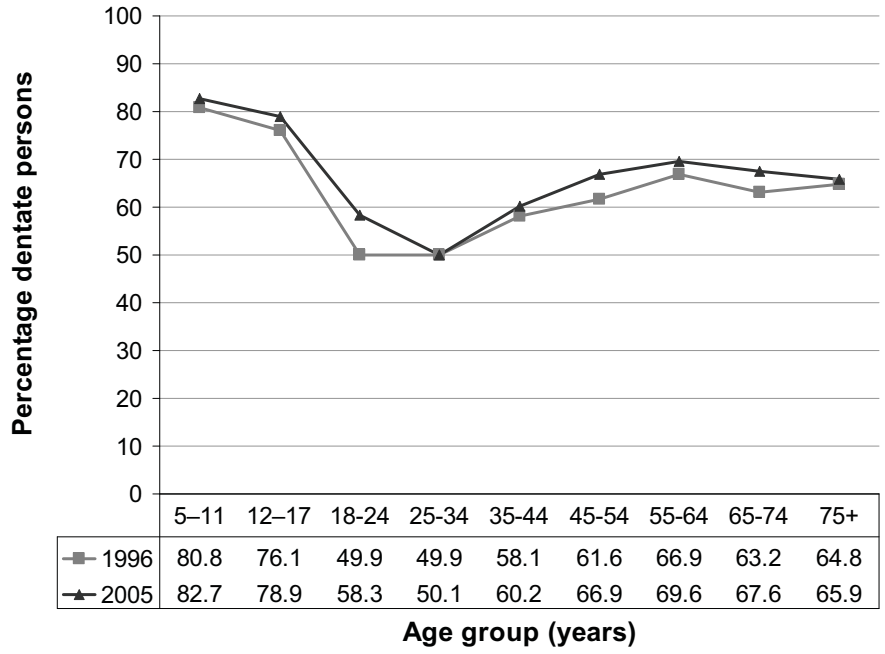
7.1 Shifts in patterns of accessing dental care

Access to dental care

The percentage of dentate persons accessing dental care in the last 12 months is a key indicator of access to dental care and is a measure of recentness of the last visit. Accessing dental care annually is a well-known recommendation by the dental profession. Some of those visits will be for a check-up, while others will be to receive treatment to resolve a problem.

Over the last decade the percentage of dentate persons accessing dental care has increased marginally. In 1996 the percentage of dentate persons reporting that they had visited a dental provider in the previous 12 months was 61.8%; this increased marginally to 65.2% by 2005.

The percentage accessing dental care varies by age group; in 2005 dentate persons in the two age groups aged 17 years or younger had the highest percentages accessing dental care in the previous 12 months (82.7% and 78.9%). The percentage accessing dental care declined substantially in early adulthood (18 to 34 years of age) and increased among older adults, with 55–64-year-olds having the highest percentage (69.6%) of the adult age groups, visiting in the previous 12 months (Figure 20). For dentate people of all ages, 9.0% had not visited in the last 5 years (including those who had never visited).



Sources: NDTIS 1996, 2005.

Figure 20: Percentage dentate persons accessing dental care in the last 12 months, 1996 and 2005

In 2005, of those dentate persons who had visited in the last 12 months nearly two-thirds (61.2%) cited 'check-up' as the reason for their last visit and over one-third (38.8%) cited that their reason for last visit was for a problem.

Among edentulous persons, 19.8% had made a dental visit in the previous 12 months and nearly half (44.9%) had not visited in the last 5 years.

Various policy directions could potentially influence patterns of access; barriers to access such as affordability and regional maldistribution of providers could be addressed via government oral health policy initiatives. The proposed sections examine the impact on demand projections if levels of access to dental care were to alter. The following scenarios examine the impact on total demand by varying access among dentate persons only; demand by edentulous persons is not altered as they are a small component of total demand. The impact of altering access for persons under 18 years of age is not examined as this group, at a population level, has high levels of access and therefore it is unlikely that changes in levels of access for this group would make substantial differences.

Impact if dentate persons not currently accessing dental care gain access

This scenario tests the sensitivity of the demand projection model if dentate persons not accessing care in the previous 12 months were to access care at half the rate and one-quarter the rate of those who had accessed in the previous 12 months.

For example, in 2005, 65.9% of dentate persons 75 years or older made an average of 2.32 dental visits in the previous 12 months. Under this scenario the additional demand for visits by dentate persons 75 years or older would be calculated by multiplying the remaining 34.1% of persons in that age group by 1.16 visits (50% of 2.32 visits) and 0.58 visits (25% of 2.32 visits).

If those not currently accessing care in a 12 month period were to access care at a quarter the rate of those accessing, then the estimated demand for dental visits by 2020 would be 37.89 million visits, 12.9% more than demand under the 'no PCD growth' scenario. For the scenario of increased access at half of the average number of visits, total demand in 2020 would be 25.9% higher than projected demand under the 'no PCD growth' scenario (Table 19).

Table 19: Projected demand for dental visits if access increased for dentate persons currently not accessing care in a 12-month period, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase over 'no PCD growth' projection
	Number of visits (millions)				
'No PCD growth' projection	28.21	30.01	31.76	33.55	. .
Increased access, 25% of average number of visits	31.82	33.85	35.86	37.89	12.9
Increased access, 50% of average number of visits	35.44	37.70	39.95	42.24	25.9

Impact of increased access to dental care by dentate adults aged 18 to 54 years

Dentate persons in the 18 to 54 years age groups typically have lower rates of accessing dental care than other age groups. Hence this scenario tests the sensitivity of the demand projection model if an increased percentage of dentate persons aged 18 to 54 years accessed care in a 12-month period.

For example, in 2005, 58.3% of dentate persons aged 18 to 24 years accessed dental care in the previous 12 months. Under this scenario the additional demand for visits by dentate persons in this age group would be calculated by multiplying an additional 10% and 20% of persons by the average number of visits (2.18 visits) made by those currently accessing care in a 12-month period.

In comparison to the 'no PCD growth' projection, demand for dental visits in 2020 would increase by 7.8% if an additional 10% of dentate persons aged 18 to 54 years accessed dental care, and by 15.6% if an additional 20% accessed care (Table 20).

Table 20: Projected demand for dental visits if access increased for dentate persons aged 18 to 54 years, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase over 'no PCD growth' projection
	Number of dental visits (millions)				
'No PCD growth' projection	28.21	30.01	31.76	33.55	. .
Additional 10% of dentate persons aged 18 to 54 years accessing care in 12-month period	30.60	32.49	34.32	36.17	7.8
Additional 20% of dentate persons aged 18 to 54 years accessing care in 12-month period	32.99	34.97	36.88	38.78	15.6

Impact of increased access to dental care by dentate adults aged 55 years or older

In 2005, persons 55 years or older comprised 24% of the total population, and this is projected to increase to 31% by 2020. In addition, the proportion of edentulous persons in this age group is projected to decline, from 19.5% in 2005 to 11.0% in 2020.

Despite overall PCD remaining relatively stable over the last decade, there have been incremental increases in demand for dentate persons aged 55 years or older. Furthermore, dentate baby boomers will have more teeth to maintain than dentate persons in this age group in previous decades (Slade et al. 2007). Therefore, apart from the consequences of any shifts in oral health policy aimed at influencing access for this age group, it appears likely that demand will continue to grow in this age group. Hence, this scenario aims to test the sensitivity of the demand projection model if an increased percentage of dentate persons aged 55 years or older accessed care in a 12-month period.

For example, in 2005, 69.6% of dentate persons aged 55 to 64 years accessed dental care in the previous 12 months. Under this scenario the additional demand for visits by dentate persons in this age group would be calculated by multiplying an additional 10% and 20% of persons by the average number of visits (2.45 visits) made by persons currently accessing care in a 12-month period in this age group.

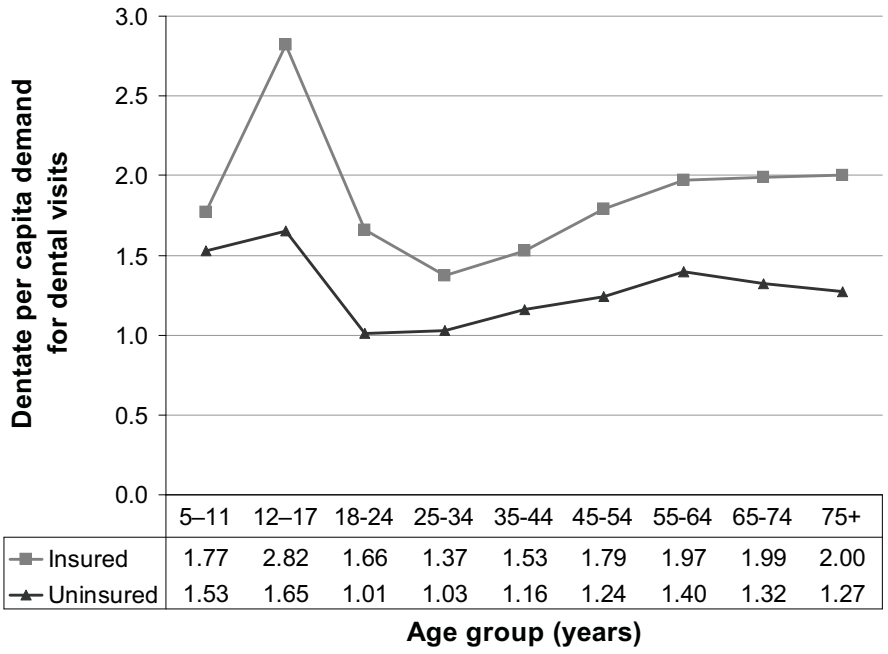
In comparison to the 'no PCD growth' projection, demand for dental visits in 2020 would increase by 4.7% if an additional 10% of dentate persons aged 55 years or older accessed dental care, and by 9.4% if an additional 20% accessed care (Table 21).

Table 21: Projected demand for dental visits if access increased for dentate persons aged 55 years or older, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase over 'no PCD growth' projection
	Number of dental visits (millions)				
'No PCD growth' projection	28.21	30.01	31.76	33.55	. .
Additional 10% of dentate persons aged 55+ years accessing care in 12-month period	29.15	31.13	33.10	35.14	4.7
Additional 20% of dentate persons aged 55+ years accessing care in 12-month period	30.09	32.26	34.45	36.72	9.4

7.2 Changes in levels of dental insurance coverage

In 2005, 46.9% of dentate Australians held dental insurance. Per capita demand rates for dentate persons were substantially higher for insured persons in all age groups (Figure 21).



Source: NDTIS 2005.

Figure 21: Dentate per capita demand by insurance status and age group, 2005

Although demand varies by insurance status, there is no evidence in Australia to suggest that the patterns of consumption would change greatly if an insured person were to become uninsured or the converse. The rebate recovered by insurance leaves a considerable gap, averaging only 49% of costs incurred (Slade et al. 2007). Access to dental care is associated with both income and insurance status, and insurance status is also associated with income; therefore, cross-sectional associations between access to dental care and dental insurance are confounded by income and not necessarily causal (Carter & Stewart 2003).

In the period 1998 to 2000 an additional 13% of Australians gained hospital insurance coverage, an increase of 39%. This increase was related to the federal *Private Health Insurance Incentives Act 1998* (30% rebate) and the introduction of Lifetime Community Rating in 1999 (Butler 2002). Since those policy initiatives, the percentage of persons covered by health insurance has remained relatively stable; however, it is not inconceivable that new policy initiatives may influence levels of insurance coverage in the future.

Although it is unknown whether a dramatic change in the level of dental insurance coverage would result in a shift in access patterns, this scenario examines the potential impact if levels of dental insurance coverage were to alter.

Impact if dental insurance coverage decreased/increased

In this scenario the impact of changes in levels of insurance coverage is assessed by assuming that if an uninsured person were to become insured their PCD would be the same as a currently insured person in the same age group. Similarly, if an insured person was to become uninsured, their PCD would decline to the demand of an uninsured person. Demand for visits by edentulous persons was not recalculated.

If an additional 10% of dentate persons gained dental insurance, demand for dental visits in 2020 would be 4.1% greater than the level of demand projected under the 'no PCD growth' scenario, while if insurance coverage was to fall by 10%, demand would be lower by 3% (Table 22).

Table 22: Projected demand for dental visits if dental insurance coverage altered, 2005, 2010, 2015 and 2020

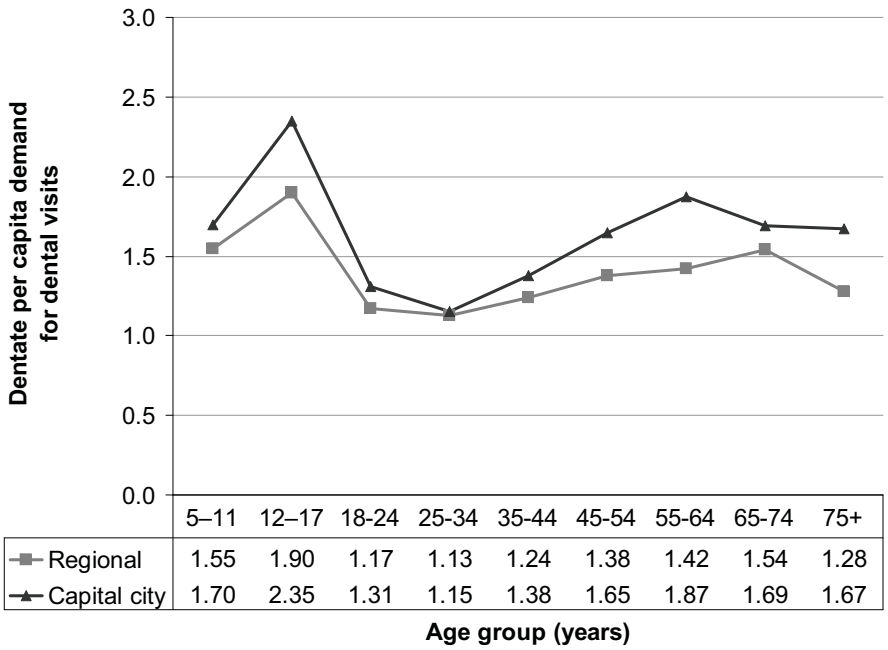
Scenario	2005	2010	2015	2020	Per cent increase over 'no PCD growth' projection
	Number of dental visits (millions)				
'No PCD growth' projection	28.21	30.01	31.76	33.55	. .
Insurance coverage increased (+10%)	29.38	31.25	34.00	34.94	4.1
Insurance coverage decreased (–10%)	27.42	29.16	31.69	32.56	-3.0

7.3 Increased access to dental care by regional dwellers

In 2005, 37.8% of the population lived outside capital city areas (as defined by ABS statistical divisions). Differences in oral health status of regional versus metropolitan dwellers has been well documented; for example, in 2005 the percentage of edentulous persons in regional areas was higher than in capital city areas (9% compared to 5%) (Slade et al. 2007)

Access to dental care also varies by geographic location. Those in 'urban' areas are more likely to have made a dental visit in the previous 12 months than 'rural' or 'remote' dwellers. In 2002, 58.2 % of dentate adults (aged 18 years or older) had visited a dental provider in the last 12 months compared to 53.1% for 'rural' dwellers and 50.5% for 'remote' dwellers (AIHW DSRU 2005).

Per capita demand of dentate persons living in capital city locations was higher in all groups compared with those living in regional locations (Figure 22).



	5–11	12–17	18-24	25-34	35-44	45-54	55-64	65-74	75+
Regional	1.55	1.90	1.17	1.13	1.24	1.38	1.42	1.54	1.28
Capital city	1.70	2.35	1.31	1.15	1.38	1.65	1.87	1.69	1.67

Source: NDTIS 2005.

Figure 22: Dentate per capita demand by location of dwelling, 2005

Impact if access for regional dwellers increased

This scenario attempts to estimate the impact on demand projections if regional dwelling dentate persons were to access dental care at the same rate as dentate persons living in capital cities.

This was calculated by multiplying the PCD for dentate persons residing in capital city areas in a given age group by all dentate persons in that age group. Compared to the projected growth under the 'no PCD growth' scenario, the increased access for regional dwellers scenario resulted in an additional 5.4% demand for dental visits in 2020 (Table 23).

Table 23: Projected demand for dental visits if regional dwelling dentate persons accessed dental care at the same rate as those in capital city areas, 2005, 2010, 2015 and 2020

Scenario	2005	2010	2015	2020	Per cent increase over 'no PCD growth' projection
	Number of visits (millions)				
'No PCD growth' projection	28.21	30.01	31.76	33.55	. .
Regional dwellers increase access to same level as capital city dwellers	29.66	31.59	33.44	35.36	5.4

7.4 Summary

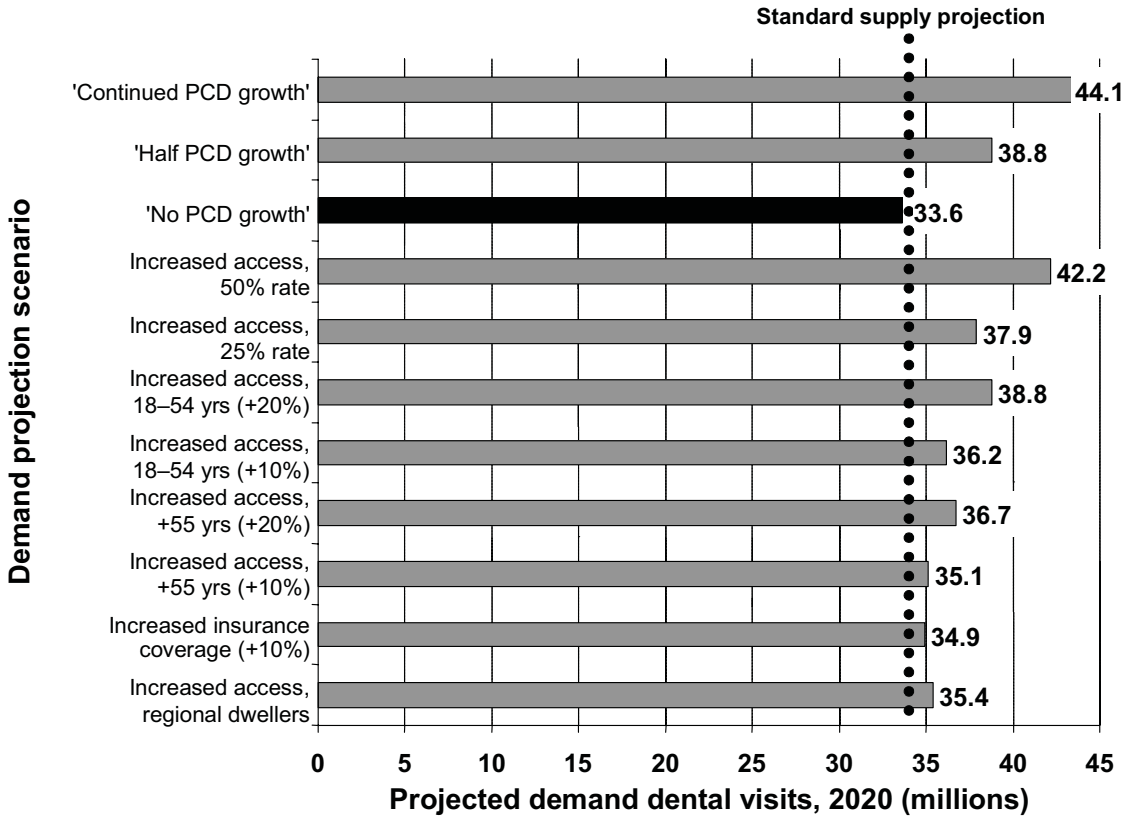
Two aspects of dental visiting influence the PCD for visits—the percentage accessing dental care in the previous 12 months and the mean number of visits made by those accessing. The various scenarios presented in the preceding sections assessed the impact if either or both of these factors were to alter. The projected demand in 2020 is compared under three different assumptions of growth in PCD and by the various scenarios assessed in the preceding sections (Figure 23).

The demand projections were very sensitive to differing assumptions of growth in PCD. The greatest impact was observed under the 'continued PCD growth' scenario, where PCD was assumed to continue growing from 2005 at the same rate of growth observed from 1979 to 1995.

Substantial increases in demand above the 'no PCD growth' scenario were observed in the scenarios which examined the impact if all dentate persons currently not accessing care in a 12-month period were to access care at 25% and 50% of the rate of those currently accessing.

The demand projection model was least sensitive to changes in levels of insurance coverage, which assumed that if an uninsured dentate person gained insurance they would demand at the same rate as those currently insured.

With the exception of the scenario of increased access for all dentate persons at 50% of the rate of those currently accessing, all scenarios assessed resulted in demand greater than the 'no PCD growth' but less than the 'half PCD growth scenario'. It could be argued that some of these scenarios have a high likelihood of occurring regardless of any changes in oral health policy. The scenarios replicate the sort of changes that led to the high increases in PCD in the period 1979 to 1995. If several of these scenarios were to occur the 'half PCD growth' projection would be a likely outcome. Consequently demand would exceed the standard supply projection by approximately 5 million visits per year from 2020; this equates to an approximate short fall of 1,800 to 1,900 dental practitioners (on the basis of current productivity levels).



Notes

1. The 'no PCD growth' model keeps age-specific demand for dental visits constant and therefore represents the increase due solely to changes in population, demographic changes and changes in the rate of edentulism. 'Continued PCD growth' assumes that demand increases at the same rate as that observed between 1979 and 1995.
2. The standard supply projection estimates that supply capacity will be 33.7 million visits by 2020. For details of the inputs and assumptions of the standard supply projection see Section 3.4 and Appendix B.

Figure 23: Projected demand for dental visits in the year 2020 by projection scenario

8 Discussion

The primary aim of this publication was to revise previously published supply and demand projections for dental visits and to assess the impact on those projections if key inputs and assumptions were to alter, either as a result of policy initiatives or changes in existing social or profession-related trends.

Since the publication of dental demand and supply projections in 2003, recruitment of dental practitioners has increased. A new dental school (at Griffith University) and new Bachelor of Oral Health courses have been established. There have been incremental increases in the numbers of students in existing dental schools and substantial increases in numbers of successful ADC candidates. ARCPOH's dental supply projection report (Spencer et al. 2003) recommended a conservative increase in recruitment of 150 dental providers per year. However, the increases cited above, coupled with marginal increases in migration from the United Kingdom and New Zealand, exceed this previous recommendation.

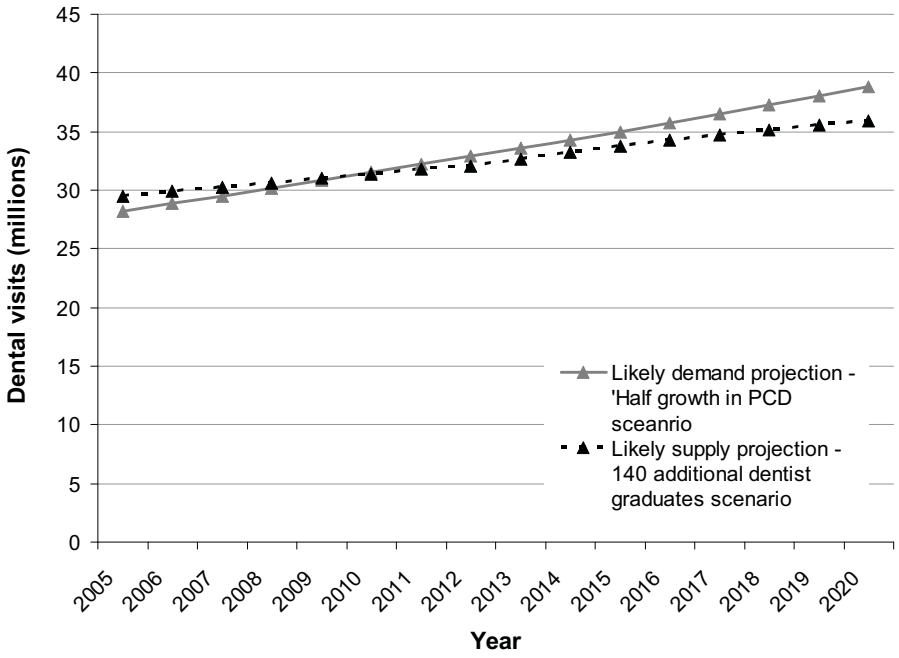
8.1 Revised supply and demand projections

Revisions of both demand and supply projections for dental visits reveal that the projected supply of dental visits under the 'standard' supply projection would adequately meet the demand for visits under the 'no PCD growth ' projection. The standard supply projection is based on the assumption that known graduation numbers at the start of 2007 and estimated attrition levels will be maintained and that productivity will continue to decline at half the rate of that previously observed. This supply projection can be considered conservative—the establishment of new BDS and BOH courses were recently announced and numbers of successful ADC candidates are running at levels 50% higher than assumed in the standard supply projection. In addition, assumptions related to declining levels of productivity (in terms of dental visits supplied per annum) have by far the most substantial impact on the supply projections. Actual supply may be quite different to the revised projections if these assumptions under or overestimate future productivity levels. As it appears evident that there will be further increases in recruitment at around 2013, it is likely that supply may be similar to the additional 140 graduate dentists scenario.

The 'no PCD growth ' projection assumes that demand remains static and that there are no future changes in patterns of accessing dental care. The 'no PCD growth' projection represents increases in demand due solely to population change and declining edentulism. In a historical context this scenario seems unlikely. Although PCD has remained relatively stable over the last decade, it is the contention of the authors, that this plateau in demand is possibly an artefact of a 'supply infrastructure bottle neck'. That is, growth in demand has effectively been capped by the capacity of the dental labour force to supply dental visits.

It could be argued that a number of the scenarios assessed, such as increased levels of access by older adults, are more likely than the 'no PCD growth' scenario. These and other scenarios provide an underpinning for something like the 'half PCD growth' scenario. Therefore the authors consider that demand in 2020 will approximate the estimate projected under the 'half PCD growth' scenario.

These 'most likely' supply and demand projections result in an estimated supply shortfall of 2.8 million dental visits. If PCD continues to grow at half the rate previously observed, then demand will exceed a 'likely' supply projection, based on an approximate increase in dentist graduates by 140 per year from 2013 (Figure 24). This equates to an undersupply of 1,000 to 1,100 dental practitioners (on the basis of current productivity levels).



Notes

1. The 'half PCD growth' projection assumes that PCD increases at half the rate of that observed between 1979 and 1995 and estimates that demand will be 38.8 million visits by the year 2020 (see Appendix D).
2. The supply projection for the additional 140 dentist graduates scenario estimates that aggregate supply capacity will be 36.0 million visits by 2020 (see Appendix B).

Figure 24: Most likely demand and supply projections for dental visits, 2020

Sensitivity of projections to changes in key inputs

Two aspects of visiting a dental provider influence the PCD for dental visits—the percentage accessing dental care in the previous 12 months and the mean number of visits made by those accessing. The various demand scenarios tested the impact if either or both of these factors were to alter; the resulting projections indicated that demand was very sensitive to differing assumptions of growth in PCD. The greatest impact was observed under the 'continued PCD growth' scenario, where demand was assumed to continue growing from 2005 at the same rate as observed from 1979 to 1995.

The supply projection model was most sensitive to differing productivity assumptions and increases in dentist recruitment beyond the standard projection recruitment levels (307 graduates per year).

Changes in numbers of ADC candidates have an immediate impact on supply relative to changes in domestic graduate numbers. The changes in ADC numbers can be

implemented without the lead time associated with training domestic dentists. However, projections based on 150 successful ADC candidates per year would only increase supply capacity by 1.4 million visits in 2020.

The standard projection model appeared least sensitive to changes in attrition rates and increases in allied dental practitioner recruitment.

Overseas migration of dentists

The standard supply projection assumed that ADC candidates would average 100 dentists per year. Although the numbers of successful candidates in recent years exceed this estimate (there were 158 successful ADC candidates in 2006), a more conservative estimate was considered likely as numbers could fluctuate due to domestic or overseas influences.

Relying on recruitment of large numbers of overseas dentists to resolve perceived labour force shortages is attractive as there is a short lead time and no capital is required to expand training infrastructure; however, it can not necessarily be assumed that the current large numbers applying for migration to Australia will continue. The numbers applying are primarily influenced by migration policy, but can also be influenced by world events and the relative attractiveness of Australia as a migration destination.

In addition, migration of dentists to Australia raises ethical concerns, including the draining of skilled labour forces from less developed countries and the restriction of opportunities for Australian school leavers to enter dentistry as a career. For these reasons, it is a stated goal in Australia's National Oral Health Plan to be self-sufficient in supply of the dental labour force (NACOH 2004).

Allied dental practitioners

The supply projections of allied dental practitioners vary by occupational group. The numbers of dental therapists and dental prosthetists are expected to decline slightly over the next decade while the numbers of dental hygienists are projected to more than double.

However, the projections of therapists and hygienists are complicated by several factors. The future practice activity of dual-qualified hygienists and therapists is uncertain. The future scope of practice of hygienists and therapists may change if/when the national registration system is implemented, and there is a possibility that the two occupational groups may merge.

Regardless of the uncertainty around the future occupational roles of therapists and hygienists in the oral health team, there will be more therapists and hygienists overall and their increased numbers will impact on the supply and demand for dental visits. For example, anecdotally it has been reported that when an oral health team is expanded to include an allied dental practitioner, demand for services is effectively increased. Alternatively, the increase in provision of essentially preventive dental services may influence demand for more complex services downstream. These phenomena and the mechanisms behind them have not been studied, and remain areas for research.

Although the projected number of visits supplied by the allied dental labour force is expected to increase substantially, from 5.6 million visits in 2005 to 7.8 million visits in 2020, only those visits without contact with a dentist at the same visit are counted towards the total aggregate dental labour force supply. The reason for this adjustment is that the community report a single visit when they see a dentist and hygienist/therapist, but each supplier counts the visit in their visits supplied. Consequently, primarily as a result of this adjustment, the contribution of the allied dental labour force to total dental visits supplied remains relatively small and varies only marginally across the course of the projection (approximately 12% to 13% of all visits supplied).

8.2 Further issues

There are several issues that need to be examined further. Firstly, what are the longer term implications, especially for the supply projections? The various scenarios for the supply projections only run to 2020, which, for increased dentist graduate numbers as a result of new schools and courses run for only 7 years across the projection period. Longer term projections need to be assessed, even if assumptions become more tenuous.

Second, some disaggregated projections for smaller areas would be appropriate to explore regional situations. This is pertinent to the bids from 'regional' universities to establish dental schools and to service regional needs. The models employed in this set of national projections are limited in their appropriateness for regional analysis, as the small numbers of practitioners in these areas render the projections less robust. Estimation of internal migration is also difficult and the future locality choices made by practitioners graduating from regional universities is uncertain.

Third, there is continued difficultly in estimating the number of full-fee-paying international graduates from Australian universities who may seek to practice in Australia. In the current projections, only graduates with Australian citizenship are counted in the Australian university graduates recruitment component, but it is known that many international students stay on to live and practise in Australia after graduation. Some international graduates may be captured in migration data or return from abroad depending on the timing of gaining permanent residency, but most probably fall outside these inputs. If 50% of international graduates were to end up practising in Australia, this would provide approximately 30 additional dentist recruits per year. Further research is required to more accurately incorporate this group into the recruitment numbers.

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10 Glossary

Capital city	The administrative seat of government of each of Australia's six states and two territories. Each capital city also represents the most populous location of its respective state or territory
Dentate	Having one or more natural teeth
Edentulous	A state of complete loss of all natural teeth
Mean	The arithmetic average of a set of values
State/territory	Geographic regions of Australia. The nation has six states and two territories
Trend	The general direction in which change over time is observed

Appendix A: Dental labour force estimates, 2003

Table A.1: Registered dentists by work status, sex and age group, Australia, 2003

	Age group (years)					
	<35	**35–44**	**45–54**	**55–64**	**65+**	**Total**
			Male			
Working in dentistry[(a)]	1,337	1,674	2,154	1,410	559	7,132
Mainly or solely in another state	53	97	140	60	29	380
On leave	3	2	6	4	7	22
Overseas	74	114	150	82	24	444
Not working	12	14	35	46	73	180
Working but not in dentistry	17	8	21	17	11	74
Retired	—	—	5	41	111	157
Total	**1,495**	**1,910**	**2,510**	**1,661**	**814**	**8,390**
			Female			
Working in dentistry[(a)]	1,079	795	513	130	28	2,546
Mainly or solely in another state	34	36	19	12	—	102
On leave	23	11	—	6	—	40
Overseas	70	50	24	5	—	150
Not working	32	36	32	11	5	116
Working but not in dentistry	6	20	16	4	—	45
Retired	—	—	2	4	8	15
Total	**1,245**	**948**	**606**	**173**	**41**	**3,014**
			Persons			
Working in dentistry[(a)]	2,415	2,469	2,667	1,540	587	9,678
Mainly or solely in another state	88	133	160	73	29	482
On leave	26	13	6	11	7	62
Overseas	145	164	174	87	24	593
Not working	44	51	67	57	78	297
Working but not in dentistry	23	28	37	21	11	120
Retired	—	—	7	45	119	171
Total	**2,740**	**2,858**	**3,117**	**1,834**	**855**	**11,404**

(a) Working in dentistry includes all dentists who work 'only' or 'mostly' in the state which they maintain registration.

Source: Teusner et al. 2007.

Table A.2: Practising dentists by sex, age group and state/territory, 2003

Age group (years)	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Total	Per cent
					Male					
<25	46	23	36	23	6	1	1	—	137	1.9
25–29	182	124	99	35	41	1	4	4	490	6.9
30–34	248	154	149	62	62	11	17	7	710	10.0
35–39	323	180	128	72	38	12	9	2	763	10.7
40–44	287	225	187	107	59	10	29	7	911	12.8
45–49	406	219	208	110	107	27	26	16	1,119	15.7
50–54	357	223	158	119	125	24	25	4	1,035	14.5
55–59	271	204	171	103	110	12	18	11	899	12.6
60–64	165	120	120	58	32	10	4	2	510	7.2
65–69	104	83	56	22	22	5	7	—	299	4.2
70–74	62	37	41	9	7	3	7	—	166	2.3
75+	43	21	13	6	8	—	3	—	94	1.3
Total	**2,494**	**1,612**	**1,365**	**728**	**617**	**117**	**148**	**51**	**7,132**	**100.0**
					Female					
<25	29	34	36	9	4	—	5	—	116	4.6
25–29	159	122	83	56	44	7	8	—	479	18.8
30–34	176	123	87	32	37	4	21	4	484	19.0
35–39	151	114	67	37	27	4	8	4	412	16.2
40–44	121	109	72	34	25	7	13	2	383	15.0
45–49	109	69	55	28	40	7	10	—	320	12.6
50–54	62	56	28	18	20	5	3	2	194	7.6
55–59	20	25	15	10	16	3	—	2	92	3.6
60–64	13	13	3	3	1	4	—	2	39	1.5
65–69	6	5	6	1	1	—	—	—	20	0.8
70–74	1	—	3	—	—	—	—	—	4	0.2
75+	3	—	—	—	1	—	—	—	4	0.2
Total	**852**	**672**	**455**	**229**	**216**	**41**	**68**	**14**	**2,546**	**100.0**

(continued)

Table A.2 (continued): Practising dentists by sex, age group and state/territory, 2003

Age group (years)	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Total	Per cent
					Persons					
<25	75	57	72	32	9	1	7	—	253	2.6
25–29	342	246	182	91	85	8	12	4	968	10.0
30–34	425	277	236	94	99	15	38	11	1,194	12.3
35–39	474	293	195	110	65	16	17	5	1,176	12.1
40–44	409	334	259	141	84	16	42	9	1,293	13.4
45–49	515	288	263	138	147	34	36	16	1,438	14.9
50–54	419	279	186	137	145	30	27	5	1,229	12.7
55–59	290	229	186	114	126	15	18	12	991	10.2
60–64	178	134	122	61	33	14	4	4	549	5.7
65–69	109	88	62	23	24	5	7	—	319	3.3
70–74	63	37	44	9	7	3	7	—	170	1.8
75+	46	21	13	6	9	—	3	—	98	1.0
Total	**3,346**	**2,284**	**1,821**	**957**	**833**	**157**	**216**	**65**	**9,678**	**100.0**
Average age										
Males	46.6	47.0	46.6	46.9	47.7	48.2	47.9	45.8	46.9	
Females	38.0	38.1	37.5	38.0	39.7	43.0	36.3	43.5	38.1	
Persons	**44.4**	**44.4**	**44.3**	**44.8**	**45.6**	**46.9**	**44.3**	**45.3**	**44.6**	
Practising rate[(a)]	50.1	46.5	47.9	49.1	54.5	33.0	66.8	32.7	48.7	

(a) Practising rate: number of practitioners per 100,000 population.

Note: Includes dentists practising solely or mainly in state of registration. Adjusted to take into account non-response.

Source: Teusner et al. 2007.

Table A.3: Practising dentists by area of main practice by sex and age, Australia, 2003

Area of practice	Age group (years)						Average age (years)
	<30	30–39	40–49	50–59	60+	Total	
				Male			
General practice	593	1,270	1,662	1,584	855	5,964	46.4
Registered specialist	8	146	300	278	150	882	49.7
Restricted practice	1	18	16	18	6	59	46.6
Administration	—	4	19	27	17	67	54.7
Teaching/Education	15	19	24	17	24	98	47.7
Research	1	1	1	4	8	15	62.6
Other	9	16	8	8	7	48	41.9
Total	**627**	**1,473**	**2,029**	**1,934**	**1,069**	**7,132**	**46.9**
				Female			
General practice	567	788	589	229	62	2,235	37.7
Registered specialist	7	64	76	28	2	177	41.9
Restricted practice	1	5	2	6	—	14	43.3
Administration	1	7	7	5	—	20	43.9
Teaching/Education	4	14	17	9	1	44	42.7
Research	3	3	1	6	—	13	42.1
Other	12	15	10	3	1	42	36.6
Total	**595**	**896**	**702**	**285**	**67**	**2,546**	**38.1**
				Persons			
General practice	1,159	2,059	2,251	1,813	918	8,200	44.0
Registered specialist	16	209	376	305	152	1,058	48.4
Restricted practice	2	22	18	24	6	73	45.9
Administration	1	11	26	31	17	87	52.5
Teaching/Education	18	33	40	26	25	142	46.1
Research	4	5	2	10	8	28	53.2
Other	21	31	18	11	8	90	39.5
Total	**1,222**	**2,370**	**2,732**	**2,220**	**1,136**	**9,678**	**44.6**

Source: Teusner et al. 2007.

Table A.4: Practising dentists by type of main practice and age, Australia, 2003

Practice type	Age group (years)						Average age (years)	Percentage female
	<30	30–39	40–49	50–59	60+	Total		
Private sector								
Solo	87	568	920	850	537	2,961	49.1	13.5
Solo with assistant	108	313	468	331	104	1,324	45.0	19.7
Partnership	54	239	302	207	61	863	44.5	26.6
Associateship	111	335	385	352	104	1,289	44.5	17.4
Assistant	470	447	222	117	69	1,326	36.2	49.5
Locum	23	35	31	21	20	131	43.6	29.8
Public sector								
Dental hospital	126	109	87	68	71	460	42.2	42.7
Mainly school dental	13	19	38	43	10	123	46.2	38.5
Mainly general dental	124	134	133	92	53	535	41.3	45.3
Defence forces	27	35	15	14	4	96	37.3	32.7
Other public	11	33	30	20	21	114	45.5	45.3
Tertiary education institution	21	31	47	44	29	171	47.5	36.3
Other practice type								
Industry	5	15	8	10	8	46	45.6	52.2
Other practice type	42	57	46	50	44	239	44.8	34.3
Total	**1,222**	**2,370**	**2,732**	**2,220**	**1,136**	**9,678**	**44.6**	**26.3**

Source: Teusner et al. 2007.

Table A.5: Employed dental prosthetists, selected characteristics by state/territory, 2000 and 2003

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Total
Numbers									
2000	305	297	117	60	27	52	16	. .	872
2003	308	268	125	84	29	50	15	. .	878
Age group (years)									
20–29	3	4	—	2	—	1	—	. .	11
30–39	66	41	8	17	—	9	3	. .	142
40–49	109	129	47	38	16	20	8	. .	361
50+	129	94	70	27	13	20	5	. .	353
Average age (years)	48.5	47.9	52	45.9	52.3	47.5	52.7	. .	48.7
Percentage female	11.0	7.8	5.2	12.8	—	18.2	—	. .	9.2
Average hours usually worked per week	43.5	42.1	43.5	43.2	41.0	43.2	44.4	. .	43.0
Percentage working part-time (< 35 hrs per week)	19.9	21.3	20.0	21.6	18.2	12.8	—	. .	19.8
	Practitioner rate (per 100,000 population)								
2000	4.7	6.2	3.3	3.2	1.8	11.1	5.1	. .	4.6
2003	4.6	5.5	3.3	4.3	1.9	10.4	4.8	. .	4.5

Note: Dental prosthetists were not permitted to practise in the Northern Territory.

Source: Teusner et al. 2007.

Table A.6: Employed dental therapists, selected characteristics by state/territory, 2000 and 2003

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Total
Numbers									
2000	216	153	405	331	128	50	19	16	1,317
2003	195	153	354	314	128	61	22	16	1,242
Age group (years)									
20–29	34	29	25	24	20	5	—	2	139
30–39	42	42	104	81	30	18	9	—	324
40–49	108	70	216	181	63	27	12	14	692
50+	10	13	9	28	15	11	1	—	87
Average age (years)	39.4	38.4	40.2	41.3	40.2	41.9	42.2	42.6	40.3
Average hours usually worked per week	30.7	27.8	31.8	26.6	28.4	29.4	30.6	36.8	29.4
Percentage working part-time (< 35 hrs per week)	52.6	65.9	45.3	64.9	64.4	62.7	55.6	—	56.3
	Practitioner rate (per 100,000 population)								
2000	3.3	3.2	11.4	17.6	8.5	10.6	6.1	8.2	6.9
2003	2.9	3.1	9.3	16.1	8.4	12.7	6.9	8.0	6.3

Source: Teusner et al. 2007.

Table A.7: Employed dental hygienists, selected characteristics by state/territory, 2000 and 2003

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Total
Numbers									
2000	58	97	45	81	110	. .	22	2	416
2003	104	123	81	93	134	6	30	6	577
Age group (years)									
20–29	15	32	16	58	13	—	7	2	143
30–39	38	53	40	16	59	5	10	3	222
40–49	41	30	21	18	48	—	6	—	163
50+	11	8	4	1	14	2	7	2	49
Average age (years)	38.3	36.0	35.8	30.4	39.7	38.3	38.2	40.0	36.5
Average hours usually worked	32.2	29.5	28.9	31.7	26.0	30.6	28.2	32.5	29.5
Percentage working part-time (<35 hrs per week)	62.3	66.0	58.2	46.5	73.2	50.0	80.0	50.0	63.3
	Practitioner rate (per 100,000 population)								
2000	0.9	2.0	1.3	7.3	4.4	—	7.1	1.0	2.2
2003	1.5	2.5	2.1	8.8	4.8	1.3	9.2	3.2	2.9

Note: Hygienists were not permitted to practise in Tasmania until 2002.
Source: Teusner et al. 2007.

Appendix B: Methods: supply projection model

This section describes in detail the inputs and the components of the standard supply projection.

Supply projection model

The framework underlying the projection of practising dental professionals in Australia conceives the labour force as a dynamic system of stocks and flows. The stock of dental service providers is equivalent to the number of registered dentists, therapists, hygienists and prosthetists. Movement into the stock of dental practitioners (recruitment) consists of practitioners who were educated in Australian educational institutions, practitioners who have migrated into Australia, and practitioners who return to practice after a period of cessation from practice. Attrition (wastage) from the stock of practitioners is associated with migration out of Australia, retirement, death and cessation of practice. Cessation of practice may be permanent (e.g. to pursue another career) or short-term (e.g. prolonged parental leave, study leave).

To ensure accurate representation of the stock of practitioners in Australia, dentists were categorised into sex and age groups, and allied dental professionals into age groups. Each element of the inflows and outflows were followed through each age and sex group, as shown in Figure 25.

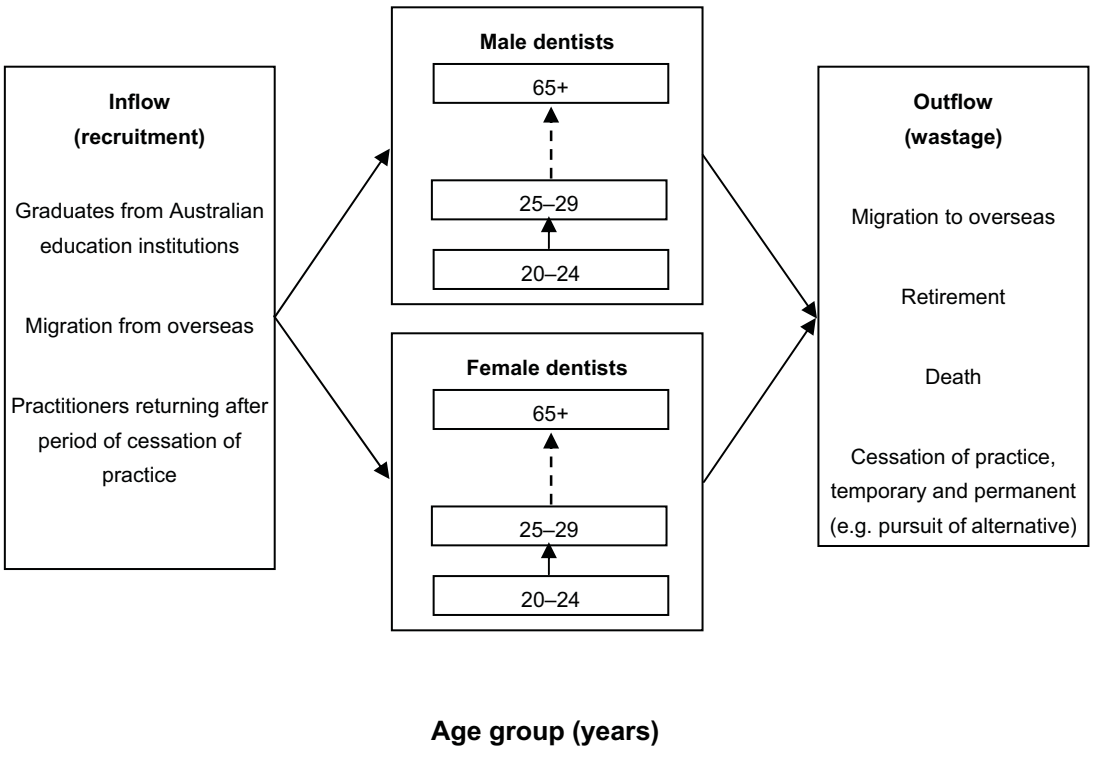


Figure 25: Framework of the labour force projection model

The baseline stock of dentists was divided into male and female dentists and then grouped into 12 age categories, i (i = 1, 2,…12). The baseline stock of allied dental professionals was divided into 10 age categories. There was no categorisation by sex as these groups are highly gendered, the prosthetists dominated by males and the therapists and hygienists by females.

A basic Markov chain model was adopted; the model assumes that dentists flow in and out of age categories independently and with identical probabilities that do not vary over time (Bartholomew & Forbes 1979). Each dentist with the passage of time has a given probability of staying in the same age group (P_{ii}) or of making a transition into an older age group ($P_{i,i+1}$). The transitional probabilities between each of the age groups are set out in an array as follows:

P_{11}	P_{12}	…	…	…	W_1
…	P_{22}	P_{23}	…	…	W_2
…	…	P_{33}	P_{34}	…	W_3
…	…	…	P_{II}	P_0	W_I

Each element $\mathbf{P}_{ii}$ is the probability that a member of the age category i at the start of the time interval remains in that age category at the end, and $\mathbf{P}_{i,i+1}$ is the probability that a member of age category i at the start of the time interval is in age category i+1 at the end. $\mathbf{W}_i$ is the probability that a member of age category i at the start would no longer contribute to the stock of dentists at the end of the time interval. Because each dentist must either stay in the same age group, move to the next age group or no longer contribute to the stock of dentists, each row sums to 1:

$$P_{ii} + P_{i,i+1} + W_i = 1$$

(Note: As there are only 12 age categories, dentists who are 75 years or older cannot move into the next age category—they can only stay in the current age category or be wasted out of the stock of dentists.)

The matrix **P** is the transition matrix, and the row vector **W** (W_1, W_2…W_I) is the wastage vector. It is implicit in this model that time is discrete, typically one year. The elements of **P** and **W** are assigned numerical values by estimating the probabilities from past data.

The Markov chain model is completed by an estimation of the flow of new recruits. The number of recruits at year T and for age category i is denoted by $R_i(T)$, referred to as the recruitment vector. The recruitment vector is set out in an array as follows:

$R_1(2001)$	$R_1(2002)$	…$R_1(T)$
$R_2(2001)$	$R_2(2002)$	…$R_2(T)$
…	…	…
$R_I(2001)$	$R_I(2002)$	…$R_I(T)$

The following notation specifies the calculation for each age category, with the total number of practising dentists in an age category for year T denoted by $D_i(T)$:

$$D_i(T) = R_i(T) + D_i(T–1) \times P_{ii} + D_{i-1}(T–1) \times P_{i-1,i}$$

$$i = 12, T>2000$$

For example, the notation for the calculation of the number of practising dentists in age category 2 (i = 2, 25–29 years) in 2003 would be:

$$D_2(2003) = R_2(2003) + D_2(2002) \times P_{22} + D_1(2002) \times P_{12}$$

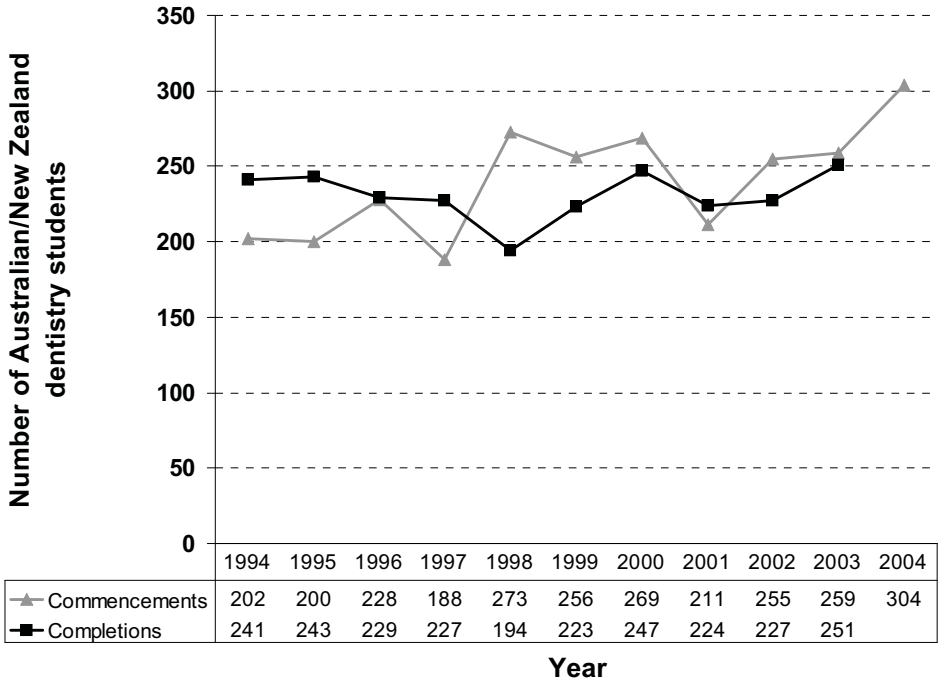
Dentist recruitment vector

The recruitment vector consists of several components each described in some detail below. There are varying degrees of confidence in each component, their accuracy being contingent upon the availability of data and the degree of potential overlap between components.

Australian university graduates

In 2003 there were five universities in Australia that provided Bachelor of Dental Science courses. In addition to these, Griffith University established a Dental School in 2004. Data on course commencements and completions were obtained from the Department of Education, Science and Training (DEST). There has been a marginal increase in the number of graduate completions in the decade to 2003 (Figure 26). The number of commencements has increased since 2001, suggesting continued growth in the number of completions until approximately 2009, when the first year of commencements from Griffith are expected to graduate.

Estimates for the number of completions were obtained by taking the average number of completions between 2000 and 2003. This estimate was validated by comparing it with the number of students currently enrolled in dental courses. It was estimated that 237 graduates per year would enter the dental labour force between 2003 and 2008, increasing to 307 per year in 2009. From 2009 the additional 70 graduates accounts for Griffith University graduates and for incremental increases in completion numbers from other institutions.



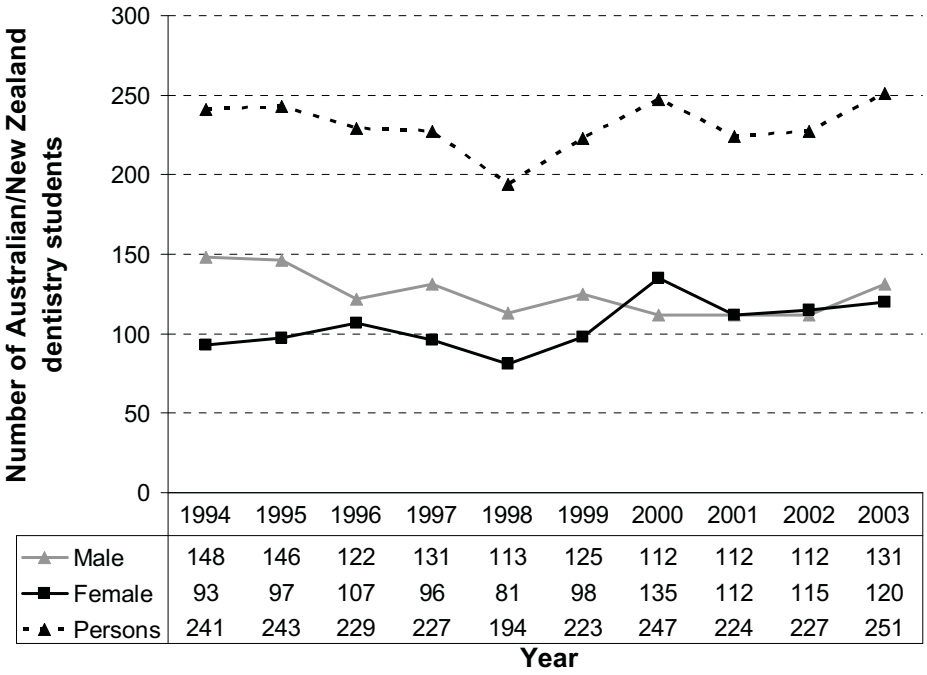
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Commencements	202	200	228	188	273	256	269	211	255	259	304
Completions	241	243	229	227	194	223	247	224	227	251	

Note: The number of completions for 2004 was not available at time of publication.

Sources: Tables C.1, C.2.

Figure 26: Australian/New Zealand citizens and permanent residents commencements and completions in dentistry by year, 1994 to 2004

The proportion of graduates that were female has increased from approximately 40% in the mid 1990s to approximately 50% since 2000 (Figure 27). This has implications in terms of attrition rates and supply of visits. For development of an appropriate recruitment vector, the sex and age distribution of the graduate component is based on the average age and sex distribution for Australian citizens and permanent residents completing courses in dentistry between 2000 and 2003.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Male	148	146	122	131	113	125	112	112	112	131
Female	93	97	107	96	81	98	135	112	115	120
Persons	241	243	229	227	194	223	247	224	227	251

Source: Table C.3.

Figure 27: Australian/New Zealand citizens and permanent residents completions in dentistry by sex, 1994 to 2003

Overseas entrants

Overseas entrants to the dentist labour force enter the pool of dentists from two main pathways. Dentists who obtained their qualifications in the United Kingdom, Ireland or New Zealand are automatically recognised and are granted registration. Dentists who trained in other countries are required to undertake an examination process with the ADC.

Information on the number of dentists entering the labour force through the automatic recognition pathway is difficult to obtain because not all state and territory registration boards are able to provide qualifications data of registrants. Information on this group is obtained from immigration data on overseas arrivals into Australia. An estimate can be made by looking at the number of entrants into Australia from the United Kingdom, Ireland and New Zealand who recorded dentistry as their occupation and intended to stay for 12 months or more (Table B.1). It should be emphasised that these figures are indicative only because it cannot be determined whether all these entrants will apply for recognition and subsequently work as a dentist in Australia. Also, these entrants may have obtained their qualification from other countries and may therefore not be eligible for automatic recognition.

In addition to the uncertainties of intention to practise, the number of overseas entrants fluctuates from year to year (as shown in Table B.1). Consequently, the number of entrants was averaged over the years 2000 to 2006 and then multiplied by the employment rate for the Australian dentist labour force from the 2003 survey (84.9%).

Table B.1: Long-term overseas arrivals to Australia of entrants with United Kingdom, Ireland or New Zealand citizenship and stated dentistry as their profession, 2000 to 2006

Age group (years)	2000	2001	2002	2003	2004	2005	2006 (as at Nov 2006)	Average
20–29	21	41	43	47	39	35	27	36
30–39	15	8	26	22	33	26	28	23
40–49	3	5	5	5	8	5	5	5
50+	—	3	7	3	3	3	3	3
Total	**39**	**57**	**81**	**77**	**83**	**69**	**63**	**67**

Source: ABS—DIMA overseas arrivals and departures unpublished data.

The number of successful ADC candidates has progressively increased since 2002 (Dental Board of Queensland Bulletin 2006). There were 37 successful candidates in 2002, increasing to 48 in 2003, 61 in 2004, 110 in 2005 and 158 in 2006. The number of overseas-trained dentists sitting final clinical exams increased from 50–60 per year in 2000 to 299 in 2006.

While the numbers of ADC candidates are expected to continue to increase in the coming years, numbers are sensitive to changes in local and world events as well as changes in migration policies. However because it is unlikely that the number of successful candidates will drop below 100 per year in coming years, consequently a conservative estimate of 100 successful ADC candidates per year was applied in the recruitment vector for 2007 and onwards.

Information on sex and age of dentists completing ADC examinations was not available. As a proxy, the Victorian Dental Board's data (2000–2006) on qualifications and age collected at first registration was used to estimate a representative age distribution of ADC candidates.

Return to practice

The final component of the recruitment vector is the group of dentists who return to practise (RTP). This component includes dentists who return to Australia after an extended visit overseas (longer than 12 months) and those that return to dentistry after cessation of practice for other reasons (e.g. career break, family responsibilities).

There are a number of difficulties in capturing accurate return to practice data, including the inability to match registration details across jurisdictions; the inability to consistently match registration data across time within each state and territory; and the possible double counting of registrations for dentists who have travelled overseas for an extended period yet have kept their registration active. Given the difficulties in this component of the model, estimates for return to practice were derived by the addition of two estimates from different sources.

First, return from an extended visit overseas (greater than 12 months) was derived from the overseas arrivals data collected by the Department of Immigration and Multicultural Affairs (DIMA). The numbers of Australian citizen arrivals who indicated that they were dentists between 2000 and 2006 are shown in Table B.2. An average of the 6 years was used as an estimate of return to practice from an extended visit overseas. These estimates were then multiplied by the employment rate for the Australian dentist labour force from the 2003 survey (84.9%).

Table B.2: Australian citizen dentists arriving in Australia after a long-term stay abroad, by age group, 2000 to 2006

Age group (years)	2000	2001	2002	2003	2004	2005	2006 (YTD)	Average (2000–06)
20–29	31	32	23	29	19	25	20	26
30–39	29	37	29	44	35	43	38	36
40–49	26	25	21	31	34	28	18	26
50+	16	19	26	22	26	27	14	21
Total	**102**	**113**	**99**	**126**	**114**	**123**	**90**	**110**

Note: YTD–year to date totals (as at November, 2006).
Source: ABS—DIMA overseas arrivals and departures unpublished data.

The second component of the return to practice vector is return to dentistry after a cessation of practice of 12 months or more. Obtaining an estimate for this group is problematic due the inability to track the practice status of dentists over time—not all state/territory datasets can be linked from year to year. Where it is possible to perform longitudinal analysis, the ability to track changes in practice status is inhibited by the numerous dentists that do not respond in consecutive surveys.

Given these difficulties, an estimate for return to practice was derived by tracking the change in work status across years and weighting for consecutive non-response. For state/territory datasets that could be linked, the proportion of dentists who indicated they were not working in a given year and were employed in the following year was determined (Table B.3). This component is a rate rather than a fixed estimate. The RTP percentage is multiplied by the estimated number of dentists practising/employed in a given year of the projection in order to calculate the RTP component of the recruitment vector for the following year of the projection.

Table B.3: Percentage of practising dentists returning to practice after a cessation of practice

	Age groups (years)										
	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65+	Total
Males	3.2	2.5	0.9	1.7	0.8	0.8	0.9	1.1	1.4	2.3	**1.2**
Females	4.8	3.1	4.5	3.4	1.7	1.0	0.8	2.0	0.6	2.4	**2.6**

Note: Cessation of practice is for a period of 12 months or more.

Dentist recruitment summary

The components of the recruitment vector are presented in Table B.4. With the exception of the numbers of Australian university graduates (which increase to 307 in 2009) and the RTP component, estimates were kept constant through the course of the projection.

Table B.4: Dentist recruitment vector (standard projection) by age group and sex

Age group (years)	Grads	ADC	RTP (base)	RTP (expat.)	UK/NZ	Total
			Male			
20–24	94	—	4	5	7	110
25–29	14	6	12	5	7	43
30–34	5	16	6	8	5	41
35–39	1	11	13	8	5	39
40–44	3	8	7	8	2	27
45–49	1	8	9	8	2	27
50–54	—	—	9	5	1	15
55–59	—	1	10	5	1	16
60–64	—	—	7	3	1	11
65+	—	—	7	3	—	10
Total	117	50	85	57	29	338
			Female			
20–24	99	—	6	6	9	120
25–29	12	11	15	6	9	52
30–34	4	15	22	7	5	53
35–39	3	14	14	7	5	42
40–44	2	5	7	3	1	18
45–49	1	3	3	3	1	11
50–54	—	1	2	1	—	4
55–59	—	1	2	1	—	4
60–64	—	—	—	—	—	1
65+	—	—	—	—	—	—
Total	121	50	70	36	28	304
			Persons			
20–24	193	—	10	11	15	229
25–29	26	17	27	11	15	96
30–34	9	31	28	15	10	94
35–39	4	25	27	15	10	81
40–44	4	13	14	11	2	45
45–49	1	11	12	11	2	38
50–54	—	1	11	6	1	18
55–59	—	1	12	6	1	20
60–64	—	—	7	4	1	12
65+	—	—	7	3	—	11
Total	237	100	155	93	57	643

Dentist attrition (wastage vector)

The attrition component of the model includes dentists who leave the profession either permanently or for an extended break (12 months or more). In order to estimate attrition, labour force collection data sets, where possible, were linked from year to year, and the following dentists were identified as having ceased practice in Australia:

- dentists who were practising in Australia in 1998 and 1999 but not practising in the following year (numbers were weighted up to account for non-response).

- dentists who became unregistered in a given year but had reported practising in the previous year. In order to limit the number of dentists migrating interstate from being included in this group, only dentists working solely or mainly in their state of registration were included as attrition. For those dentists whose work status was mainly or solely in another state and who then became unregistered, it was assumed that their un-registered status was a result of permanent interstate migration and therefore they were included as attrition.

The attrition rates were used to calculate the matrix of transition probabilities. Attrition rates by age and sex, and the resulting probabilities of remaining in the same age group (P_{ii}) in the following year of the projection and of moving into the next age group ($P_{i-1,I}$) are presented in Table B.5.

Table B.5: Dentist attrition rates and transition probabilities by age group and sex (standard projection)

	Male			Female		
Age group (years)	**Wastage**	**P_{ii}**	**$P_{i-1,i}$**	**Wastage**	**P_{ii}**	**$P_{i-1,i}$**
20–24	5.45%	0.1891	0.7564	5.69%	0.1886	0.7545
25–29	4.21%	0.7663	0.1916	5.00%	0.7600	0.1900
30–34	2.80%	0.7776	0.1944	5.29%	0.7577	0.1894
35–39	1.81%	0.7855	0.1964	5.04%	0.7597	0.1899
40–44	0.91%	0.7927	0.1982	2.59%	0.7793	0.1948
45–49	0.73%	0.7941	0.1985	3.71%	0.7703	0.1926
50–54	1.89%	0.7849	0.1962	3.92%	0.7686	0.1922
55–59	4.21%	0.7663	0.1916	7.33%	0.7413	0.1853
60–64	8.06%	0.7355	0.1839	9.10%	0.7272	0.1818
65–69	12.54%	0.6997	0.1749	20.00%	0.6400	0.1600
70–74	12.10%	0.7032	0.1758	21.73%	0.6262	0.1565
75+	24.18%	0.7582	0.0000	21.73%	0.7827	0.0000

Notes

1. Wastage rates determined using the following AIHW DSRU dentist labour force data sets: Victoria 1998, 1999; South Australia, 1998, 1999, 2000; New South Wales 1998, 1999, 2000.
2. Wastage is proportionally applied to P_{ii} and $P_{i-1,I}$, e.g. P_{22} =0.8– (0.8 x 0.0421), P_{23} = 0.2 – (0.2 x 0.0421).
3. There was no observed wastage in the 75+ years age group for female dentists due to extremely low numbers of female dentists in that age group. The wastage rate for the 70–74 years age group was applied to the 75+ years age group.

Estimation of dentist visits supplied

To estimate the projected supply of dentist visits by dentists in 2020, the numbers of practising dentists were multiplied by age-and sex-specific supply rates (Table D.2). Over the past 40 years, the length of a visit has been increasing, as has the number of services supplied at a visit. Because the number of hours worked per week has remained stable, the number of visits supplied has declined substantially over that period (Brennan & Spencer 2006). It is unlikely that this decline in productivity, in terms of visits supplied per annum, will suddenly discontinue, and it is also uncertain that it can continue at the previous rate. Hence, the standard supply projection assumes that the number of visits supplied per annum per dentist will continue to decline at half the rate that was observed over the period 1983–84 to 2003–04. The low supply projection presented in Section 6.4 presents a scenario in which productivity is assumed to decline at 100% of the previous rate of decline. The age by sex supply rates for this scenario are presented in Table D.5.

Total aggregated supply of visits is calculated by the summation of projected dentist supply and allied dental practitioner supply. Estimation of allied supply is outlined in the following section.

Allied dental practitioner recruitment

Estimation of future allied dental practitioner recruitment is complicated by several factors. The numbers of students graduating from allied dental courses will increase substantially over the next decade. In addition, the proportions of graduates completing a dual qualification who will practise principally as a hygienist rather than a therapist is unknown. The resulting recruitment vector shown in Table B.6 was based solely on estimates of recruitment of domestic graduates plus a small RTP component (1.3%) for therapists and hygienists.

Table B.6: Allied dental recruitment vector by age group and sex

	2003 (baseline)			2020		
Age group (years)	Dental prosthetists	Dental therapists	Dental hygienists	Dental prosthetists	Dental therapists	Dental hygienists
20–24	0	27	58	0	26	59
25–29	9	27	59	9	28	63
30–34	9	13	34	9	14	39
35–39	6	14	18	6	13	21
40–44	6	5	1	6	2	3
45–49	0	4	1	0	2	2
50–54	0	1	1	0	2	1
55–59	0	0	0	0	1	1
60–64	0	0	0	0	1	0
65+	0	0	0	0	0	0
Total	**30**	**90**	**172**	**30**	**90**	**190**

Note: RTP percentage included in recruitment for therapists and hygienists, rate set at 50% of overall female dentists RTP rate (1.3%).

Allied dental practitioner attrition (wastage vector)

Due to the inability to link annual allied dental labour force datasets and the relatively small numbers in those groups, the calculation of occupation specific wastage rates was considered to be not viable. Therefore, dentist wastage rates were used to develop the allied dental wastage vectors. The dental hygiene and dental therapy projections used female dentist attrition rates with a 50% loading. The dental prosthetist projection used male dentist attrition rates (Table B.7).

Table B.7: Allied dental practitioner attrition rates and transition probabilities by age group and sex (standard projection)

	Prosthetists			Dental therapists / dental hygienists		
Age group (years)	Wastage	P_{ii}	$P_{i-1,i}$.	Wastage	P_{ii}	$P_{i-1,i}$.
20–24	5.45%	0.1891	0.7564	8.54%	0.3658	0.5488
25–29	4.21%	0.7663	0.1916	7.5%	0.7400	0.1850
30–34	2.80%	0.7776	0.1944	7.9%	0.7366	0.1841
35–39	1.81%	0.7855	0.1964	7.6%	0.7395	0.1849
40–44	0.91%	0.7927	0.1982	3.9%	0.7689	0.1922
45–49	0.73%	0.7941	0.1985	5.6%	0.7555	0.1889
50–54	1.89%	0.7849	0.1962	5.9%	0.7529	0.1882
55–59	4.21%	0.7663	0.1916	11.0%	0.7120	0.1780
60–64	8.06%	0.7355	0.1839	13.7%	0.6908	0.1727
65–69	12.54%	0.6997	0.0000	45.2%	0.5485	0.0000

Notes

1. Wastage rates determined using the following AIHW DSRU dentist labour force data sets: Victoria 1998, 1999; South Australia, 1998, 1999, 2000; New South Wales 1998, 1999, 2000.
2. Dental therapist and dental hygienist wastage rates are based on female dentist wastage rates increased by 50%.
3. Wastage is proportionally applied to P_{ii} and $P_{i-1,I}$, e.g. P_{22} =0.8– (0.8 x 0.0421), P_{23} = 0.2 – (0.2 x 0.0421).
4. Due to small numbers the allied dental labour force was categorised into 10 age groups, unlike dentists who were categorised into 12 age groups.

Estimation of allied dental visits supplied

To estimate the projected supply of dental visits by allied dental practitioners, the numbers of practising allied dental practitioners were multiplied by the occupation specific supply rates (Section 3.2, Table 3). There were no additional assumptions relating to changes in productivity over time.

For aggregation with dentist supply dental therapist and dental hygienist supplies were discounted to enable an appropriate comparison to demand estimates.

Use of services data (demand) is sourced from the NDTIS. This survey collects data on dental visiting patterns and does not discern between visits supplied by dentists and other oral health service providers. Hence, the community typically report a single visit when they see a dentist and hygienist or therapist at the same visit, but each supplier counts the visit in their visits supplied. For the purposes of reconciliation with demand projections, only allied visits supplied without contact with a dentist at the same visit are counted towards total aggregate dental labour force supply. This is achieved by estimating the proportion of allied visits supplied which would be single provider visits. For hygienists it was estimated that 20% of all visits supplied would be independent of a visit to the dentist. The total number of visits supplied by dental therapists was reduced by 135,000 visits per year, which was an estimate of 50% of visits supplied by all school dentists.

Appendix C: Australian university dentistry course commencements and completions

Table C.1: Australian / New Zealand citizens and permanent residents commencing courses in dentistry by sex and institution, 1994 to 2004

Institution	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
						Male					
Griffith University	—	—	—	—	—	—	—	—	—	—	36
The University of Adelaide	25	20	22	25	21	30	16	13	19	21	23
The University of Melbourne	26	31	22	25	25	23	33	22	28	25	24
The University of Queensland	32	34	30	23	31	27	29	8	25	34	32
The University of Sydney	29	30	28	26	32	35	36	21	29	23	23
The University of Western Australia	6	5	4	4	28	25	23	16	26	20	19
Total	**118**	**120**	**106**	**103**	**137**	**140**	**137**	**80**	**127**	**123**	**157**
						Female					
Griffith University	—	—	—	—	—	—	—	—	—	—	22
The University of Adelaide	20	24	25	17	23	16	27	30	16	19	19
The University of Melbourne	20	18	38	23	26	18	13	27	22	29	29
The University of Queensland	17	14	20	24	37	44	48	21	46	44	40
The University of Sydney	27	20	35	18	27	23	30	31	22	23	21
The University of Western Australia	—	4	4	3	23	15	14	22	22	21	16
Total	**84**	**80**	**122**	**85**	**136**	**116**	**132**	**131**	**128**	**136**	**147**
						Persons					
Griffith University	—	—	—	—	—	—	—	—	—	—	58
The University of Adelaide	45	44	47	42	44	46	43	43	35	40	42
The University of Melbourne	46	49	60	48	51	41	46	49	50	54	53
The University of Queensland	49	48	50	47	68	71	77	29	71	78	72
The University of Sydney	56	50	63	44	59	58	66	52	51	46	44
The University of Western Australia	6	9	8	7	51	40	37	38	48	41	35
Total	**202**	**200**	**228**	**188**	**273**	**256**	**269**	**211**	**255**	**259**	**304**

Source: AIHW DSRU analysis of DEST data.

Table C.2: Australian / New Zealand citizens and permanent residents completing courses in dental studies by sex and institution, 1993 to 2003

Institution	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
						Male					
The University of Adelaide	24	23	24	31	18	22	17	26	22	15	25
The University of Melbourne	29	31	24	27	25	19	26	22	22	19	25
The University of Queensland	30	32	26	20	29	32	30	25	25	28	30
The University of Sydney	43	54	52	32	47	24	37	26	25	32	34
The University of Western Australia	19	8	20	12	12	16	15	13	18	18	17
Total	**145**	**148**	**146**	**122**	**131**	**113**	**125**	**112**	**112**	**112**	**131**
						Female					
The University of Adelaide	16	18	21	18	20	9	23	29	14	17	20
The University of Melbourne	12	15	20	26	24	23	18	24	23	26	23
The University of Queensland	16	19	14	22	18	12	18	36	32	35	41
The University of Sydney	25	31	33	26	21	26	24	26	29	26	27
The University of Western Australia	13	10	9	15	13	11	15	20	14	11	9
Total	**82**	**93**	**97**	**107**	**96**	**81**	**98**	**135**	**112**	**115**	**120**
						Persons					
The University of Adelaide	40	41	45	49	38	31	40	55	36	32	45
The University of Melbourne	41	46	44	53	49	42	44	46	45	45	48
The University of Queensland	46	51	40	42	47	44	48	61	57	63	71
The University of Sydney	68	85	85	58	68	50	61	52	54	58	61
The University of Western Australia	32	18	29	27	25	27	30	33	32	29	26
Total	**227**	**241**	**243**	**229**	**227**	**194**	**223**	**247**	**224**	**227**	**251**

Source: AIHW DSRU analysis of DEST data.

Table C.3: Australian / New Zealand citizens and permanent residents completing courses in dental studies by age and sex, 1994 to 2003

Age group (years)	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Average completions 2000–03
Male											
<25	123	121	98	118	88	95	93	89	90	103	94
25–29	15	16	13	8	16	14	9	11	14	21	14
30–34	8	7	11	4	8	11	3	7	4	6	5
35–39	—	—	—	—	—	3	2	2	—	1	1
40–44	2	2	—	1	1	2	4	2	4	—	3
45+	—	—	—	—	—	—	1	1	—	—	1
Total	**148**	**146**	**122**	**131**	**113**	**125**	**112**	**112**	**112**	**131**	**117**
Female											
<25	75	81	86	82	69	72	114	89	94	99	99
25–29	11	10	16	8	7	16	9	13	13	13	12
30–34	7	4	4	4	5	7	4	6	3	3	4
35–39	—	—	—	—	—	2	4	4	1	3	3
40–44	—	2	1	2	—	1	3	—	2	2	2
45+	—	—	—	—	—	—	1	—	2	—	1
Total	**93**	**97**	**107**	**96**	**81**	**98**	**135**	**112**	**115**	**120**	**121**
Persons											
<25	198	202	184	200	157	167	207	178	184	202	193
25–29	26	26	29	16	23	30	18	24	27	34	26
30–34	15	11	15	8	13	18	7	13	7	9	9
35–39	—	—	—	—	—	5	6	6	1	4	4
40–44	2	4	1	3	1	3	7	2	6	2	4
45+	—	—	—	—	—	—	2	1	2	—	1
Total	**241**	**243**	**229**	**227**	**194**	**223**	**247**	**224**	**227**	**251**	**237**

Source: AIHW DSRU analysis of DEST data.

Appendix D: Comprehensive tables of dental labour force and supply projections

Table D.1: Standard projection: projected number of practising dentists by age group and sex, 2003 to 2020

Sex/age	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
								Male										
20–24	137	136	135	135	135	135	163	169	170	171	171	171	171	171	171	171	171	171
25–29	490	520	543	563	579	592	606	638	668	693	712	728	741	750	758	764	769	773
30–34	710	678	661	660	661	665	672	681	693	709	726	743	760	775	789	802	813	823
35–39	763	770	771	775	776	777	779	782	786	792	800	809	820	832	845	858	870	883
40–44	911	895	884	880	876	873	872	871	872	873	874	877	882	887	894	902	911	921
45–49	1,119	1,092	1,068	1,051	1,035	1,022	1,011	1,002	994	989	984	981	979	978	978	980	983	987
50–54	1,035	1,049	1,055	1,055	1,052	1,046	1,038	1,031	1,022	1,015	1,007	1,000	994	989	985	981	979	978
55–59	899	908	917	926	933	937	940	940	939	936	933	929	924	919	915	910	906	902
60–64	510	559	597	627	652	671	687	699	708	715	719	722	723	723	722	721	719	717
65–69	299	313	332	353	374	393	411	426	440	451	461	469	475	479	483	485	486	487
70–74	166	169	174	180	188	198	208	218	228	237	246	253	260	266	271	275	278	281
75+	94	100	106	111	116	121	126	132	139	145	152	158	165	171	176	181	186	190
Total	**7,133**	**7,188**	**7,243**	**7,315**	**7,376**	**7,431**	**7,513**	**7,590**	**7,660**	**7,725**	**7,785**	**7,841**	**7,893**	**7,941**	**7,987**	**8,030**	**8,071**	**8,111**
								Female										
20–24	116	141	147	149	149	149	178	185	187	187	188	188	188	188	188	188	188	188
25–29	479	498	534	572	602	626	648	688	725	756	780	799	814	827	836	844	850	854
30–34	484	503	523	554	585	615	645	673	704	735	766	795	823	847	870	889	907	921
35–39	412	440	468	500	530	560	590	620	649	678	706	735	763	791	818	843	867	889
40–44	383	392	405	423	443	465	488	513	538	563	589	615	641	667	694	719	745	770
45–49	320	330	341	352	365	378	393	410	427	446	465	486	506	528	549	571	594	616
50–54	194	214	232	248	263	276	290	303	316	330	345	359	375	391	407	424	442	460
55–59	92	109	126	142	158	173	187	200	212	224	236	248	260	272	284	297	309	322
60–64	39	46	54	64	73	84	94	104	113	123	132	141	150	158	167	176	184	193
65–69	20	20	22	24	28	32	36	41	46	51	56	61	66	71	76	81	86	90
70–74	4	6	7	8	9	10	11	13	15	17	19	21	23	25	27	29	31	33
75+	4	4	4	4	4	5	5	6	7	8	8	10	11	12	13	15	16	17
Total	**2,547**	**2,703**	**2,861**	**3,040**	**3,208**	**3,372**	**3,567**	**3,756**	**3,940**	**4,118**	**4,291**	**4,458**	**4,620**	**4,777**	**4,929**	**5,076**	**5,217**	**5,354**
Total	**9,680**	**9,891**	**10,104**	**10,355**	**10,585**	**10,803**	**11,080**	**11,345**	**11,600**	**11,843**	**12,076**	**12,299**	**12,513**	**12,719**	**12,916**	**13,106**	**13,289**	**13,465**

Note: For details of the assumptions and inputs for these scenarios see Section 3.4.

Table D.2: Dentists' capacity to supply visits per annum by sex and age group, 2005 to 2020, assuming productivity continues to decline at 50% of the rate of decline observed in the period 1983–84 to 2003–04

Age group (years)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
								Male								
20–29	2,377	2,360	2,342	2,324	2,307	2,289	2,271	2,253	2,236	2,218	2,200	2,183	2,165	2,147	2,130	2,112
30–39	2,581	2,549	2,517	2,485	2,453	2,421	2,389	2,357	2,325	2,293	2,262	2,230	2,198	2,166	2,134	2,102
40–49	3,132	3,113	3,093	3,073	3,053	3,033	3,013	2,993	2,973	2,953	2,934	2,914	2,894	2,874	2,854	2,834
50–59	3,175	3,163	3,151	3,139	3,127	3,115	3,103	3,091	3,078	3,066	3,054	3,042	3,030	3,018	3,006	2,994
60+	1,880	1,854	1,827	1,800	1,773	1,746	1,719	1,692	1,665	1,638	1,612	1,585	1,558	1,531	1,504	1,477
								Female								
20–29	2,494	2,490	2,486	2,482	2,478	2,474	2,471	2,467	2,463	2,459	2,455	2,451	2,447	2,443	2,439	2,435
30–39	2,119	2,110	2,101	2,092	2,084	2,075	2,066	2,057	2,048	2,039	2,031	2,022	2,013	2,004	1,995	1,986
40–49	2,196	2,182	2,169	2,155	2,142	2,128	2,115	2,101	2,088	2,074	2,060	2,047	2,033	2,020	2,006	1,993
50–59	2,255	2,246	2,237	2,228	2,219	2,209	2,200	2,191	2,182	2,173	2,164	2,155	2,146	2,136	2,127	2,118
60+	2,440	2,448	2,457	2,465	2,473	2,481	2,489	2,497	2,505	2,513	2,522	2,530	2,538	2,546	2,554	2,562

Note: Number of visits supplied is that used in the standard supply projection.

Table D.3: Standard projection: projected number of dental visits supplied ('000s) by practising dentists, sex and age of dentist, 2003 to 2020

Age group (years)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Male																		
20–24	319	313	310	308	305	303	362	373	373	371	368	365	362	359	356	353	350	348
25–29	1,140	1,190	1,243	1,282	1,308	1,326	1,347	1,408	1,462	1,505	1,536	1,557	1,571	1,579	1,583	1,582	1,579	1,574
30–34	1,810	1,708	1,645	1,621	1,604	1,594	1,590	1,589	1,597	1,611	1,628	1,644	1,657	1,667	1,672	1,674	1,672	1,667
35–39	1,945	1,940	1,919	1,903	1,882	1,861	1,842	1,826	1,811	1,800	1,793	1,789	1,788	1,788	1,790	1,790	1,790	1,789
40–44	2,786	2,719	2,670	2,639	2,612	2,587	2,566	2,548	2,532	2,518	2,506	2,498	2,493	2,492	2,494	2,499	2,506	2,515
45–49	3,422	3,318	3,224	3,152	3,086	3,027	2,975	2,929	2,888	2,852	2,820	2,792	2,768	2,747	2,729	2,715	2,705	2,697
50–54	3,192	3,224	3,230	3,217	3,194	3,164	3,130	3,094	3,058	3,023	2,989	2,957	2,927	2,900	2,876	2,855	2,837	2,822
55–59	2,773	2,788	2,807	2,823	2,833	2,836	2,833	2,823	2,808	2,790	2,769	2,745	2,721	2,696	2,672	2,648	2,625	2,604
60–64	951	1,027	1,082	1,121	1,147	1,165	1,174	1,177	1,174	1,166	1,155	1,141	1,124	1,105	1,085	1,064	1,042	1,020
65–69	558	576	602	631	658	682	702	718	729	736	740	740	737	732	725	715	705	693
70–74	310	311	315	322	332	343	355	367	378	387	395	400	404	406	407	406	403	400
75+	175	185	192	198	204	210	216	223	230	237	244	250	256	261	264	267	269	270
Total	**19,379**	**19,308**	**19,239**	**19,217**	**19,165**	**19,098**	**19,093**	**19,073**	**19,040**	**18,995**	**18,941**	**18,878**	**18,808**	**18,733**	**18,653**	**18,570**	**18,485**	**18,398**
Female																		
20–24	280	340	354	357	358	357	426	442	445	446	445	445	444	443	442	442	441	440
25–29	1,155	1,200	1,283	1,372	1,442	1,498	1,549	1,642	1,727	1,797	1,852	1,894	1,927	1,953	1,972	1,987	1,998	2,006
30–34	997	1,031	1,069	1,127	1,184	1,240	1,295	1,346	1,401	1,457	1,512	1,563	1,610	1,652	1,687	1,718	1,744	1,764
35–39	849	903	955	1,017	1,074	1,130	1,186	1,240	1,293	1,344	1,395	1,445	1,494	1,542	1,587	1,629	1,667	1,703
40–44	821	834	857	890	926	966	1,008	1,052	1,097	1,141	1,186	1,230	1,274	1,317	1,359	1,401	1,440	1,478
45–49	686	704	721	741	762	786	812	841	871	903	936	971	1,006	1,041	1,077	1,113	1,148	1,183
50–54	425	467	503	537	566	593	620	645	671	698	725	753	782	812	843	874	906	939
55–59	202	238	273	308	340	371	399	425	450	474	497	520	542	565	588	611	634	658
60–64	91	108	128	150	174	198	223	248	272	296	319	342	364	386	409	431	453	476
65–69	47	48	52	58	66	76	87	98	111	123	136	149	162	174	186	199	211	223
70–74	9	13	16	18	21	24	27	31	35	40	45	50	55	61	66	71	77	82
75+	9	9	9	10	10	11	13	14	16	18	20	23	26	29	32	36	39	43
Total	**5,571**	**5,894**	**6,220**	**6,585**	**6,925**	**7,250**	**7,645**	**8,026**	**8,389**	**8,737**	**9,068**	**9,385**	**9,687**	**9,975**	**10,249**	**10,510**	**10,759**	**10,996**

Note: For details of the assumptions and inputs for these scenarios see Section 3.4.

Table D.4: Projected number of employed allied dental practitioner projections and number of visits supplied, 2005 to 2020

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
								Numbers of allied dental practitioners								
Dental therapists	1,271	1,283	1,292	1,298	1,300	1,300	1,296	1,290	1,282	1,272	1,261	1,250	1,238	1,226	1,215	1,204
Dental hygienists	831	947	1,055	1,156	1,251	1,339	1,422	1,500	1,572	1,641	1,705	1,766	1,824	1,878	1,929	1,977
Dental prosthetists	860	856	852	848	845	841	837	832	827	822	816	810	804	798	792	786
								Dental visits supplied (millions)								
Dental therapists	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5
Dental hygienists	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.7	3.9	4.0	4.1	4.2
Dental prosthetists	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Total	**5.6**	**5.9**	**6.1**	**6.3**	**6.5**	**6.7**	**6.9**	**7.0**	**7.1**	**7.3**	**7.4**	**7.5**	**7.5**	**7.6**	**7.7**	**7.8**

Notes:

1. This table present projections of total visits supplied by allied dental practitioners. Allied dental practitioner visits are discounted when aggregated with dentist visits. For the purposes of reconciliation of supply with demand, only visits supplied independent of a visit to the dentists are counted toward total aggregated supply (Appendix B).
2. For the details of the assumptions and inputs for these projections see Section 3.4.

Table D.5: Dentists' capacity to supply visits per annum by sex and age group, 2005 to 2020, assuming productivity continues to decline at 100% of the rate of decline observed in the period 1983–84 to 2003–04

Age group (years)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
								Male								
20–29	2,342	2,307	2,271	2,236	2,200	2,165	2,130	2,094	2,059	2,024	1,988	1,953	1,918	1,882	1,847	1,811
30–39	2,517	2,453	2,389	2,325	2,262	2,198	2,134	2,070	2,006	1,942	1,879	1,815	1,751	1,687	1,623	1,559
40–49	3,093	3,053	3,013	2,973	2,934	2,894	2,854	2,814	2,774	2,735	2,695	2,655	2,615	2,576	2,536	2,496
50–59	3,151	3,127	3,103	3,078	3,054	3,030	3,006	2,982	2,958	2,933	2,909	2,885	2,861	2,837	2,813	2,788
60+	1,827	1,773	1,719	1,665	1,612	1,558	1,504	1,450	1,396	1,343	1,289	1,235	1,181	1,128	1,074	1,020
								Female								
20–29	2,486	2,478	2,471	2,463	2,455	2,447	2,439	2,431	2,423	2,416	2,408	2,400	2,392	2,384	2,376	2,368
30–39	2,101	2,084	2,066	2,048	2,031	2,013	1,995	1,977	1,960	1,942	1,924	1,907	1,889	1,871	1,854	1,836
40–49	2,169	2,142	2,115	2,088	2,060	2,033	2,006	1,979	1,952	1,925	1,898	1,870	1,843	1,816	1,789	1,762
50–59	2,237	2,219	2,200	2,182	2,164	2,146	2,127	2,109	2,091	2,073	2,054	2,036	2,018	2,000	1,981	1,963
60+	2,457	2,473	2,489	2,505	2,522	2,538	2,554	2,570	2,587	2,603	2,619	2,635	2,652	2,668	2,684	2,700

Note: Visits supplied applied in the low supply scenario (see Section 6.4).

Table D.6: Projected number of dental visits (millions) by additional graduates scenario, age group and sex, 2005, 2010, 2015 to 2020

Age group (years)	Additional 70 graduates (total 377)				Additional 140 graduates (total 447)				Additional 210 graduates (total 517)			
	2005	2010	2015	2020	2005	2010	2015	2020	2005	2010	2015	2020
						Male						
20–24	0.31	0.37	0.44	0.42	0.31	0.37	0.51	0.49	0.31	0.37	0.59	0.56
25–29	1.24	1.41	1.68	1.81	1.24	1.41	1.79	2.06	1.24	1.41	1.90	2.30
30–34	1.64	1.59	1.68	1.80	1.64	1.59	1.70	1.93	1.64	1.59	1.72	2.06
35–39	1.92	1.83	1.79	1.84	1.92	1.83	1.80	1.89	1.92	1.83	1.80	1.94
40–44	2.67	2.55	2.50	2.54	2.67	2.55	2.50	2.57	2.67	2.55	2.51	2.60
45–49	3.22	2.93	2.77	2.71	3.22	2.93	2.77	2.72	3.22	2.93	2.77	2.73
50–54	3.23	3.09	2.93	2.83	3.23	3.09	2.93	2.83	3.23	3.09	2.93	2.83
55–59	2.81	2.82	2.72	2.61	2.81	2.82	2.72	2.61	2.81	2.82	2.72	2.61
60–64	1.08	1.18	1.12	1.02	1.08	1.18	1.12	1.02	1.08	1.18	1.12	1.02
65–69	0.60	0.72	0.74	0.69	0.60	0.72	0.74	0.69	0.60	0.72	0.74	0.69
70–74	0.31	0.37	0.40	0.40	0.31	0.37	0.40	0.40	0.31	0.37	0.40	0.40
75+	0.19	0.22	0.26	0.27	0.19	0.22	0.26	0.27	0.19	0.22	0.26	0.27
Total	**19.24**	**19.07**	**19.03**	**18.94**	**19.24**	**19.07**	**19.24**	**19.47**	**19.24**	**19.07**	**19.46**	**20.01**
						Female						
20–24	0.35	0.44	0.53	0.53	0.35	0.44	0.62	0.62	0.35	0.44	0.71	0.71
25–29	1.28	1.64	2.05	2.30	1.28	1.64	2.18	2.58	1.28	1.64	2.31	2.87
30–34	1.07	1.35	1.63	1.89	1.07	1.35	1.64	2.02	1.07	1.35	1.66	2.15
35–39	0.96	1.24	1.50	1.75	0.96	1.24	1.51	1.80	0.96	1.24	1.51	1.86
40–44	0.86	1.05	1.28	1.50	0.86	1.05	1.28	1.51	0.86	1.05	1.28	1.53
45–49	0.72	0.84	1.01	1.19	0.72	0.84	1.01	1.20	0.72	0.84	1.01	1.20
50–54	0.50	0.65	0.78	0.94	0.50	0.65	0.78	0.94	0.50	0.65	0.78	0.95
55–59	0.27	0.43	0.54	0.66	0.27	0.43	0.54	0.66	0.27	0.43	0.54	0.66
60–64	0.13	0.25	0.36	0.48	0.13	0.25	0.36	0.48	0.13	0.25	0.36	0.48
65–69	0.05	0.10	0.16	0.22	0.05	0.10	0.16	0.22	0.05	0.10	0.16	0.22
70–74	0.02	0.03	0.06	0.08	0.02	0.03	0.06	0.08	0.02	0.03	0.06	0.08
75+	0.01	0.01	0.03	0.04	0.01	0.01	0.03	0.04	0.01	0.01	0.03	0.04
Total	**6.22**	**8.03**	**9.93**	**11.58**	**6.22**	**8.03**	**10.17**	**12.17**	**6.22**	**8.03**	**10.42**	**12.76**
Total dentist visits	**25.46**	**27.10**	**28.96**	**30.52**	**25.46**	**27.10**	**29.42**	**31.65**	**25.46**	**27.10**	**29.88**	**32.77**
Allied dental visits	**4.06**	**4.31**	**4.35**	**4.30**	**4.06**	**4.31**	**4.35**	**4.30**	**4.06**	**4.31**	**4.35**	**4.30**
Total dental visits	**29.52**	**31.41**	**33.30**	**34.82**	**29.52**	**31.41**	**33.76**	**35.95**	**29.52**	**31.41**	**34.23**	**37.07**

Table D.7: Projected number of dental visits supplied (millions) by ADC scenarios, age group and sex, 2005, 2010, 2015 to 2020

	ADC candidates, 50 per year				ADC candidates, 150 per year			
Age group (years)	**2005**	**2010**	**2015**	**2020**	**2005**	**2010**	**2015**	**2020**
				Male				
20–24	0.31	0.37	0.36	0.35	0.31	0.37	0.36	0.35
25–29	1.24	1.39	1.54	1.55	1.24	1.43	1.60	1.60
30–34	1.64	1.53	1.57	1.57	1.64	1.65	1.75	1.76
35–39	1.92	1.77	1.68	1.66	1.92	1.88	1.90	1.92
40–44	2.67	2.50	2.37	2.33	2.67	2.60	2.62	2.69
45–49	3.22	2.88	2.65	2.52	3.22	2.98	2.88	2.87
50–54	3.23	3.08	2.87	2.71	3.23	3.11	2.99	2.94
55–59	2.81	2.82	2.70	2.54	2.81	2.83	2.75	2.67
60–64	1.08	1.18	1.12	1.01	1.08	1.18	1.13	1.03
65–69	0.60	0.72	0.74	0.69	0.60	0.72	0.74	0.70
70–74	0.31	0.37	0.40	0.40	0.31	0.37	0.40	0.40
75+	0.19	0.22	0.26	0.27	0.19	0.22	0.26	0.27
Total	**19.24**	**18.82**	**18.26**	**17.59**	**19.24**	**19.33**	**19.36**	**19.21**
				Female				
20–24	0.35	0.44	0.44	0.44	0.35	0.44	0.44	0.44
25–29	1.28	1.60	1.87	1.95	1.28	1.68	1.98	2.06
30–34	1.07	1.29	1.52	1.65	1.07	1.40	1.70	1.87
35–39	0.96	1.19	1.39	1.56	0.96	1.29	1.60	1.84
40–44	0.86	1.02	1.19	1.36	0.86	1.08	1.35	1.60
45–49	0.72	0.83	0.96	1.10	0.72	0.85	1.05	1.27
50–54	0.50	0.64	0.76	0.89	0.50	0.65	0.81	0.99
55–59	0.27	0.42	0.53	0.63	0.27	0.43	0.55	0.69
60–64	0.13	0.25	0.36	0.46	0.13	0.25	0.37	0.49
65–69	0.05	0.10	0.16	0.22	0.05	0.10	0.16	0.23
70–74	0.02	0.03	0.06	0.08	0.02	0.03	0.06	0.08
75+	0.01	0.01	0.03	0.04	0.01	0.01	0.03	0.04
Total	**6.22**	**7.82**	**9.26**	**10.38**	**6.22**	**8.23**	**10.11**	**11.61**
Total dentist visits	**25.46**	**26.64**	**27.52**	**27.97**	**25.46**	**27.56**	**29.47**	**30.82**
Allied dental visits	**4.06**	**4.31**	**4.35**	**4.30**	**4.06**	**4.31**	**4.35**	**4.30**
Total dental visits	**29.52**	**30.95**	**31.87**	**32.27**	**29.52**	**31.86**	**33.82**	**35.12**

Table D.8: Projected number of dental visits supplied (millions) by attrition scenario, age group and sex, 2005, 2010, 2015 to 2020

	Decline in dentist attrition rates, 50–64 years (-30% by 2020)				Decline in female dentist attrition rates (-20% by 2020)			
Age group (years)	**2005**	**2010**	**2015**	**2020**	**2005**	**2010**	**2015**	**2020**
				Male				
20–24	0.31	0.37	0.36	0.35	0.31	0.37	0.36	0.35
25–29	1.24	1.41	1.57	1.57	1.24	1.41	1.57	1.57
30–34	1.64	1.59	1.66	1.67	1.64	1.59	1.66	1.67
35–39	1.92	1.83	1.79	1.79	1.92	1.83	1.79	1.79
40–44	2.67	2.55	2.49	2.51	2.67	2.55	2.49	2.51
45–49	3.22	2.93	2.77	2.70	3.22	2.93	2.77	2.70
50–54	3.23	3.11	2.96	2.86	3.23	3.09	2.93	2.82
55–59	2.81	2.86	2.80	2.72	2.81	2.82	2.72	2.60
60–64	1.09	1.21	1.19	1.12	1.08	1.18	1.12	1.02
65–69	0.60	0.73	0.77	0.75	0.60	0.72	0.74	0.69
70–74	0.31	0.37	0.42	0.42	0.31	0.37	0.40	0.40
75+	0.19	0.22	0.26	0.28	0.19	0.22	0.26	0.27
Total	**19.25**	**19.16**	**19.03**	**18.76**	**19.24**	**19.07**	**18.81**	**18.40**
				Female				
20–24	0.35	0.44	0.44	0.44	0.35	0.44	0.44	0.44
25–29	1.28	1.64	1.93	2.01	1.29	1.66	1.97	2.07
30–34	1.07	1.35	1.61	1.76	1.07	1.36	1.66	1.85
35–39	0.96	1.24	1.49	1.70	0.96	1.26	1.54	1.80
40–44	0.86	1.05	1.27	1.48	0.86	1.06	1.31	1.56
45–49	0.72	0.84	1.01	1.18	0.72	0.85	1.03	1.25
50–54	0.50	0.65	0.79	0.96	0.50	0.65	0.80	0.99
55–59	0.27	0.43	0.57	0.71	0.27	0.43	0.56	0.71
60–64	0.13	0.26	0.39	0.54	0.13	0.25	0.38	0.52
65–69	0.05	0.10	0.17	0.25	0.05	0.10	0.18	0.26
70–74	0.02	0.03	0.06	0.09	0.02	0.03	0.06	0.10
75+	0.01	0.01	0.03	0.05	0.01	0.02	0.03	0.06
Total	**6.22**	**8.05**	**9.77**	**11.17**	**6.23**	**8.12**	**9.97**	**11.61**
Total dentist visits	**25.47**	**27.21**	**28.79**	**29.93**	**25.47**	**27.19**	**28.78**	**30.01**
Allied dental visits	**4.06**	**4.31**	**4.35**	**4.30**	**4.06**	**4.31**	**4.35**	**4.30**
Total dental visits	**29.53**	**31.52**	**33.14**	**34.23**	**29.53**	**31.50**	**33.13**	**34.31**

Table D.9: Projected number of dental visits supplied (millions) by productivity scenario, age group and sex, 2005, 2010, 2015 to 2020

	High supply, no decline in productivity				Low supply, continued decline in productivity			
Age group (years)	**2005**	**2010**	**2015**	**2020**	**2005**	**2010**	**2015**	**2020**
				Male				
20–24	0.31	0.39	0.40	0.40	0.31	0.35	0.33	0.30
25–29	1.26	1.48	1.72	1.80	1.22	1.33	1.42	1.35
30–34	1.69	1.74	1.94	2.10	1.60	1.44	1.38	1.24
35–39	1.97	1.99	2.09	2.25	1.87	1.66	1.49	1.33
40–44	2.70	2.66	2.70	2.81	2.64	2.43	2.29	2.21
45–49	3.27	3.06	2.99	3.02	3.18	2.79	2.54	2.38
50–54	3.25	3.18	3.07	3.02	3.21	3.01	2.79	2.63
55–59	2.83	2.90	2.85	2.78	2.79	2.75	2.59	2.43
60–64	1.11	1.30	1.35	1.34	1.05	1.05	0.90	0.70
65–69	0.62	0.79	0.88	0.91	0.58	0.64	0.59	0.48
70–74	0.32	0.41	0.49	0.52	0.31	0.33	0.32	0.28
75+	0.20	0.25	0.31	0.35	0.19	0.20	0.20	0.19
Total	**19.53**	**20.16**	**20.78**	**21.30**	**18.94**	**17.98**	**16.84**	**15.50**
				Female				
20–24	0.36	0.45	0.45	0.45	0.35	0.44	0.44	0.43
25–29	1.29	1.66	1.96	2.06	1.28	1.62	1.89	1.95
30–34	1.08	1.39	1.69	1.90	1.06	1.31	1.53	1.63
35–39	0.96	1.28	1.57	1.83	0.95	1.20	1.42	1.57
40–44	0.87	1.10	1.37	1.65	0.85	1.01	1.17	1.31
45–49	0.73	0.88	1.09	1.32	0.71	0.80	0.93	1.05
50–54	0.51	0.66	0.82	1.01	0.50	0.63	0.74	0.87
55–59	0.28	0.44	0.57	0.71	0.27	0.41	0.51	0.61
60–64	0.13	0.24	0.35	0.45	0.13	0.25	0.38	0.50
65–69	0.05	0.10	0.16	0.21	0.05	0.10	0.17	0.24
70–74	0.02	0.03	0.05	0.08	0.02	0.03	0.06	0.09
75+	0.01	0.01	0.02	0.04	0.01	0.01	0.03	0.05
Total	**6.27**	**8.23**	**10.12**	**11.71**	**6.17**	**7.82**	**9.26**	**10.29**
Total dentist visits	**25.80**	**28.40**	**30.90**	**33.00**	**25.12**	**25.80**	**26.09**	**25.79**
Allied dental visits	**4.06**	**4.31**	**4.35**	**4.30**	**4.06**	**4.31**	**4.35**	**4.30**
Total dental visits	**29.86**	**32.70**	**35.24**	**37.30**	**29.18**	**30.11**	**30.44**	**30.09**

Appendix E: Australian Bureau of Statistics projected estimated resident population, 2003 to 2020 (Series 8)

	Age group (years)										
Year	0–4	5–11	12–17	18–24	25–34	35–44	45–54	55–64	65–74	75+	Total
2003	1,265,374	1,890,964	1,645,751	1,938,824	2,891,454	2,996,291	2,711,925	2,025,362	1,349,623	1,195,638	19,911,206
2004	1,257,648	1,886,631	1,659,124	1,968,443	2,895,814	3,011,793	2,758,666	2,111,798	1,372,030	1,233,244	20,155,191
2005	1,248,596	1,883,134	1,674,110	1,987,507	2,900,745	3,027,697	2,803,928	2,199,742	1,399,661	1,267,421	20,392,541
2006	1,239,830	1,877,931	1,688,774	1,996,455	2,893,158	3,057,026	2,853,383	2,286,587	1,428,706	1,304,212	20,626,062
2007	1,237,600	1,863,788	1,700,913	2,004,238	2,896,588	3,081,185	2,903,980	2,364,144	1,472,020	1,333,269	20,857,725
2008	1,234,359	1,854,348	1,703,625	2,012,597	2,914,740	3,093,038	2,951,930	2,444,519	1,517,887	1,360,489	21,087,532
2009	1,230,959	1,845,535	1,700,873	2,027,513	2,937,278	3,101,890	2,995,420	2,507,980	1,579,562	1,388,509	21,315,519
2010	1,227,659	1,839,474	1,694,642	2,040,193	2,969,102	3,111,557	3,024,403	2,569,333	1,647,729	1,417,608	21,541,700
2011	1,224,451	1,830,540	1,690,536	2,053,917	3,002,419	3,121,973	3,043,169	2,629,718	1,713,709	1,455,479	21,765,911
2012	1,222,323	1,820,095	1,686,360	2,070,017	3,034,756	3,133,516	3,062,331	2,650,369	1,813,634	1,495,877	21,989,278
2013	1,222,433	1,809,953	1,679,526	2,086,483	3,065,327	3,143,123	3,075,048	2,687,946	1,904,597	1,538,546	22,212,982
2014	1,224,747	1,806,486	1,669,793	2,094,394	3,096,441	3,144,936	3,090,779	2,735,250	1,988,666	1,585,541	22,437,033
2015	1,229,195	1,802,170	1,661,457	2,096,201	3,125,575	3,149,382	3,107,508	2,781,484	2,074,043	1,634,396	22,661,411
2016	1,235,881	1,797,633	1,656,045	2,090,264	3,148,624	3,142,640	3,137,785	2,831,944	2,158,204	1,687,013	22,886,033
2017	1,243,738	1,794,039	1,647,898	2,086,336	3,166,448	3,146,809	3,162,924	2,883,370	2,233,706	1,745,472	23,110,740
2018	1,251,446	1,792,759	1,638,235	2,083,169	3,179,807	3,165,554	3,175,847	2,932,225	2,311,553	1,804,772	23,335,367
2019	1,258,830	1,793,830	1,628,802	2,078,187	3,196,136	3,188,624	3,185,743	2,976,613	2,374,140	1,878,865	23,559,770
2020	1,265,745	1,797,196	1,625,959	2,064,269	3,211,789	3,220,904	3,196,350	3,006,808	2,435,007	1,959,715	23,783,742

Source: ABS, projection Series 8.

Appendix F: Methods: demand projection model

This section describes in detail the inputs and components of the demand projection model.

For the purposes of this publication, the word 'demand' is used synonymously with usage of dental care or expressed demand. Historical patterns of usage are examined and used to estimate future demand for dental care. Projections of future demand presented in this publication are not based on the number of visits that will be 'needed' or actually used; rather, they are an estimate of the quantity of dental visits that people are likely to consume based on previous patterns of consumption.

Projected demand is calculated by multiplying estimated age-specific PCD rates for dentate and edentulous persons by the numbers of people that are projected to be in those age groups in the future.

Demand for dental visits in 2020 for a given age group i is equivalent to:

$$\text{Demand 2020, age group (i)} = ERP_{2020} \left(PCD(D)_{(i,\,2020)} \times (1 - \%E_{2020}) + PCD(E)_{(i,\,2020)} \times \%E_{2020}\right)$$

Where:

ERP_{2020} = projected estimated resident population in 2020
$PCD(D)_{(i,\,2020)}$ per capita demand for dentate persons for age group i in 2020
$PCD(E)_{(i,\,2020)}$ per capita demand for edentulous persons for age group I in 2020
$\%E_{2020}$ = projected percentage edentulous persons in the year 2020.

Hence, there are three key components of the demand projection:

- **Population projection**
  Population projections were sourced from the ABS. See Appendix E.

- **Projection of percentage of edentulous persons**
  The projection of the percentage of edentulous persons (those with no natural teeth remaining) of the total population is estimated from a 2005 baseline (source NSAOH 2004–06) and is based on projected percentages previously published (Carter & Stewart 2003) (Table F.1).

- **Per capita demand (PCD) per annum by age group**
  PCD is calculated by multiplying the percentage accessing in the previous 12 months by the mean number of visits made in that period (source NDTIS 2005). The 'no PCD growth' projection was based on the 2005 PCD rates for dentate and edentulous persons, and these rates were held constant through out the projection.

- **Dentate PCD projection**
  Future growth was forecasted from a 2005 baseline using linear regression with available data points from the period 1979 to 1995. Under the 'half PCD growth' projection, PCD was assumed to grow at half the rate observed between 1979 and 1995. Under the 'continued PCD growth' projection, it was assumed that PCD will grow at the same rate observed between 1979 and 1995 (Table F.2).

- **Edentulous PCD projection**
  Future growth was forecasted by applying an annualised percentage growth rate observed between 1988 and 1995. Under the 'half PCD growth' projection, the percentage growth was 50% of the growth observed in that period, and under the 'continued PCD growth' projection growth was 100% (Table F.3).

Table F.1: Projected percentage of edentulous persons, 2005 to 2020

	Age group (years)									
Year	0–4	5–11	12–17	18–24	25–34	35–44	45–54	55–64	65–74	75+
2005[(a)]	0.0	0.0	0.0	0.2	0.2	0.2	2.9	9.8	20.3	35.7
2006	0.0	0.0	0.0	0.2	0.2	0.4	2.9	9.5	19.8	35.1
2007	0.0	0.0	0.0	0.2	0.3	0.5	2.8	9.1	19.3	34.5
2008	0.0	0.0	0.0	0.1	0.3	0.7	2.8	8.8	18.8	34.0
2009	0.0	0.0	0.0	0.1	0.4	0.8	2.7	8.4	18.3	33.4
2010[(b)]	0.0	0.0	0.0	0.1	0.4	1.0	2.7	8.1	17.8	32.8
2011	0.0	0.0	0.0	0.1	0.4	1.0	2.6	7.8	17.0	31.7
2012	0.0	0.0	0.0	0.1	0.4	0.9	2.5	7.4	16.3	30.6
2013	0.0	0.0	0.0	0.1	0.3	0.9	2.5	7.1	15.5	29.5
2014	0.0	0.0	0.0	0.1	0.3	0.9	2.4	6.7	14.8	28.4
2015	0.0	0.0	0.0	0.1	0.3	0.9	2.3	6.4	14.0	27.3
2016	0.0	0.0	0.0	0.0	0.3	0.8	2.2	6.1	13.2	26.1
2017	0.0	0.0	0.0	0.0	0.3	0.8	2.1	5.7	12.5	25.0
2018	0.0	0.0	0.0	0.0	0.2	0.8	2.1	5.4	11.7	23.9
2019	0.0	0.0	0.0	0.0	0.2	0.7	2.0	5.0	11.0	22.8
2020[(b)]	0.0	0.0	0.0	0.0	0.2	0.7	1.9	4.7	10.2	21.7

Sources: (a) NDTIS 2005, (b) Carter & Stewart 2003, NDTIS 2002. Projections of percentage edentulous persons by age group.

Table F.2: Dentate per capita demand for dental visits by growth assumption and age group, 2005 to 2020

Year	Age group (years)									
	0–4	5–11	12–17	18–24	25–34	35–44	45–54	55–64	65–74	75+
					'Half PCD growth' projection					
2005	0.20	1.64	2.17	1.27	1.14	1.33	1.55	1.71	1.63	1.53
2006	0.20	1.68	2.20	1.25	1.14	1.35	1.56	1.72	1.67	1.56
2007	0.20	1.70	2.22	1.26	1.14	1.36	1.58	1.74	1.70	1.58
2008	0.20	1.72	2.24	1.26	1.14	1.38	1.60	1.76	1.72	1.60
2009	0.20	1.74	2.26	1.27	1.14	1.39	1.62	1.78	1.74	1.62
2010	0.20	1.76	2.28	1.27	1.15	1.40	1.64	1.80	1.77	1.65
2011	0.20	1.78	2.30	1.28	1.15	1.42	1.67	1.82	1.79	1.67
2012	0.20	1.80	2.33	1.29	1.15	1.43	1.69	1.84	1.81	1.69
2013	0.20	1.82	2.35	1.29	1.15	1.45	1.71	1.86	1.84	1.71
2014	0.20	1.85	2.37	1.30	1.15	1.46	1.73	1.88	1.86	1.74
2015	0.20	1.87	2.39	1.30	1.15	1.47	1.75	1.90	1.88	1.76
2016	0.20	1.89	2.41	1.31	1.16	1.49	1.77	1.92	1.91	1.78
2017	0.20	1.91	2.43	1.31	1.16	1.50	1.80	1.94	1.93	1.80
2018	0.20	1.93	2.45	1.32	1.16	1.51	1.82	1.96	1.95	1.82
2019	0.20	1.95	2.48	1.33	1.16	1.53	1.84	1.98	1.98	1.85
2020	0.20	1.97	2.50	1.33	1.16	1.54	1.86	2.00	2.00	1.87
					'Continued PCD growth' projection					
2005	0.20	1.64	2.17	1.27	1.14	1.33	1.55	1.71	1.63	1.53
2006	0.20	1.71	2.22	1.23	1.14	1.36	1.56	1.74	1.71	1.59
2007	0.20	1.76	2.27	1.25	1.14	1.39	1.61	1.78	1.76	1.63
2008	0.20	1.80	2.31	1.26	1.14	1.42	1.65	1.82	1.81	1.68
2009	0.20	1.84	2.35	1.27	1.15	1.45	1.69	1.86	1.85	1.72
2010	0.20	1.88	2.40	1.28	1.15	1.48	1.74	1.90	1.90	1.77
2011	0.20	1.93	2.44	1.29	1.15	1.50	1.78	1.94	1.95	1.81
2012	0.20	1.97	2.48	1.30	1.15	1.53	1.82	1.98	1.99	1.85
2013	0.20	2.01	2.52	1.31	1.16	1.56	1.87	2.02	2.04	1.90
2014	0.20	2.05	2.57	1.32	1.16	1.59	1.91	2.06	2.09	1.94
2015	0.20	2.10	2.61	1.34	1.16	1.61	1.95	2.10	2.13	1.99
2016	0.20	2.14	2.65	1.35	1.17	1.64	2.00	2.14	2.18	2.03
2017	0.20	2.18	2.69	1.36	1.17	1.67	2.04	2.18	2.23	2.08
2018	0.20	2.22	2.74	1.37	1.17	1.70	2.08	2.22	2.27	2.12
2019	0.20	2.27	2.78	1.38	1.18	1.72	2.13	2.26	2.32	2.17
2020	0.20	2.31	2.82	1.39	1.18	1.75	2.17	2.29	2.37	2.21

Note: Under the 'no PCD growth' projection PCD is assumed to remain constant at 2005 rate.

Table F.3: Edentulous per capita demand for dental visits by growth assumption and age group, 2005 to 2020

	Age group (years)									
Year	0–4	5–11	12–17	18–24	25–34	35–44	45–54	55–64	65–74	75+
					'Half PCD growth' projection					
2005	0.00	0.00	0.00	0.67	0.67	0.67	0.67	0.67	0.67	0.67
2006	0.00	0.00	0.00	0.68	0.68	0.68	0.68	0.68	0.68	0.68
2007	0.00	0.00	0.00	0.69	0.69	0.69	0.69	0.69	0.69	0.69
2008	0.00	0.00	0.00	0.70	0.70	0.70	0.70	0.70	0.70	0.70
2009	0.00	0.00	0.00	0.71	0.71	0.71	0.71	0.71	0.71	0.71
2010	0.00	0.00	0.00	0.72	0.72	0.72	0.72	0.72	0.72	0.72
2011	0.00	0.00	0.00	0.73	0.73	0.73	0.73	0.73	0.73	0.73
2012	0.00	0.00	0.00	0.74	0.74	0.74	0.74	0.74	0.74	0.74
2013	0.00	0.00	0.00	0.74	0.74	0.74	0.74	0.74	0.74	0.74
2014	0.00	0.00	0.00	0.75	0.75	0.75	0.75	0.75	0.75	0.75
2015	0.00	0.00	0.00	0.76	0.76	0.76	0.76	0.76	0.76	0.76
2016	0.00	0.00	0.00	0.77	0.77	0.77	0.77	0.77	0.77	0.77
2017	0.00	0.00	0.00	0.78	0.78	0.78	0.78	0.78	0.78	0.78
2018	0.00	0.00	0.00	0.79	0.79	0.79	0.79	0.79	0.79	0.79
2019	0.00	0.00	0.00	0.80	0.80	0.80	0.80	0.80	0.80	0.80
2020	0.00	0.00	0.00	0.81	0.81	0.81	0.81	0.81	0.81	0.81
					'Continued PCD growth' projection					
2005	0.00	0.00	0.00	0.67	0.67	0.67	0.67	0.67	0.67	0.67
2006	0.00	0.00	0.00	0.69	0.69	0.69	0.69	0.69	0.69	0.69
2007	0.00	0.00	0.00	0.71	0.71	0.71	0.71	0.71	0.71	0.71
2008	0.00	0.00	0.00	0.73	0.73	0.73	0.73	0.73	0.73	0.73
2009	0.00	0.00	0.00	0.74	0.74	0.74	0.74	0.74	0.74	0.74
2010	0.00	0.00	0.00	0.76	0.76	0.76	0.76	0.76	0.76	0.76
2011	0.00	0.00	0.00	0.78	0.78	0.78	0.78	0.78	0.78	0.78
2012	0.00	0.00	0.00	0.80	0.80	0.80	0.80	0.80	0.80	0.80
2013	0.00	0.00	0.00	0.82	0.82	0.82	0.82	0.82	0.82	0.82
2014	0.00	0.00	0.00	0.84	0.84	0.84	0.84	0.84	0.84	0.84
2015	0.00	0.00	0.00	0.86	0.86	0.86	0.86	0.86	0.86	0.86
2016	0.00	0.00	0.00	0.87	0.87	0.87	0.87	0.87	0.87	0.87
2017	0.00	0.00	0.00	0.89	0.89	0.89	0.89	0.89	0.89	0.89
2018	0.00	0.00	0.00	0.91	0.91	0.91	0.91	0.91	0.91	0.91
2019	0.00	0.00	0.00	0.93	0.93	0.93	0.93	0.93	0.93	0.93
2020	0.00	0.00	0.00	0.95	0.95	0.95	0.95	0.95	0.95	0.95

Appendix G: Comprehensive tables of demand projections for dental visits

Table G.1: Demand projections for dental visits (millions) by assumptions of growth in per capita demand, 2005, 2010, 2015 and 2020

Age group (years)	'No PCD growth'				'Half PCD growth'				'Continued PCD growth'			
	2005	2010	2015	2020	2005	2010	2015	2020	2005	2010	2015	2020
0–4	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
5–11	3.08	3.01	2.95	2.94	3.08	3.24	3.36	3.55	3.08	3.47	3.78	4.15
12–17	3.64	3.68	3.61	3.53	3.64	3.87	3.97	4.06	3.64	4.06	4.33	4.59
18–24	2.52	2.59	2.66	2.62	2.52	2.60	2.73	2.75	2.52	2.61	2.80	2.87
25–34	3.32	3.39	3.57	3.67	3.32	3.40	3.60	3.73	3.32	3.40	3.63	3.78
35–44	4.03	4.13	4.18	4.28	4.03	4.35	4.62	4.95	4.03	4.57	5.06	5.62
45–54	4.28	4.62	4.76	4.91	4.28	4.90	5.38	5.89	4.28	5.17	5.99	6.86
55–64	3.53	4.17	4.56	4.98	3.53	4.41	5.09	5.85	3.53	4.65	5.61	6.71
65–74	2.01	2.41	3.11	3.73	2.01	2.60	3.58	4.57	2.01	2.80	4.06	5.41
75+	1.55	1.77	2.11	2.63	1.55	1.90	2.43	3.21	1.55	2.04	2.74	3.80
Total	**28.21**	**30.01**	**31.76**	**33.55**	**28.21**	**31.51**	**35.01**	**38.80**	**28.21**	**33.01**	**38.25**	**44.05**

Note: For details of the assumptions and inputs for these scenarios see Section 4.2 and Appendix F.

Table G.2: Demand projections for dental visits (millions) by access scenario, 2005, 2010, 2015 and 2020

	Access at 25% of the average rate for those currently not accessing care in a 12-month period				Access at 50% of the average rate for those currently not accessing care in a 12-month period			
Age group (years)	2005	2010	2015	2020	2005	2010	2015	2020
0–4	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
5–11	3.25	3.17	3.11	3.10	3.41	3.33	3.26	3.25
12–17	3.88	3.93	3.85	3.77	4.12	4.17	4.09	4.00
18–24	2.97	3.05	3.14	3.09	3.42	3.52	3.61	3.56
25–34	4.14	4.23	4.46	4.58	4.96	5.08	5.35	5.50
35–44	4.70	4.80	4.87	4.98	5.36	5.48	5.55	5.68
45–54	4.80	5.19	5.34	5.51	5.33	5.75	5.93	6.11
55–64	3.90	4.61	5.05	5.52	4.27	5.05	5.53	6.05
65–74	2.23	2.67	3.45	4.16	2.45	2.94	3.80	4.59
75+	1.71	1.95	2.35	2.93	1.87	2.14	2.58	3.23
Total	**31.82**	**33.85**	**35.86**	**37.89**	**35.44**	**37.70**	**39.95**	**42.24**

Note: For details of the assumptions and inputs for these scenarios see Section 7.1.

Table G.3: Demand projections for dental visits (millions) by access scenario, 18 to 54 years of age, 2005, 2010, 2015 and 2020

	Additional 10% of dentate persons aged 18 to 54 years accessing care in 12-month period				Additional 20% of dentate persons aged 18 to 54 years accessing care in 12-month period			
Age group (years)	**2005**	**2010**	**2015**	**2020**	**2005**	**2010**	**2015**	**2020**
0–4	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
5–11	3.08	3.01	2.95	2.94	3.08	3.01	2.95	2.94
12–17	3.64	3.68	3.61	3.53	3.64	3.68	3.61	3.53
18–24	2.95	3.03	3.12	3.07	3.39	3.48	3.58	3.52
25–34	3.98	4.07	4.28	4.40	4.64	4.74	4.99	5.13
35–44	4.70	4.81	4.87	4.99	5.37	5.49	5.56	5.69
45–54	4.91	5.30	5.46	5.63	5.54	5.99	6.17	6.36
55–64	3.53	4.17	4.56	4.98	3.53	4.17	4.56	4.98
65–74	2.01	2.41	3.11	3.73	2.01	2.41	3.11	3.73
75+	1.55	1.77	2.11	2.63	1.55	1.77	2.11	2.63
Total	**30.60**	**32.49**	**34.32**	**36.17**	**32.99**	**34.97**	**36.88**	**38.78**

Note: For details of the assumptions and inputs for these scenarios see Section 7.1.

Table G.4: Demand projections for dental visits (millions) by access scenario, 55 years or older, 2005, 2010, 2015 and 2020

	Additional 10% of dentate persons aged 55 years or older accessing care in a 12-month period				Additional 20% of dentate persons aged 55 years or older accessing care in a 12-month period			
Age group (years)	**2005**	**2010**	**2015**	**2020**	**2005**	**2010**	**2015**	**2020**
0–4	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
5–11	3.08	3.01	2.95	2.94	3.08	3.01	2.95	2.94
12–17	3.64	3.68	3.61	3.53	3.64	3.68	3.61	3.53
18–24	2.52	2.59	2.66	2.62	2.52	2.59	2.66	2.62
25–34	3.32	3.39	3.57	3.67	3.32	3.39	3.57	3.67
35–44	4.03	4.13	4.18	4.28	4.03	4.13	4.18	4.28
45–54	4.28	4.62	4.76	4.91	4.28	4.62	4.76	4.91
55–64	4.02	4.75	5.20	5.69	4.50	5.32	5.84	6.39
65–74	2.28	2.73	3.54	4.26	2.55	3.06	3.97	4.79
75+	1.74	1.99	2.39	2.98	1.93	2.21	2.66	3.34
Total	**29.15**	**31.13**	**33.10**	**35.14**	**30.09**	**32.26**	**34.45**	**36.72**

Note: For details of the assumptions and inputs for these scenarios see Section 7.1.

Table G.5: Demand projections for dental visits (millions) by scenario, 2005, 2010, 2015 and 2020

	Increase in dental insurance coverage (+10%)				Regional dwellers accessing care at same rate as capital city dwellers			
Age group (years)	**2005**	**2010**	**2015**	**2020**	**2005**	**2010**	**2015**	**2020**
0–4	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
5–11	3.13	3.05	2.99	2.98	3.19	3.12	3.06	3.05
12–17	3.93	3.98	3.90	3.82	3.94	3.99	3.91	3.83
18–24	2.69	2.76	2.84	2.80	2.61	2.68	2.75	2.71
25–34	3.44	3.52	3.72	3.81	3.33	3.41	3.59	3.69
35–44	4.16	4.25	4.33	4.41	4.19	4.28	4.34	4.44
45–54	4.44	4.79	5.01	5.09	4.55	4.91	5.06	5.22
55–64	3.65	4.31	4.92	5.15	3.86	4.57	5.00	5.47
65–74	2.09	2.51	3.51	3.90	2.07	2.48	3.20	3.86
75+	1.60	1.83	2.54	2.73	1.66	1.90	2.28	2.85
Total	**29.38**	**31.25**	**34.00**	**34.94**	**29.66**	**31.59**	**33.44**	**35.36**

Note: For details of the assumptions and inputs for these scenarios see Sections 7.2 & 7.3.

Appendix H: Projected supply of dental visits by multiple scenarios, 2020

		Average ADC accreditations – 50 per year						Average ADC accreditations – 100 per year						Average ADC accreditations – 150 per year					
		Allied dental graduates – standard			Additional allied graduates (+100)			Allied dental graduates – standard			Additional allied graduates (+100)			Allied dental graduates – standard			Additional allied graduates (+100)		
Number of graduates in 2013	Productivity assumption	W (10%)	W (std)	W (+10%)	W (–10%)	W (std)	W (+10%)	W (–10%)	W (std)	W (+10%)	W (–10%)	W (std)	W (+10%)	W (–10%)	W (std)	W (+10%)	W (–10%)	W (std)	W (+10%)
307	No decline in productivity	36.42	35.70	35.02	37.43	36.72	36.03	38.04	37.30	36.60	39.05	38.32	37.61	39.66	38.9	38.18	40.67	39.92	39.19
	Half declire in productivity	32.89	32.27	31.66	33.91	33.28	32.68	34.34	**33.7**[(a)]	33.07	35.36	34.71	34.09	35.79	35.12	34.48	36.80	36.14	35.5
377	No decline in productivity	37.68	36.95	36.25	38.70	37.97	37.27	39.30	38.55	37.83	40.32	39.57	38.85	40.92	40.15	39.41	41.94	41.17	40.43
	Half declire in productivity	34.03	33.39	32.78	35.05	34.41	33.79	35.48	34.82	34.19	36.50	35.84	35.20	36.93	36.25	35.6	37.94	37.27	36.61
447	No decline in productivity	38.95	38.20	37.49	39.96	39.22	38.50	40.57	39.80	39.07	41.58	40.82	40.08	42.19	41.4	40.65	43.2	42.42	41.66
	Half declire in productivity	35.17	34.52	33.89	36.19	35.54	34.91	36.62	35.95	35.30	37.64	36.96	36.32	38.07	37.38	36.71	39.08	38.39	37.73
517	No decline in productivity	40.21	39.45	38.72	41.23	40.47	39.74	41.83	41.05	40.30	42.85	42.07	41.32	43.45	42.65	41.88	44.47	43.67	42.9
	Half declire in productivity	36.31	35.65	35.00	37.33	36.66	36.02	37.76	37.07	36.41	38.78	38.09	37.43	39.21	38.5	37.82	40.22	39.52	38.84
587	No decline in productivity	41.48	40.70	39.96	42.49	41.72	40.97	43.10	42.30	41.54	44.11	43.32	42.55	44.72	43.9	43.12	45.73	44.92	44.14
	Half declire in productivity	37.45	36.77	36.12	38.47	37.79	37.13	38.90	38.20	37.53	39.92	39.22	38.54	40.35	39.63	38.94	41.36	40.65	39.95

(a) Standard supply projection

Notes:

1. For comprehensive details of assumptions and inputs for standard supply projection see Appendix B.
2. Dentists recruitment for standard supply projection, ADC = 100/year, Australian University graduates = 237/year 2003 to 2009, 307/year 2009 to 2020. For details of the automatic recognition, RTP and expatriates returning to practice in Australia components of the recruitment vector, see Appendix B.
3. Allied dental practitioner recruitment for standard model: therapists 74 per year, hygienists 164 per year, prosthetists 30 per year.
4. W (–10%) scenario: the wastage rates for dentists (all age and sex groups) incrementally declines by 10% over the period of the projection. W (std) scenario: the wastage rates for dentists (all age and sex groups) as per wastage rates applied in standard projection model. W (+10%) scenario: the wastage rates for dentists (all age and sex groups) incrementally increase by 10% over the period of the projection.

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