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Australia's dental generations

The National Survey of Adult Oral Health 2004–06

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Australia's dental generations

The National Survey of Adult Oral Health 2004–06

Edited by

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Contents

Overview of results

This report describes the state of oral health of the Australian adult population at the beginning of the twenty-first century. The findings are drawn primarily from the 2004–06 National Survey of Adult Oral Health (the Survey) in which 14,123 people aged 15–97 years were interviewed and 5,505 people were dentally examined.

Survey aims

The survey aimed to describe levels of oral disease, perceptions of oral health and patterns of dental care within a representative cross-section of adults in all states and territories of Australia. This report focuses on four 'dental generations' who experienced different historical influences on their oral health:

- the earliest generation, born before 1930, reached adulthood during an era when oral disease was widespread, and frequently was treated by extraction of teeth;
- two intermediate generations, each born in two-decade periods after 1930, were more likely to retain teeth, but they experienced historically high rates of decay;
- the generation born since 1970 was exposed to more dental prevention than any preceding generation, particularly through fluorides in toothpaste and drinking water.

A further aim was to evaluate trends in oral health during the 17 years that have elapsed since the nation's first oral examination survey, conducted in 1987–88.

Survey methods

A random sample of Australian adults was interviewed by telephone and those with their own teeth were asked to undergo a standardised dental examination conducted in a local clinic by one of 30 dentists trained in the Survey methods.

The 14,123 people interviewed represented 49% of those asked to participate, while the 5,505 people examined, represented 44% of interviewed people who were invited to the examination.

Analysis of response patterns and comparisons with Census data revealed that participants differed from non-participants in some characteristics that influence oral health.

The survey therefore probably underestimated some aspects of oral disease and overestimated the frequency of favourable dental attendance, although the degree of variation was found to be 3% or less for most oral health indicators.

Accuracy of 29 survey examiners was assessed by comparing their examination findings with those of the Survey's principal examiner. The observed levels of

agreement for most oral health indicators were equivalent to benchmarks reported for national oral health surveys conducted in the United Kingdom and the United States.

Oral health status

Approximately 1-in-20 Australian adults (6.4%) had lost all their natural teeth. Among the 93.6% who were dentate (that is, people who had one or more natural teeth), an average of 4.5 teeth per person had been extracted because of dental decay or gum disease, leaving 11.4% of people with an inadequate natural dentition, defined as fewer than 21 teeth.

A slightly higher percentage of dentate Australian adults (14.9%) wore one or two removable dentures. An average of 1.3 missing teeth per person had been replaced, either by wearing a denture or by the presence of a fixed bridge.

- Generations born in the first half of the twentieth century had profoundly greater levels of tooth loss and tooth replacement than more recent generations.

- Both tooth loss and tooth replacement were considerably more frequent among people who were eligible for public dental care compared with people who were not, and among people who completed year 9 or less of schooling compared with people who completed at least year 10.

- Although the relationship was less pronounced, dental insurance and a usual pattern of dental attendance for a check-up were both associated with lower levels of tooth loss and lower frequency of denture wearing.

Experience of dental decay was ubiquitous within the adult population. Over 95% of people born before 1970 had some experience of dental decay, and the figure dropped only to 76% among people in the most recent generation, born 1970–90. The average number of teeth affected by decay per person ranged from 4.5 in the 1970–90 generation to 24.3 in the pre-1930 generation.

Much of the decay was treated, predominantly by fillings in recent generations and by a combination of fillings and extractions in earlier generations.

Yet one-quarter of Australian adults had untreated decay, and the figure varied by no more than 5% among generations. Additionally, 6.7% of Australian adults had untreated decay on exposed root surfaces, a condition that was much more frequent in the pre-1930 generation (17.3%) than the 1970–90 generation (1.6%).

- Levels of untreated decay were more than twice as high among Indigenous Australians (57.0%) compared with non-Indigenous Australians (25.1%)

- There was a similar two-fold difference in prevalence of untreated decay associated with a pattern of dental attendance for treatment of dental problems.

- Although less pronounced, untreated decay was also more frequent among males, people who lived outside capital cities, people with no dental insurance and those eligible for public dental care.

Approximately one in five Australian adults had moderate (20.5% of people) or severe (2.4% of people) gum disease, also called 'periodontitis'. Similar prevalence rates were found using a range of case definitions reported for previous studies. The definitions refer to the destructive forms of periodontitis in which there is loss of tissue that attaches the tooth to the jaw.

Periodontitis was strongly associated with age, occurring among 60.8% of people aged ≥75 years. Yet even in that age group, signs of periodontitis were found in only one or two anatomical sites around the mouth, on average, from among the 84 sites measured per person.

- Periodontitis occurred more frequently among males, people who completed year 9 or less of schooling, people with no dental insurance, those eligible for public dental care, and people who attended the dentist for treatment of dental problems.

- One in five Australian adults (19.7%) additionally had signs of gum inflammation (redness, swelling or bleeding). The frequency of inflammation, which can be a precursor to destructive periodontitis, did not vary meaningfully among generations.

There were 25.9% of Australian adults who had wear visible on their lower front incisor teeth, to the extent that it had worn through the tooth's hard, enamel edge. More severe wear was observed among 3.3% of adults in whom at least half of the height of the lower incisors had worn away. This severe level of wear was much more frequent in the pre-1930 generation (12.0%) than the 1970–90 generation (0.5%).

- Severe wear of one or more lower incisors was three times more likely among males compared with females, and among Indigenous compared with non-Indigenous Australians.

- Although the associations were less pronounced, severe wear was also more frequent among people who lived outside capital cities, the uninsured and people who attended the dentist for treatment of dental problems.

Patterns of dental attendance

Nearly 60% of adults visited a dentist during the 12 months preceding the Survey, while only one in eight reported attending at least 5 years ago. More than four-fifths of Australian adults attended a private dentist (83.1%) and 91.4% paid out of pocket for the visit. Approximately one-half of adults usually visited a dentist at least once a year (53.1%), while 56.2% usually visited for a check-up. Most Australian adults (78.6%) usually visited the same dentist. When three 'favourable' patterns of dental care were considered in combination, 44.5% of dentate Australian adults reported visiting the same dentist at least once a year for a check-up.

- Favourable patterns of dental attendance were more likely among dentate people, the insured, residents of capital cities and people with higher levels of schooling.

- In contrast, favourable patterns of dental care were less likely among Indigenous Australians and those who were eligible for public dental care.

Perceived need for dental treatment

Only 7.2% of adults said that they needed a new or repaired denture, although the figure was 20.4% among people in the pre-1930 generation.

Nearly six of every ten dentate adults said that they needed a dental check-up, although it was only 39.5% in the pre-1930 generation.

One-third of dentate adults felt they needed an extraction or filling, a proportion that was not dissimilar from the one-quarter of dentate people found to have untreated decay.

- All perceived dental treatment needs were markedly more frequent among people who usually attended the dentist for treatment of a dental problem, the uninsured and people with relatively lower levels of schooling.

- Indigenous Australians were more likely to report a need for fillings or extractions than non-Indigenous Australians.

Perceptions of oral health and dental care

Sixteen per cent of Australians rated their oral health as fair or poor, 22.6% had experienced orofacial pain in the preceding month, 15.1% had experienced toothache in the preceding 12 months, and 17.4% said that they had avoided some foods due to problems with their teeth, mouth or dentures.

- All four maladies were reported more frequently by the uninsured and by people who usually attended the dentist for treatment of a dental problem.

- Indigenous Australians and people eligible for public dental care were more likely to report fair/poor oral health, toothache and food avoidance than non-Indigenous Australians.

Thirty per cent of Australians reported avoiding dental care due to cost, 20.6% said that cost had prevented them from having recommended dental treatment and 18.2% reported that they would have a lot of difficulty paying a $100 dental bill.

- All three barriers to dental care were more likely to be reported by Indigenous Australians, the uninsured, people eligible for public dental care and people who usually attended the dentist for treatment of a dental problem.

Trends in oral health: 1987–88 to 2004–06

In order to distinguish historical influences on oral health that occurred before the 1987–88 survey from the effects of time between surveys, trends in oral health were evaluated among generations born during 17-year intervals. Additional comparisons were made among 10-year age groups in each survey.

During the 17 years since the first Australian oral health examination survey, the percentage of Australian adults who had no natural teeth more than halved, from 14.4% to 6.4%.

- Almost all of the reduction occurred because of the passing of older generations that had experienced an 'epidemic' of dental extractions during the first half of the twentieth century. Within generations, levels of complete tooth loss did not change meaningfully as members of each generation aged 17 years between surveys.
- During the next four decades, with the passing of older generations that experienced historically high rates of tooth loss, the decline in prevalence of complete tooth loss is projected to continue, falling to 1% or less by the 2040s.

Among dentate people (those who had one or more natural teeth), there were similar large reductions in the percentage with an inadequate natural dentition, defined as fewer than 21 teeth.

- As they aged during the 17 years between 1987–88 and 2004–06, no more than 7% of people in any single generation lost sufficient teeth to leave them with an inadequate natural dentition.

However, dental decay progressed markedly in generations born since 1930: during the 17-year interval between surveys, decay in previously healthy teeth developed in an average of 3–4 teeth per dentate person.

- The same rate of decay in previously healthy teeth was observed, even in the 'fluoride generation' of people born 1967–83, and exposed to more dental prevention than any previous generation.
- Yet as young adults, members of the fluoride generation had about half the level of decay that their parents' generation had developed as young adults. This finding provides evidence that exposure to fluoride in water and in toothpaste during childhood produced substantial benefits for oral health among Australian adults.
- These two findings illustrate that fluoridation of water and toothpaste is not the same as immunisation: Australia's fluoride generation had substantially less decay than its parents' generation, but most of the benefit accrued during childhood.

Unlike the predominant method of extractions used to treat decay in the first half of the twentieth century, most newly decayed teeth in the period between these two surveys were filled, not extracted. This pattern was observed in all four generations.

Trends in dental visits and perceived treatment needs

Sixty-two per cent of dentate Australian adults per year made a dental visit in 2004–06, up from 53% in 1987–88.

- However, the rate of visits declined within the most recent generation, born 1967–83, as its members aged 17 years between the two surveys.

While the vast majority of adults saw a private dental practitioner, the percentage declined between the two surveys from 87% to 83%, with most of the decline observed in the 1970–90 generation.

In both surveys, nearly one half of Australia's adults reported having dental insurance.

- Dental insurance coverage decreased among 25–44–year-olds, while it increased among 55–74–year-olds.

In all age groups the percentage who reported a need for dentures decreased markedly. However, there were increases in perceived need for fillings among people aged 35 years or more and for extractions among all ages.

- There was a doubling in perceived need for extractions among people in the 1967–83 generation as they aged 17 years between surveys. The trend may have been fuelled by a requirement for removal of wisdom teeth or for orthodontic extractions.

When trends regarding oral disease, dental visits and perceived treatments were considered together, markedly different patterns were observed between generations.

- As they aged 17 years between surveys, members of the 1967–83 generation, developed as much decay in previously healthy teeth as their parents' generation during the same period. As well, their perceived need for fillings and extractions increased. However, during the same period the frequency of dental visits within the 1967–83 generation reduced significantly.
- As the three generations born before 1967 aged through the 17-year period between surveys, dental decay continued to develop in previously healthy teeth. However, their frequency of dental care did not change and their perceived need for treatment remained similar or reduced.

Interpretation

Chapter 4 highlights the importance of historical events and lifetime experience in shaping the contrasting oral health standards of the four generations that feature in this survey. While Australians are unlikely to again endure the deprivations of the Great Depression or World War II, which contributed to the 'epidemic' of tooth extractions before the 1950s, an understanding of the past illuminates present challenges that remain today. History has shown, for example, that the fluoridation of municipal water systems substantially improved the oral health of children. A 'fluoride generation' of Australians has now reached adulthood, a majority of them exposed to fluoridated water and fluoride in toothpaste since childhood. This survey found that, as young adults, the 'fluoride generation' had about half the level of dental

decay as their parents' generation. Yet today, 31% of Australian adults remain without access to fluoridated public water.

Within the Australian adult population, oral diseases were pervasive. They caused a substantial amount of pain and other impacts on quality of life. This burden of disease persisted despite marked reductions among age groups in levels of tooth loss and lifetime experience of dental decay. The frequency of oral disease and related symptoms were inequitably distributed, being greater in groups that were already disadvantaged.

Yet during in-depth oral histories narrated by 15 survey participants, there was a general tendency of people to blame their oral health problems only on diet, genetics or fate, while overlooking the fact that failure to prevent and treat dental disease in a timely manner led to their problems worsening, and, in some cases, becoming irreparable. In general, they tended to blame themselves or their lifestyle choices for dental problems rather than recognising that their ability to obtain dental care was often constrained by their low income or lack of other resources.

The findings regarding oral disease have direct relevance to four elements of the Nation's Oral Health Plan (NACOH 2004):

- The finding of substantial benefits for oral health among the 'fluoride generation' of Australians born since 1970 provides support for the Plan's emphasis on fluorides as a method to promote oral health 'across the population'.

- While this survey found marked reductions in tooth loss among older adults, there were other adverse 'consequences of success' for them: people aged ≥75 years had prevalence rates of gum disease and root decay that were 2–3 times as great as the population at large. These findings provide strong endorsement for the Plan's action areas for older adults.

- The Plan has an additional action area for 'Low income and social disadvantage'. Virtually all aspects of oral disease measured in this study were more frequent and more severe among people who were eligible for public dental care and therefore were economically disadvantaged.

- Aboriginal and Torres Strait Islander people are the focus of an additional action area in the Plan. This survey found disproportionately elevated rates of tooth loss, untreated decay and tooth wear among Indigenous Australians. There was a similar pattern of poorer oral health for several other conditions, although limitations in sample size created uncertainty about the magnitude of the difference. The oral examination results were consistent with findings that Indigenous Australian adults also reported poorer self-rated oral health, more toothache and more difficulty with eating due to dental problems compared with non-Indigenous Australians.

The survey's results have additional implications for policies regarding oral health and dental care for Australia's adults.

- Despite the widespread distribution of oral diseases, only about half of Australia's adults made dental visits annually, usually for a check-up and at the same dentist. Those who did so overwhelmingly attended a private dentist, paid for their own dental care and were frequently supported in doing so by dental insurance. This dental attendance pattern was consistent with that recommended by the dental profession.

- For the other half of the adult population, the dental attendance pattern presented a striking contrast. Dental visiting was irregular and mostly associated with a dental problem, whether the visit was to a private dentist or the public dental services. For some, there was no effective contact with a dentist at all. This pattern of attendance was disproportionately more frequent in disadvantaged population groups: Indigenous Australians, people with less schooling, people living outside capital cities, people who were uninsured and people eligible for public dental care. Those are the very groups that experienced the highest levels of oral disease.

These two halves of the adult population present contrasting profiles of oral health in Australia. One group illustrates the degree of progress made in the way the dental system serves the population. In the other group, there was a conspicuous need for improvement in dental care and oral health.

Increases in dental attendance were observed across all adult age groups except for 25–34–year-olds. Yet, in the 17 years between surveys, both dental attendance and dental insurance became less frequent in the 1967–83 'fluoride generation'. As noted elsewhere, people in this 1967–83 generation developed dental decay in previously healthy teeth at a rate equal to their parents' and grandparents' generations. There is a risk that the oral health benefits acquired during childhood by Australia's 'fluoride generation' will be eroded during adulthood.

These results, in turn, have implications for the dental care system and the dental labour force.

- The percentage of adults who attended for dental care during the preceding year increased between 1987–88 and 2004–06, reflecting an increased demand for dental care in Australia's adult population.

- Because more than 80% of dental visits are made to dentists in private practice, this sector needs attention in any dental labour force policy response. Even among adults eligible for public dental care, 63% attended a private dental practice.

- If even a small proportion of adults with unfavourable patterns of dental attendance were to seek more frequent and comprehensive care, there would be a substantial increase in demand for dental care. Most of the additional care would be sought in private dental practices, creating a further challenge for health policies at a time when there are shortages in the dental labour force. Additional demand would represent a particular challenge to state and territory public dental services where scarcity of resources already acts as a barrier to timely and comprehensive care among those eligible for such services.

1 Introduction

by Gary Slade

This report describes the state of oral health of the Australian adult population at the beginning of the twenty-first century using information from the 2004–06 National Survey of Adult Oral Health (NSAOH). Adults are defined here as people aged 15 years or more and they are further classified into four age groups, or 'dental generations'. The four generations were born during two-decade intervals through the twentieth century. The results illustrate how unique historical experiences of each generation have left an imprint on the distribution of oral health in today's population. Oral health is also described for major sociodemographic subgroups defined according to sex, Indigenous identity, residential location and completed years of schooling. In addition, subgroups relevant to oral health are delineated based on dental insurance coverage, eligibility for public dental care, usual reason for dental visits, and presence or absence of natural teeth.

Summary statistics in this report were computed from two sources. Information about oral disease, particularly dental decay and gum disease, was recorded during examinations of the teeth and gums that were conducted by survey dentists. Additional information about perceptions of oral health and patterns of dental care was obtained from responses to standardised questions asked during telephone interviews. In addition to the statistical findings, people's qualitative experiences of oral health and dental care were recorded during more detailed 'oral history' interviews. Oral histories were collected from a small number of survey participants from each dental generation. Excerpts from those interviews are presented to illustrate historical influences on oral health using people's own words.

The 2004–06 NSAOH took place 17 years after the first national oral examination survey of Australians, the 1987–88 National Oral Health Survey of Australia (Barnard 1993). This report includes a comparison of results from the two surveys, evaluating trends in oral disease and dental care that have occurred during the period. Distinct patterns of change between generations and within generations are illustrated. Those trends provide insights into historical influences on dental care and likely trends in oral health status.

To provide a background for the Survey, the remaining sections of this chapter describe the circumstances that motivated the Survey, including the rationale for the focus of this report on four dental generations. The aims of the Survey are presented in Chapter 2 together with a description of the Survey's methods.

1.1 Purpose of this report

The purpose of this report is to provide a descriptive 'snapshot' of oral health in the adult population of Australia. The findings are intended to provide up-to-date evidence that can contribute to the development of oral health policies and programs in Australia. Such evidence continues to be essential because oral diseases represent a considerable burden on the health of the public. This calls for information about the distribution of oral disease and provision of dental care among relevant subgroups of the Australian population, which is the focus of Chapters 5, 6 and 7 of this report. Trends observed between surveys are reported in Chapter 8, providing further evidence about generational change in oral health. Analysis of trends provide additional insights into historical circumstances that have influenced oral health, and permit some predictions to be made about future trends in oral disease.

1.2 Why was the Survey undertaken?

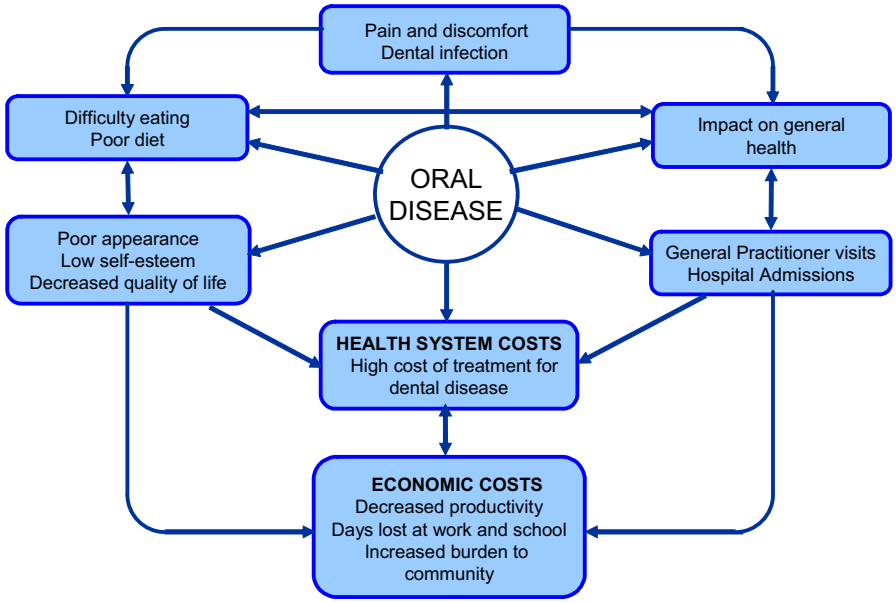
Up-to-date information about population oral health is important for the nation because oral diseases have broad implications for the health of the public. Dental problems are ranked among the most frequently reported illness episodes by Australians (AIHW 2000) and provision of dental care accounts for 5.4% of total health expenditure (AHMAC 2001). In the United States the Surgeon General characterised oral disease as a 'silent epidemic'(Surgeon General 2000).

The impact of oral diseases on the Australian population has been represented diagrammatically in a report of the Victorian Department of Human Services (DHS Victoria 1999) (Figure 1.1). The report describes dental decay and periodontal diseases as the most commonly occurring oral conditions, and it illustrates their potential to cause impacts ranging from pain and infection to loss of productivity. The broad-ranging impact of oral conditions has been cited in Australia's National Oral Health Plan (NACOH 2004), and underpins a series of short-term and long-term actions proposed for 2004–13 that aim 'to improve health and wellbeing across the Australian population by improving oral health status and reducing the burden of oral disease'.

Developing oral health policies

Information from health surveys is used to develop new policies, change old ones and evaluate the impact of prevention and treatment programs within the community. Many aspects of Australia's oral health and dental care at the beginning of the twenty-first century can be attributed to health policies and programs that have evolved through the twentieth century. There are examples now and in the past of broad-based government actions that affect general health and have additional influences on oral health, including initiatives in education, welfare, nutrition and smoking. Taxation systems provide incentives for the purchase of private health insurance and influence the cost of a range of dental products. Federal and state government programs provide dental care to targeted subgroups of the population.

Governments, health professions and private industry are primarily responsible for promoting oral health in the community and for providing population-based preventive programs including community water fluoridation. Governments fund universities that educate dental health professionals, who practise within acts of parliament that provide for regulation of professions by peers and the community. Most oral health research is funded by governments and industry. Oral health surveys provide the essential benchmarks needed for planning all those initiatives.



Source: Adapted from Victorian Department of Human Services (DHS Victoria 1999).

Figure 1.1: Impact of oral disease

What is known already about oral health in the Australian population?

The final decades of the twentieth century witnessed fundamental changes in the distribution of oral diseases in the Australian population that underscored the need for a second survey. Among 12-year-old children the average number of teeth affected by decay per child more than halved from 2.6 teeth per child in 1983 to 1.0 teeth per child in 1995 (AHMAC 2001). In the adult population the percentage of people with no natural teeth more than halved, from 20% in 1979 to 8% in 2002 (Sanders et al. 2004). The resulting increase in tooth retention, coupled with technological advancements in

materials and instruments, coincided with greater public demand for complex dental restorative treatments (AHMAC 2001).

These trends fuelled speculation about population-based strategies for prevention and control of oral diseases. For example, it has been assumed that the well-documented benefits of community water fluoridation in childhood will be translated into improved oral health for adult members of the 'fluoride generation' born since the 1960s and 1970s when most of Australia's capital city water supplies became fluoridated and when fluoride was added to virtually all brands of toothpaste. Yet evidence from other countries has questioned this assumption (Jackson 1974) and some studies suggest that fluoride exposure may simply defer the onset of decay to later in adulthood (Burt & Warner 1983). Another consistent, although untested, assertion is that dentistry has spawned adverse 'consequences of success'— improvements in tooth retention in the demographically expanding older age groups have resulted in more teeth at risk and hence higher prevalence of dental caries and periodontal diseases (Joshi et al. 1996). Finally, there has been growing concern that socioeconomic disparities in oral health may be worsening as oral diseases become concentrated within disadvantaged population subgroups (Brown et al. 1999).

The 1987–88 National Oral Health Survey of Australia

The 1987–88 National Oral Health Survey of Australia (NOHSA) was the first oral health examination survey to include a nationally representative sample of Australian adults. The sample comprised 16,897 people aged 5 years or more who were selected from the six states and the Australian Capital Territory (Barnard 1993). Households were sampled in both capital cities and remaining parts of the states, except in Western Australia, where areas outside Perth were excluded. Oral examinations were conducted in subjects' homes by a large number of volunteer dentists who had been advised on the Survey methodology during seminars conducted in each state and the ACT. The dental examination was based on the World Health Organization's basic methods (WHO 1977). Prior to the examination, sampled people completed an interview in which they were asked eight questions about dental visits and preventive dental behaviours.

The 1987–88 survey was administered by a National Planning Committee that drew on resources of the Australian Bureau of Statistics, the Commonwealth Department of Health and individual dentists through the Australian Dental Association. The main publication from the 1987–88 NOHSA provided descriptive statistics that documented prevalence and severity of oral conditions within each state and the ACT (Barnard 1993).

Initiatives for a second national oral health survey

In the decade following the 1987–88 NOHSA, several collaborative efforts among federal and state/territory stakeholders attempted to secure support for a second national oral health survey, although none were funded.

- In 1995, in response to a request from the Australian Dental Association, the Australian Institute of Health and Welfare's (AIHW) Dental Statistics and Research Unit (DSRU) developed plans for a national oral health survey. The Plan, which received endorsement from AIHW and the Australian Bureau of Statistics, was for DSRU to select and interview a random sample of adults, and for state/territory health departments to provide 'in-kind' support through their dental staff conducting survey examinations.

- In mid 1997 the National Public Health Information Working Group supported a similar proposal, listing oral health as a priority national health data collection.

- In 1998 the Senate Community Affairs References Committee Inquiry into Public Dental Services recommended that the Commonwealth allocate resources for a national survey.

- Renewed impetus for a national survey began with the work of the National Advisory Committee on Oral Health (NACOH) (AHMAC 2001).

In addition to voicing support for the Survey, the work of the NACOH clarified key information requirements that a second survey should address. They were outlined in Australia's National Oral Health Plan that was published when the current survey began (NACOH 2004).

Australia's National Oral Health Plan 2004–2013

Chapters 5, 6 and 7 report aspects of oral health and use of dental care that are intended to be broadly consistent with Australia's National Oral Health Plan 2004–13 (NACOH 2004). Specifically, the tables in Chapters 5 and 6 are relevant to five of the seven 'action areas' that encompass the Plan's major themes (Table 1.1). Notably, the Survey fulfils one of four short-term goals listed for the Plan's first action area.

Table 1.1: Seven action areas proposed in Australia's National Oral Health Plan 2004–13 (NACOH 2004)

Action area	Relevance to this report
1. Promoting oral health across the population	This report fulfils the Plan's short-term goal 1.3 to 'Undertake a National Adult Oral Health Survey and a National Children's Oral Health Survey, each to be repeated every ten years.' The report presents evidence about dental decay during adulthood of Australia's first 'fluoride generation', thereby providing evidence relevant to the Plan's recommendations that water fluoridation be extended.
2. Children and adolescents	None
3. Older people	This report presents results for four generations including 'young elderly' people aged 55–74 years and 'old elderly' people aged 75 years or more at the time of the Survey. Time trends investigate the effects of ageing and historical influences on the oral health of four generations.
4. People with low income and social disadvantage	Tables in Chapters 5, 6 and 7 compare oral health and dental care between the following priority groups cited in the Plan: people in rural and remote areas (reported in tables according to residential location); low income earners and their families (reported in tables according to eligibility for public dental care). Additionally, results are reported by subgroups classified according to educational attainment.
5. People with special needs	None
6. Aboriginal and Torres Strait Islander people	Tables in Chapters 5, 6 and 7 compare oral health and dental care for Indigenous and non-Indigenous Australians.
7. Workforce development	Chapter 9 discusses implications of the Survey, including relevance for the dental workforce.

Aspects of oral health and dental care relevant to the National Oral Health Plan

The National Oral Health Plan outlined nine population indicators that were informative in developing the Plan and that are cited as key performance indicators to evaluate the outcomes of the Plan. This survey reports findings that relate to six of those key performance indicators.

- The percentage of the dentate population reporting a social impact (for example, toothache, difficulty chewing, concerned about appearance) because of problems with teeth, mouth or gums in the last 12 months, by age group, living circumstance, eligibility for public dental care, Indigenous identity and special needs.

- The percentage of the population with untreated decay, by age group, living circumstance, eligibility for public dental care, and Indigenous identity.

- The proportion of the dentate population with a maximum periodontal pocketing of 3.5 mm and 5.5 mm, by age group.

- The mean number of missing teeth and proportion of existing teeth with untreated decay, by age group, living circumstance, eligibility for public dental care and card status, Indigenous identity.

- The percentage of the dentate population who visited a dental practitioner in the last 2 years, by age group, living circumstance, eligibility for public dental care, Indigenous identity.

- The percentage of the dentate population whose reason for visiting a dental practitioner in the last 12 months was for a check-up, by age group, living circumstance, eligibility for public dental care, Indigenous identity.

Monitoring trends in oral health

The 2004–06 NSAOH represents Australia's second national oral examination survey, occurring 17 years after the 1987–88 NOHSA. By most standards, 17 years is a long interval between 'dental check-ups'. Even when considering the oral health of a population, where change manifests more slowly than it does for an individual, Australia was already overdue for a second national adult oral health survey to update the 1987–88 survey. The desire to evaluate trends in population oral health was one of the motives for undertaking the current survey.

Typically, changes in oral health of an individual occur as consequences of dental disease and other disorders of the teeth or gums that accumulate over time. Additionally, some changes in oral tissues occur as a consequence of ageing. Exposure to preventive agents and provision of dental treatment may further alter the extent to which oral health changes. For an individual, changes in oral health over time can be monitored using records from successive 'snapshots' of their oral health. The snapshot may exist in the form of records from dental examinations, radiographs or results from tests. Additionally, many individuals can recall aspects of their oral health that have changed over a period of years. Changes in health status observed between successive snapshots of an individual or group of individuals reflect the passage of time coupled with the effects of ageing. Together they have been described as the effects of time on 'the life course' of a person or group of people (Riley & Foner, 1972).

The process of monitoring population oral health differs in some important respects from the assessment of change in an individual. This comes about, first, because national surveys do not re-evaluate the health of the same individuals from one survey to the next. Instead, surveys capture a snapshot of a random sample of the population at each time point. (Because each survey carefully selects a random sample that is only a small proportion of the population at that time, it is extremely unlikely that any individual will be a participant in two successive population surveys.) Another consequence is that a population surveyed at two points in time is composed of generations born in different historical periods. Hence, the passage of time between population surveys captures two dimensions of time (Riley et al. 1972). One dimension represents the effects of ageing and events that occur between surveys on the life course of individuals in the population. The other reflects the unique historical experiences of different generations that constitute the populations studied in each survey.

Historical experiences are important when comparing sequential cross-sectional surveys because any given age group in the 1987–88 survey was born in a different

historical period compared with the same age group in the 2004–06 survey. Consequently, two identical age groups in each survey may have been exposed to very different historical influences on their oral health. For example, a minority of people aged 25–34 years in the 1987–88 survey would have been exposed to school dental services. By contrast, a majority of people aged 25–34 years in the 2004–06 survey would have had access to school dental services during their childhood. These historical effects can be important explanations for change observed between surveys, even though 25–34-year-olds did not attend school dental services at the time of either of the surveys examined here.

The influence of these parallel dimensions of life course and history can be illustrated by considering the representation of different generations in Australia's two national oral examination surveys (Figure 1.2).

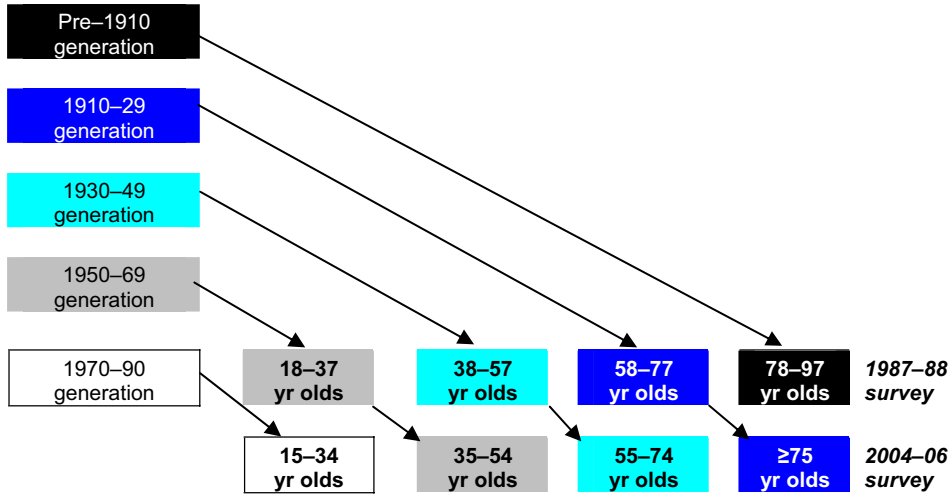


Figure 1.2: Generations comprising two survey populations

The earliest generation, born before 1910, was aged 78–97 years in the first survey. Only a few of them survived the 17 additional years, with the consequence that very few members of that generation were represented in the second survey. Instead, most people in the oldest age group in the 2004–06 survey were born in the 1910–29 generation. Seventeen years earlier, that same generation represented people aged 58–77 years in the 1987–88 survey.

At the other end of the age spectrum, 15–34-year-olds studied in the second survey were represented by people born between 1970 and 1990. Most members of that generation were not of an adult age in the first survey. Intermediate generations were represented in both surveys but at different ages. The consequence is that the 'snapshot' of oral health observed in the first survey included one early generation that was born in a period of history not captured in the later survey. Meanwhile, the later

survey was influenced by a generation born too late to represent the adult population sampled for the first survey.

Changes in population health observed between two surveys therefore can be influenced by each dimension of time. One influence occurs between surveys and is due to the effects of time on the oral health of people during their life course. This includes the effects of ageing itself and events affecting health that occur between surveys. An example of the latter was an expansion of public sector dental care targeted towards low-income adults that began in 1994. These life course effects can be isolated for some generations that are included in both surveys, as represented by the diagonal arrows in Figure 1.2. This influence is comparable to the effects that would be recorded between successive examinations of an individual. Chapter 8 presents results from birth cohort analyses that isolate those life course effects. The second influence, however, represents historical differences between generations that make up the population at each point in time. For each successive survey, a new generation enters adulthood, the oldest generation passes away and intervening generations enter successively older age groups. This is illustrated in Figure 1.2 by the different combinations of shading that make up the two lower rows of age groups in each survey. The consequence is that each 'snapshot' produced by separate surveys contains different imprints created by the different historical periods in which its constituent generations were born and through which each has lived.

1.3 Genesis of the 2004–06 survey

In 2003, during the period that the NACOH was deliberating, researchers at the Australian Research Centre for Population Oral Health (ARCPOH) in The University of Adelaide sought a new avenue of funding in the form of a project grant application to the National Health and Agency and Medical Research Council (NHMRC). The proposal was for funding to support a collaborative project that pooled resources already committed or promised from the following sources: funding from the Australian Government's Department of Health to the DSRU, a research unit within ARCPOH, to undertake a telephone interview survey; commitment of staff from oral health sections within state and territory health departments to conduct oral epidemiological examinations; and core funding from AIHW to DSRU. Following peer review, the NHMRC awarded a project grant to ARCPOH in November 2003.

Management of the Survey

Two advisory committees were established to assist in the design and implementation of the NSAOH. An expert advisory committee provided technical advice on the design, implementation and analysis of the Survey. It included representatives from the Australian Bureau of Statistics, AIHW, the Commonwealth Department of Health and Ageing, a social survey researcher and epidemiologists from Australian dental schools. An additional community advisory committee was formed, comprising community representatives and key stakeholders from the Australian Dental Association, the NACOH, state/territory dental authorities and consumer bodies such as the Australian Council of Social Services. The committee provided guidance on the

overall coverage and content of the study, and helped to develop strategies to secure support and publicity for the Survey. Membership of each committee is listed at page iv.

1.4 Organisation of this report

This introductory chapter outlines the motives for undertaking the Survey and explains the report's focus on 'dental generations'. Chapter 2 presents the Survey's aims and methods. Chapter 3 describes levels of participation in the Survey and investigates the potential for bias due to non-participation. Chapter 3 also summarises variation among generations in key sociodemographic characteristics that influence oral health, and which define the subgroups for whom oral health is described in later chapters. Chapter 4 describes key events during the twentieth century that have shaped generations, and it presents narratives in which survey participants describe their experiences of oral health using their own words. Statistical findings regarding oral disease are tabulated and described in Chapter 5, followed by statistical findings regarding dental care (Chapter 6) and perceptions of oral health (Chapter 7). Trends in oral health between the 1987–88 survey and the current survey are evaluated in Chapter 8. The survey's findings are summarised in Chapter 9, with a focus on their health implications for Australia's National Oral Health Plan.

The Appendix contains additional tables of oral health statistics for conventional 10-year age groups. These are narrower than the age ranges reported throughout the report, and are presented to permit comparisons with surveys conducted at other places and other times. Additional appendix material has been published on the ARCPOH website:

<http://www.arcpoh.adelaide.edu.au/project/distribution/NSAOH.html>.

2 Survey aims and methods

by Gary Slade, Kaye Roberts-Thomson and Anne Ellershaw

This cross-sectional study was Australia's second national oral examination survey of a representative sample of Australian adults. The survey was undertaken primarily to describe levels of oral health in the population and to evaluate trends since the first survey, conducted in 1987–88. Data collection for this 2004–06 survey began in July 2004 with the aim to complete 7,500 examinations by mid 2006, necessitating approximately 13,000 completed interviews. Survey participants were selected using a multi-stage probability sampling design that began with sampling of all listed telephone numbers in Australia. Sampled phone numbers were called, and when private dwellings were identified, one person aged 15 years or more was sampled at random from household residents. Sampled people were asked questions about their oral health during computer-assisted telephone interviews that were conducted from University of Adelaide research offices. Subjects who completed an interview and who reported having one or more of their own natural teeth were invited to undergo a standardised oral examination. Examinations were conducted by state/territory dentists who underwent prior training and calibration in survey procedures at the University of Adelaide.

This chapter describes the study's aims and provides details of the major methodological steps undertaken to collect data: sampling, interviews and examinations. The chapter concludes by outlining the rationale for the Survey's target sample size of 7,500 examinations of dentate people.

2.1 Aims of the Survey

As described in Chapter 1, a catalyst for this survey was the award of an NHMRC project grant to ARCPOH researchers at The University of Adelaide. This report addresses the first two aims proposed in the NHMRC grant application.

Aims proposed in NHMRC grant application

1. To describe prevalence and severity of dental caries, periodontal disease, tooth loss and related oral conditions.
2. To evaluate changes in the prevalence and severity of oral diseases in the adult Australian population since the 1987–88 National Oral Health Survey of Australia.
3. To evaluate regional and socioeconomic variations in prevalence and severity of the principal oral diseases and conditions in the Australian adult population.

4. To describe variations in onset and progression of oral disease among 'synthetic cohorts' of the Australian population that have been differentially exposed to community water fluoridation.

5. To establish a prospective surveillance system that captures mortality and hospital admission data among the cohort of people examined in the 2004–06 survey, thus creating a research database for future epidemiological and health services research.

Additional aims and supplementary studies

In 2004, questions were added to the telephone interview survey to evaluate the validity of screening questions for gum disease. The investigation was supported by the US Centers for Disease Control & Prevention.

In 2005, the Survey investigators were awarded an additional NHMRC project grant to study biological processes that could be responsible for higher levels of periodontitis among people from relatively poorer socioeconomic circumstances. The study addresses a mechanism called 'allostatic load', a disruption of biological adaptive mechanisms described as the physiological 'cost' of prolonged stress. Allostatic load has been implicated as a determinant of other diseases affecting the cardiovascular system, immune system and endocrine system that also have an inverse socioeconomic gradient in populations.

In 2005, a supplementary project began among New South Wales survey participants to investigate relationships between tooth loss and quality of nutritional intake. The supplementary study continued among Queensland survey participants. The project is supported by the Australian Dental Research Foundation.

In the same two states, additional questions were added to the telephone interview survey and additional measurements of body size were added to the examination. This additional information aimed to evaluate the validity of self-reported body size, and was undertaken in collaboration with the New South Wales and Queensland Health Departments.

In 2006, a supplementary project was begun in Tasmania to study the impact of dental care on people's quality of life. Survey participants will be followed for one year after the Survey, during which time they will keep a record of any dental treatments they receive. The project is supported by the Australian Dental Research Foundation.

2.2 Study population and sampling

Surveys gather information from a defined population at one point in time. The information may be collected from different sampling units such as families, institutions or individuals. The data collection process must be well defined and systematic (Aday 1996). An important initial step is to decide how the sampling units

will be selected — this is known as the sampling design. In probability sampling, these units must be selected in such a way that the unit represents the entire population of interest (that is, the target population). To define the selection, it is necessary to have a 'listing', called a sampling frame, of all the units in the population. There are many limitations in obtaining a proper sampling frame—available frames may be incomplete or they may be out-of-date. Concurrently, it is necessary to consider how to obtain the information required. The information may be gathered through clinical examinations, in-person or telephone interviews, or through a self-administered questionnaire. Each method has a series of advantages and disadvantages that should be evaluated in light of the questions asked and the population of interest.

In this survey, a three-stage, stratified clustered sampling design was used to select people from the target population of Australian residents aged 15 years or more. The sampling frame was households with listed telephone numbers recorded in an 'electronic white pages' database. The first stage selected postcodes, the second stage selected households within sampled postcodes, and the third stage selected one person aged 15 years or more from each sampled household.

For the six states and the Northern Territory, postcodes were first stratified into two groups based on the Australian Bureau of Statistics postcode geographic classification: capital city ('metropolitan' stratum) and remainder of state ('ex-metropolitan' stratum). The Australian Capital Territory was defined as a single metropolitan stratum. In the Northern Territory, ex-metropolitan postcodes were limited to the regional centres of Alice Springs, Katherine, Tennant Creek and Nhulunbuy.

Postcodes represented the geographic clustering in the design and were selected with probability proportional to size, where size was defined as the number of households listed in the 'electronic white pages' in each postcode.

The second stage of sampling selected a systematic sample of households listed in the 'electronic white pages' for each sampled postcode. Prior to selection, duplicate records were removed from the electronic 'white pages' sampling frame. Households with mobile phone numbers were excluded due to cost constraints; however, the majority of these households had a corresponding landline number and hence were eligible for selection. Thirty households per metropolitan stratum and 40 households per ex-metropolitan stratum were selected, after elimination of non-residential phone numbers identified during initial contact by telephone interviewers. The cluster size for ex-metropolitan postcodes was larger due to the extra cost of undertaking dental examinations outside capital cities. Based on previous survey experience, it was expected that these cluster sizes would achieve approximately 17 examinations per metropolitan postcode and 21 examinations per ex-metropolitan postcode.

The final stage entailed random selection of one person aged 15 years or more per household. In households where only one person was aged 15 years or more, that person was selected. In other households telephone interviewers asked for the name of the person aged ≥15 years who most recently had had a birthday and the name of the person aged ≥15 years who would next have a birthday. A computer algorithm then selected one of those two people at random.

2.3 Computer-assisted telephone interview

In order to obtain self-reported information about oral health and characteristics associated with it, survey participants were interviewed by telephone. Interviewers read questions from a computer screen and recorded answers directly onto the computer. They were conducted from a dedicated computer-assisted telephone interview (CATI) suite at University of Adelaide research offices. The methods were based on those advocated by Dillman, including the mailing of a letter to households prior to telephoning, a protocol for contacting each household, and standardised procedures for asking questions and recording answers (Dillman 2000).

Approximately 10 days prior to dialling each sampled telephone number, a primary approach letter explaining the Survey's purpose and encouraging participation was mailed to the address that accompanied each sampled telephone number. A toll-free telephone number was provided to allow those who received a primary approach letter to discuss the Survey with survey staff. When a person from a sampled telephone number contacted the researchers requesting not to be included in the Survey, their phone number was recorded as a 'refusal' for the purpose of calculating response rates (see Chapter 3). Such telephone numbers were then made inaccessible to interviewers.

On each occasion when interviewers dialled a sampled telephone number, a record of each attempt was made on the computer system. When interviewers achieved contact with a person at a sampled telephone number, they went through the following procedure to establish that the household was within scope and to randomly select a target person:

- Telephone numbers that did not serve residential dwellings were excluded: business numbers; hospitals or nursing homes (where the telephone was not within a private room); caravan parks; hotels and hostels. To ensure that business numbers were identified, sampled telephone numbers were dialled at least once during business hours.

- If only one person resided at a residential dwelling, that person was selected as the target person.

- At other residential dwellings the CATI program randomly selected a target person aged 15 years or more from either the resident named as having the last birthday or the resident who was due to have the next birthday (based on a 50% probability to select one or the other).

Target people were invited to participate in the interview that consisted of 79 questions, several with multiple response categories. Every effort was made to interview the target person. However, in certain circumstances the questions were answered by another adult in the form of a proxy interview. These interviews included instances where the selected person was unable to communicate by telephone, for example due to hearing impairment, severe speech impediment, illness or language barriers. If the target person did not speak English, an attempt was made to conduct a proxy interview with a resident of the household who spoke English. In some

instances interviews were conducted in foreign languages by interviewers who could speak Italian, Greek, Polish or Vietnamese. In other instances proxy interviews were conducted when the target person was rarely at home but another person in the household was willing to provide the information.

Each sampled telephone number was initially called up to six times at varying times of the day and evening, and on different days of the week. Where no answer was obtained after six calls, the number was abandoned and recorded as a 'non-contact' for the purpose of calculating participation rates. When a sampled person was identified for any dwelling, up to six additional calls were made in an attempt to contact that person. Those who refused to participate were recorded as 'refusals' for the purpose of calculating participation rates.

Interviews were conducted by 29 interviewers, each of whom was trained in the Survey methods. Training was in small groups with emphasis placed on the quality of data and highest possible response rate, rather than on speed or performance targets. Interviewers were encouraged to become familiar with the aims of the Survey so that, during the interview, they could explain the importance of the study to participants. During interviewing hours, a senior interviewer worked as a supervisor and was available to answer questions from both interviewers and participants, and to monitor data collection procedures. Queries and concerns from survey participants that could not be answered satisfactorily by interviewers were referred to the supervisor.

Questions in the interview were based on those used in previous National Dental Telephone Interview Surveys conducted by ARCPOH (Carter et al. 1994; Carter & Stewart 2002; Carter & Stewart 2003). A copy of the questions used is included in an Appendix available online:

<http://www.arcpoh.adelaide.edu.au/project/distribution/NSAOH.html>.

Most of the Survey questions were closed-ended, requiring participants to choose from a limited number of predetermined responses. Open-ended questions were used to collect information such as age, country of birth and language mainly spoken at home. Although most questions had pre-coded responses, some additional information was collected in text fields if an option marked 'other' was selected. Skip sequences were built into the computer-assisted interviews so that the questions flowed seamlessly without intervention from the interviewer (for example, people who had no remaining teeth were not asked whether they had toothache or needed fillings). The questions and interview procedures were pilot tested on randomly selected Adelaide households, and modifications were made to the procedures prior to the initiation of formal data collection.

The CATI operated using Windows-based WinCati 4.2 software* on a network of personal computers. The software implemented selection criteria for the Survey and managed skip sequences during the interview. Responses that were entered by interviewers were saved by the software onto data files for subsequent analysis. The

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* Sawtooth Technologies, Inc. 1500 Skokie Blvd., Suite 510, Northbrook, IL 60062, USA.

software also assisted with call scheduling, monitoring the outcome of calls and supervision of the interviewers.

2.4 Oral epidemiological examination

Information about clinical oral status was collected during standardised dental examinations conducted by dentists who undertook training in the Survey procedures. Examinations were limited to people who reported having some or all of their own natural teeth at the time of the interview. Appointments for examinations were made primarily at public dental clinics within or near the postcode in which people were sampled. Survey participants who attended the examination first completed a consent form and a questionnaire regarding their medical history. Examining dentists followed a standardised protocol to record levels of tooth loss, dental decay experience, tooth wear and —for subjects with no medical contraindications to periodontal probing— signs of gum disease. Although not described in any further detail in this report, there were additional components of the examination, including: oral mucosal lesions, assessments of horizontal tooth wear, dental plaque, dental calculus, dental fluorosis and biological samples collected for laboratory analysis. During data collection, replicate examinations were conducted for approximately five study participants per examiner to evaluate the consistency of their findings when judged against the principal survey examiner.

Selection of examiners

The survey was undertaken in collaboration with health departments of the eight Australian states and territories. Their principal role in the study was to provide dental examination teams, each team comprising a dentist examiner and a data recorder.

In oral epidemiological studies it is important to have a small number of highly trained examiners to minimise variability. There is always a choice between having a small number with the associated heavy workload and a large number of less well-trained and calibrated examiners. A small number of examiners each with a heavy individual caseload creates a risk that variation in diagnostic criteria of any one examiner could significantly bias the overall results. Alternatively, a large number of examiners undertaking fewer examinations increases the complexity of training, calibration and appointment scheduling.

State and territory public dental services selected 30 dentists to conduct survey examinations. The dentists completed a total of 5,505 examinations, with individual workloads varying from 32 examinations per dentist to 585 examinations per dentist (Table 2.1). Most dentists were staff members of the state/territory public dental service, although some were hired specifically for the Survey.

Examiner training

All 30 examiners undertook a two-day training and calibration session at the University of Adelaide. Separate training sessions were held for the examination teams from each state and territory and two sessions were provided for New South Wales.

Prior to the scheduled training session, each examiner was sent a 50-page manual and a DVD detailing the Survey protocol, including the criteria and coding for the examination. The manual had been written by staff at ARCPOH and had been reviewed by lead investigators of national oral health surveys in the United Kingdom and the United States of America. The DVD, which had been filmed over two days at the Australian Dental Association (NSW Branch) Centre for Professional Dental Development, illustrated the intra-oral procedures and demonstrated how criteria should be applied to make diagnoses and to code oral conditions.

Table 2.1: Distribution of examiners and examinations among states and territories

			No. of examinations per examiner		
State	**No. of examiners**	**No. of people examined**	**Minimum**	**Maximum**	**Mean**
NSW	11	1,113	32	164	101
Vic	3	1,181	267	585	394
Qld	3	824	217	305	275
SA	2	629	241	388	315
WA	3	470	134	196	157
Tas	3	385	49	186	128
ACT	2	386	125	261	193
NT	3	517	154	203	172
All states	**30**	**5,505**	**32**	**585**	**184**

Training of examination teams began with a half-day didactic session and discussion with ARCPOH investigators. The ARCPOH investigators included the principal survey examiner, Dr Kaye Roberts-Thomson, and an assistant survey examiner, Dr Loc Do. Both had been involved in the development of the Survey examination protocol, and they led dentists through the remaining day and a half of clinical training. During clinical sessions, dentists examined volunteers from a limited pool, most of whom were involved in at least four training sessions. Each volunteer was examined by two or three examiners, and the results of the examinations were compared by the trainers. Areas of difference were discussed, and the rationale for decisions was explored by the trainers and examiners. Difficult decisions or interesting problems were shown to the whole group. This facilitated calibration between examiners, although inter-examiner reliability was not assessed during training. At the conclusion of each half-day session a tutorial was held to clarify any outstanding issues.

For the first half-day of training, recorders had parallel sessions where they were instructed in the use of the laptop computers by a third ARCPOH investigator. The recorders were then involved in the clinical sessions, using the computers to record the examination and working with the examiner to whom they had been assigned.

A manual detailing the program and the coding system as well as information on forwarding the results of the examinations was provided to the recorders.

Appointment scheduling for survey examinations

At the end of the interview, people who reported having some or all of their own teeth were told of the intention to additionally conduct a survey examination and asked if they would be willing to be contacted again to schedule an appointment. Those who replied affirmatively were sent an information sheet explaining the examination procedures and a letter advising them that they would be phoned to schedule an appointment. Appointments were arranged soon after the interview by an appointment coordinator in the relevant state or territory. The appointment coordinator attempted to schedule an appointment at a convenient location within or near the Survey participant's residential postcode, primarily using public dental clinics owned by state/territory dental health services. Appointment schedules were forwarded to examination teams prior to each day's visits, and the examination team kept records of attendance. Study participants who did not attend a scheduled appointment were noted, and they were contacted again by the appointment coordinator in an attempt to find another timeslot. Most examinations were conducted during working hours on weekdays, although provision was made for visits at other times and on some weekends.

Procedures prior to the examination

On arrival at the clinic, the examiner or recorder checked the participant's understanding of the procedures and if necessary gave them another information sheet and explanation. Survey participants were then asked to read and sign a consent form and complete a medical history questionnaire. The medical history questionnaire asked about conditions which, if present, would preclude a periodontal examination (Table 2.2). The medical history was then checked by the dentist, and if any of the relevant medical conditions were confirmed the periodontal component of the examination was omitted.

Table 2.2: Questions asked to assess fitness for periodontal examination[(a)]

1.	Has a doctor or dentist ever told you that you must ALWAYS take antibiotics (for example, penicillin) before you get a dental check-up or care?
2.	Has a doctor ever told you that you have: →congenital heart murmur →heart valve problems →congenital heart disease →bacterial endocarditis.
3.	Have you ever had rheumatic fever?
4.	Do you have kidney disease requiring renal dialysis?
5.	Do you have haemophilia?
6.	Do you have a pacemaker or automatic defibrillator?
7.	Do you have other artificial material in your heart, veins or arteries?
8.	Do you have a hipbone or joint replacement that has been inserted during the last three months?
9.	Do you have any transplanted organs (for example, kidney transplant)?

(a) People who answered 'yes' to one or more questions were excluded from the periodontal component of the examination.

Scope of examination

Survey participants were examined in a supine position in standard dental chairs with illumination provided by the chair's overhead dental light. Examiners used an intra-oral mirror that additionally had its own battery-powered light source. A periodontal probe with 2mm markings was used to record distances, for example when assessing periodontal destruction (described further below). However, sharp explorers were not used, and no radiographs were taken. Full details of the examination protocol are provided online:

<http://www.arcpoh.adelaide.edu.au/project/distribution/NSAOH.html>.

The following overview summarises criteria used to assess the main oral health variables reported in this volume.

Tooth loss

For people aged less than 45 years, examiners distinguished between missing teeth that had been extracted due to decay or periodontal disease and teeth that were absent for any other reason (that is, congenitally missing, unerupted or extracted for orthodontics, trauma or impaction). For people aged 45 years or more, no such distinction was made, so that an extracted or otherwise absent tooth was recorded as missing. Dental implants, root fragments and deciduous teeth were coded separately and not counted as missing or absent teeth.

Replacement teeth

All lost teeth were further classified as replaced or not replaced by a fixed bridge or a removable denture that was worn to the examination.

Decay experience of coronal tooth surfaces

All teeth present were subdivided into five tooth surfaces: mesial, buccal, distal, lingual, and either occlusal (for premolars or molars) or incisal (for incisors and canines). Each coronal surface was assessed and categorised using visual criteria (no explorer was used) and one of the following codes was assigned.

- Decay: cavitation of enamel or dentinal involvement or both are present;
- Recurrent caries: visible caries that is contiguous with a restoration;
- Filled unsatisfactorily: a filling placed for any reason in a surface that requires replacement but that has none of the above conditions;
- Filling to treat decay: a filling placed to treat decay in a surface that had none of the above conditions;

- Filling placed for reasons other than decay: in a surface that has none of the above conditions (incisors and canines only);
- Fissure sealant: where none of the above conditions were found;
- Sound: when none of the above conditions was found.

Decay experience of tooth root surfaces

All teeth present were subdivided into four root surfaces: medial, buccal, distal and lingual. Each root surface was assessed visually and, if necessary, using a ball-ended periodontal probe. One of the following codes was assigned:

- Decay: a discrete, well-defined or discoloured lesion on the root surface that is soft to exploration using the periodontal probe;
- Recurrent caries: detectable caries that is contiguous with a restoration;
- Filled unsatisfactorily: a filling placed for any reason in a surface that has unacceptable defects but none of the above conditions;
- Filled root surface: one or more permanent restorations placed for any reason but none of the above conditions;
- Wear of 2 mm or more: recorded only on buccal surfaces with none of the above conditions;
- Sound root surface: when none of the above conditions was found;
- No visible root surface.

Periodontal tissue destruction

The assessment of periodontal tissue destruction was based on methods used in the US National Health and Nutrition Examination Survey (NHANES) (NHANES 2005). Assessments were made of probing pocket depth and gingival recession, both recorded in millimetres using a periodontal probe that had 2 mm markings. Measurements were made at the mesio-buccal, mid-buccal, and disto-buccal aspects of all teeth present, except for third molars. All fractional millimetre measurements were rounded down to the lowest whole millimetre before calling the number. For recession, the cemento-enamel junction (CEJ) was identified or its position was estimated (for example, if a filling obscured its position), and the distance from the CEJ to the free gingival margin was recorded in millimetres. When the CEJ was subgingival the number called was negative otherwise it was positive. For probing pocket depth, the distance from the free gingival margin to the bottom of the periodontal crevice/pocket was called.

Examiners did not make a direct measurement of clinical attachment loss; instead, it was computed during data analysis.

Gingival inflammation around six index teeth

The Loe and Silness (Loe & Silness 1963) gingival index was used to assess inflammation of the marginal gingival tissues around six index teeth (if present): the most anterior molar in each dental quadrant (up to four teeth), the right maxillary central incisor and the left mandibular central incisor. Pressure was applied to the free gingival margin on the buccal aspect of the tooth by swiping with the side of a periodontal probe that was held at approximately 90 degrees to the long axis of the tooth. One of the following codes was assigned:

- Severe inflammation: marked redness and oedema, ulceration or tendency to spontaneous bleeding;
- Moderate inflammation: redness, oedema, glazing or bleeding after applying pressure with the probe;
- Mild inflammation: slight change in colour or slight oedema but no bleeding after applying pressure with the probe;
- None of the above.

Wear and coronal height assessment of mandibular Incisors

Tooth wear and coronal height were recorded for each of the four lower incisors. Based on visual criteria, one of the following codes for tooth wear was assigned:

- Complete loss of enamel on the incisal surface, exposing dentine encircled by a band of enamel;
- Some incisal dentine is exposed, but some incisal enamel is still in place;
- No exposure of dentine;
- Missing tooth or restored incisal edge or tooth that could not otherwise be assessed.

The periodontal probe was then used to measure the height of the anatomical crown at the midpoint of the labial surface of each incisor. Height was defined as the vertical distance from CEJ to the labial-incisal line angle. Height was recorded in whole millimetres, and fractional millimetres were rounded down to the lower whole millimetre. Horizontal wear of 2 mm or more on the buccal tooth surfaces was recorded separately during the assessment of the buccal root surfaces.

Data recording for examinations

Each code called by an examiner was recorded directly onto laptop computers using Microsoft Excel software designed for the purpose. The software included logic checks and skip sequences to reduce the probability of recording errors. Recording was done by state/territory staff who had experience in clinical dental procedures, primarily dental assistants. They were trained in use of the software during the two-day training session for examination teams held at the University of Adelaide.

Procedures following the examination

At the end of the examination, study participants received a written report completed by the Survey dentist that described the main clinical findings. The report included general advice regarding dental treatment. Study participants who completed the examination were also offered a Colgate gift pack containing oral hygiene products. At the end of each examination, a paper copy of the examination was printed and archived as a backup.

Assessment of inter-examiner reliability

In this survey, 30 dentist-examiners recorded oral conditions of 5,505 survey participants. Whenever there are multiple examiners, there is potential for variation between examiners in their diagnostic criteria and recording of oral health indices. In order to minimise this variation three approaches were adopted. First, each examiner was given a 50-page manual describing the examination protocol and a DVD that demonstrated intra-oral procedures. Each contained simple and clear codes for each component of the examination. Second, a two-day training session was undertaken by all examiners. Third, within a few weeks of beginning survey examinations, each examiner was tested against the principal examiner to measure the degree of inter-examiner reliability. The first two approaches are described above. The remainder of this section presents the results of inter-examiner reliability.

The principal survey examiner was used for reliability testing. She had been involved in the development of the examination protocol and the DVD and in the training of all examiners. She visited each examiner in their state/territory on a day when they were conducting examinations of survey participants. The purpose of her visit was to conduct 'masked replicate' examinations of survey participants. They are referred to as 'replicate' examinations because survey participants are examined twice, once by the Survey dentist and once by the principal survey examiner. 'Masking' refers to the fact that the principal survey examiner recorded her findings without being aware of the findings recorded by the Survey examiner. Replicate examinations were conducted with all but one examiner who withdrew from the Survey after completing 32 examinations.

The replicate examination entailed assessments of tooth presence, periodontal assessment of teeth in one jaw, and assessment of caries experience in both crowns and roots of teeth. The gingival index was not replicated because the clinical procedures of

one assessment can influence the results of a subsequent assessment. Reliability of each examiner relative to the principal survey examiner was measured by calculating the intra-class correlation coefficient (ICC). The ICC can range from negative values to a maximum of 1.0, with higher values demonstrating greater agreement. Guidelines for interpreting the related kappa statistic propose that values of 0.2 or less represent 'poor or slight' agreement, values from >0.2–0.4 represent 'fair' agreement, values from >0.4–0.6 represent 'moderate' agreement, values from >0.6–0.8 represent 'substantial' agreement, and values greater than 0.8 represent 'almost perfect' agreement (Landis & Koch 1977).

Replicate pairs of examinations were conducted with 157 survey participants to assess reliability of 29 examiners (Table 2.3). The number of replicate pairs of examinations ranged from two to eight depending on the number of participants who arrived and consented to be re-examined on the scheduled particular day. Fewer than 29 examiners could be assessed for some indices, either because no relevant conditions were present, or because there was no variability among examiners and subjects assessed. For example, 13 of the 29 replicate pairs of examinations occurred in study subjects where both the examiner and the principal survey examiner found no root decay, leaving only 16 examiners whose agreement could be quantified. Reliability of most aspects of the examination was based on person-level summary indices (for example, number of missing teeth). Additionally, reliability was measured for coding of decayed, missing or filled status of 4,953 teeth and for periodontal measures recorded at 4,577 sites.

Table 2.3: Summary of findings from assessment of inter-examiner reliability

Index	No. of examiners evaluated	No. of replicate pairs evaluated	Median reliability[(a)]	Number of examiners with reliability ≤0.2
Number of teeth present per person	28	157 people	1.00	0
Number of teeth missing due to pathology per person	29	157 people	1.00	1
Number of filled coronal surfaces per person	29	156 people	0.98	0
Number of decayed, missing or filled teeth per person	29	157 people	0.98	1
Decayed, missing or filled status of individual teeth	29	4,953 teeth	0.85	0
Number of filled root surfaces per person	27	111 people	0.82	1
Millimetres of clinical attachment loss per site	29	4,577 sites	0.59	0
Number of decayed coronal surfaces per person	29	156 people	0.56	12
Millimetres of probing pocket depth per site	29	4,577 sites	0.54	0
Number of decayed root surfaces per person	16	111 people	0.46	7

(a) Numbers are intra-class correlation coefficients, except for decayed, missing or filled status of individual teeth, where the kappa statistic is presented.

The highest levels of agreement (median ICC 1.00) were obtained for tooth presence and missing teeth (Table 2.3). There was also excellent agreement for filled coronal surfaces; person-level DMFT, number of filled root surfaces; and decayed, missing or filled status of individual teeth. Moderate agreement was obtained for site-level periodontal measurements. The latter represents a very stringent criterion, as examiners were trained to be within 1 mm of the principal examiner's measurement, yet the maximum ICC of 1.0 would have been achieved only if individual sites had 0 mm of difference between replicate measurements.

Moderate agreement was obtained for measures of decayed coronal surfaces (median ICC 0.56) and decayed root surfaces (median ICC 0.46), and up to 12 examiners achieved an ICC of <0.2. One factor contributing to this poor level of reliability was that decayed surfaces were uncommon in the participants on the days of reliability testing, and with a relatively small number of observations it was difficult to achieve moderate to high ICC scores.

Summary of examiner reliability findings

The levels of examiner reliability found for this survey were similar to benchmarks reported for the 1998 UK Adult Dental Health Survey (Kelly et al. 2000) and the 1999–2002 National Health and Nutrition Examination Survey (NHANES 2005). In the UK survey, where 70 examiners were used, and where reliability was measured for eight blocks of examiners on the second day of their training, mean kappa values ranged from 0.88 to 0.96, which is similar to the median of 0.85 reported in Table 2.3. However, the UK survey did not report reliability for periodontal measures. In the US survey, where only four examiners were used, ICCs for probing pocket depth ranged from 0.55 to 0.87 and for clinical attachment loss from 0.72 to 0.89.

2.5 Period of data collection

Data collection began in July, 2004 and was completed in September, 2006 (Table 2.4). Interviews were timed to begin approximately one month prior to the planned start of examinations in each jurisdiction.

Table 2.4: Periods of data collection in states and territories

	Dates of interviews		Dates of examinations	
State/territory	Beginning	End	Beginning	End
ACT	Jul, 2004	Oct, 2004	Jul, 2004	Oct, 2004
SA	Sep, 2004	Dec, 2004	Sep, 2004	May, 2005
WA	Oct, 2004	Mar, 2005	Nov, 2004	May, 2005
Vic	Jan, 2005	Sep, 2005	Feb, 2005	Sep, 2005
NSW	May, 2005	Nov, 2005	Jun, 2005	Jul, 2006
NT	Aug, 2005	Oct, 2005	Sep, 2005	Mar, 2006
Tas	Jan, 2006	May, 2006	Mar, 2006	Sep, 2006
Qld	Mar, 2006	Sep, 2006	Jun, 2006	Sep, 2006
Australia	Jul, 2004	Sep, 2006	Jul, 2004	Sep, 2006

2.6 Ethical conduct of research

This project was reviewed and approved by the University of Adelaide's Human Research Ethics Committee. Interviewed subjects provided verbal consent prior to answering questions. All examined subjects provided signed, informed consent prior to the examination.

2.7 Target sample size

Sample size requirements were calculated for a range of key outcome variables, both means and proportions. The 1987–88 NOHSA was used to generate parameter estimates, variances and design effects. A 25% reduction in NOHSA age-specific estimates of mean number of decayed teeth was nominated as the critical threshold that should be detectable with standard statistical power of 80%. A more stringent threshold of 10% reduction was proposed for mean DMFT. Sample size requirements for other indices and for proportions were considered, but they yielded lower numbers of required subjects. Table 2.5 therefore summarises the calculations for mean DT and mean DMFT. For example, among 15–24-year-olds, a 25% reduction in observed DT (that is, a reduction from 2.04 to 1.5) would require a total of 1,627 examinations, given the design effect of 2.61 observed in NOHSA. The proposed number of examinations (Table 2.5) provided sufficient numbers for all inferences except for one cell—a 10% reduction in mean DMFT for 15–24 year olds. Instead, it was proposed to examine 1,627 subjects in that age group, sufficient to detect a 12% change in mean DMFT (calculation not shown).

The required number of interviews for dentate subjects assumed a 65% participation rate in the examination, while the total interview sample size reflects the fact that edentulous people were to be interviewed (but not examined). Based on these calculations, it was planned to conduct a total of 7,500 dental examinations, necessitating 13,560 interviews.

Table 2.5: Critical sample size requirements to meet study objectives[(a)]

	Mean no. of decayed teeth			Mean DMFT				Required no. of interviews	
Age group (years)	Observed mean	DEFF(b)	Required no. of exams	Observed mean	DEFF[†]	Required no. of exams	Proposed no. of exams	Dentate	Dentate + edentulous
15–24	2.04	2.61	1,627	7.14	2.27	2,281	1,627	2,503	2,506
25–34	2.32	2.33	1,227	14.25	1.92	696	1,227	1,888	1,897
35–44	1.78	2.23	1,288	17.82	2.37	572	1,288	1,982	2,054
45–54	1.61	2.16	1,349	18.86	2.09	523	1,349	2,075	2,357
55–64	1.57	1.81	1,101	20.08	2.08	566	1,101	1,694	2,231
65+	1.70	1.70	907	21.04	2.07	516	907	1,395	2,511
All ages							**7,499**	**11,537**	**13,556**

(a) Means and design effects calculated from 1987–88 National Oral Health Survey of Australia. Required number of examinations reflects minimum sample size required to detect a 25% difference in mean number of decayed teeth and a 10% difference in mean number of DMFT. Type I error=0.05, Type II error=0.20.

(b) DEFF = sampling design effect

2.8 Weighting of data for analysis

The purpose of using sampling weights is to enable estimates (for example, percentages and means) to be generated that are representative of the underlying Australian population from which survey participants were selected. In this survey postcodes, households and people were sampled with different probabilities of selection, and there were additional differences in the probability of participation.

In order to reflect these differences and to ensure that survey estimates are consistent with the age by sex distribution of the Australian population, it was necessary to create sampling weights for use during statistical analysis. The sample design used in the Survey was a multi-stage design where the first stage selected postcodes, the second stage selected households within sampled postcodes, and the third stage selected one person in the target age group in each sampled household.

A person's chance of selection in the Survey is determined by the stratum and postcode from which their phone number was selected and the number of people in the target age group usually resident in the selected household. Weights were calculated to reflect these probabilities of selection and to adjust for different participation rates across postcodes and among age and sex categories. For the telephone interview survey, weights were adjusted to ensure survey estimates were consistent with the 2005 Australian Bureau of Statistics Estimated Residential Population data. For the oral examination survey, which was restricted to dentate people aged 15 years or more, estimates of the dentate population were derived from the telephone interview survey and used to derive examination weights.

2.9 Reporting 95% confidence intervals to express sampling variability

There is necessarily some uncertainty about the true value within a population of any estimated value (for example, percentage) derived from a sample. This occurs even when the data are weighted and comes about because of random variability introduced in the process of selecting a sample. For example, in this survey 14,123 adults were selected at random and interviewed from among the population of approximately 16 million Australian adults. Yet, another random sample of 14,123 adults almost certainly would have resulted in the selection of different individuals. Because the number of possible random samples is nearly infinite, the results from any single random sample must be expressed with a degree of uncertainty.

The uncertainty can be measured using statistical theory, and in this survey it is expressed using 95% confidence intervals (95% CIs). For example, Chapter 5 reports that 6.4% of Australian adults had no natural teeth and there was a 95% CI of 6.0–6.9 (see Table 5.1, page 83). The 95% CI signifies the likely lower and upper range of values within which the true population percentage would fall. In this context 'likely' means that there is a 95% probability that the true population value lies between those two values. Hence, while the 'best estimate' for complete tooth loss is 6.4%, the 95% CI signifies that the true population estimate could be as low as 6.0%, or as high as 6.9%.

95% CIs can also be used as a guideline to identify differences between population subgroups that are statistically significant. For example, Table 5.1 reports that 0.0% of 15–34-year-olds and 1.7% of 35–54-year-olds were edentulous, and there was no overlap between the corresponding 95%CIs (0.0–0.1 and 1.3–2.2, respectively) signifying that this small difference of 1.7% in absolute terms was statistically significant. In contrast, the much larger absolute difference in prevalence of edentulism between Indigenous Australians aged 35–54-years (7.6%) compared to Indigenous Australians aged 55–74-years (20.8%) was not statistically significant because corresponding 95% CIs overlapped (2.5–21.4 and 10.5–37.0, respectively.)

Hypothesis tests are another widely-used method to identify differences between groups that exceed the margin of sampling error. Results from hypothesis tests usually are reported as probabilities, or 'P-values', and by convention, a threshold of $P<0.05$ is regarded as evidence of a statistically-significant difference between groups. There is a mathematical relationship between P-values and 95% CIs that can be summarised by two general guidelines:

- Whenever there is a lack of overlap between 95% CIs for two groups, it is a mathematical certainty that a hypothesis test of the difference between the same two groups would yield a P-value of less than 0.05, and it could be as small as 0.005.
- However, the criterion of non-overlapping 95% CIs is a 'conservative' method of identifying between-group differences, because 95% CIs that overlap to a small degree could, nevertheless, be found to differ to a statistically significant degree using a hypothesis test (that is, yielding a P-value of <0.05).

2.10 Data analysis

The aim of the data analysis was to generate summary statistics describing oral health for the Australian population. To achieve this, separate data files were constructed from the sampling frame, the telephone interview software and the examination recording software. Out-of-range responses and logical inconsistencies were identified and resolved and the data files were merged. Where necessary, summary measures of disease were computed and response categories were collapsed to create oral health outcome variables of interest. This produced two analytic data files, one representing the 14,123 people who completed the interview, and the other representing the subset of 5,505 people who completed the examination. As described above, unit record weights were computed for each analytic data file.

Data files were managed and summary variables were computed using SAS software version 9.1.* For the results presented in Chapters 5, 6, and 7, percentages, means and their associated 95% CIs were generated using SAS callable procedures from SUDAAN software release 9.0.0† The SUDAAN procedures used sampling weights to generate population estimates and calculated 95% CIs that allowed for the complex sampling design used in this survey. To do so, 'with replacement' sampling was specified with two levels of stratification (state and section of state). The subject's sampling postcode was specified as the primary sampling unit, which was used by SUDAAN as the clustering variable.

Cross-sectional findings

Tables in Chapters 5, 6, and 7 present estimates of the frequency of oral health conditions, behaviours and perceptions in the Australian population. Many of the conditions, behaviours and perceptions were assessed for all survey participants, in which case the table subheading states that the base population was 'all people aged 15 years or more'. However, other aspects of oral health were assessed only for a population subgroup. This includes all oral examination findings that were measured only for dentate people (those with one or more natural teeth). In those instances, the table subheading states the population for whom estimates were generated (for example, dentate people aged 15 years or more).

The tables use two measures to express frequency of oral health conditions, behaviours and perceptions:

- Prevalence was expressed as the percentage of people with a characteristic of interest. This included percentages for some characteristics that were dichotomous (for example, presence versus absence of natural teeth) and for other characteristics that were collapsed to create a single category of interest (for example, presence of one or more decayed tooth surfaces). Some other outcomes represented a composite of characteristics based on several variables (for example, case definitions for periodontitis that were derived from measurements of probing pocket depth and recession at multiple sites throughout the mouth).

- Disease severity was expressed as the mean number, per person, of anatomical sites that had a condition of interest. Sites were teeth, tooth surfaces or periodontal landmarks. The landmarks were identified and their condition was diagnosed by examiners as described for the examination protocol above. To compute severity, the number of affected sites was first counted for each examined person. The mean number of counted sites per person was then computed, together with its 95% CI.

Oral health measures are tabulated for each of four age groups representing the Survey participant's age reported in the telephone interview. The four age groups are

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† Research Triangle Institute. PO Box 12194, Research Triangle Park, NC 27709–2194, USA.

15–34 years, 35–54 years, 55–74 years and ≥75 years. In the tables in Chapters 5, 6 and 7 those same age groups are also labelled as generations, with approximate birth dates of the generations listed as 1970–90, 1950–69, 1930–49 and pre-1930. Because the Survey was conducted over a two-year period, age is not a direct proxy for year of birth: for example, a person aged 35 years who was interviewed in 2004 would have been born in the period 1950–69, as labelled, whereas a person aged 35 years who was interviewed in 2006 would have been born in the period 1970–90. Hence, the listed generations are intended as descriptive labels to emphasise the historical periods in which each age group was born and lived.

The tables in Chapters 5, 6 and 7 report estimates for additional subgroups of people. Two mutually exclusive subgroups were created for each of eight characteristics based on responses to the telephone interview questions. The subgroups and unweighted number of respondents are listed in the Appendix to this volume and the eight characteristics are described below.

Sex

Sex was classified as 'Male' or 'Female'.

Indigenous identity

Indigenous identity was based on responses to the question 'Are you of Aboriginal or Torres Strait Islander origin?' People who responded 'Yes, Aboriginal', 'Yes, Torres Strait Islander' or 'Yes, Torres Strait Islander & Aboriginal' were classified as Indigenous. People who responded 'no' were classified as non-Indigenous. Twelve interviewees did not respond or said 'don't know' and they were excluded from estimates for the two subgroups.

Residential location

Residential location was classified as 'Capital city' or 'Other places', based on the sampling postcode used in selection of households.

Year level of schooling

Year level of schooling was based on responses to the question 'What is the highest year level of schooling you have completed?' People who responded 'Primary school [Year 7 or less]', 'Year 8' or 'Year 9' were classified as Year 9 or less. People who responded 'Year 10', 'Year 11' or 'Year 12' were classified as Year 10 or more. Seventy interviewees did not respond or said 'don't know' and they were excluded from estimates for the two subgroups.

Eligibility for public dental care

Most people who receive state and territory public dental care are deemed to be eligible for those services based on a means test administered by Centrelink, an agency of the Australian Government's Family Assistance Office. The means test assesses individuals based on their household income, assets, family composition and other criteria indicating disadvantage.

For this survey, eligibility for public dental care was based on responses to three questions in the interview. People were first asked 'Do you currently have a pension or allowance from the Government, or have a pensioner concession card, a Health Care Card or a Department of Veterans affairs card?' People who responded 'yes' were then read a series of six concession card types and asked to indicate if they were covered by each one. People were classified as eligible for public dental care if they responded 'yes' to the first question and reported that they were covered either by a pensioner concession card, health care card or both. They were classified as ineligible if they responded 'no' to the first question, or if they responded 'yes' to the first question but 'no' to both questions regarding pensioner concession card and health care. Twenty-one interviewees replied 'don't know' to the first question and they were excluded from estimates for the two subgroups.

Dental insurance

Dental insurance coverage was based on responses to the question 'Do you have private insurance cover for dental expenses?' People were classified as insured if they responded 'yes' or uninsured if they responded 'no'. There were 147 people who responded 'don't know' and they were excluded from estimates for the two subgroups.

Oral status

Oral status was based on responses to the question 'Do you have any of your own NATURAL teeth?' People who answered 'yes' were classified as dentate while people who answered 'no' were classified as edentulous.

Usual reason for dental visits

The usual reason for dental visit was asked only of 12,828 people who said they had one or more of their own natural teeth and who reported having had a dental visit at some time in their life. They were asked 'Which is your usual reason for visiting a dental professional, for check-ups or when you have a dental problem?' People who answered 'Check-up' or 'Problem' were classified accordingly. There were 39 people who responded 'don't know' and, together with the 1,295 who were not asked the question, they were excluded from estimates for the two subgroups.

Analysis of trends between surveys

As described in Chapter 1, changes observed between surveys may be attributable to two dimensions of time (see p7). One dimension is represented by events occurring in the interval between surveys that affect the life course of individuals, including the effects of ageing itself. The other dimension is represented by particular historical experiences of different generations that make up the population studied in each survey. In order to distinguish between those two dimensions of time, Chapter 8 evaluates trends since the 1987–88 survey using three methods.

- Age group analysis describes the degree of change in population oral health between surveys for selected age groups.
- Within-generation birth cohort analysis determines if change can be attributed to events occurring between surveys, including disease onset or progression, ageing, provision of dental care and changes to population health determinants.
- Between-generation birth cohort analysis determines if change can be attributed to historical circumstances prior to the first survey that selectively influenced the levels of oral health in different generations.

Age group analysis

Age group analysis aims to describe the amount of change in population health for selected age groups. The method of age group analysis is illustrated in Figure 2.1 for three hypothetical age groups classified as 'youngest', 'middle' and 'oldest'. The height of each bar represents the percentage of people with a health condition measured using comparable methods in each survey. Pairs of bars are compared by contrasting the height of the white bar, representing the first survey, with the height of the blue bar, representing the second survey. Change that exceeds the margin of sampling error can be identified when there is no overlap between adjacent bars of 95%CIs. This occurs for the youngest and oldest age groups in the hypothetical example shown in Figure 2.1. Furthermore, the magnitude of difference in height of the white and blue bars provides the basis for describing the change as a 'marked' reduction in the youngest age group but only a 'small increase' for the oldest age group. In contrast, the 95%CI error bars overlap for the middle age group, where the trend between surveys is described as 'no change'.

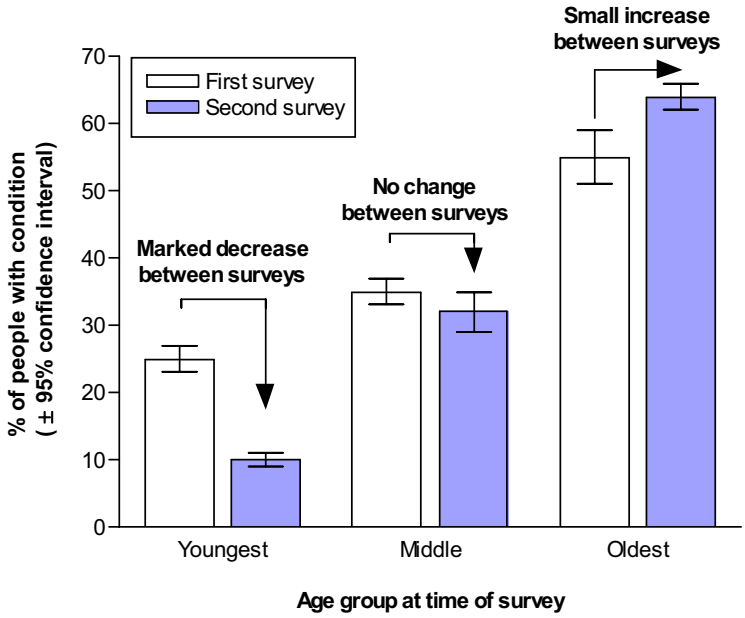

Figure 2.1: Method of age group analysis (hypothetical data)

Description of the degree of change between surveys for selected age groups is useful because most oral diseases accumulate with age. Additionally, some aspects of oral health are influenced by circumstances that occur at age-related milestones. For example, pensioner concession cards, issued to retirees, confer eligibility for public dental care. Consequently, it is valuable to make comparisons within age groups so that any differences observed between surveys are due to factors other than age-related effects. However, even when differences are observed for specific age groups, there can be no way to determine if the difference has arisen because of events that may have changed between surveys or because of different historical experiences of the same age group in each survey.

Birth cohort analysis

Changes attributable to effects within generations and between generations can be assessed using birth cohort analysis. The principles of birth cohort analysis are illustrated in Figure 2.2. The youngest generation studied in both surveys was born between 1967 and 1983. At the time of the first survey its members were aged between 5 and 21 years. Seventeen years later they were aged between 22 and 38 years when surveyed in 2004–06. Information about change *within* that generation can be assessed because its members were sampled for both surveys, as depicted by the diagonal blue line. Changes observed between surveys for members of that cohort therefore represent the effects of ageing or events that occurred between surveys, or a combination of the two.

The oldest generation was born between 1916 and 1932 and in the interval between surveys its members aged from 56–72 years to 73–88 years. Nonetheless, as for the most recent birth cohort, any changes observed within that birth cohort between surveys represent the effects of ageing or events that occurred between surveys, or a combination of the two.

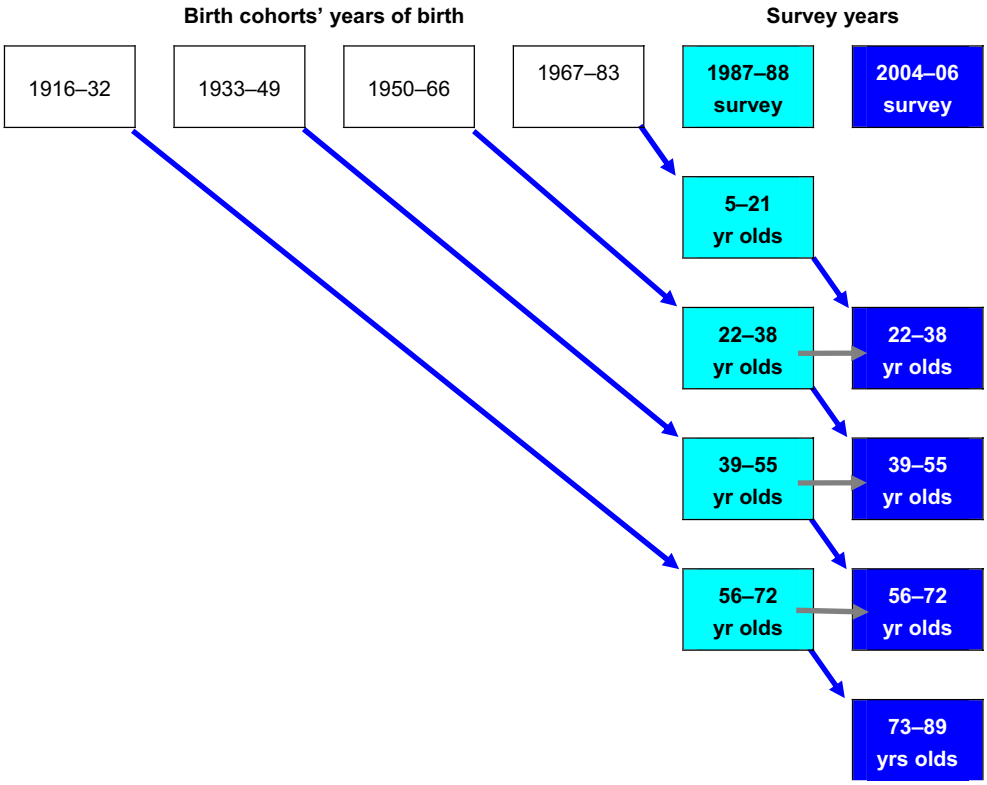

Figure 2.2: Design for birth cohort analyses presented in Chapter 8

Birth cohort analysis also permits assessment of inter-cohort, or *between-generation* differences in oral health. These are depicted using the grey lines in Figure 2.2. The aim is to determine the extent to which any age-group differences observed between surveys could be attributed to different historical circumstances experienced by different generations before the first survey. For example, comparison of oral health among 22–38-year-olds in both surveys is indicative of different historical influences that affected the 1950–66 generation compared to the subsequent 1967–83 generation. Typically, differences between two generations observed when they are of the same age are indicative of historical influences on oral health that have left different imprints on different generations.

Figure 2.3 illustrates the two methods of cohort analysis used in Chapter 8 to explain trends. The data are hypothetical percentages of people with an oral health condition observed in two surveys conducted 17 years apart. The blue arrows indicate the direction of *within-generation* comparison, that is the change in one generation of adults detected at the second survey relative to the first survey. The top pair of bars represent the most recent generation who were aged 5–21 years at the first survey and aged 22–38 years 17 years later at the second survey. In this hypothetical example prevalence of the condition halved over the period between surveys from 20% (white bar) to 10% (blue bar). The error bars represent 95% CIs, indicating the degree of uncertainty surrounding the true population value. When the 95% CIs of a pair of estimates do not overlap, as in this example for the most recent generation, the estimates are likely to represent a true difference in the population. A decrease of the magnitude depicted for this most recent generation can be described as a 'marked decrease'.

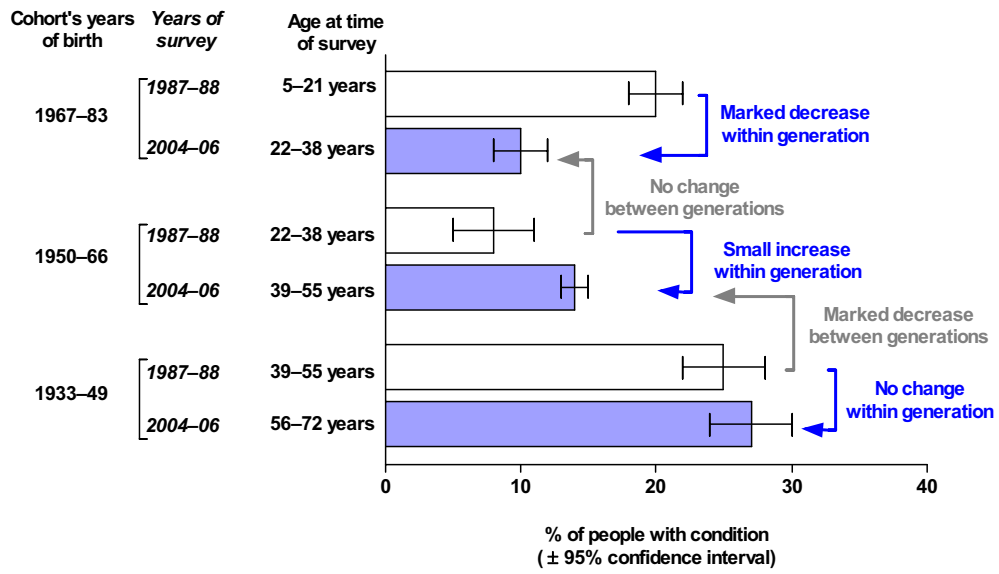

Figure 2.3: Illustration of birth cohort analysis of within-generation and between-generation trends (hypothetical data)

The magnitude of change for the middle generation was smaller. Prevalence increased from 8% to 14% between surveys and change of this magnitude is described as a 'small increase'. Finally, a comparison of the bottom pair of bars shows an overlap of the 95% CI. Any difference in prevalence may be due to sampling error and consequently this is described as 'no change' with the generation.

The grey arrows in Figure 2.3 indicate the direction of comparison *between-generations*. In this analysis the length of the white bar, denoting results for one age group in the first survey, is compared with the length of the blue bar above it denoting the results for preceding generation when its members were of *the same age*. The contrast is with the same age group, captured at two different points in time. Differences between those same age groups usually are caused by historical experiences of the generations that occurred before the first survey.

In the example in Figure 2.3, 22–38-years-olds were sampled from the 1950–66 birth cohort in the first survey, and 8% had the condition (white bar), while 17 years later in the second survey when 22–38-years-olds were sampled from the 1967–83 birth cohort, 10% had the condition (blue bar above). Based on these hypothetical results, the difference was only a negligible, and there was considerable overlap of 95%CIs, so the contrast is labelled as 'No change between generations'. In contrast, the white bar for 39–55-year-olds sampled from the 1933–49 cohort in the first survey represented a substantially greater prevalence than the blue bar above it, representing the same age group sampled from the 1950–66 birth cohort 17 years later. The reduction in prevalence over 17 years exceeded the margin of error, and it therefore is labelled as 'marked decrease between generations'.

Analysis of data from 1987–88 National Survey of Adult Oral Health

In order to evaluate trends for this report, original data from the 1987–88 National Oral Health Survey of Australia (NOHSA) were analysed. The NOHSA was a cross-sectional study of a random sample of Australian residents aged 5+ years selected from the six states and the Australian Capital Territory. The Northern Territory was not included. The methods of data collection for the Survey have been described previously (Barnard 1993). In summary, 13 sampling strata were defined by capital city and non-capital city sections of each state together with the ACT. A random sample of census collectors' districts (CDs) was selected from each stratum, and within each CD a random sample of eight households was selected. Households were identified by consulting a map of each CD, selecting a starting grid point at random and then systematically selecting subsequent households along a predetermined route using a predetermined skip interval. Each sampled household was visited, and all people within the household were invited to take part in the interview and examination. The Australian Bureau of Statistics provided the samples of CDs to each state and the ACT, advised on the method for selection of households and maps of CDs.

Participants in the study underwent an interview consisting of three demographic questions and eight behavioural questions, and were invited to take part in an examination. Examinations were conducted by volunteer dentists who were instructed in the Survey protocol during a period of one or two nights. The examination was based on the World Health Organization's protocol (WHO 1987). The examination assessed: tooth loss, dental caries experience of deciduous and permanent teeth and treatment needs for caries and periodontal disease. Approximately 840 volunteer dentists were recruited by state/territory health agencies to conduct examinations. Principal examiners from each state and the ACT undertook clinical training at the

University of Sydney. However, there was no clinical training of other examiners in the Survey methods, and there were no replicate examinations to assess inter-examiner reliability.

As previously reported, interviews were conducted with 16,897 people and 14,430 of them (85.4%) had an oral examination (Barnard 1993). Interview and examination data were keypunched and validated, estimated resident population (ERP) statistics were included for each subject, and the data were written to ASCII files contained on two diskettes that are retained by the AIHW Dental Statistics and Research Unit. The ERP, which was taken from the 1986 Population Census, was the estimated number of people in the Australian population corresponding to each sampled person's state, metropolitan locality (categorised into two strata, metropolitan and extra-metropolitan), age (categorised into 14 five-year age strata in the range 5–74 years, and a fifteenth stratum of people aged 75+ years) and sex (two strata).

Data were managed and summary variables were computed using SAS software version 9.1.* Percentages, means and their associated 95% CIs were generated using SAS-callable procedures from SUDAAN software release 9.0.0.† The SUDAAN procedures used sampling weights to generate population estimates and CIs calculated 95% that allowed for the complex sampling design used in this survey. To do so, 'with replacement' sampling was specified with two levels of stratification (state and section of state). The subject's CD was specified as the primary sampling unit, which was used by SUDAAN as the clustering variable.

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3 Participation in the Survey

by Gloria Mejia, Gary Slade and A John Spencer

The 2004–06 National Survey of Adult Oral Health collected information from a representative sample of the Australian population. In studying only a sample, the Survey differs from a census of all members of a population. Despite the fact that sample surveys do not study all people in a population, they are capable of generating estimates of oral health for the entire population. However, there are two important caveats that have to be considered that affect the accuracy of those estimates.

1. Imprecision that is inherent due to sampling.

   As described in Chapter 2, there is necessarily some uncertainty about the true value within a population of any estimated value (for example, percentage) derived from a sample. This comes about due to variability that is inherent in the process of random sampling. In this survey the variability is expressed using 95% CIs.

2. Bias that occurs due to non-participation.

   Bias is defined as the difference between a value observed in a sample survey and the true value that exists in the population. Systematic errors, or biases, affect the estimates consistently in the same direction such as underestimating or overestimating the parameter. One such bias is due to non-participation in the survey and is usually called non-response bias. It occurs when the responders and the non-responders differ in one or more characteristics. If there is no difference between the estimates obtained from responders and non-responders then there is no bias, regardless of subject participation or response rate. In virtually all circumstances, the true value in a population is not known; the extent of potential bias for a given survey usually can be assessed only indirectly. One factor that contributes to bias is the extent to which people are excluded for reasons other than the random chance of selection. Such exclusions can occur when members of the population cannot be sampled or when information is not collected from one or more individuals who were selected for the survey. For all practical purposes such exclusions are inevitable in population surveys. In this survey, for example, some sampled phone numbers had been disconnected, while some households could not be contacted despite repeated phone calls. Even after contacting a household, some selected people chose not to answer questions. Finally, among interviewed people, some were unwilling or unable to attend for a dental examination.

This chapter describes participation rates in the Survey and investigates such differences. It concludes with a description of key sociodemographic characteristics of the target population studied in this survey.

3.1 Participation rates in the Survey

Large-scale surveys frequently use telephone interviewing because of its relative ease cost—efficiency, and because most homes have telephones. For example, 94.4% of Australian households had a telephone (ABS 1987) in 1986, and 1996 telephone ownership had increased to 97.5% (ABS 2001a). As described in Chapter 1, the sampling frame used for this survey was a commercially-available database of listed telephone numbers (see p12).

Of 36,931 telephone numbers selected at random from the 'electronic white pages' sampling frame, 8,119 were out-of-scope numbers (Figure 3.1). Out-of-scope telephones refer to business lines, faxes or modems, and disconnected telephones; whereas in-scope telephones refer to eligible household numbers. Of the 28,812 eligible (in-scope) household numbers, 14,689 were classified as non-respondents. This group included 3,016 households that who did not answer the call, 10,159 direct refusals, 46 people who asked to be called back but could not be re-contacted, 662 who spoke a foreign language for which there was no available translator, and 806 who were unable to participate due to other reasons such as the failure to schedule an appropriate time for the interview. Considering only adults, 14,123 people completed the interview. (Additional interviews regarding children's oral health were conducted in 1,291 households, but those findings are not described in this report, and those interviews are not considered further.) Dentate individuals aged 15 years or more who had responded to the interview represented the target sample for the examination, except for 255 such people who lived in seven remote postcodes that were excluded because it was logistically not possible for examining teams to visit those postcodes. A total of 5,505 adults underwent an oral examination.

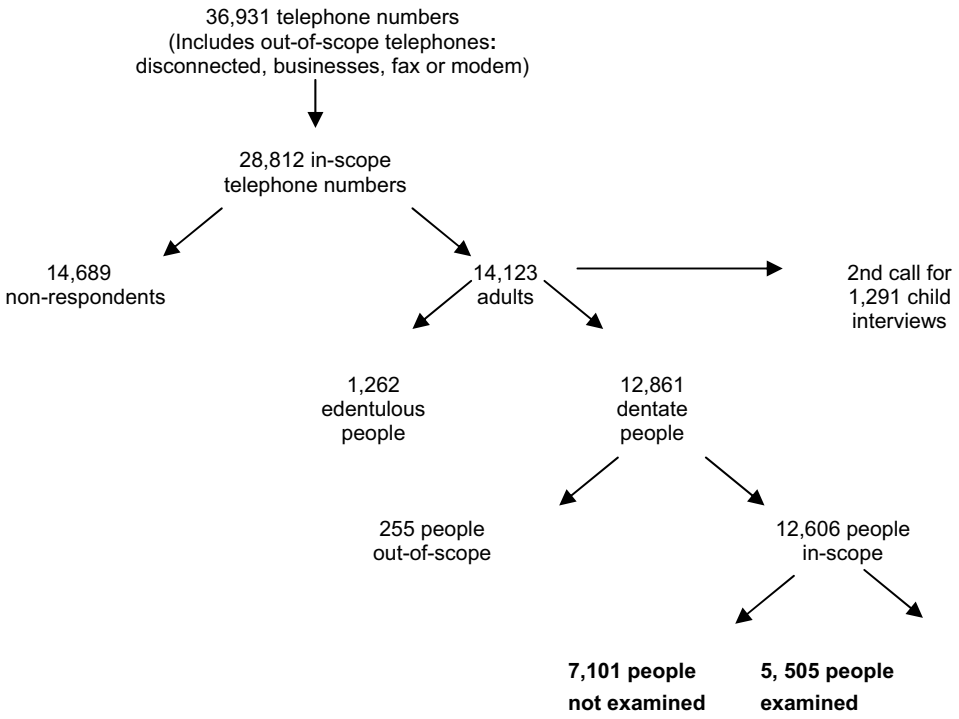

Figure 3.1: Number of people selected and participating in the Survey

The extent of participation in a survey is measured by dividing the number of participants by the total number of eligible people (for example, individuals living in households considered to be in-scope). In NSAOH one adult from each contacted household was asked to be interviewed. The interview participation rate was 49.0%, which was calculated with 14,123 adults in the numerator; the denominator, 28,812, included the total sampling frame minus the out-of-scope or ineligible units. The examination participation rate was calculated from among the 12,606 people who completed an interview and were in-scope for an examination. There were 5,505 people examined, representing an examination participation rate of 43.7%.

Participation rates were additionally calculated for each of the 387 postcodes sampled for the study, yielding participation rates ranging from 9% to 83% and a mean participation of 50%. By state, South Australia had the highest participation and New South Wales the lowest (Table 3.1). Interview participation rates generally were higher in non-metropolitan areas than in metropolitan areas. Examination participation rates varied from 29.2% in metropolitan New South Wales 58.5% in metropolitan South Australia.

Table 3.1: Interview and examination participation rates among sampling strata

	Participation rate (%)	
Sampling stratum	**Interview**	**Examination**
New South Wales – Metropolitan	40.6	29.2
New South Wales – Non-metropolitan	50.5	40.3
Victoria – Metropolitan	42.2	48.9
Victoria – Non-metropolitan	50.8	53.3
Queensland – Metropolitan	47.7	44.4
Queensland – Non-metropolitan	49.4	45.1
South Australia – Metropolitan	61.8	58.5
South Australia – Non-metropolitan	62.0	55.1
Western Australia – Metropolitan	53.5	39.6
Western Australia – Non-metropolitan	56.7	49.1
Tasmania – Metropolitan	64.0	45.5
Tasmania – Non-metropolitan	57.0	43.0
Australian Capital Territory	54.2	40.8
Northern Territory – Metropolitan	49.3	46.0
Northern Territory – Non-metropolitan	51.4	53.6
All	**49.0**	**43.7**

Although telephone interviews usually have higher number of respondents than self-administered methods of collecting individual data (McLennan 1999), it is exceptional to achieve 100% responses. Large population surveys such as the Behavioural Risk Factor Surveillance System in the United States reported participation rates among states ranging from 34.6% to 67.4% with a median of 51.1% (CDC 2005). Proposed factors contributing to the lowering of response rates include people spending less time at home, increased use of answering machines and other methods of screening incoming calls, and mobile phone use (Frankel 2004). New approaches and combinations of approaches are now being tested to address decreasing trends in response rates (Link et al. 2006).

3.2 Assessment of non-participation bias

By convention, participation rates below a threshold of 80% have led to concerns that potential non-participation bias may affect results of the study. However, it is now acknowledged that participation rate should not be considered a proxy for bias and that surveys need to be planned and analysed recognising that some level of non-response is inevitable (Couper 2004). Relatively little bias has been reported in some studies, even with participation rates ranging from 30% to 60% (Kulka & Fowler 2004). Studies of response bias in some Canadian oral health surveys have concluded that low participation rates do not necessarily indicate error in the estimates or compromise the results of studies (Locker 1993; Locker et al. 1990).

For this survey two approaches were adopted to investigate non-participation bias. The first 'population benchmark' approach compared estimates derived from the NSAOH sample with the known distribution of selected demographic characteristics within the Australian adult population. However, this method is limited to measures that are reported from the population census, which collects only a limited set of

demographic characteristics. In particular, there is little information published from the census concerning socioeconomic status, a characteristic that is frequently associated with survey response rates and which is a prominent determinant of population oral health. For that reason a second method that evaluated non-participation bias used a 'small area socioeconomic characteristics' approach.

Population benchmarks

The demographic characteristics used to investigate non-participation bias in this survey were population 'benchmarks' reported in the 2001 Australian Census of Population and Housing. The rationale is that if one demographic group was more likely to be excluded from the Survey than another, the Survey's estimated percentage of people who are in that group would differ from the percentage recorded in the census. For example, if non-English speakers were less likely to participate in the Survey, the Survey's estimate of the percentage of non-English speakers would be lower than the 'benchmark' percentage of non-English speakers reported in the census.

If differences in population benchmarks are observed, the statistical method of *direct standardisation* can be used to adjust other estimates from the Survey (for example, the estimated percentage of people with oral disease). The difference between the adjusted estimate and the Survey's unadjusted estimate provides a measure of the degree of bias due to non-participation. For example, direct standardisation that adjusted for under-representation of non-English speakers would produce an estimate of oral disease from an 'adjusted' survey sample. Conceptually, the adjustment would inflate the number of non-English speakers in the sample so that it became equivalent to the census distribution of non-English speakers.

The method of direct standardisation is used widely in epidemiology to remove the influence of factors that differ between groups and that can influence measures of interest (Schoenbach 2000). Studies comparing different methods of adjustment support the use of direct standardisation. The method was used in a study that adjusted for non-participation bias in the Mexican American portion of the US Hispanic Health and Nutrition Examination Survey (Rowland & Forthofer 1993). For this analysis, direct standardisation was achieved using SUDAAN statistical analysis software* by specifying the Census distribution of each demographic variable in the 'stdwgt' statement.

Comparison with population benchmarks

Table 3.2 compares prevalence estimates of selected demographic characteristics from NSAOH and the 2001 Census. Census figures are for the Australian population aged 15 years or more, except for language spoken at home, which was reported only for all ages. Information on age, sex, and geographic area were not included because those

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variables represent the characteristics used to calculate NSAOH weights. These weights were used to define the number of people in the target population represented by each participant. The consequence is that NSAOH estimates necessarily adjust for any differences in representation between age groups, sexes, and state/territories. The primary focus of Table 3.2 is on the difference between percentages reported from the Census and the corresponding NSAOH sample estimates. In particular, there is potential for bias if the census figure within any row lies outside the 95% CI (presented in square brackets) for the sample-based estimates within the same row.

Table 3.2: Population benchmark comparison of demographic characteristics

		Interviewed sample	Examined sample	2001 Census
Demographic characteristic		**% of people [95%CI] [(a)]**	**% of people [95%CI]**	**% of people**
Occupation	Manager/Admin	9.9 [9.0–10.9]	9.4 [8.0–11.1]	9.2
	Professional	19.3 [18.0–20.6]	21.2 [19.1–23.5]	18.2
	Para-professional	11.1 [10.3–12.1]	10.3 [8.9–11.9]	11.8
	Tradesperson	12.7 [11.6–13.8]	12.6 [10.6–15.0]	12.3
	Clerical[(b)]	26.4 [25.1–27.6]	26.0 [23.8–28.4]	29.8
	Blue-collar operator or labourer	13.4 [12.4–14.6]	14.3 [12.1–16.7]	16.7
	Other[(b)]	7.1 [6.4–7.9]	6.0 [5.0–7.3]	0.8
	Not stated[(b)]	0.2 [0.1–0.4]	0.1 [0.0–0.6]	1.2
Birthplace	Australian	76.7 [75.4–78.0]	77.6 [75.7–79.4]	69.0
	Foreign	23.3 [22.0–24.6]	22.4 [20.6–24.4]	26.2
	Not stated	0.0	. .	4.8
Level of schooling	Year 8 or below[(b)]	6.7 [6.1–7.3]	4.9 [4.2–5.6]	10.6
	Year 9 or equivalent	4.8 [4.4–5.3]	4.4 [3.7–5.2]	7.5
	Year 10 or equivalent.	21.4 [20.4–22.5]	20.1 [18.5–21.7]	23.8
	Year 11 or equivalent	9.8 [9.2–10.4]	8.3 [7.4–9.2]	9.6
	Year 12 or equivalent	47.6 [46.1–49.1]	51.9 [49.8–54.0]	37.7
	Still at school[(b)]	9.3 [8.6–10.2]	10.3 [8.7–12.2]	3.4
	Not stated	0.3 [0.2–0.5]	0.2 [0.1–0.5]	7.7
Indigenous identity	Aboriginal	1.3 [1.2–1.8]	1.1 [0.8–1.6]	1.5
	Torres Strait Islander	0.1 [0.1–0.2]	0.1 [0.0. 0.7]	0.0
	Both Aboriginal and Torres Strait Islander	0.1 [0.0–0.2]	0.0	0.0
	Non-Aboriginal	98.5 [98.2–98.8]	98.7 [98.2–99.1]	94.3
	Not stated	0.1 [0.0–0.2]	. .	4.0
Employment category	Employed	64.5 [63.2–65.7]	65.3 [63.2–67.2]	55.9
	Unemployed	2.5 [2.1–2.9]	3.6 [2.6–5.0]	4.4
	Not in labour force[(b)]	33.0 [31.9–34.2]	31.1 [29.4–33.0]	35.4
	Not stated[(b)]	0.0	. .	4.3
Language spoken at home	English	86.9 [85.6–88.15]	87.2 [85.2–88.9]	80.0
	Other	13.1 [11.8–14.4]	12.8 [11.1–14.9]	15.2
	Not stated	0.0	. .	4.8

(a) Population estimate and 95% CI, both computed using weighted data from NSAOH samples

(b) Categories do not correspond exactly between 2001 Census and NSAOH

With respect to occupation, the estimates obtained from the NSAOH interview and examinations and the population parameters obtained from the 2001 Census, were

very similar. However, NSAOH and the Census differed in their classification and labelling of a few categories. This could explain the small differences observed, particularly in the category labelled 'other', which showed the most dissimilar results. The differences between interview and examination estimates were not significant, based on the overlapping 95% CIs.

The percentage of Australian-born participants estimated in NSAOH was higher than the percentage reported for the Census (Table 3.2). Although not to the same extent, the percentage of foreign-born participants was lower in NSAOH than in the target population. The difference, particularly for the Australian-born, may be partially explained by the larger level of non-response to this question in the Census.

Compared to census data, there was a greater percentage of NSAOH participants still at school, a smaller percentage with schooling levels below or equal to year 10, and a greater percentage with year 12 or equivalent (Table 3.2). However, part of the difference could be due to the relatively high percentage of people in the category of 'Not stated' education (7.7%). Comparing the two NSAOH components, the interview had a greater percentage of people with education levels below year 8 and a lower percentage of participants with year 12 or equivalent. This could indicate that more educated people agreed to undergo the clinical examination.

With respect to Indigenous identity, both NSAOH components had a higher percentage of people that identified themselves as non-Indigenous compared to the general population. However, the Census reported a greater percentage of people that did not state their Indigenous identity. If these people are assumed to be non-Indigenous, the differences in values would be explained; if the opposite was true, the gap between NSAOH and census data on Indigenous identity would widen.

Results from the total Australian population differed slightly from NSAOH estimates regarding employment; a greater percentage of NSAOH respondents reported being employed and consequently a smaller percentage report being unemployed or not in the labour force. A lower percentage of NSAOH participants spoke a language other than English at home when compared to the target population and a higher percentage spoke only English at home. Estimates from the interview and the examination phases were similar.

In summary, compared with census data, NSAOH may have overestimated the percentage of people who were Australian-born, English speakers or employed. Other differences may have been due to higher percentages of 'not stated' responses in the Census than in NSAOH, including the Survey's higher percentages of people who were non-Indigenous, and higher percentage who had year 12 or equivalent schooling. NSAOH participants were more likely to have higher levels of education or continue to be in school. The examination component differed from the interview in the greater percentage of people with year 12 or equivalent and less people with educational levels equivalent to year 8 or below.

Direct standardisation using population benchmarks

The preceding information indicates that the sample may be biased with respect to some census benchmark variables but it does not give information regarding the magnitude of impact on survey estimates. There is potential for bias in the estimates related to level of education, and employment. Indigenous identity may contribute to this but the percentage of Indigenous Australians was low, with the consequence that bias in population estimates was unlikely.

When NSAOH estimates of oral health were adjusted to reflect the Census distributions of employment, language spoken at home and level of schooling, there were generally small changes, suggesting that bias was of a small magnitude (Table 3.3). After adjustment for occupation category, most oral health estimates differed by 1–3% in absolute terms. The largest absolute difference was noted for the estimate of percentage of people who usually visit for a dental check-up; the observed estimate of 56.2% was 4.4% higher than the occupation-adjusted estimate of 51.8%. This latter estimate was 3% lower than the lower 95% CI for the unadjusted estimate, indicating that there was a statistically significant difference after adjustment for employment status. The difference of 4.4% was similar in magnitude to the width of the 95% CI of 54.8–57.5%.

Differences between observed estimates and adjusted estimates were smaller after standardisation of sample estimates to the Census distribution of language spoken at home. Most adjusted percentage estimates differed by no more than 1% in absolute value (Table 3.3). The oral health indicator that displayed the largest amount of change after adjustment for language spoken at home was percentage of people with 2 mm or more of gingival recession, which was underestimated by 3.9% (52.3% observed estimate versus 56.7% after being adjusted for language spoken at home). That represented a relative difference of 7% between observed and adjusted estimates. The adjusted estimate exceeded the upper 95% CI of the observed estimate by 1% in absolute terms.

Table 3.3: Observed and adjusted estimates of oral health indicators, standardised to the 2001 Census benchmarks

Oral health indicator	Observed estimate	Estimate and 95%CI[(a)] adjusted for: Occupation category	Language spoken at home	Level of schooling
% of people with complete tooth loss	6.4 [6.0–6.9]	5.8 [5.3–6.3]	6.3 [5.9–6.8]	8.6 [8.1–9.1]
% of people with dental visit <12 months	59.3 [58.2–60.5]	56.4 [53.5–59.2]	59.48 [58.3–60.6]	57.3 [56.2–58.5]
% of people who visit for a dental check-up	56.2 [54.8–57.5]	51.8 [48.5–54.8]	56.2 [54.9–57.6]	52.5 [51.1–53.8]
% of people with toothache	15.1 [14.2–16.1]	18.1 [15.9–20.8]	15.2 [14.3–16.2]	15.3 [14.4–16.3]
% of people with fair or poor oral health	16.4 [15.5–17.4]	19.9 [17.7–22.3]	16.5 [15.5–17.4]	18.3 [17.3–19.7]
% of people with coronal decay	25.5 [23.7–27.3]	28.6 [24.7–32.8]	25.2 [23.6–26.9]	26.3 [24.6–28.0]
% of people with root decay	6.7 [6.0–7.6]	7.9 [6.1–10.2]	7.5 [6.7–8.4]	9.0 [8.0–10.0]
Average number of missing teeth	4.5 [4.3–4.8]	4.5 [4.2–4.9]	5.0 [4.8–5.3]	6.2 [5.9–6.4]
Average number of decayed tooth surfaces	0.8 [0.7–0.9]	0.9 [0.7–1.2]	0.8 [0.7–0.9]	0.9 [0.8–1.0]
Average number of filled tooth surfaces	19.8 [18.9–20.7]	19.8 [18.6–21.0]	21.7 [20.8–22.5]	23.3 [22.4–24.1]
% of people with 2+ mm gingival recession	52.8 [50.3–55.3]	52.7 [48.6–56.8]	56.7 [54.4–58.9]	62.0 [59.9–64.1]
% of people with 4+ mm periodontal pocket depth	19.8 [17.9–21.8]	21.1 [17.6–25.0]	20.8 [19.1–22.6]	21.9 [20.0–23.9]
% of people with 4+ mm clinical attachment loss	42.5 [40.1–44.9]	44.7 [40.3–49.2]	46.1 [44.0–48.3]	51.2 [49.0–53.4]

(a) 95% CI shown in square brackets

Larger differences between observed and adjusted estimates were found after adjustment for level of schooling (Table 3.3). The largest discrepancy was observed for percentage of people with gingival recession of 2 mm or more, where the NSAOH estimate 9.2% lower in absolute terms than the adjusted estimate. Other notable variations were clinical attachment loss (underestimated by 8.7%), average number of filled tooth surfaces (underestimated by 3.5 surfaces per person) and check-up dental visits (overestimated by 3.7%). However, as noted above, the largest discrepancy in distribution of education categories between NSAOH and the Census was due to the high percentage of people whose education was 'not stated' in the Census (7.7%, see Table 3.2). The method of direct standardisation used here effectively inflated the much smaller number of NSAOH people who did not answer that question, while reducing the larger numbers with year 12 or equivalent schooling. For this characteristic, the Census figures represent an imperfect benchmark for adjustment. Consequently, these apparent underestimates may be an artefact of incompleteness of published census data, rather than an indicator of the likely extent of bias.

In summary, adjustment for three census 'benchmark' characteristics yielded slightly lower rates of favourable dental visiting patterns and slightly higher rates of dental

disease. The discrepancies were smallest when the estimates were adjusted for employment or language spoken at home. The discrepancies were greatest after adjustment for level of schooling, although that may represent a weak 'benchmark' because a sizable percentage of the 2001 Census respondents did not state their level of schooling.

Small area socioeconomic indicators

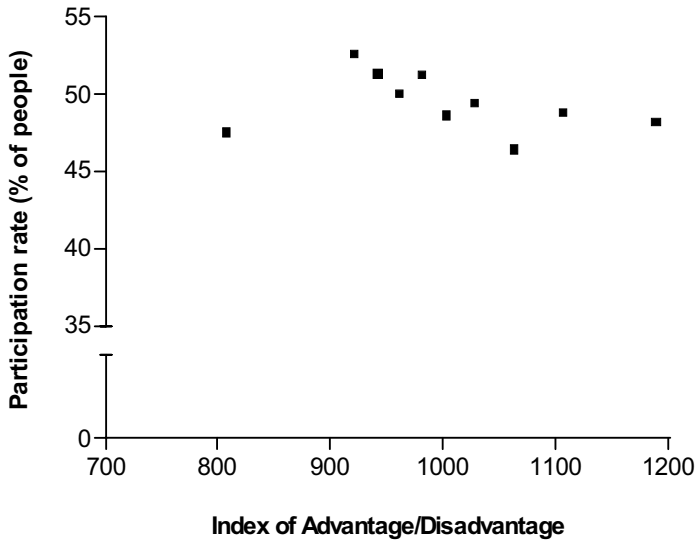
Among the 387 postcodes sampled for the Survey, the interview participation rate ranged from 9% to 83%. Among the 380 postcodes in which interviewed people were targeted for examinations, the examination participation rate among interviewed people who were in-scope for the examination ranged from 0% (in three postcodes) to 100%. This degree of variability between geographic areas provided an opportunity to investigate the extent to which characteristics of those areas were associated with participation. The second approach to evaluation of bias therefore considered a large array of census characteristics that have been integrated to create socioeconomic indicators for small geographic areas (ABS 2001b). The aim was to answer three related questions:

- Did survey participation rates differ systematically between disadvantaged and advantaged areas of Australia?
- Which of the key indicators of oral health differed systematically between disadvantaged and advantaged areas of Australia?
- To what degree do population estimates of oral health differ after adjusting the Survey results to reflect differing participation rates between disadvantaged and advantaged areas of Australia?

Relationship between socioeconomic indicators and participation rates

In order to quantify levels of advantage and disadvantage for areas, the Australian Bureau of Statistics' Socioeconomic Indices for Areas (SEIFA) dataset was merged with the NSAOH dataset. The SEIFA indices use information from the 2001 Census to assign a measure of socioeconomic status to all geographic areas in Australia. The geographic area is the census Collection District (CD), which represents the workload of one census collector. In 2001 there were 37,209 CDs defined across Australia. In urban areas CD's average about 220 dwellings. Each CD is assigned a value using the Index of Relative Socioeconomic Advantage/Disadvantage (IRSAD), an aggregate measure of socioeconomic status based on characteristics of the CD recorded in the 2001 Census. An area that has a relatively high proportion of people with high incomes or a skilled labour force is assigned a relatively higher value on this index. Conversely, a low score on the index indicates that an area has a higher proportion of individuals with low incomes and more people who work in unskilled occupations. In a similar manner three different sets of census characteristics are used to construct indices of Relative Socioeconomic Disadvantage, Economic Resources, and Education and Occupation.

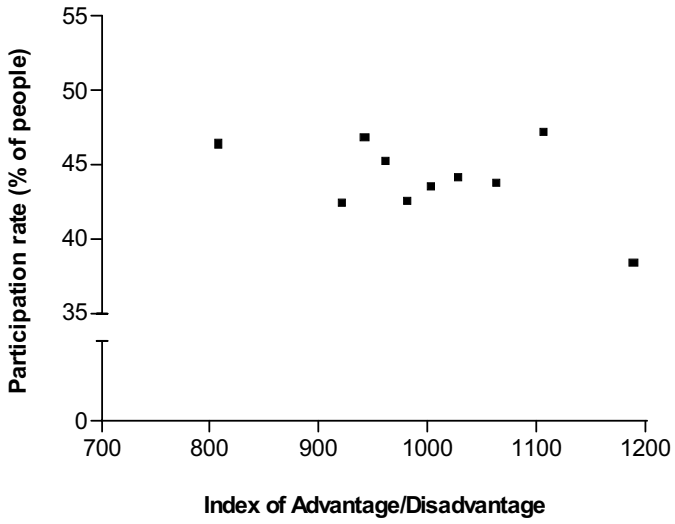
This analysis focussed on a single SEIFA index, the IRSAD because it captures aspects of both advantage and disadvantage. In addition to assigning IRSAD values to CDs, the Australian Bureau of Statistics aggregates SEIFA indices to the levels of postcode. For this analysis, postcodes were grouped according to the decile distribution within the Australian population of IRSAD values and the interview participation rate was calculated for each of the 10 groups (Figure 3.2). The results revealed a tendency for the interview participation rate to be lower among postcodes with higher IRSAD values. For example, the highest participation rate was observed among postcodes with IRSAD values in the range 911–930, and lowest rate among postcodes with IRSAD values in the range 1042–1082. However, the pattern was not linear, with both the highest IRSAD postcodes and the lowest IRSAD postcodes having interview participation rates of 48.2% and 47.5%, respectively. Overall, the findings in Figure 3.2 indicate that interview responses generally reduced as the socioeconomic status of areas increased, although the pattern was not consistent.



Note: Data points are participation rates for 387 postcodes grouped according to deciles of the distribution of the Index of Relative Socioeconomic Advantage/Disadvantage within the Australian population, plotted on the horizontal axis as the decile's midpoint of the index.

Figure 3.2: Participation in the interview among areas classified according to deciles of the Index of Relative Socioeconomic Advantage/Disadvantage

Examination participation rates among interviewed people who were in-scope for the examination revealed a similarly weak and inconsistent relationship with area-level socioeconomic status (Figure 3.3). For example, the examination participation rate was lowest (38.4%) in postcodes with IRSAD values of 1128 or more. However, it was highest (47.2%) in postcodes in the ninth decile of the IRSAD distribution, and it exceeded 46% for postcodes in the first and third deciles.



Note: Data points are participation rates for 380 postcodes grouped according to deciles of the distribution of the Index of Relative Socioeconomic Advantage/Disadvantage within the Australian population, plotted on the horizontal axis as the decile's midpoint of the index.

Figure 3.3: Participation in the examination among areas classified according to deciles of the Index of Relative Socioeconomic Advantage/Disadvantage

Relationship between socioeconomic indicators and oral health

Survey participants were classified into three groups based on the IRSAD value of their postcode: low (scores below 960), medium (between 960 and 1040), and high (greater than 1040). These interval cut points were based on the standardized distribution of SEIFA indexes at the CD level (mean of 1000 and standard deviation of 100) and considering that around 95% of index scores were between 800 and 1200 (ABS 2001c). Estimates of oral health were then compared between people living in areas with low, medium and high IRSAD values.

This type of analysis is said to be 'ecological' (Morgenstern 1998) because it is not based on individuals but on aggregated data. It is appropriate when detailed information on non-participants is not available and there are no other means of obtaining individual data. However, care should be taken in the interpretation of results, understanding that because SEIFA scores refer to areas, not individual, results are not interpretable at the level of the individual.

There was a general trend towards more oral health problems or less favourable patterns of dental care among people living in areas with lower IRSAD values (Table 3.4). For example, in relatively disadvantaged areas (those with low IRSAD values), the prevalence of complete tooth loss was greater than in more advantaged

areas. The same pattern was observed for the proportion of people who rated their oral health as fair or poor and for the average number of missing teeth. Similarly, compared to the areas with low IRSAD values, the more advantaged areas showed significant declines in the proportion of people with toothache, coronal and root caries, and the average number of decayed tooth surfaces. These results are consistent with the expected relationship in which oral health tends to be poorer in poorer neighbourhoods, and among disadvantaged groups.

Regarding the percentage of people who visited the dentist in the past year there was an increasing trend from more disadvantage to more advantage (Table 3.4). This same pattern was observed for the percentage of people who usually visit for a check-up. These estimates showed significant differences among all levels of IRSAD. Likewise, the average number of filled teeth showed a clear pattern where people living in more disadvantaged areas had less filled teeth. There was no difference across subgroups for proportions of people with gingival recession, 4+ mm of periodontal pocket depth, and 4+ mm of clinical attachment loss.

Table 3.4: Variation in selected oral health indicators among people classified according to socioeconomic status of their area[(a)]

	Index of Relative Socioeconomic Advantage/Disadvantage[(b)]		
Oral health indicator	**Low**	**Medium**	**High**
% of people with complete tooth loss	9.4 [8.5–10.3]	6.3 [5.5–7.2]	3.5 [3.0–4.1]
% of people with dental visit <12 months	53.5 [51.6–55.4]	57.2 [55.5–59.0]	67.4 [65.6–69.1]
% of people who visit for dental check-up	46.9 [45.1–48.8]	54.1 [51.7–56.4]	67.0 [64.9–69.1]
% of people with toothache	16.4 [14.8–18.2]	15.5 [13.8–17.3]	13.6 [12.2–15.1]
% of people with fair or poor oral health	18.9 [17.2–20.6]	16.7 [15.0–18.4]	13.9 [12.5–15.32]
% of people with coronal decay	29.9 [26.8–33.2]	27.1 [24.0–30.6]	19.7 [16.9–22.8]
% of people with root decay	8.3 [7.0–9.9]	7.1 [5.7–8.9]	4.8 [3.8–6.1]
Average number of missing teeth	5.4 [5.0–5.9]	4.4 [4.0–4.8]	3.9 [3.5–4.2]
Average number of decayed tooth surfaces	0.9 [0.8–1.1]	1.0 [0.8–1.2]	0.5 [0.4–0.7]
Average number of filled tooth surfaces	18.7 [17.3–20.0]	18.7 [17.2–20.21]	21.9 [20.2–23.6]
% of people with 2+mm gingival recession	51.8 [47.2–56.2]	52.7 [48.3–57.2]	54.0 [49.8–58.0]
% of people with 4+mm periodontal pocket depth	18.4 [15.5–21.8]	19.5 [16.5–22.8]	21.3 [17.8–25.3]
% of people with 4+mm clinical attachment loss	44.0 [39.7–48.5]	42.0 [38.0–46.1]	41.5 [37.3–45.7]

(a) Low SEIFA Score: <960; Medium SEIFA Score: >/=960; High SEIFA Score: ≥1040

(b) 95% confidence interval shown in square brackets

Direct standardisation using socioeconomic indicators

The findings thus far indicate that there is potential for bias in the Survey estimates: although participation rates varied inconsistently according to area-level socioeconomic disadvantage (Figure 3.2 and Figure 3.3), socioeconomically disadvantaged areas consistently had higher prevalence of oral disease and less frequent dental care (Table 3.4). As the final step in the analysis, the extent of bias was quantified by computing adjusted estimates of oral health that accounted for the potential bias. Direct standardisation was again used, and in this instance the sample population was adjusted to represent ten deciles of the distribution of the IRSAD values within the Australian population.

Table 3.5: Observed and adjusted estimates of oral health indicators, standardised to the distribution of the Index of Relative Socioeconomic Advantage/Disadvantage

	Observed		Adjusted	
Oral health indicator	**Estimate**	**95%CI[(a)]**	**Estimate**	**95%CI**
% of people with complete tooth loss	6.4	6.0–6.9	6.5	6.1–6.9
% of people with dental visit <12 months	59.3	58.2–60.5	59.1	58.0–60.1
% of people who visit a for dental check-up	56.2	54.8–57.5	55.6	54.4–56.8
% of people with toothache	15.1	14.2–16.1	15.2	14.3–16.2
% of people with fair or poor oral health	16.4	15.5–17.4	16.6	15.7–17.6
% of people with coronal decay	25.4	23.7–27.3	25.2	23.6–26.9
% of people with root decay	6.7	5.9–7.6	7.6	6.8–8.4
Average number of missing teeth	4.5	4.3–4.8	5.2	4.9–5.4
Average number of decayed tooth surfaces	0.8	0.7–0.9	0.8	0.7–0.9
Average number of filled tooth surfaces	19.8	18.9–20.7	21.9	21.1–22.8
% of people with 2+ mm gingival recession	52.8	50.3–55.3	56.9	54.7–59.1
% of people with 4+ mm periodontal pocket depth	19.8	17.9–21.8	20.4	18.7–22.1
% of people with 4+ mm clinical attachment loss	42.5	40.1–44.9	46.4	44.2–48.6

(a) 95% confidence interval

The difference in absolute terms between observed estimates from NSAOH and adjusted estimates that were standardised to the Australian distribution of the IRSAD index were minimal (Table 3.5). The largest difference between adjusted and unadjusted estimates occurred for the percentage of people with 2+ mm gingival recession and the percentage of people with 4+ mm clinical attachment loss, where the observed estimates of 52.8% and 42.5% respectively were approximately 4.0% lower than their adjusted estimates. In general, NSAOH oral health indicators remained stable after standardization indicating that bias was unlikely. When differences were observed measures of oral disease tended to be underestimated and favourable dental behaviours overestimated. For most oral health indicators, the direction and magnitude of bias in Table 3.5 was similar to that observed in the previous benchmark method of adjustment (Table 3.3).

Summary of non-participation bias

All analyses are subject to uncertainty: biases are likely to be introduced at any stage of an investigation, from population factors that distort associations to interpreting

published results (Maclure & Schneeweiss 2001). It is inevitable that some people will choose not to take part in health surveys where their consent must be obtained. Response rates to health surveys are declining worldwide, creating concern that bias will be introduced into surveys that collect information from as few as one-half of sampled subjects. Current epidemiologic thinking encourages quantitative assessment of all hypothesised biases in order to assess validity and precision of results (Greenland 1996).

In this Survey 49% of sampled people participated in the interview, and among those who were interviewed and in-scope to be examined 44% completed the oral examination. In this chapter two methods were used to investigate and quantify potential bias that may have occurred as a consequence of non-participation. The results were consistent with several other health surveys that have reported under-representation of demographic groups such as non-English speakers. On the other hand, participation rates varied inconsistently among areas classified according to socioeconomic status. As expected, several oral health indicators measured in this study were associated with those same characteristics. The consequence was that non-participation in this Survey produced observed estimates that probably were 'healthier' than the population value. It appeared likely that the Survey overestimated the frequency of favourable dental visits and underestimated some aspects of oral disease. Stated another way, these analyses suggest that if the Survey had achieved 100% participation, the reported frequency of favourable dental attendance would be lower and the reported frequency of some oral diseases would be higher.

Yet, the degree of non-participation bias generally was small. For most oral health indicators expressed as percentages, adjustment produced estimates that differed by less than 3% in absolute terms. For indicators of disease severity, most adjusted estimates differed by no more than 10% in relative terms (for example, an increase of 0.5 missing teeth per person after adjustment for non-response). In many instances, differences of this magnitude were similar to the magnitude of variability in survey estimates attributable to random error, as indicated by the width of 95% CIs. Taken together, the results indicate that the degree of bias present in most of the estimates is of low magnitude, providing evidence that analyses using NSAOH data are valid estimates for the Australian adult population.

3.3 Sociodemographic characteristics of the population

The preceding analyses focused on the extent to which participants in the Survey were representative of the target population of Australian adults. In general the results indicate that estimates calculated from this sample closely approximated benchmarks for the distribution of key demographic characteristics of the population. Naturally, there is marked heterogeneity of such characteristics within subgroups of the Australian population, most notably among age groups. For example, there are large differences among age groups in the distribution of benchmarks such as employment and labour force participation. It follows that several determinants of oral health should display marked heterogeneity among the generations that are the focus of this report. The remainder of this chapter investigates variation among generations in key

sociodemographic characteristics that are used to describe variation in oral health, dental care and oral health perceptions in Chapters 5, 6 and 7.

Each of the generations studied in this report has lived through different historical periods that have shaped numerous opportunities and barriers in their development of oral conditions and receipt of dental care. Frequently these opportunities or barriers link together, cascading over time to produce different life outcomes. The distribution of demographic and oral health characteristics frequently reflect this process.

Table 3.6 presents the sociodemographic and oral health characteristics in the Australian population and in the four generations. Australian adults in most generations were evenly distributed between males (49.4%) and females (50.6%). However, in the earliest (the pre-1930) generation, males constituted only 40.7%. This is due to higher age-specific death rates and overall shorter life expectancy among males compared with females.

Table 3.6: Estimated percentages of people with selected sociodemographic characteristics within the Australian population and four generations

	Population: all people aged 15 years or more				
	Generation (decade of birth[(a)]) and age group				
Sociodemographic characteristic	All ages	1970–90 15–34 years	1950–69 35–54 years	1930–49 55–74 years	Pre-1930 ≥75 years
Sex					
Male	49.4	50.7	49.7	49.7	40.7
Female	50.6	49.3	50.3	50.3	59.3
Indigenous identity					
Indigenous	1.4	1.8	1.3	1.3	0.6
Non-Indigenous	98.6	98.2	98.7	98.7	99.4
Residential location					
Capital city	64.2	67.4	64.1	60.2	60.9
Other places	35.8	32.6	35.9	39.8	39.1
Year level of schooling					
Year 9 or less	12.8	6.7	5.8	23.3	42.3
Year 10 or more	87.2	93.3	94.2	76.7	57.7
Eligibility for public dental care					
Eligible	26.1	17.4	14.5	43.8	67.7
Ineligible	73.9	82.6	85.5	56.2	32.3
Dental insurance					
Insured	45.6	40.8	52.1	49.1	26.4
Uninsured	54.4	59.2	47.9	50.9	73.6
Usually visit dentist					
Check-up	56.2	58.9	52.7	56.8	59.1
Problem	43.8	41.1	47.3	43.2	40.9
Oral status					
Dentate	93.6	100.0	98.3	86.1	64.3
Edentulous	6.4	0.0	1.7	13.9	35.7

(a) Columns are arranged by age at time of survey while generations represent approximate decade of birth (see p. 28)

Higher age-specific death rates and shorter life expectancy also shape the percentage of the four generations who are Indigenous Australians. While Indigenous Australians constituted 1.4% of adults of all ages, the percentage within the four generations varied considerably, being higher in the most recent generation (1.8%) but markedly lower in the earliest (the pre-1930) generation (0.6%).

Nearly two-thirds of people of all ages lived in capital cities and one in eight had year 9 or less of schooling. Across the generations the percentage residing in places other than capital cities increased from the most recent through to the 1930–49 and pre-1930 generations. The percentage with year 9 or less schooling was highest in the pre-1930 generation (42.3%) but was dramatically lower in the most recent generation.

Just over a quarter of people of all ages were eligible for public dental care (26.1%) and nearly half (45.6%) had dental insurance. These characteristics varied considerably across the generations. Eligibility for public dental care was less frequent in the two most recent generations (17.4% and 14.5% respectively), but markedly higher in the 1930–49 generation (43.8%) and the pre-1930 generation (67.7%). Dental insurance was most frequent in the 1950–69 generation (52.1%), but was markedly lower among the earliest pre-1930 generation (26.4%).

More than half of Australian adults usually attended a dentist for a check-up (56.2%) rather than a dental problem (43.8%). The percentage who usually attended for a check-up did not vary markedly across the four generations, with only the 1950–69 generation showing a trough in the percentage usually visiting for a check-up (52.7%). While 6.4% of adults were edentulous, this increased markedly across the four generations (0.0% to 35.7%).

In summary, the two most recent generations were generally similar in terms of sociodemographic and oral health characteristics. Compared with those generations, higher percentages of the 1930–49 generation lived in places other than capital cities, had year 9 or less schooling and were edentulous. In the pre-1930 generation larger differences were found. The pre-1930 generations more female, less Indigenous and reside somewhat more in other places than capital cities. They have less schooling, higher eligibility for public dental care and less dental insurance, and a higher percentage are edentulous.

This variation between the generations has implications for the interpretation of the NSAOH findings. Generational variation in sociodemographic and oral health determinants shown in Table 3.6 indicate that where oral health status or dental attendance are associated with sociodemographic or oral health characteristics, simple generational comparisons will be confounded. It is beyond the scope of this report to extend the analyses conducted to address this issue. Instead, the possibility of confounding will be mentioned when considered important.

4 The historical context of Australia's oral health

*by Paul Sendziuk**

4.1 The social and historical determinants of oral health

It is impossible to precisely determine the historical factors that have had the most impact in shaping the oral health of Australians. This is because people of different gender, socioeconomic status, ethnicity and residential location — all of which influence life opportunities — experience historical events differently. Nevertheless, we know that gradual improvements in dentistry and oral health surveillance, dietary changes, the deprivations suffered during the Depression and World War II, and a range of government policies and programs have significantly shaped the contrasting standards of oral fitness of the four generations of Australians that feature in this report. Such historical circumstances explain, for example, why, in 1979, 60% of men and 71% of women aged over 65 years were edentulous, while in 2002 these figures, for the same age group, had dropped to 30% and 45% respectively (Sanders et al). The following pages describe how a number of historical events and 'turning points' affected the oral health of the particular generations who experienced them. Reference to these events, as well as to the impact of gender, class, ethnicity and geographical isolation, occur frequently in the testimonies of the people we interviewed for this study. Their 'oral histories' are reproduced in the second half of this chapter.

The Great Depression

The Great Depression of the late 1920s until the mid 1930s would have been the first major disruption to the lives of the generation born before 1930, as few of these men and women were alive during World War I. The Depression, caused by falling agricultural and industrial prices, the New York Stock Market crash and the subsequent squeeze on credit, saw businesses in Australia fail and hundreds of thousands of people left without work. At its peak in 1932 approximately 33% of those willing to work were unemployed. Wages fell as a consequence, and women (who, by law, could be paid at nearly half the rate) were preferred to men. People were not affected equally, with those who had savings or owned land (or who could grow their own food) faring better than those who relied on the sale of their labour.

The economic effects of the Depression decreased the purchasing power of families and individuals, affecting their diet and capacity to attend dental services or even buy rudimentary items such as toothbrushes and toothpaste (which, at the time, was

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* The author is grateful for the research assistance of Troy Stone and Sonia Laidlaw.

dispensed from tins in powder form). Habits learned by children during the Depression, such as foregoing dental care or teeth-brushing, endured long afterwards and were passed onto their descendants. Moreover, as Ray testifies in his oral history (page 64), poor people with otherwise treatable oral health problems neglected their teeth or simply had them all removed in order to avoid the cost of on-going treatment and maintenance. In her autobiography, the famous novelist Ruth Park describes how her parents could not afford 3s 6d to have a painful molar filled so it was extracted without anaesthetic, during which the young girl fainted in agony. (The dentist pleaded with her father to pay him 'a couple of bob' if he could but he didn't have a penny in the house (Cannon 1996a). In a similar way, fathers had all the teeth of their daughters extracted and dentures fitted once the young women attained marrying age, so that they became more attractive propositions to potential suitors who might be fearful of future dental expenses. This was known as the 'dental dowry' and was a common enough experience among women in the two generations born before 1930 and 1949. After this time the economy improved and Australia entered a period marked by relatively high wages and almost full employment that lasted over two decades. Women in particular gained a measure of financial self-sufficiency during this time and could afford to have a say in their dental treatment.

The Depression's impact on nutritional standards, and the associated effect on oral health, should not be underestimated. While the consumption of dairy products—an important source of calcium that is incorporated into developing teeth—decreased due to its price, sugar intake seems to have increased during the Depression (at least among the poor), as it remained a cheap and tasty treat for families deprived of many other comforts. Indeed, empty sugar sacks became ubiquitous and were used by the poor in inventive ways to fortify leaky roofs and walls, line shoes and patch clothing (Green 1983). Benevolent manufacturers often donated sugary products to charities to be dispensed to the poor, and relief committees opened their own 'jam factories', where unemployed girls were paid to process fruit with sugar, which was then distributed free to the unemployed (Cannon 1996b). Bread and dripping, golden syrup and treacle, and sugary tea, which had been staple foods in poor homes even before the economic downturn, also became much more widely consumed (Mackinolty 1981). As Michael Cannon has remarked, it kept people plump but did little for their health (Cannon 1996c).

World War II (1939–45)

Prior to 1939 (perhaps partly as a result of the Great Depression) Australian dental and nutritional health was extremely poor, a fact that was highlighted by examinations of new recruits to the Army. The hazards of enlisting soldiers who were not dentally fit had already been demonstrated during the Boer War (1899–1901), when dental disorders constituted 25% of all evacuations from the frontline (Halliday 1977a). The profession had thus long agitated for dental units to serve in the armed forces and, by the outbreak of World War II, those in power had come to recognise the need for dental fitness. In 1926 approval was given for the appointment of dental officers in the Australian Army Medical Corps, and in April 1943 the Australian Army Dental Corps attained separate status. Similar organisational transitions occurred in the Royal Australian Air Force (RAAF) and Royal Australian Navy (RAN). Despite this

increased emphasis on dental care, the imperatives of war (namely, the need for manpower and the need for immediate battle readiness) meant that the Army was forced to take an approach that required, first, 'the removal of all badly carious teeth'; second, 'the restoration of those which could be so treated'; and third, 'making good gaps in dental architecture where necessary' (Walker 1952a). The RAN, on the other hand, emphasised much stricter enlistment and procedures, the RAAF subscribed to a philosophy of tooth preservation and maintenance, with extraction and prosthetic replacement as the final resort (Halliday 1977b). At times, however, units in all three divisions were inadequately equipped or staffed and often resorted to 'quick fix' solutions such as tooth extraction, when restoration and maintenance might have been more appropriate. It was not until September 1942, for example, that the number of fillings began to overtake the number of extractions (Walker 1952b). By the end of the war over 1.5 million tooth extractions and nearly 2.9 million fillings had been performed, and members of the Australian Army Dental Corps had made approximately 500,000 dentures (Walker 1952c). Despite the high number of tooth extractions, especially in the Army and particularly during the start of the war, many people nevertheless received dental care who would not otherwise have done so. Service personnel were also exposed to posters, films and lectures that reinforced advice about the maintenance of oral health. As nearly one million Australians served in World War II (from a total population of 7 million), this event clearly had a significant impact on the oral health of many Australians, mainly the two generations born before 1930 and 1949 that feature in this study.

As food supplies were directed towards the United Kingdom and Australia's fighting forces during World War II, sugar, butter and meat were all rationed, changing the diets of most Australians. The sugar ration was introduced on 31 August 1942 and constituted 1 pound per person per week. Extra sugar for jam making was made available from time to time by allocation of additional coupons from the general ration book (ABS 1945). Sugar consumption and snacking thus decreased with wartime rationing, as did the incidence of dental caries. Following the war the caries rate rose as sugar restrictions were lifted (Wei 1995). The measurable differences were most significant in England, Norway and Japan, although Australians benefited from their change in diet and eating habits as well.

Nutritional changes over time

The Australian sweet-tooth was cultivated early by the inclusion of 2 pounds of sugar in the weekly rations for convicts and farm workers. A five-fold increase in Queensland sugar production between 1880 and 1896 saw the price of sugar plummet to half its 1860 value and its consumption greatly increase (Davidson 1981; Coghlan 1995). By the 1920s doctors, nutritionists and even Royal Commissioners were happily recommending a weekly allowance of 6 pounds of sugar for a family of five, in addition to 2 pounds of jam (containing 60% sugar) and half a pound of treacle (Sentich 1995). Australia was soon among the top five sugar producers and consumers in the world, each person devouring around 55 kilograms per year for most of the twentieth century (Sivaneswaran & Barnard 1993; Griggs 2006). While consumption decreased with wartime rationing, it most likely increased during the Depression, as sugar remained a cheap and satisfying source of nourishment.

Changes in dentistry

The improvement in the standard of oral health of subsequent generations of Australians described in this report can be partially attributed to the development of dentistry as a profession. These developments improved the quality and range of services provided and diminished the intensity and duration of pain and discomfort associated with dental treatment, which, as a number of our interviewees recall, was (and remains) a chief disincentive to access dental services. It is not surprising that many people in the generation born before 1930 forewent dental treatment until driven to do so by the pain of *not* seeking attention, by which time teeth were often beyond salvage. In the nineteenth and early stages of the twentieth centuries, the dental profession included barbers and pharmacists. It was regarded as little more than a band of itinerant tooth-pullers who were trained as apprentices (rather than at university) in the mechanical and technical art of teeth extraction and reconstruction (Davis 1980a). The biological and medical aspects of oral treatment tended to be neglected, as did education about the causes of tooth decay. It was usual for practitioners to accept pupils for three years of training, although some were known to accept as many students as possible and provide instruction for only a few months (Halliday 1977c). The first dental schools and state-based Dental Acts, which aimed to restrict the registration of dentists to trained and 'ethical' practitioners, did not emerge in Australia until the first two decades of the twentieth century (Chapman 1937). Local anaesthesia and pain relief, delivered in the form of nitrous oxide, cocaine solution or chloroform, was also still in its relative infancy, and patients shuddered when it came time to face the foot-pedal-powered drill. Howe's ammoniacal silver nitrate, a common sterilisation treatment introduced in 1917, turned teeth an unsightly black, (yet was still used by some as late as the 1960s). Amalgam employed for fillings, when plied by unqualified practitioners, resulted in patients' mouths becoming gangrenous (Gelbier 2005). However, the movement towards the exclusive registration of qualified dental practitioners, and the development of more efficient techniques (such as the high-speed drill in 1950) and more consistent and local pain relief (such as Xylocaine in 1948), improved dental services and encouraged patient attendance.

In struggling to transform itself from a trade to a science and claim legitimacy with the medical profession, dental practitioners fell prey to a number of spurious theories about dental decay and disease (Davis 1980b). The theory of focal infection, which held sway until the 1950s, was one such example. It posited that bad teeth or gums harbour germs (or 'foci' of infection) that would, without invasive intervention, inevitably spread to the rest of the body, causing widespread systemic disease. Accordingly, many people in the two generations born before 1930 and 1949 presenting with oral health problems suffered extraction of all their teeth, often early in life and before any restorative dental work had been attempted (Davis 1980c). (This appears to be Ray's experience, told on page 64.) This 'blood and vulcanite' philosophy of extraction and denture fitting gave way to a 'drill and fill' philosophy in the 1950s with the introduction of high-speed drills, the development of antibiotics and more effective means of pain control. It was only in the 1960s that effective oral health maintenance and decay prevention began to be achieved through the use of fissure sealants by dentists and, more importantly, the population-wide increase in exposure to fluorides in drinking water and toothpaste.

Fluoride

Studies conducted in the United States during the first half of the twentieth century reported large reductions in levels of dental decay among children who were born and grew up consuming water containing natural or added fluoride. By the middle of the twentieth century clinical studies began to evaluate the effects on dental decay of fluoride added to toothpaste. The introduction of fluoride toothpastes and drinking water in Australia, beginning in the 1950s, thus offered the potential to substantially improve the oral health of Australians, particularly the two generations born after 1950.

Fluoride toothpaste began to be marketed in 1959 and reached close to 100% market share by the 1970s. The introduction of fluoride to public water supplies occurred slightly earlier, beginning in Beaconsfield, Tasmania, in 1953, but remains an unfinished project. Canberra became the first large city to receive fluoridated public water in 1964, and by 1977, when Melbourne undertook the measure, two-thirds of the Australian population had access to fluoridated water (Akers et al. 2005). Yet significant sections of the population have been denied access through a series of decisions at local and state government level that can only be described as political rather than motivated by scientific evidence. Less than 5% of Queenslanders have access to fluoridated public water, for example, and tooth decay in children in this state is higher than the national average (Robertson 2006a). Tellingly, children in Townsville, one of the few Queensland towns to begin fluoridation (in 1964), have 45% less tooth decay than their counterparts in Brisbane, a city of nearly 1.8 million people that refuses to fluoridate its public water (Slade et al. 1996).

In 2001 69% of people in the Australian population lived in places where the public water supply contained fluoride at a concentration of at least 0.7 parts per million, the amount recommended for prevention of dental decay (Table 4.1).

Table 4.1: Population served by fluoridated water supplies in Australian states and territories, 2001[(a)]

	People served by fluoridated water	
State/territory	**Number of people ('000)**	**% of state/ territory population**
New South Wales	5,827.3	89.8
Victoria	3,580.3	75.3
Queensland	171.1	4.7
South Australia	1,247.0	82.6
Western Australia	1,676.0	90.1
Tasmania	435.5	94.7
Northern Territory	17.9	9.2
Australian Capital Territory	317.0	100.0
All	**13,272.0**	**69.1**

(a) Water containing at 0.7 parts per million fluoride or more. Adapted from Armfield 2006 (Armfield 2006).

Water fluoridation remains a divisive issue. Opponents claim that addition of fluoride to municipal water takes away individual choice as to the substances a person ingests and that it amounts to mass medication. They say it can have adverse health effects such as dental fluorosis, bone cancer and osteoporosis, which outweigh the reported benefits of water fluoridation for dental decay. A number of interviewees in the oral histories below describe their own folk understandings of the effects of fluoride, such as it turning teeth black, and purport to being confused by the range of evidence of its effects.

Government funding for health, welfare and school dental services

The introduction of fluoride to public water supplies is just one case of government intervention improving the standard of oral health in Australia. Throughout the twentieth century, both state and federal governments have also introduced various income support and social welfare programs that have increased the capacity of individuals — and particular generations — to spend money on dental care. Before the 1930s Australia was regarded as the 'social laboratory of the world', mandating a fair and reasonable (minimum) wage for workers in 1907, granting old-age pensions in 1908, and introducing a maternity allowance for mothers of newborn babies in 1912. After returning from war, soldiers also became entitled (through the Gold Card) to low-cost loans for land, pensions and free health and dental services for the rest of their lives. Welfare services expanded even further in the decade after World War II, when unemployment benefits and child and family allowances were introduced or extended. These payments, in addition to increased participation rates in the workforce, higher rates of pay and greater entitlements in the event of divorce or separation (most of which came in the 1970s) have provided a degree of financial security and independence for women especially. Women are thus more able — and feel more entitled — to access dental services, instead of subordinating their care to the needs of their husbands and children, as has traditionally been the case. (Although, if Fiona's testimony on p66 is any indication, this is still prevalent.)

In 1973, the federal government significantly boosted funding for school dental services that previously had variable levels of population coverage among the states, being least in the two most populous states, New South Wales and Victoria (Spencer 2001). The South Australian School Dental Service, for example, had been established in 1922 but only provided services to country students (via mobile clinics and transportable equipment) until the 1960s. The additional funding allowed it to offer dental care to all pre-school and primary school aged children in the state; by 1988 children up to 16 years of age were also covered (SADS 2006). The expansion of school dental services has increased their capacity to provide education, treatment and surveillance of oral health problems, and enables intervention to occur before a child's teeth and gums deteriorate to the extent of requiring surgery. Access to this service has diminished recently, however, as the Commonwealth government withdrew from direct involvement and most states and territories introduced co-payments for public dental patients (NACOH 2004).

Health insurance schemes

A conspicuous feature of Australia's system of health care is that, general dental treatment is excluded from Medicare, the taxpayer-funded, universal health insurance scheme that funds a comprehensive range of services provided in hospitals, by doctors and by some other health professionals. The two youngest generations in this survey benefited, to an extent, from the universal health insurance scheme introduced in 1974 as Medibank and in 1983 as Medicare. This is not to say that older people have not benefited from these schemes, but that they were more likely to have been introduced after older people required crucial but costly health care earlier in life. Medicare aims to make health care accessible to all Australians by providing a generous rebate on hospital and doctor charges and establishing limits on fees. Reduced medical costs also enable individuals to allocate a higher portion of their income for specialist services.

Dental care was excluded from this scheme — with the approval of dentists who feared that 'imposed controls and political conflict will go hand-in-hand with government money' (Australian Senate 1986). Instead, states and territories provide general dental care to adults who are low-wage earners, or holders of a Health Care Card or Pensioner Concession Card. Due to the number of people trying to access these services and the scarcity of dentists willing to work in the public sector (86% are employed in private practice), waiting periods for public dental care are lengthy in many parts of the country. They currently stretch up to seven years in the case of some residents of rural Queensland, despite this state offering the most generous funding for public dental services (ADA 2006a; Robertson 2006b; ADA 2006b). As a number of our interviewees testify, the delay in accessing public dental care often results in fairly minor oral health problems becoming irreparable, and has led some to request complete removal of their teeth so as to avoid future problems and the pain associated with waiting for treatment. Anecdotal evidence also suggests that some public dental providers are recommending extractions to patients because they do not have the time or resources to complete more complex treatments (ADA 2006a).

At the end of the 1990s the federal government introduced a range of incentives for individuals and families to purchase private health insurance in an effort to ease the burden on the public health system. As of 30 September 2006, 43% of the Australian population held private hospital cover, nearly all of whom also took up cover for ancillary services such as dentistry. The rebate they receive for dental services is poor, however, amounting on average to only 49% of the cost (PHIAC 2007; ADA 2006c). This is a disincentive for even those with comprehensive private health insurance to seek dental treatment. As health insurance premiums are relatively high, and continue to rise well above the average rate of inflation each year, many low-income earners cannot afford to take advantage of the government's offer of a 30% rebate on policies. Spencer, among others, has suggested that the government's money would be better spent on improving public dental services, thus facilitating access to the poorest members of society (Spencer 2001; Harford & Spencer 2004; Leeder 2003). Those left in the middle — earning too much to qualify for a Health Care Card but not enough to afford private health insurance or the additional changes associated with ancillaries cover — are faced with the spiralling cost of dental care, which might severely impact on the oral health of Australians in the future. In the decade between 1992–93 and 2002–03, dental fee inflation increased at a rate of 50.5%, while the average price of

goods and services in the Australian economy increased by only 20% over the same period (AIHW DSRU 2004). In 2003 the average hourly rate of private dental care was $295 per hour (ranging from $200 to $450), and 26% of people ineligible for public dental care reported that they delayed or avoided dental treatment because of the cost (NACOH 2004).

Conclusion

It is clear that the historical events and circumstances described above significantly shaped, and continue to influence, the contrasting standards of oral health of the four generations in this survey. However, they do not constitute the only important 'turning points' in the oral health of Australians. The extension of consumer credit in the final decades of the twentieth century could also be mentioned, for example, as this increased the capacity of individuals to pay for dental treatment even if they could not really afford it. The postwar 'baby boomers' first, and most, benefited from the extension of consumer credit, particularly the advent of credit cards etc., and they remain the biggest spenders on health care. Patterns of tobacco consumption and control could also be traced, as smoking is a primary risk factor for the development of periodontal disease and oral cancer. Still, the events described above provide a telling illustration of the impact of history on oral health. In addition to the interviewee testimonies reproduced below, they also hint at the role played by gender, socioeconomic status, ethnicity and residential location in determining the opportunities for Australians to access dental care, a theme that will be developed in much greater detail in subsequent chapters.

4.2 Histories reported by survey participants

In order to gain an impression of some of the broader structural and historical factors that influence the oral health of Australians, 16 people from the Survey were selected to take part in an additional telephone interview with trained oral historians. The selection of interviewees is broadly representative of the Australian population and the Survey participants. We chose four people (two men and two women) from each of the four generations that constitute the Survey. Approximately half of the sample reported that they had 'good' oral health, and five of the interviewees were born outside Australia, some with non-Anglo backgrounds. Each state and territory is represented. To ensure their anonymity, each of the interviewees has been given a pseudonym, and the exact birth dates of our oldest participants are not revealed. The extracts of the 15 interviews reproduced here have been slightly edited to achieve a narrative format. Each extract represents approximately one-fifth of the actual interview.

Dan Barlow, born in the 1910s in Hobart, Tasmania

Dan Barlow was born in the second decade of the twentieth century and has lived in Hobart his entire life except for a period of war service. His mother encouraged him to care for his teeth and he has always lived close to a dentist. Dan visited the dentist regularly during the economic Depression of the 1930s, when many others could not afford to do so. He has attended the same dental practice since World War II. He says he has good oral health, having had very few teeth extracted and retaining all his front teeth. Here are some of Dan's experiences:

I did not have very strong teeth and my parents were very insistent that I should look after them very, very carefully, which I have done all my life. I was told to brush my teeth regularly when I was a child, but I can't admit to doing it satisfactorily every day, or even twice a day. Back then when I brushed them, I used a pink powder that came in a round tin.

I went to the dentist mainly to have check-ups and, from age 14 or 15 years onwards, the occasional filling. I didn't look forward to it! In those days they didn't have anaesthetics and dentists were not very kind. The dentist had a chair and a foot pedal-driven-type drill. It was a contraption like a couple of bicycle wheels, if you know the thing. Now it is a totally different experience. Today all the equipment is so up-to-date and the approach is, if I can say, on equal terms. I mean, I call my dentist by his Christian name and he calls me by my Christian name. That sort of approach certainly didn't exist pre-war.

Over the years I suppose I've had four teeth extracted. Mainly my wisdom teeth. It was the dentist's recommendation in all cases. They made the decisions because of dental decay getting to the stage where reconstruction was no longer possible. Once, though, I lost one tooth through decay at the back and the dentist rebuilt that tooth and anchored it down into my jaw. It has broken off three times and he's persisted in keeping that tooth. The last time it was done he inserted three or four steel rods and a lot of concrete [laughs] and it's perfect. I certainly had no intention of having a plate with one tooth on it.

My parents looked after payments for my dental treatment in my early years and from about 1930 I did all my own appointments and paid my way. I had private dental insurance but I gave that up because I'm a Gold [war service veteran] Card holder and my Gold Card covered all my dental expenses until quite recently. My dentist now says that he cannot be properly reimbursed from Veterans' Affairs and he refuses to accept the Gold Card any longer. I have been with the same firm for 60 or 70-odd years and I don't want to go looking for another dentist. So I've got to now pay the going rate for all the dental work that is done.

I remember the debate about adding fluoride to the water very, very clearly, because I was a member of the Hobart City Council staff. I was for it. In 1954 the City Council sent me on a 16-week, 16-country tour that included America. One of the subjects I was interested in was the fluoridation of water in America. I gave my report when I came back. In 1956, I think, the City Council made the recommendation and installed the staff and the equipment to fluoridate Hobart City Council's water.

However, there were arguments against putting fluoride in the water. The Hobartians generally had good teeth so some said: 'why attempt to make them better?' Others were worried that fluoride would make your teeth go black and fall out, and all sorts of funny things. But none of that happened. The dental fraternity strongly supported the fluoridation because they were seeing so many children with dental caries. Also, at that stage we had, I think, two doctors on the Council as aldermen and they were very, very strongly in favour of fluoridation. I don't for one minute think that I was the deciding factor. I just put in my penny worth.

– Edited extracts of an interview conducted by Paul Sendziuk, 30 November 2006.

Nicolette Manduca, born in the 1930s, Sicily, Italy

Nicolette Manduca grew up in Sicily, Italy, before her family moved to Australia in the 1950s when she was aged in her 20s. Though living in Italy during World War II, she claims to remember little of the war. And while she did not attend a dentist prior to coming to Australia, she has never had toothache and has only had two of her teeth removed. Her experiences are perhaps typical of some non-British migrants to Australia.

The first time I brush my teeth was as soon as I come in here in Australia. I tell the truth. I don't know somebody who brush when he little one. Now is different. Now I brush every night. Every night. I got the electrician brush. Yep. After it broke I say, 'Oh, I do for myself, for a year.' Afterwards I say, 'OK, I buy another one electrician.' But sometime I brush more better, I think, I brush more better for my brush. When I a young one nobody brush the teeth anyway. When we stay in Italy, we never go for clean the teeth. Here sometime, depending which one you eat, or which one you no eat, you know, because sometime the mouth is smelly a little bit and somebody say, 'You better go for clean your teeth.' Here go [to the dentist] every year. If it is me, go every year. If it is my children—I'll listen—they say, 'Oh, I must go for the clean my teeth the dentist.' When me in Italy age 22, I never go to the dentist. Anyway, here I go nearly every year for the clean my teeth. Now I go since I was 40. Now I go one time a year, or one time after eight months, just to clean my teeth. And that's all.

When I go, oh, I'm in fright! I'm in fright! Even of the clean—because they no do nothing else—even the clean I'm in fright anyway. For so many years I go to the same dentist, and she know I'm in scare when I go there. She's stopping all the time 'cause I'm in fright anyway.

For people on the pension it's a little bit expensive. It takes for me fifty dollars because I give in cash money because I'm on the pension. And the lady—because I already go so many years—she understands me, and she take only fifty dollars. My brother-in-law is on the pension. It still one hundred and twenty dollar for cleaner. See, for me fifty is OK, so thank you for the lady—not much money take. But too expensive, yes. I told you, sometime I go [after] eight months, sometime one year. You know, depends. Because when you all by yourself you must pay all the bill, too many bill for the home. You must look after yourself, nobody give something. All the pension I got, well, I must look after my money. I must look at this money every two week. When I have the pension I must say, ' All this for the bill. This for this.' And see, that's why I go later. All

the time the dentist say, 'You got very good teeth,' or 'Must look after yourself.' I would like to come in every six months. I must sometime come in eight months, one year. Depends.

I eat all Italian. Everything you got in the restaurant. Spaghetti. Everything. Meatball. I not go much in the restaurant, me. Sometime my children go. Me no go in the restaurant. And I don't know what my children eat there. I do everything fresh in the home, and that's it, for better delici, for better than the restaurant. I can't say to the children, 'Oh, you no go the restaurant.' I cannot control them.

– Edited extracts of an interview conducted by Troy Stone, 5 December 2006.

Ray Barker, born in the 1920s rural New South Wales

Born in the early 1920s, Ray Barker has lived on banana farms in or near Gympie, Queensland, for most of his life. He had all his teeth extracted before 20 years of age, probably due to tooth decay and because dental services were expensive and difficult to access in rural Queensland during the Depression.

I had very bad teeth [as a child]. I can remember having bad toothaches and even putting strong brandy on them to stop the ache in the early days, 'cause we had nothing else then. I remember getting amalgam fillings, but I didn't have any problems with the gums. We lived on a farm and times were pretty tough and there wasn't so much importance put on teeth cleaning, as is now the case. I don't remember ever using toothpaste.

We had a banana farm but during the Depression the bananas got a disease on them. So Dad had to walk off the farm and went on unemployment relief. He was unemployed for some time, but then he took to making mesh wire for fences and even the stain glass window of the Catholic church.

When I was 18 or 19 years of age — I'm not entirely sure — I had all my teeth removed under anaesthetic. My father paid a shilling for the first tooth and five cents for the rest. I've had false teeth ever since. I've never regretted having my teeth out. No more toothache. I've had no trouble with false teeth and I've never regretted losing them and not having to attend dentists. All my troubles were solved!

Growing up we ate very basic food, I'll tell you that. We didn't get a lot of luxuries in those days. Corned beef and potatoes and some vegetables, I 'spose. I wouldn't say the food caused my teeth troubles. I think it was hereditary. We didn't eat much sugar, even though we were near the plantations. We probably ate more bananas than sugar cane. I can't say lollies affected my teeth, 'cause we were lucky to get a bag of boiled lollies once every three months when we got to town. We were about 20 miles out of town and we didn't have transport in those days.

I was never very conscious of how my teeth looked, or anyone else's. These days it's a totally different lifestyle. We didn't have TV in those days but now they're dishing up every minute how good your teeth are and what the dentist will do for you and

everything else. It's a different lifestyle altogether. I mean, we didn't even get newspapers where we were in those days, so we had no contact with advertising or anything.

I've been lucky to have three boys. They're all going strong, doing well and have families themselves. They would go to a dentist pretty regularly and I got the big bills [laughs]. I'm always saying 'Get your teeth out, get your teeth out, you'll have no worry anymore!' I know they spend a lot of money on their teeth, but they had free dental [care] while they were at school.

We don't have fluoride in the public water supply here in Gympie, but the Council provides free fluoride tablets. They had a referendum about it some years back, and I think we voted against it because we didn't need it. We've drunk tank water all our lives, and we still drink tank water. So it doesn't matter to us either way. No fluoride in tank water, only bird poo, and I don't think that does any harm! My children never took the tablets. There's so much controversy about fluoride that I don't think they really ever proved that it is beneficial or harmful. It depends what faction you're in.

– Edited extracts of an interview conducted by Paul Sendziuk, 6 December 2006.

Margaret Bowman, born in the 1930s, Brisbane, Queensland

Born soon before the outbreak of World War II, Margaret Bowman recalls a number of bad experiences at the dentist. Mother to six children and grandmother to several more, she still laments a decision that has since seen her eldest daughter require extensive dental work:

I don't remember going to the dentist during the war at all. I was about seven when the war ended. I remember going after that, and I hated it. I guess because I hadn't gone to the dentist during the war I must have had a lot of fillings to be done and in those days we didn't get injections. It was the old very noisy drill. It made a terrible noise and hurt like hell. From then on the first thing I did when I sat down was clamp my hands on the arms of the chair. I was terrified of the dentist from then on.

I must have been 12 or 13 when I was at school and a girl was fooling around. We had those taps that we called bubblers; they were drinking fountains, where the water squirted up and you drank from them. And she, well, she was meaning to push my face into the water, just fooling around—because it was only a little stream of water that you drank from—but she pushed a bit hard and I bumped my tooth on the drinking fountain, which was metal.

Unfortunately the nerve died in that tooth. Over a period of about—I suppose it was about 3 or 4 years—it went dark. Well, darker than the tooth next to it. They tried to save it. I went to the dentist and I had, I think it was called an apicectomy. They tried to remove the top third of the root, but that was never a success. Eventually I got an abscess on it and had to have it extracted. There must have been another tooth beside it that was affected because I got a partial [denture], and the partial never looked much good. Eventually the wires on the partial affected the teeth that they were sort of

attached to, and gradually I lost more and more teeth. Eventually—this is later on, after I was married—I had them all extracted and got upper dentures.

I think I was probably fed up with the way things were going and I thought I'd be better off with dentures, which I *have* been. I still maintain I wish I was born with them. I think I got the upper ones, oh, I'm not sure, '65 or '67, and I'm still wearing the same set. And the other [bottom ones] were probably about three to five years later and they're still the same set too. They look fine and never give me any trouble. Apart from normal things like sesame seeds underneath them and so forth. You've gotta be wary of those sort of things, but it doesn't restrict my eating. The only thing I can't do is bite into an apple.

I'm sure dentists are fine now. I mean, my grandchildren seem to go at a very early age, and they seem to think it's quite fun. So I don't enlighten them. My eldest daughter has got braces on now. She's 47. She didn't get them when she was young, although we *did* take her to an orthodontist. I don't know whether it was just too hard or why, but he told us that she didn't need them. She's always had a funny jaw. And when she went this time, she was told she needs monumental work. Apparently she's got to wear braces for 12 months and then she's got to go into hospital and have her lower jaw broken, because as she's got older, I think, her chin must have been going back or something. So she's gotta have a huge amount of work done. She's about, I don't know, six months into the first bit, the braces I think. The end of 12 months is when she has the jaw broken and they realign it. I certainly feel now that they made the wrong decision when she was younger! I said I felt terribly guilty! But the new dentist said, 'Probably it was just too hard.' That's what he said, because what she's having done now *is* hard. So maybe they thought at 13 it was, you know, just too bad [to fix]. I don't think they knew what to do back then.

– Edited extracts of an interview conducted by Troy Stone, 4 December 2006.

Fiona Morris, born in the 1970s, Brisbane, Queensland

Fiona Morris has lived in Brisbane her entire life. Her English father and Scottish mother arrived as government-assisted migrants in 1970. They worked long hours and provided little parental supervision or instruction about dental care. Fiona received periodic free dental examinations from the school dental van, but this stopped after she had a baby at 15 years of age and left school. As Fiona relates, the oral health of her family deteriorated because of its financial situation and reduced access of services.

I had quite a lot of problems with my teeth as a child. I think I had a tooth removed in grade 3. I don't remember my parents taking me to see a dentist. My Mum grew up in an orphanage and hygiene with teeth was never an issue for her. We were never told to clean our teeth. The only time I remember brushing my teeth was when the dentist came to school and they gave me a little toothbrush and toothpaste and some stickers. I'd do it for a few weeks and then I'd end up forgetting 'cause no one was telling me to do it.

I lost a tooth at the front when I was 15 years old, 'cause I had my first child at 15. It had a hole in it, but then it just fell out one morning. I was so conscious about it that I'd smile with my hand over the front of my face. It eventually got replaced with a screw-in crown that my Mum paid for.

My Mum's an alcoholic and her teeth, over the years, have been slowly decaying. She's got abscesses and what not and she lives with the pain. Mum had about eight teeth pulled at one sitting and I've been trying to get her to go to the dentist since. But the public health system is shocking, isn't it? Two years waiting or something like that. Still, she's actually got some money that she could use to get her teeth fixed. I mean, she's conscious of them but she's so terrified of the dentist that she doesn't want to go. So that's another issue for her. She's willing to put up with the pain.

I had a lot of problems with my teeth when I was about 17 or 18 years of age. I'd moved out of home and had a young child and things were quite bleak. I wasn't looking after my teeth at all and I wasn't eating very well, so obviously my teeth started deteriorating. I was constantly getting abscesses. The whole top of my mouth would be full of them, which were just horrible. I was not eating because of the pain and I didn't realise that you had to go to the doctor at that stage to get antibiotics. I thought it was something that would go away. I just put oil of cloves on it and I ended up becoming quite ill. I think it can be quite serious if you're constantly having mouth abscesses and not treating them because then you've got that sort of poison going into your system.

I don't have dental health insurance now. I was on a dental plan with one of the health funds but something happened and to get back up to date I had to pay them $500. I just didn't have the money at the time so I just went 'Ahh…' It was good when I was covered; it was obviously cheaper and you got a free clean each year and what not. But since then, which was nearly two years ago, I haven't been to the dentist myself.

I've just had a letter come from my dentist, but, like I said, affordability is the issue with me now, especially with three children and I'm not working at the moment. The only way I can get to a dentist is through the public health system for low-wage earners. But we can't go through the public system because we earn $2,000 a year too much to get the Health Care Card. But, even if we did, you have to wait. You have to turn up at 7 o'clock in the morning and sit there, and you could wait all day and not get in. That's hard to do with three children. So, it's a no-win situation at the moment. What do you do?

My husband also has teeth problems. His dentist said she could treat it, that's not the problem. It is the cost. We've actually found some 'lost' super [superannuation money] to pay for his treatment and we're trying to get it out but it's starting to cost more money to go to specialists to try and get this friggin' super out. And it's not like we're gonna have the money, 'cause the money goes straight to the dentist, so I can't see the issue with it. I mean, it's someone's health for God's sake. You have to be unemployed for 12 months to access it. And it's his friggin' money!

He needs the treatment. The dentist sent a letter saying he needs to get all this work done or he'll lose all his teeth. He's gotta get five teeth pulled; he's got some sort of

disease in one of his gums, and now they're saying we've gotta go to a specialist, which has been put off for three months. It's ridiculous. He's gonna end up losing a few teeth before then, but what do you do? I know sometimes he doesn't eat because his tooth's hurting and he's taking pain killers and applying oil of cloves to numb the pain. I know the feeling; it's absolutely horrible because you don't want to be around anybody, so it's also affecting the kids.

My children get their teeth checked through the school dental program. My little one had some problems. He chews rocks and crayons and had to have a tooth filled. He actually wore his back teeth really badly and I didn't realise, and so one of the ones he wore down really badly was starting to expose the little nerve. Thank goodness it was all right to fill it and he hasn't had any problems since. That is why I'm in favour of putting fluoride in the Brisbane water. I was just speaking to my dentist about it and she said it is needed, we need it, that's why Queensland has such a high rate of tooth decay in children.

Having good teeth tells a lot about some people because a lot of drug addicts have really bad teeth. If I saw someone with bad teeth, they'd probably either come from a poor family and can't afford dental care, or there are other issues. Or they hadn't been told to brush. I sort of know about that. I look at people who have got money; their teeth are perfect. I mean, you look at them when they smile and their teeth are white and they're clean and they're straight.

– Edited extracts of an interview conducted by Sonia Laidlaw, 4 December 2006.

Christine Cunningham, born in the 1910s, Skipton, Yorkshire

The sixth child of her family, Christine Cunningham arrived in Australia under the Group Settlement Scheme when she was four years old. Her family set up a farm halfway between Denmark and Nornalup, Western Australia, where she lived through the Depression and World War II. Although she cannot remember visiting the dentist until she was well into her teens, she retains all her front teeth and has no dentures whatsoever. She attributes her good health to a plain rural diet and speaks of growing up in the country:

Wild bush. Very wild bush. Very little of it settled, the area I was in. I never saw a dentist. I can't remember seeing a dentist until I was in my teens. If you had toothache, you went to the doctor and he pulled them out. I was very lucky, I think, because we had a very plain sort of diet. We were seventeen and a half miles from Denmark and our only transport was a horse or a horse and cart. And that took quite a long time, so you weren't able to go to the shops and buy lollies. That was a sort of Spartan way of life. You got groceries once a month, and there were no butchers. You couldn't get meat sent out to the bush—it would've been bad before you got it—so you ate what you could kill or catch: kangaroos, rabbits… You could kill a chook or a calf, you know, a pig, that type of thing. We always had milk and cream and butter. Lots of it. Plenty of vegetables and stuff that you grew. You were used to that plain diet. We didn't go short of butter during the war, because we had cows and dairying, so we'd always had plenty of homemade butter as a child. But apart from that—butter and sugar—I don't think it

worried us a great deal, the rationing. People like myself growing up in the bush were used to living fairly plainly.

We still ate all sorts of things though. I used to go and stay with people who were *real* bushies, that had lived there for years before us—really, truly, bushies—and they lived entirely off the land. Anything they could shoot they ate. I had all sorts of queer things to eat there. I had wallaby and parrot and all sorts of birds. When I was staying with these people there'd be about four of us, four kids, and we'd be given a pack of Milk Arrowroot biscuits—they're a plain sweet biscuit—and a tin of Nestles condensed milk. And that's what we used to take to the beach with us for the whole day. That was a treat. So it was a funny diet, I suppose, in a way, compared with today. But you see we were so active. We had to walk everywhere or ride a horse everywhere. And I think that's why that sort of plain diet and lots of exercise kept us fit. I don't think we had an excess of sugar. We always had cake, of course. Mother was the English cook. There was always cake and pastry: tarts and meat pies and things like that. Bread with good beef dripping on it and a bit of salt and pepper was a tasty bite.

During most of the Depression we were there in the country, and our diet didn't vary except that we didn't have much money, so we couldn't have much from the grocery shop anyway. The same when we came to Fremantle. My father had worked for Singer sewing machines in England, and he got back with them in Fremantle. He had a Singer sewing machine round, and that was the only income the family had. But I don't think it affected our diet particularly. I think we probably went on much the same diet we always had: very plain.

Back then I don't know that you were so conscious of how teeth looked except they were supposed to be clean. I don't think in my day we worried as much about looks as today's young people. You liked to have your hair done and be tidy and neat. We didn't have the makeup and, you know, we didn't have the publicity, didn't have the magazines and television and things like that to, you know, egg you on.

I didn't have a lot of dental problems really. When I was living in Wyndham, right up in the Kimberleys, my children and I used to go to the dentist when we went down to Perth on holidays. We used to come down about every two years. Sometimes we flew; sometimes, more often than not, we went by the state shipping service, by sea. The first time I went I had two babies—one four and one six months old—on my own, and I went in an old DC3 plane. I was violently airsick the whole way. Went from Gilford in Perth at two o'clock in the morning and got to Derby at five o'clock at night. We had to stay the night there 'cause they couldn't fly at night in those days—there were no landing lights. And I was so ill they lifted me out of the plane and laid me on the ground. I didn't know who had the babies. So we stayed the night there and then we went on the next day to Wyndham in a little tiny Lockheed — a ten-seater or something like that. Not much bigger anyway. After that I think I mainly travelled by ship.

– Edited extracts of an interview conducted by Troy Stone, 1 December 2006.

Jarred Bynum, born in the 1980s, Southport, Queensland

Jarred Bynum, our youngest interviewee, speaks of growing up in the school dental system:

I went to see the dentist at school. Probably only once a year. They came around and did visits and you sort of just had the option and it was free to go. And then if anything was wrong, I'd go to another dentist. I had to get a few fillings a few times and that's pretty much it. And I chipped my tooth once or twice. I chipped one tooth just, like, playing around on the front lawn and someone knocked my tooth. And the other tooth, I was playing football at school and someone, like, someone pretty much punched me in the face and just snapped half the tooth off. So now I've got this bond stuff—not a cap—over my tooth to cover it over.

I was never scared of dentists or anything. It was just, like, it was just a normal thing. Yeah, it's pretty good. I like going there, just knowing that I'm gonna find any problems if I have them. I actually didn't go for about three years and then I went back, like, a few weeks ago to get a mouthguard fitted. I decided to get a check-up and everything as well, but I just got a teeth clean and all my teeth were fine anyway. Fear is not really what made me not go. It's just, I didn't get around to it. Going to the dentist isn't something that you think about doing, like, it's not a major factor in your life.

I *was* actually pretty self-conscious about my teeth though. Every time when I chipped it or whatever I was really worried. I've got a calcium sort of stain thing just at the bottom of my teeth. It's just a lot whiter at the bottom and I'm just, like, conscious about that. I was just born with it. I've heard it's caused by, like, your parents taking calcium pills or something like that.

I brush them two times a day now. Listerine sometimes, but that's it, not floss very often. The dentist showed my parents and my parents showed me. Everyone says different, like, some say to brush with circles and some say across, but I just, like, do it straight across. I don't eat so much sugar any more, but until six months ago I worked at Hungry Jack's for about two years, and I used to eat there probably three or four times a week. That wasn't very good for it. But I probably only eat a few sugary items now. Not much.

– Edited extracts of an interview conducted by Troy Stone, 5 December 2006.

Jan Bailey, born in the 1950s, Brisbane, Queensland

Jan Bailey lived most of her life in Brisbane, but made the move to the Northern Territory about 12 years ago. As a child, she attended the dentist regularly, brushed her teeth, wore bands and took fluoride tablets that she recalls, 'looked like lollies but tasted like shit'. Jan's adult years have seen her teeth deteriorate rapidly as she has had to fit her dental health around her children and the constraints of her geography.

As a child I got one of me front teeth pulled. It wouldn't grow back. [Laughs]. I can't quite remember what happened there. I remember me Dad bluing with the dentist about the front tooth. I don't think he was meant to pull it out.

When I was older I had to travel to see a dentist. I reckon it was probably about 400 kms. About a three-hour drive it was. I went to Mount Isa to the dentist. And I was living in a country town. That's probably about ten years ago. One time when I had to travel, I think a filling fell out—um, can't quite remember now. I remember having bad toothache and going to the dentist, and he wanted me to have root canal surgery. And I said, 'no, just pull it out.' Cheaper. And I would have had to keep going back for revisits. And I was, like, three hours away.

When I was pregnant with my son I got—oh, can't think of the name of it. All me gums flared up and all me teeth just started— They still looked good and normal, but they were, like, eating away from the inside out. Does that make sense? And then I didn't really do much about it because I was pregnant at the time and I was on medication. I also fell over and hit my front tooth, and I chipped it, and then once I did that all the rest just seemed to eat away.

Now I got a top plate. Me teeth had started looking yuck. I felt self-conscious about it and had sort of stopped eating certain foods. I went to a public dentist in Darwin. She pulled some [teeth] out here and there. Eventually she took the whole lot. I was sick of waiting. I probably could have saved some, but because I got stuffed around a bit at the dentist, to get in and that, like, it took a fair while to get done. And by then all the rest were just not worth it. It was probably easier to get the whole lot done.

I'm not nervous or anything when I see a dentist. When I *have* gone recently, I know it's to get my teeth pulled out, so I just wait my turn. Oh, it's not really nice going there, but it's just gotta be done. It's not really nice getting teeth pulled out, for a few hours afterwards, but I cope pretty well. It's a long wait for the public dentist. A two-year waiting list or something like that. I just use the government one now, when I need to go.

– Edited extracts of an interview conducted by Troy Stone, 1 December 2006.

Melissa Williams, born in the 1960s, Melbourne, Victoria

The mother of a five-year-old child and ten-month-old baby, Melissa Williams has spent the better part of her life in Canberra. Melissa's parents and her brother's unfortunate tooth loss encouraged her to care for her teeth as a youngster. Today, a desire to remain attractive and the demands of her own family are more likely to influence her dental care.

I got braces on my teeth when I was in year 7. I was about 13. It was the best thing my parents did, looking back now, 'cause I've got family members who didn't have their teeth straightened. It wasn't too traumatic. A lot of children at that age have them on. I guess I had them on for about two and a half years. I didn't have any other problems that required teeth to be removed or anything like that.

I'm a twice-a-day girl as far as brushing goes. Morning and night. It has always been the same. In the morning I use my manual toothbrush, and at night I use the battery-operated one. I only floss once or twice a week—not as often as my husband. I actually prefer cleaning my teeth with the normal toothbrush, but I know that the other toothbrush does a better job, so I use both. There's lots of fluoride in the water in Canberra, too, so that's a big advantage.

My brother fell off his bike and knocked his front tooth out when we were young. He was an older brother, and he was very conscious of his teeth, so I guess that made me conscious of mine. I think if you've got nice teeth and a nice smile that makes you far more attractive.

In 1999 my dentist picked up a small crack, and he sort of monitored it, but then in 2005—six years down the track—I went and had an Indian meal, and must have chewed too hard. Anyway, the tooth cracked all the way down, so I had root canal treatment, from the end of 2005 all the way through this year basically. It wasn't very good. I probably had about 12 or 13 visits all up. And I still actually haven't got the crown done. I fell pregnant midway through, so I had to stop the treatment. They can't do X-rays and things, so that's something I've got to get done in the next few months. My baby is ten months old now and I could have had the crown done ten months ago. It's just fear that has put me off. I was traumatised I guess. They picked up that I've got some muscular jaw problem, and the pain associated is not due to the tooth. It's a jaw problem which women can get, but I still associate the pain subconsciously with having the treatment done on the teeth.

It's expensive. We haven't really changed our [insurance] 'extras' cover for some time, so the benefits we get back are pretty dismal. I mean, they're expensive, but it's important. You know, I'm only midway through my life, and I certainly don't want terrible teeth or no teeth down the track. We used to go to Medibank dentists, 'cause I used to work for Medibank before I had the children. You used to be able to get free check-ups—check-ups, scale and clean, that sort of thing—through these dentists that were affiliated with Medibank but we don't do that any more. Now we basically go to a dentist that we heard good things about through family and friends. We feel that we've got the children now and we probably prefer to have a family sort of set-up.

Actually, our five-year-old—she's just turned five—she'll be going to the dentist with me early in the new year for her first time. We try to get our children to brush their teeth as much as they can by themselves with us watching. Basically it is just us doing it with *our* teeth, showing how to brush correctly. They seem to do quite a good job, and we always check what they've done afterwards.

– Edited extracts of an interview conducted by Troy Stone, 5 December 2006.

Dawn Barbour, born in the 1930s, St Mary's, Tasmania

Dawn Barbour grew up on an isolated dairy farm near Ringarooma, Tasmania, before and during World War II. She saw a travelling dentist only once a year when he arrived with a caravan to pull teeth and fix dentures. To save the expense of treating caries, her parents ordered the extraction of a number of her teeth at an early age, which became the source of embarrassment.

Our farm had a good orchard with fruit and father grew potatoes during the war. Mother was great in the vegetable garden but the main content of our diet would've been milk products. We had a lot of milk and cream and butter and all those type of things. From what I've read, milk was about the worst thing for your teeth. I don't know if that's true. In those days we more or less lived on what we could grow.

Very few dentists visited those little towns. The only dentist came in his caravan once a year. He was not part of a school dental scheme. He was a private dentist. He treated anyone in the town from his caravan. It was fairly basic; it only had enough room for the dentist to stand and pull your teeth. The pain didn't last that long—the blood and the mess afterwards was worse than the tooth coming out. Nobody was too happy when he drove into town! My future husband—I didn't know him then—lived in the next town and he says they were terrified of him too!

The state had a scheme that if you passed an ability test you were eligible to go to a hostel for isolated country girls. I don't think I owned a permanent toothbrush until I went to the hostel with the high school girls in Launceston.

I had a little plate as young as about 13. I think my parents were against fillings; I don't know if it was the cost or whatever, but once my teeth started to decay they had to come out. My front teeth started to get cavities and, I suppose, money being short—I didn't know how short, being too young—they took out four teeth to get a plate. Because one tooth wouldn't be very economic, would it?

After the war, money was less tight for farming families so I went under anaesthetic at about age 16 to have the rest of the top teeth out. I don't know how many good ones went—they weren't all decayed —but they took the lot, all the top teeth. I was the only child at the hostel that had a denture. So that was a bit unpleasant, but my Mum and Dad didn't seem to worry about it.

When I was at senior school I needed to have a back tooth removed at the dentist's in the centre of Launceston. It took about two hours to travel from the dental surgery

back to the farm. Sitting on the public bus on the way home, I couldn't spit the blood out so it congealed. When I got home I couldn't get my mouth open or get any of the blood out. They had to break where it had congealed, you know, in the canal where the tooth came out. They had to break it and start the bleeding all over again.

My mother had dentures; she was from a family of 13 children. She had all her teeth pulled even before she was married. It surprises me they could make such good dentures in those times. Me father wore his out. He wore his bottom teeth right down to the gum. He lived to be 80 years old. They wore right down 'til there was nothing. But then he had done a lot of eating.

I don't know if fluoride in the water had any effect. I don't think it was detrimental because my daughter is in her fifties and her teeth are good and she grew up, most of her life, in Launceston and so did my son. But they had regular dental appointments once we moved to Launceston to live. I don't think they've ever had any fillings. My son's got nice teeth and so has my daughter. But I haven't got many natural teeth left. I got two back ones and about five of me front bottom teeth. I've got two dentures now.

– Edited extracts of an interview conducted by Sonia Laidlaw, 4 December 2006.

William Simpson, born in the 1940s in India, emigrated to Australia in 1964

William Simpson was born in India during the fifth decade of the twentieth century of Anglo-Indian parentage. He followed his brother and migrated to Australia in 1964. William received the occasional dental check at boarding school, although he does not remember ever attending a dentist in India. He claims to have always experienced good oral health and has never had a tooth extracted. Nevertheless, William has adopted some unusual practices in looking after his teeth and gums.

I clean my teeth once a day and, if I feel the need, in the evening too. I learnt my good oral practices from my parents and it was reinforced as a teenager at boarding school. The only time I was ever conscious of my teeth was when my wisdom teeth flared up. There was a little bit of pain, but nothing had to be done.

My family used to brush with toothpaste, but other Indians would do a different thing. They would break a branch or sapling from a plant known as the Neem tree. You just chew on it and it is supposed to be very good for the teeth, for protection and for hygiene too. The poorer people were taught that, and we used to try it because we would see them; they used to be our friends. We would just laugh and use it. It might be good. The people in India don't suffer from bad teeth like the people from here because they don't keep eating lollies.

Having strong white teeth is important to me. Teeth, in women, they're very good and attractive, you know, a white set of teeth when you smile. Someone told me to use a bit of bicarbonate soda if they don't look as white as they should. You just put in the powder and it does make your teeth look a bit whiter.

I have never smoked and the only time I have visited a dentist was to accompany my daughter for a check-up. There was a bit of time spare so the dentist asked me if I needed anything done. I said 'No, I've always had good teeth', and he said 'Just sit in this chair and I have a look. I'll only charge you $40, but I'll give you a clean up and see if there's anything under the gums'. He did take out some things from the gums but he said there's nothing that needed to be done other than the removal of the plaque.

We didn't think too much about gums and all in India, but here they look after you a lot more closely. We had good teeth, we got away with it there, but here there is much better knowledge. I gathered one has to be careful of gum infection. I know that if your teeth and gums are not clean, the water you swallow could be poisonous to your system. So for a precaution I boil all our drinking water.

I remember the fluoride debate and that there were points for and against it. Some people say that a lot more Australians have bad teeth since it has been added [to the drinking water], and others say the opposite.

Dental care in Australia is expensive, but if things had to be done, we'd collect the money to pay for it. I leave the dental decisions to the dentists. I'm not an expert to make any decisions, if they give me all the information I wouldn't hesitate to act because we regard teeth as the most important thing. Anyway, my daughters had access to the school dental program and we didn't spend too much money. They all have good teeth.

My daughters live close to me. Two are living in this very big house, but one is married and she just lives almost next door. I look to see that they are brushing their teeth because I'm very much interested in them doing well in Australia. I always tell them that everything should be done to perfection now we live in Australia.

– Edited extract of an interview conducted by Sonia Laidlaw, 5 December 2006

Wade Lang, born in the 1950s, Adelaide, South Australia

Born in Adelaide, Wade Lang describes himself as a bit of a petrol-head who has been living in country South Australia since he was 27. He currently lives in Maitland on the Yorke Peninsula. Despite establishing an early routine of brushing his teeth (he recalls it was 'a capital offence, with 50 bloody lashes if I didn't do it'), Wade has had a long history of dental problems, which he blames on brittle teeth.

I suppose like most people, and most kids, I didn't really like dentists. It's just the same old thing — that *bloody* drill! You know, if they could make something that didn't make the noise it'd probably be alright. When I was a kid I had to get a few fillings a few times and that's pretty much it. And I chipped my tooth once or twice. Apparently I've just got horrible teeth. They don't like fillings. I've bitten apples and my teeth have broken. The small, yellow lolly bananas as well. I mean fairly insignificant little things, but I've actually cracked teeth with those. There's nothing to be done apart from just

ripping them out or trying to repair them. I mean, eating apples, I've actually torn teeth out of my head.

We don't have a dentist out here any more. We haven't had a community dentist, as in a Health Card dentist type one. Used to go to the one at the local school but due to budget cuts and whatever, it's no longer required. And the local dentist, he bloody retired some years ago. You have to travel an hour or so now. Or travel to Adelaide, which is a two-hour drive.

A couple of times I've actually had to go to Adelaide. One was on a Sunday. The tooth split down the middle, which was pretty exciting. Even large amounts of alcohol on the Saturday night didn't, sort of, shut me up. So Angela bundled me up in the car and we actually drove down on the Saturday to the Frome Street dental place there. And they tied me in the chair and removed it. The side ones seem to be the biggest dramas, the wisdom teeth and so forth. The front sort of four or five on the top and bottom, they seem to be OK, but the rest just seem to be rapidly disappearing.

I think the wife and I mentioned false teeth years ago, but I think it was just in passing, so nothing's ever been done about it. I mean, they're all just falling out naturally, so when they've all fallen out I think we'll go and do something. But in the meantime I'll keep just eating me yoghurt and jelly.

I can't eat steak. Um, thin steak is OK. I eat a lot of stir fry and such, so it's not too bad. I can get stuck into that. But the old, bloody, sit-down-to-a-huge-kilo-bloody-chunk-of-steak-on-your-plate is few and far between these days. Unless I can suck it to death.

I'm in the process now of getting myself organised to go and do something because one of the teeth on the upper back left has actually sheared off and it's just the filling sitting there by itself. I mean, I don't go to the dentists to get something done, but just to get 'em extracted because they're buggered or broken. Like now, I'm actually waiting for an appointment about this tooth of mine on the upper left that needs something done about it. So when I get confirmation of what I can do, how I can do it and where, I'll get it fixed—well, get it remedied. The appointment, that'd be the main thing. I'm on a waiting list. We've had the low-income Health Card for a while, but apparently I earn about $260 a year too much now, so I don't get it. And that's the reason we're having problems getting a dentist now, I suppose.

A couple of times I've actually had—what do you call it? My face has been infected. My eyes got all twitchy, ears ringing and all sorts of things because of an infected tooth, which I didn't realise until I went to the doctor's and he said, 'It's not my problem, Wade.' He said, 'You need a dentist.' And I said, 'OK.' And that's happened a couple of times. I had the tooth removed, just a dose of antibiotics, and job sweet.

– Edited extracts of an interview conducted by Troy Stone, 5 December 2006.

Aburizal Bakrie, born in the 1940s in Jakarta, Indonesia

Born to Australian parents in Jakarta, Indonesia, during the fifth decade of the twentieth century, Aburizal Bakrie spent time studying in Australia before emigrating permanently in 1987. He now resides in New South Wales. He remembers having problems with his baby teeth as a child in Indonesia, and has suffered gum disease, abscesses and two teeth extractions as an adult (both before and after emigrating). Private health insurance now covers most of Aburizal's expenses, including having his three children fitted with braces. But he doesn't always take the dentist's advice…

As a child I had tooth problem. I think some [were] pulled out. I went to a general practical dentist. Indonesia is just a new country, we say. It is not very modern. There was no specialist dentist. It's not common, I mean. In Indonesia we have to pay, even for children.

There was a certain period of time when the economical condition in Indonesia was a bit low and we had to ration food. Even rice, the main food, was restricted. We didn't eat much sugar. I live[d] in a part where we don't really use sugar as the main thing, not like central Java, where sugar is number 1. Where I lived—I was bought up in Jakarta —is OK.

Before I come to Australia, I got fillings. I also have problems in Australia, because the tins of food, I think. Change of diet. I had one tooth pulled out when I was studying in Australia, and another after 1987; that was the second time I was in Australia. It was really bad. Cannot be drilled and filled. Is worse, so better taken out.

I am on health [insurance] fund. I go to the dentist when I need to. I never had to wait long. One time, the dentist said I had to go to the special dentist, and—to avoid the front teeth being taken out or become bad—some of the gum might be cut. I said 'Oh no. No'. I didn't obey what the dentist told me. I didn't go to the specialist. A little bit scared. Now I use the electric brush so I don't brush too hard—this affect the gum.

I have three children. Two were born here in Australia and the other one in Indonesia. They're all grown up now. Two of them had to go to the orthodontist and all been done with braces, corrected nicely, and they have good straight teeth.

My youngest daughter, she actually don't go to the orthodontist, but to the dentist, a senior one. He went to put on a brace, just doing treatment only. But we had some argument with the dentist before [he put the braces on], because to put the tooth into the correct way, he wants to pull the tooth, to make room for the [other] tooth. We said, 'Oh no', because it might affect [her]. We argue and I decide no.

– Edited extracts of an interview conducted by Paul Sendziuk and Sonia Laidlaw, 5 December 2006.

Patrick Wardlaw, born in the 1940s in Leeds, England

A native of Yorkshire, Patrick Wardlaw was a member of the Royal Air Force, which saw him travel to different parts of the world as a young man. He migrated to Australia in 1968 when he was aged in his 20s. He joined the RAAF and spent his entire working life within the armed forces, enjoying full dental entitlements. He now lives in Darwin and occasionally uses salt to brush his teeth. Since retirement he has not visited a dentist.

When I was about 11 or 12 years old, I was going to the dentist approximately every six weeks. I had a problem with my teeth; they were terribly crossed and crowded. It's all public health over there [in England]. I frequently used to be given a dose of laughing gas.

I emigrated to Australia and joined the RAAF in 1968 through to 1997; that's 29 years of service. The air force provided all my dental care, 24 hours a day, 365 days a year. My son-in-law is a member of the RAAF and has automatic 12-monthly check-ups. That's covered, of course, at no cost to the individual. Whenever I had felt any discomfort, such as 'cold pain' from ice cream—which I did on two or three occasions during my final years of service—I'd go down and have them checked out. Occasionally it was because of tooth decay that necessitated a filling, and on two occasions, extraction. The health care services were on the spot.

I had an ugly gap in my teeth so the dentist decided to fit me with a false tooth in early 1971. I've never used it. Well, I used it for a short time but I got sick and tired of having to take it out to clean it and then put it back in and then, you know, you get a bit of food stuck underneath it. I thought, 'Oh, stuff the looks'. I've still got it today. My youngest daughter found it one day and wore it on a chain around her neck for about four years. My eldest daughter used to laugh and say, 'Oh, my Dad's got his teeth into you!'

I haven't been to a dentist since 1997 when I discharged from the RAAF. I still had the feeling of trepidation about going; it didn't matter who it was or where it was. Even when it was a good-looking young dental nurse that was looking after me. Although that did ease the tension a little bit. I got used to different procedures as a member of the defence forces, the different things they did, the X-rays every 12 months, things like that. But they were governed by influences outside my control, the Australian Defence Force or the Department of Defence or whatever. I had no control over that. It was there and it happened and that's the way it was. I accepted it.

I'm not saying that I would be happy to go to a dentist now, but if it was necessary I most certainly would. I would not enjoy losing all my teeth. I would take advice from the dental person. They're the expert; I'm not. I would go to a public hospital if there was one available in a reasonable timeframe. But that would mean treatment, which is not available in the Northern Territory. In that case I would go private and pay. I am single—divorced, as you might say—and my financial circumstances are such that it would not be of any concern to me. I don't like pain.

I was taught to regularly brush my teeth, twice or sometimes three times a day. But I rarely use toothpaste. If I have any discolouration I use a little bit of salt as it's a very

mild abrasive. I used to use—I can't remember what it's called—a smoker's paste. I hated the taste of it. I found salt—although not the best tasting—was at least better than that other crap I was using.

There have been discussions about fluoride in the water here in Darwin for the last few years because we have fluoride in our system whereas Alice Springs and Tennant Creek do not. There is lots of argy bargy, backwards and forwards, whether they should or shouldn't have it. I have not been able to make up my mind and they have not either.

– Edited extracts of an interview conducted by Sonia Laidlaw, 1 December 2006.

Greg Pulcinzki, born in the 1960s, Perth, Western Australia

Greg Pulcinzki grew up in a number of small, isolated coastal and mining towns in Western Australia and the Northern Territory. He now lives in Kambalda (60 km from Kalgoorlie) with his wife and two young children. He claims to have enjoyed good oral health – although he admits to sensitive teeth due to decay – but his wife's dental problems have caused considerable financial strain.

As a child I had no contact with dentists in either Lehmann (WA) or Nhulunbuy (NT), where I lived between ages 5 and 16. I saw a dentist through the schooling process, as regularly as permitted I 'spose. I've got a pretty healthy set of choppers in me head so I never went out of me way to go to dentists. The most [treatment] I've ever had is fillings, although I had my wisdom teeth removed three or four years ago.

I don't believe there's a full-time dentist here in Kambalda, but one visits. I personally choose to use a dentist in Perth, 700 kilometres away, because my father has had extensive work done through him and we've established a relationship. We are happy to slot that in whenever we travel down to Perth. Our dentist respects our choices. I mean, he's quite thorough with respect to what he tells us. If I'm not sure he'll explain it 'til we understand. At the end of the day, we make the call as to whether we want the filling done or whatever.

I've always taken pride having nice, white, clean teeth. I, sort of, feel good about the fact I'm about to get me teeth checked. I'd like to think my teeth maintain their condition.

As a young man I was consciousness of teeth but I wouldn't necessarily say that I judge other people because my wife has got probably one of the most shocking set of teeth [laughs]. She's cost me thousands and thousands of dollars! You know, I'm constantly on her back saying you've gotta clean your teeth religiously; I tell her, 'You should be doing it three times a day with your teeth.' When you're talking extractions and root canals, I mean, she's been there, done that, and she's due to have more work done.

In hindsight I should have taken up dental insurance but I didn't think about it in time. We've always strapped up and made ends meet to get the dental work done because

it's required. I mean, I don't want her suffering. I'd prefer for her teeth to be as healthy as possible, but the money is always a concern.

Obviously there are timeframes associated with when we can afford to get the dental work. Now is a perfect example. We know there's at least $2,000 worth of dental work that's required for my wife. Now, if that wasn't such a financial burden—with having two kids and a mortgage etc.—then, personally, I'd certainly get it done sooner than later. But, as it is, it's something that will have to wait until we can afford to pay for it. Of course, government assistance or anything along those lines would help.

I have no opinion about fluoride in the water. What concerns me is the expense of dental care. Obviously if there was an incentive that the government could offer… I'm talking for the middle-income earners and the lesser-income earners. Dentists aren't cheap and probably more so up this neck of the woods to say the least. I mean, in Kalgoorlie they charge like wounded bulls and it is a bit of a deterrent. It makes it hard for people to have the twice-yearly check-up and a scale and polish once a year. People don't do that because of the expense involved.

– Edited extract of an interview conducted by Sonia Laidlaw, 5 December 2006.

5 Oral health status

by Kaye Roberts-Thomson and Loc Do

This chapter reports prevalence and severity of oral diseases and other conditions that affect the teeth and gums. They are arranged using a common format described in Chapter 2 (see page 28). The tables report findings regarding four sets of oral health conditions:

- tooth loss, including denture wearing and replacement of missing teeth
- experience of dental decay, including untreated cavities, and teeth that have been filled or extracted to treat past decay
- gum diseases, including periodontitis and inflammation of the gums
- tooth wear.

The tables use information collected primarily during the examination. Interview information is limited to questions about tooth loss and denture wearing, in response to two questions about objective oral health asked in the interview. More subjective questions about experience of oral symptoms and perceived needs for dental treatment were also asked in the interview, but they are reported in Chapter 7.

5.1 Tooth loss

Tooth loss occurs primarily because of a treatment decision to extract one or more teeth rather than use other treatment options. Teeth are extracted because of extensive disease precluding other treatments, the preference of the patient and the recommendation of the dentist. Most teeth are extracted because of extensive decay but periodontal disease, and less commonly trauma and poor alignment, may also result in tooth loss.

Prevalence of complete tooth loss

The loss of all teeth is a fundamental indicator of dental impairment. Complete tooth loss, also referred to as edentulism, is a consequence of both extensive dental disease and a surgical approach to its treatment. Edentulism is relevant in the Australian population not only as a permanent 'scar' reflecting factors that have affected oral health in the past, but because people with no natural teeth have limited oral function. Despite the fact that most edentulous people wear dentures, they report poorer subjective health, on average, than people who have natural teeth (Slade & Spencer 1994).

In NSAOH complete tooth loss was assessed in the interview by asking people 'Do you have any of your own *natural* teeth'. People who answered 'no' were classified as edentulous, and they represented 6.4% of the Australian population aged 15 years or more (Table 5.1). There was a large amount of variation in the prevalence of complete tooth loss among the four generations. Complete tooth loss was virtually non-existent among people born during 1970–90, but its prevalence increased in successively larger increments for preceding generations to 35.7% among people born before 1930.

For people of all ages there was marked variation in the prevalence of complete tooth loss according to level of schooling and eligibility for dental care or dental insurance. The population group with the highest prevalence of complete tooth loss was people who completed no more than year 9 of school (21.9%), while prevalence was lowest among people who were ineligible for public dental care (2.7%). In contrast, prevalence differed only to a small degree (less than 5% in absolute terms) between the sexes, between Indigenous and non-Indigenous people, and between people who lived in capital cities compared with other places.

There was a five-fold difference in the prevalence of complete tooth loss between people who completed no more than year 9 of school (21.9%) compared with people who completed at least year 10 (4.1%). However, this large relative difference is a consequence both of the effect of schooling itself and the fact that the two groups had different age distributions within the Australian population. As described in Chapter 3.3, Australia's generations have strikingly different experiences of formal education. For example, only 58% of people aged 75 years or more had completed at least 10 years of school, compared with 93% of 15–34-year-olds. This age-related difference, coupled with the fact that prevalence of complete tooth loss is strongly associated with age, inflates the relative difference in prevalence of edentulism between school level groups when the results are compared for all age groups combined. A more accurate impression is formed by comparing prevalence within each generation. For example, in the 1950–69 generation, there was a three-fold difference in prevalence of complete tooth loss (4.8% versus 1.5%), while in the two preceding generations the relative difference was approximately two-fold (24.0% versus 10.7% in the 1930–49 generation, and 45.4% versus 28.4% in the generation born before 1930).

Table 5.1: Percentage of adults with complete tooth loss in the Australian population and in four generations

		Population: all people aged 15 years or more				
		Generation (decade of birth[a]) and age group				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**6.4**	**0.0**	**1.7**	**13.9**	**35.7**
	95%CI[b]	*6.0–6.9*	*0.0–0.1*	*1.3–2.2*	*12.7–15.2*	*32.6–38.9*
Sex						
Male	% of people	5.2	0.0	1.6	11.8	31.0
	95%CI	*4.6–5.8*	*0.0–0.1*	*1.1–2.4*	*10.1–13.7*	*26.4–36.1*
Female	% of people	7.7	0.0	1.8	16.0	38.9
	95%CI	*7.0–8.4*	—	*1.3–2.3*	*14.3–17.9*	*34.9–43.1*
Indigenous identity						
Indigenous	% of people	7.9	0.0	7.6	20.8	40.4
	95%CI	*4.4–13.8*	—	*2.5–21.4*	*10.5–37.0*	*13.1–75.2*
Non-Indigenous	% of people	6.4	0.0	1.6	13.8	35.7
	95%CI	*6.0–6.9*	*0.0–0.1*	*1.3–2.1*	*12.6–15.2*	*32.5–38.9*
Residential location						
Capital city	% of people	5.0	0.0	1.0	10.8	32.6
	95%CI	*4.5–5.5*	—	*0.7–1.4*	*9.4–12.4*	*28.6–36.9*
Other places	% of people	9.0	0.0	2.9	18.6	40.5
	95%CI	*8.2–10.0*	*0.0–0.2*	*2.1–4.1*	*16.5–21.0*	*35.7–45.6*
Year level of schooling						
Year 9 or less	% of people	21.9	0.0	4.8	24.0	45.4
	95%CI	*20.1–23.9*	—	*2.7–8.2*	*21.3–26.9*	*40.9–50.0*
Year 10 or more	% of people	4.1	0.0	1.5	10.7	28.4
	95%CI	*3.7–4.5*	*0.0–0.1*	*1.1–2.0*	*9.5–12.1*	*24.4–32.8*
Eligibility for public dental care						
Eligible	% of people	17.1	0.0	4.9	21.3	40.9
	95%CI	*15.8–18.4*	—	*3.3–7.3*	*19.4–23.3*	*37.2–44.7*
Ineligible	% of people	2.7	0.0	1.2	8.2	24.6
	95%CI	*2.4–3.0*	*0.0–0.1*	*0.9–1.5*	*6.8–9.7*	*20.3–29.5*
Dental insurance						
Insured	% of people	3.1	0.0	0.8	8.3	16.2
	95%CI	*2.7–3.5*	—	*0.5–1.3*	*6.9–9.9*	*12.5–20.8*
Uninsured	% of people	9.4	0.0	2.7	19.4	42.7
	95%CI	*8.7–10.2*	*0.0–0.1*	*2.0–3.5*	*17.5–21.4*	*39.1–46.3*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28)
(b) 95%CI = 95% CI for estimated percentage.

There was a similar six-fold difference in prevalence of complete tooth loss among all ages combined when comparing people who were eligible for public dental care (17.1%) with people who were not (2.7%). However, the same caveats concerning the age distribution of those two groups should be borne in mind. Hence, a more accurate picture of the relationship between being eligible for public dental care and complete tooth loss can be observed within generations. That pattern reveals a four-fold relative difference in prevalence for the 1950–69 generation and smaller differences for the 1930–49 generation (21.3% versus 8.2% – a less than three-fold relative difference) and

the generation born before 1930 (40.9% versus 24.6%– less than a two-fold relative difference).

Among all ages combined, the prevalence of complete tooth loss was 9.4% for the uninsured versus 3.1% for the insured. In contrast to the observations (above) for education and eligibility for public dental care, this three-fold relative difference in prevalence was not markedly attenuated within specific generations. That is, there continued to be an approximate three-fold relative difference in prevalence for the 1950–69 generation (2.7% versus 0.8%), the 1930–49 generation (19.4% versus 8.3%) and the generation born before 1930 (42.7% versus 16.2%).

While other population groups generally displayed much smaller relative differences in prevalence of complete tooth loss, the pattern observed for Indigenous and non-Indigenous Australians warrants comment. For all ages combined there was little difference in prevalence of complete tooth loss (7.9% for Indigenous Australians versus 6.4% for non-Indigenous Australians). However, the age distribution of these two groups differs, there being proportionately fewer elderly people in the Australian Indigenous population compared with the non-Indigenous population (see Table 3.6, p52). When prevalence of complete tooth loss was compared within generations, greater variation in prevalence is apparent, ranging up to the five-fold difference observed in the 1950–69 generation (7.6% among Indigenous Australians compared with 1.6% among non-Indigenous Australians). Yet while that difference exceeds the relative differences observed for other characteristics (education, eligibility for dental care and dental insurance), there is an additional caveat concerning the margin of error in the estimates for the Indigenous group. That is, the estimate of 7.6% prevalence for Indigenous people in the 1950–69 generation has a wide 95% CI of 4.4–13.8%. This means that there is a high probability that the relative difference could range from much smaller to much larger ratios than the five-fold relative difference noted here.

In summary, education, eligibility for public dental care, and dental insurance were all strongly associated with prevalence of complete tooth loss (generally, between two-three-fold relative difference) when considered within generations. As reported elsewhere, these characteristics were associated with several other measures of oral health.

Inadequate natural dentition among dentate people

Traditionally, dentists have aimed to retain an optimal number of teeth consistent with oral function and appearance. To attain that goal, dentists sometimes recommend removal of selected teeth such as four wisdom teeth and four premolars to create sufficient space for the remaining 24 teeth. Nonetheless, many people with fewer than 24 teeth report acceptable levels of function and appearance. In recent decades the concept of an adequate natural dentition has been developed in an attempt to define a threshold of tooth loss that is consistent with professional judgements about function and appearance. An extensive review of the literature concluded that 20 natural teeth were sufficient for satisfactory chewing function (Elias & Sheiham 1998), diet and nutritional status (Sheiham et al. 2002). In contrast, adults with fewer than 20 teeth

were more likely to suffer impaired oral health related quality of life compared to adults with more teeth (McGrath & Bedi 2002).

Others have used case definitions that differ marginally in the number of remaining teeth or that consider other criteria such as position of remaining teeth. For example, the UK adult dental health survey used a threshold of 21 teeth when reporting the percentage of people with an adequate dentition (Kelly et al. 2000). That same threshold was used in Table 5.2 to report the percentage of people who had fewer than 21 teeth, providing an indicator of professionally defined inadequacy of the natural dentition. Excluded from the table were the 6.4% of Australians who have no natural teeth.

In the Australian population of dentate adults, 11.4% of people had fewer than 21 teeth (Table 5.2). The prevalence of an inadequate natural dentition varied considerably among generations, it was virtually non-existent in the 1970–90 generation, yet affected more than half of those in the pre-1930 generation.

Box 5.1 Healthy 'dental ageing'

While a majority of Australians born before 1930 had fewer than 21 natural teeth, this level of tooth loss is by no means an inevitable consequence of ageing.

Dan Barlow, born in the 1910s, has reached his 90s with most of his natural teeth.

Over the years I suppose I've had four teeth extracted. Mainly my wisdom teeth. It was the dentist's recommendation in all cases. They made the decisions because of dental decay getting to the stage where reconstruction was no longer possible.

–Excerpt from Dan Barlow's oral history (see Chapter 4.2, page 62)

Among all ages combined, the lowest proportion of people with fewer than 21 teeth was observed among those ineligible for public dental care (6.7%), while the highest proportion was seen among people who had achieved year 9 or less of schooling (34.0%). Prevalence of an inadequate natural dentition varied considerably according to year of schooling, eligibility for public dental care, dental insurance and usual reason for making a dental visit. However, there were only small differences in prevalence among the other subgroups defined by sex, residential location and Indigenous identity.

Among all ages combined, there was a four-fold relative difference in prevalence in relation to level of schooling. The relative difference associated with schooling was equally as pronounced within the 1950–69 generation (23.8% versus 5.8%). However, the relative difference diminished in the two older generations to become a 1.3-fold difference within the pre-1930 generation. This diminution in relative effect was an inevitable consequence of the markedly greater prevalence of dentition inadequacy in that generation.

Table 5.2: Percentage of people with fewer than 21 teeth in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a]) and age group				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**11.4**	**0.4**	**6.8**	**28.6**	**55.1**
	95%CI[b]	*10.7–12.1*	*0.2–0.6*	*6.0–7.8*	*26.6–30.7*	*51.0–59.2*
Sex						
Male	% of people	10.6	0.1	6.6	26.6	56.3
	95%CI	*9.7–11.5*	*0.0–0.3*	*5.4–8.1*	*24.0–29.4*	*49.9–62.5*
Female	% of people	12.2	0.7	7.0	30.7	54.2
	95%CI	*11.4–13.2*	*0.4–1.2*	*5.9–8.3*	*28.3–33.2*	*49.3–59.1*
Indigenous identity						
Non-Indigenous	% of people	11.4	0.4	6.8	28.4	55.4
	95%CI	*10.7–12.1*	*0.2–0.7*	*6.0–7.8*	*26.5–30.5*	*51.2–59.5*
Indigenous	% of people	10.4	0.0	8.6	43.2	n.p.
	95%CI	*6.0–17.4*	—	*2.3–27.4*	*27.8–59.9*	n.p.
Residential location						
Capital city	% of people	10.0	0.4	6.0	25.5	52.5
	95%CI	*9.2–10.9*	*0.2–0.8*	*5.0–7.2*	*23.0–28.2*	*47.1–57.7*
Other places	% of people	14.0	0.4	8.4	33.8	59.8
	95%CI	*12.8–15.2*	*0.2–0.8*	*7.0–10.0*	*30.7–37.0*	*53.4–66.0*
Year level of schooling						
Year 9 or less	% of people	34.0	0.6	23.8	45.2	64.6
	95%CI	*31.3–36.8*	*0.2–2.4*	*18.2–30.5*	*40.9–49.7*	*58.5–70.3*
Year 10 or more	% of people	8.6	0.4	5.8	24.1	49.6
	95%CI	*8.0–9.3*	*0.2–0.6*	*5.0–6.7*	*22.1–26.3*	*44.4–54.8*
Eligibility for public dental care						
Eligible	% of people	27.1	0.6	13.9	43.7	59.1
	95%CI	*25.3–29.0*	*0.3–1.4*	*11.0–17.4*	*40.7–46.7*	*53.8–64.2*
Ineligible	% of people	6.7	0.3	5.7	18.6	48.6
	95%CI	*6.2–7.3*	*0.2–0.6*	*4.9–6.7*	*16.4–21.0*	*42.0–55.2*
Dental insurance						
Insured	% of people	8.2	0.3	4.0	19.6	50.2
	95%CI	*7.4–9.1*	*0.1–0.9*	*3.1–5.1*	*17.4–22.0*	*43.1–57.2*
Uninsured	% of people	14.6	0.4	10.0	38.6	57.8
	95%CI	*13.6–15.7*	*0.2–0.8*	*8.6–11.6*	*35.8–41.4*	*52.5–62.9*
Usually visit dentist						
For a check-up	% of people	7.8	0.3	3.3	19.3	45.1
	95%CI	*7.1–8.5*	*0.1–0.7*	*2.5–4.3*	*17.3–21.5*	*39.9–50.4*
For a dental problem	% of people	16.1	0.5	10.8	40.9	70.0
	95%CI	*15.0–17.3*	*0.2–0.9*	*9.3–12.4*	*37.9–44.1*	*64.2–75.3*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

While there was a four-fold relative difference in prevalence associated with eligibility for public dental care when all ages were considered (27.1% versus 6.7%), the relative difference was smaller within individual generations. The difference is related to variations in eligibility for dental care among generations (see Table 3.6, page 52). Because eligibility for public care itself varies so much among generations, the contrast in prevalence between eligible and ineligible people of all ages combined yielded an inflated difference. The inflation occurs because the contrast based on all ages represents a mixing of two effects: one due to the greater likelihood of an inadequate dentition among those who are eligible compared with those who are ineligible, and the other due to the generally greater age of the eligible population.

Residential location was associated with only a small difference in prevalence of an inadequate natural dentition: 10.0% in capital cities, compared with 14.0% in other locations.

In summary, the percentage of dentate Australian adults who had fewer than 21 teeth was associated with generation, education, eligibility for public dental care, usual reason for making a dental visit and dental insurance.

Denture wearing by dentate people

Removable dentures, also called 'false teeth' are worn to replace missing teeth, with the objective to improve function (for example, eating), appearance or both. The need for dentures therefore arises only after the loss of one or more teeth. Among dentate people a removable denture may replace a single tooth or larger numbers of teeth. Dentate people who have had all teeth extracted from one jaw usually wear one 'complete denture' to replace all those teeth, and they may wear an additional 'partial denture' replacing the teeth missing in the other jaw. However, the decision to have a denture fitted and to wear it is not dictated solely by the number of missing teeth. For example, most individuals who have lost a single front tooth choose to replace it by one means or another. Conversely, many people who have lost only a few back teeth find that they can manage without a denture. As well, there are alternative treatments to replace one or a few teeth, including 'bridges' that are fixed to adjacent natural teeth, or dental implants that are surgically inserted into the jaw.

In NSAOH removable denture wearing was assessed by asking one question, 'Do you have a denture or false teeth for your upper jaw' and a second, similar question regarding the lower jaw. If queried, interviewers clarified that the questions were limited to removable dentures. The results in Table 5.3 are limited to dentate people, of whom 14.9% reported wearing one or more dentures. The percentage varied markedly among generations, from only 1.5% among 15–34-year-olds to 61.2% among people aged 75 years or more. Each of those percentages was marginally greater than the corresponding percentage with an inadequate dentition as reported previously (Table 5.2).

Among all age groups combined the most pronounced differences in denture wearing were associated with educational attainment and eligibility for public dental care. Denture wearing was three times as likely among people who had year 9 schooling or

less (36.0%) compared with people who had completed year 10 or more at school (12.4). As observed for other tables, this magnitude of difference diminished when the contrast was made within generations. That is, for the 1950–69 generation there was an approximate two-fold difference in frequency of denture wearing between those with year 9 or less of schooling (22.8%) compared with those who completed year 10 or more (9.6%). The relative difference between education groups was narrower for the 1930–49 generation and the pre-1930 generation. The smaller relative difference observed within generations than for all ages combined is attributable to the fact that the duration of schooling itself is strongly associated with age.

Similarly, there was a three-fold relative difference in frequency of denture wearing among people eligible for public dental care (30.1%) compared with ineligible people (10.4%). Again, however, the relative difference associated with eligibility became smaller when the comparison was made within generations. Yet even in the earliest generation, those born before 1930, there was a markedly higher frequency of denture wearing among those eligible for public dental care (64.2%) compared with those who were not (56.3%).

Dental insurance and usual pattern of dental attendance were associated with an approximate 1.5-fold relative difference in frequency of denture wearing. Consistent with patterns observed in previous tables, it was the uninsured who were more likely to wear dentures than the insured, while people who usually visit the dentist for dental problems were more likely to wear dentures than those who usually attend for a check-up. The observed 1.5-fold difference in frequency of denture wearing associated with both characteristics was of a similar magnitude when the comparison was made within generations, at least for the three generations born since 1930.

There were much smaller differences in frequency of denture wearing among groups classified according to sex, Indigenous identity and residential location.

At first it might appear informative to compare the percentage who are denture wearers (Table 5.3) with the percentage who have an inadequate natural dentition (Table 5.2). For the Australian population the figures were 14.9% and 11.4%, respectively, a ratio of 1.3. In the most recent generation the ratio was higher (1.5% versus 0.4%, a ratio of 3.8), whereas it was lower among the pre-1930 generation (61.2% versus 55.1%, a ratio of 1.1). However, such comparisons are largely meaningless, in part because it is not simply the number of missing teeth that dictates a decision to wear dentures (as explained on page 87), and in part because ratios are not necessarily informative when there are large differences in the magnitude of the numbers being compared.

In summary, 14.9% of dentate Australian adults wore one or two removable dentures. Denture wearing was strongly associated with educational attainment and eligibility for public dental care. Although smaller in magnitude, differences were also observed in association with dental insurance and usual reason for dental attendance.

Table 5.3: Percentage of dentate people who wear denture(s)

		Population: dentate people				
		Generation (decade of birth[a]) and age group				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**14.9**	**1.5**	**10.3**	**36.0**	**61.2**
	95%CI[b]	*14.2–15.7*	*1.0–2.1*	*9.3–11.4*	*34.1–37.9*	*57.5–64.8*
Sex						
Male	% of people	14.4	1.8	9.8	35.1	60.9
	95%CI	*13.3–15.5*	*1.1–3.1*	*8.3–11.6*	*32.5–37.7*	*54.6–66.8*
Female	% of people	15.5	1.1	10.8	37.0	61.4
	95%CI	*14.5–16.5*	*0.7–1.7*	*9.6–12.2*	*34.4–39.6*	*56.7–65.9*
Indigenous identity						
Non-Indigenous	% of people	15.0	1.5	10.3	35.8	61.5
	95%CI	*14.2–15.7*	*1.0–2.2*	*9.3–11.5*	*33.9–37.7*	*57.7–65.1*
Indigenous	% of people	11.5	0.9	5.3	53.5	12.2
	95%CI	*6.9–18.6*	*0.1–6.1*	*2.1–12.8*	*34.6–71.4*	*1.4–56.8*
Residential location						
Capital city	% of people	13.4	1.3	9.1	33.2	59.4
	95%CI	*12.5–14.4*	*0.8–1.9*	*7.8–10.5*	*30.9–35.7*	*54.4–64.1*
Other places	% of people	17.8	1.9	12.6	40.6	64.3
	95%CI	*16.5–19.3*	*0.9–3.7*	*11.0–14.4*	*37.7–43.6*	*58.8–69.5*
Year level of schooling						
Year 9 or less	% of people	36.0	0.9	22.8	49.2	67.9
	95%CI	*33.3–38.8*	*0.3–2.8*	*17.4–29.2*	*45.0–53.4*	*61.8–73.5*
Year 10 or more	% of people	12.4	1.5	9.6	32.4	57.2
	95%CI	*11.6–13.2*	*1.0–2.2*	*8.6–10.7*	*30.3–34.6*	*52.3–62.0*
Eligibility for public dental care						
Eligible	% of people	30.1	2.3	14.4	48.3	64.2
	95%CI	*28.1–32.0*	*1.3–4.1*	*11.6–17.8*	*45.5–51.0*	*59.2–68.8*
Ineligible	% of people	10.4	1.3	9.7	27.9	56.3
	95%CI	*9.7–11.2*	*0.8–2.1*	*8.6–10.8*	*25.4–30.4*	*49.6–62.7*
Dental insurance						
Insured	% of people	12.7	1.3	7.9	29.8	57.4
	95%CI	*11.7–13.8*	*0.7–2.4*	*6.7–9.3*	*27.2–32.5*	*51.0–63.6*
Uninsured	% of people	17.3	1.7	13.0	42.8	63.2
	95%CI	*16.1–18.5*	*1.0–2.7*	*11.5–14.7*	*40.1–45.6*	*58.3–67.7*
Usually visit dentist						
For a check-up	% of people	12.0	0.9	7.2	29.4	55.1
	95%CI	*11.1–12.9*	*0.5–1.5*	*6.1–8.6*	*27.1–31.8*	*50.0–60.1*
For a dental problem	% of people	18.8	2.3	13.8	44.9	70.4
	95%CI	*17.6–20.1*	*1.4–3.8*	*12.2–15.7*	*41.9–48.0*	*64.7–75.4*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Severity of tooth loss

Teeth may be missing for a number of reasons. The reasons include dental diseases such as dental decay and periodontal (gum) diseases, but teeth may also be missing because they did not erupt into the mouth, were extracted for orthodontic reasons or because they did not grow into the mouth correctly (were impacted). The average number of teeth missing for any reason, in people who have at least one natural tooth, has been presented in Table 5.4.

In the Australian population the average number of missing teeth among those with at least one of their natural teeth was 6.1. The number of missing teeth increased across the generations, with the 1970–90 an average of 3.5 teeth, the 1950–69 generation an average of 5.3 (1.5 times the most recent generation), the 1930–49 generation an average of 10.2 missing teeth (an almost three-fold increase over the most recent generation) and the pre-1930 generation an average of 14.1 teeth (four times the number in the most recent generation) missing for any reason. These generational differences may reflect an ageing process, with more extensive disease experience the longer teeth have been in the mouth, or they may reflect different dental treatment practices over generations. For instance, dental extraction for dental decay may have been more common in earlier periods whereas dental extractions for orthodontic treatment may be more common in younger groups.

Across all ages the highest average number of missing teeth occurred for people who completed year 9 or less at school (10.0) whereas the lowest was seen among people ineligible for public dental care (5.2). Differences in numbers of missing teeth were associated with sex, residential location, education, eligibility for public dental care, dental insurance and usual reason for making a dental visit.

Table 5.4: Average number of missing teeth for any reasons per person in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**mean**	**6.1**	**3.5**	**5.3**	**10.2**	**14.1**
	95%CI [b]	*5.9–6.3*	*3.4–3.7*	*5.0–5.5*	*9.7–10.7*	*13.1–15.1*
Sex						
Male	mean	5.8	3.3	4.9	10.2	14.7
	95%CI	*5.5–6.1*	*3.0–3.6*	*4.6–5.3*	*9.4–10.9*	*13.2–16.2*
Female	mean	6.4	3.8	5.6	10.3	13.7
	95%CI	*6.1–6.6*	*3.6–4.1*	*5.3–5.9*	*9.7–10.9*	*12.4–14.9*
Indigenous identity						
Indigenous	mean	7.4	4.0	7.4	13.1	n.p.
	95%CI	*5.9–8.9*	*2.8–5.2*	*5.4–9.5*	*9.8–16.4*	*n.p.*
Non-Indigenous	mean	6.1	3.5	5.3	10.2	14.2
	95%CI	*5.9–6.3*	*3.4–3.7*	*5.0–5.5*	*9.7–10.7*	*13.2–15.2*
Residential location						
Capital city	mean	5.7	3.5	5.0	9.5	13.3
	95%CI	*5.5–6.0*	*3.2–3.7*	*4.7–5.3*	*8.9–10.1*	*12.0–14.6*
Other places	mean	6.8	3.7	5.9	11.4	15.6
	95%CI	*6.5–7.2*	*3.4–4.0*	*5.3–6.4*	*10.7–12.1*	*14.0–17.1*
Year level of schooling						
Year 9 or less	mean	10.0	n.p.	7.8	12.6	15.5
	95%CI	*9.3–10.8*	*n.p.*	*6.5–9.2*	*11.7–13.5*	*13.7–17.3*
Year 10 or more	mean	5.6	3.5	5.1	9.5	13.4
	95%CI	*5.4–5.8*	*3.3–3.7*	*4.9–5.4*	*9.0–10.0*	*12.2–14.6*
Eligibility for public dental care						
Eligible	mean	8.7	3.5	6.3	12.5	15.1
	95%CI	*8.1–9.2*	*3.1–3.8*	*5.4–7.1*	*11.9–13.2*	*13.9–16.3*
Ineligible	mean	5.2	3.6	5.1	8.5	12.4
	95%CI	*5.0–5.4*	*3.4–3.8*	*4.8–5.3*	*8.0–9.0*	*10.7–14.2*
Dental insurance						
Insured	mean	5.8	3.8	4.9	8.8	12.8
	95%CI	*5.5–6.0*	*3.5–4.1*	*4.7–5.2*	*8.2–9.5*	*10.9–14.6*
Uninsured	mean	6.5	3.4	5.6	11.8	14.8
	95%CI	*6.2–6.8*	*3.1–3.6*	*5.2–6.1*	*11.2–12.4*	*13.6–15.9*
Usually visit dentist						
For a check-up	mean	5.5	3.5	4.7	8.6	12.0
	95%CI	*5.2–5.7*	*3.3–3.8*	*4.4–5.0*	*8.2–9.1*	*10.7–13.2*
For a dental problem	mean	6.9	3.6	5.9	12.3	17.1
	95%CI	*6.6–7.3*	*3.3–3.9*	*5.6–6.3*	*11.5–13.1*	*15.6–18.6*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated mean.

The greatest relative difference in the average number of missing teeth for any reason was related to year level of schooling, people with year 9 or less (10.0) having 1.8 times the number of missing teeth of people who completed year 10 or more (5.6). In the 1930–49 generation people who had completed year 9 or less had an average of 1.3 times more missing teeth (12.6) compared to those who left school later (9.5). People who had completed year 9 or less in the 1950–69 generation had 1.5 times the number of missing teeth of those who had finished year 10 or above (7.8 versus 5.1).

People eligible for public dental care had 1.7 times the number of missing teeth compared to ineligible people (8.7 versus 5.2). Relative differences were seen in the 1950–69 generation, where eligible people had 1.2 times more missing teeth than ineligible people (6.3 versus 5.1) and in the 1930–49 generation, where eligible people had 1.5 times more missing teeth than ineligible people (12.5 versus 8.5). Long waiting lists in the public dental sector may result in late presentation of dental problems necessitating extraction, which may be the treatment of choice of either the patient or the dentist. In the younger age groups extraction for dental disease among eligible people may be counterbalanced by orthodontic extractions in the ineligible group.

People who usually visit the dentist for a dental problem had 1.3 times the number of missing teeth (6.9) than those who visit for a check-up (5.5). In the 1950–69 generation people who visit for a problem had 1.3 times the number of missing teeth as people who visit for a check-up (5.9 versus 4.7), whereas in both the earlier generations there was a 1.4-fold relative difference in the number of teeth missing for any reason (12.3 versus 8.6 and 17.1 versus 12.0) between those who visit for a problem and those who visit for a check-up. Making a dental visit for a problem or when one has symptoms means that the disease process is likely to be more advanced and more likely to result in extraction of the tooth than when one makes an asymptomatic visit.

Residential location was also associated with number of missing teeth, with non-capital city dwellers having 1.2 times more missing teeth (6.8) than those in capital cities (5.7). When examined by generation, only in the 1930–49 generation was there a small difference, where people living outside capital cities had 1.2 times more missing teeth (11.4) than people in capital cities (9.5).

Small differences were also seen associated with dental insurance, whereby uninsured people had more missing teeth (6.5) than insured people (5.8). Differences were also seen in the 1950–69 and 1930–49 generations, where uninsured people had 1.1 and 1.3 times, respectively, the number of missing teeth of insured people.

Among people of all ages females had more missing teeth than males (6.4 versus 5.8).

In summary, the average number of missing teeth for any reason per dentate person was strongly related to the generation in which people were born. It was also related to education, eligibility for public dental care, usual reason for dental visiting, dental insurance, residential location and sex.

Severity of tooth loss due to pathology

In order to make an estimation of the average number of teeth missing due dental decay and periodontal (gum) disease, an assessment was made of the reason for missing teeth in people less than 45 years of age at the time of examination. This meant that teeth which were missing for reasons other than decay or gum disease could be excluded from the analysis. In older people the assumption was made that missing teeth had been extracted for dental disease. Teeth missing due to pathology may be extracted because of extensive disease, which makes other treatments very difficult, very expensive or impossible, or because of the preference of the patient or the dentist.

In the Australian population of dentate adults, the average number of teeth missing due to pathology was 4.5 (Table 5.5). The number of missing teeth increased across the generations, with the 1970–90 generation having an average of 0.8 teeth missing due to pathology, the 1950–69 generation an average of 3.9 (4.9 times the 1970–90 generation), the 1930–49 generation an average of 10.2 (12.8 times the latest generation) and the pre-1930 generation an average of 14.1 teeth missing (17.6 times).

Among all ages people with year 9 or less of schooling had the highest average number of missing teeth (9.0) and people ineligible for public dental care the lowest (3.5). The average number of teeth missing due to pathology was associated with years of schooling, eligibility for public dental care, usual reason for dental visiting, residential location and dental insurance.

An association was seen between missing teeth and educational attainment, with people with fewer years of schooling having 2.3 times more teeth missing due to pathology (9.0) than people who left school later (4.0). In the 1950–69 generation people with year 9 or less of schooling had 1.9 times more teeth missing due to pathology (7.1) than people with year 10 or more (3.7); while among the 1930–49 generation people who had completed year 9 or less had 1.3 times more missing teeth (12.5) than people who had completed year 10 or more (9.4).

People eligible for public dental care had 2.2 times more missing teeth than those ineligible for such care (7.6 versus 3.5). There was a 1.4-fold difference between people who were eligible for public care (5.1) and people ineligible (3.7) among those born between 1950 and 1969. In the 1930–49 generation people eligible had 1.5 times more missing teeth (12.5) than those ineligible (8.4). Eligibility for public dental care may reflect lack of affordability of timely private dental care or use of the public system where there are long waiting lists restricting access. Thus, early intervention in the disease process may be limited and late presentation may result in extraction.

Table 5.5: Average number of missing teeth for pathology per person in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**mean**	**4.5**	**0.8**	**3.9**	**10.2**	**14.1**
	95%CI [b]	*4.3–4.8*	*0.6–0.9*	*3.6–4.2*	*9.7–10.7*	*13.1–15.1*
Sex						
Male	mean	4.5	0.9	3.7	10.1	14.6
	95%CI	*4.1–4.8*	*0.6–1.1*	*3.4–4.1*	*9.4–10.8*	*13.0–16.2*
Female	mean	4.6	0.7	4.1	10.2	13.7
	95%CI	*4.3–4.9*	*0.6–0.9*	*3.7–4.4*	*9.6–10.8*	*12.4–14.9*
Indigenous identity						
Indigenous	mean	5.9	0.5	6.6	13.1	n.p.
	95%CI	*3.9–8.0*	*0.0–1.2*	*4.2–9.0*	*9.8–16.4*	*n.p.*
Non-Indigenous	mean	4.5	0.8	3.9	10.1	14.1
	95%CI	*4.3–4.8*	*0.6–0.9*	*3.6–4.2*	*9.6–10.6*	*13.1–15.1*
Residential location						
Capital city	mean	4.1	0.7	3.6	9.4	13.3
	95%CI	*3.8–4.4*	*0.5–0.9*	*3.2–3.9*	*8.7–10.1*	*12.0–14.5*
Other places	mean	5.4	0.9	4.5	11.4	15.6
	95%CI	*4.9–5.8*	*0.6–1.2*	*4.0–5.1*	*10.7–12.1*	*14.0–17.1*
Year level of schooling						
Year 9 or less	mean	9.0	n.p.	7.1	12.6	15.5
	95%CI	*8.1–9.9*	*n.p.*	*5.6–8.6*	*11.6–13.4*	*13.7–17.3*
Year 10 or more	mean	4.0	0.8	3.7	9.4	13.2
	95%CI	*3.7–4.2*	*0.6–0.9*	*3.4–4.0*	*8.9–9.9*	*12.1–14.6*
Eligibility for public dental care						
Eligible	mean	7.6	0.8	5.1	12.6	15.1
	95%CI	*7.0–8.2*	*0.5–1.0*	*4.2–6.0*	*11.9–13.2*	*13.9–16.3*
Ineligible	mean	3.5	0.8	3.7	8.4	12.4
	95%CI	*3.3–3.7*	*0.6–1.0*	*3.4–4.0*	*7.8–8.9*	*10.5–14.2*
Dental insurance						
Insured	mean	4.2	0.7	3.5	8.7	12.7
	95%CI	*3.8–4.5*	*0.5–1.0*	*3.2–3.8*	*8.0–9.4*	*10.9–14.6*
Uninsured	mean	5.0	0.8	4.4	11.8	14.7
	95%CI	*4.7–5.4*	*0.7–1.0*	*3.9–4.8*	*11.1–12.4*	*13.5–15.9*
Usually visit dentist						
For a check-up	mean	3.8	0.6	3.3	8.5	11.9
	95%CI	*3.5–4.1*	*0.4–0.8*	*3.0–3.6*	*8.1–9.0*	*10.6–13.2*
For a dental problem	mean	5.5	1.0	4.6	12.3	17.0
	95%CI	*5.1–5.9*	*0.8–1.3*	*4.2–5.1*	*11.5–13.1*	*15.5–18.6*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated mean.

Usual reason for making a dental visit was associated with missing teeth among all ages, with people who usually visit for a problem having 1.4 times more missing teeth (5.5) than people who usually visit for a check-up (3.8). This association was seen across all generations. In the 1970–90 generation people who sought care for a problem had 1.7 times more missing teeth than people who visited for a check-up (1.0 versus

0.6). The relationship was similar in other generations: in the 1950–69 generation people who visited for a problem had 1.4 times more missing teeth (4.6 versus 3.3), in the 1930–49 generation 1.4 times (12.3 versus 8.5) and in the pre-1930 generation also 1.4 times more missing teeth than those who sought care for a check-up (17.0 versus 11.9).

People of all ages living outside capital cities had 1.3 times more missing teeth than those in capital cities (5.4 versus 4.1). This was also seen in the 1950–69 generation where non-capital city dwellers had 1.3 times more missing teeth than capital city dwellers (4.5 versus 3.6); and in the 1930–49 generation, where people outside capital cities had 1.2 times more teeth missing due to pathology than people in capital cities (11.4 versus 9.4).

Dental insurance was associated with the number of teeth missing due to pathology, and was higher among people without dental insurance. In people of all ages uninsured people had 1.2 times more missing teeth than those with insurance (5.0 versus 4.2). In the 1950–69 generation people without insurance had 1.3 times more missing teeth than insured people (4.4 versus 3.5), and a similar difference was seen in the 1930–49 generation (11.8 versus 8.7). Usually visiting for a dental problem, residing outside a capital city and not having dental insurance are all related to reduced access to dental care, which may result in higher extraction rates.

In summary, the average number of teeth missing due to pathology was strongly associated with age. It was also associated with education, eligibility for public dental care, usual reason for making a dental visit, residential location and dental insurance.

Replacement of missing teeth

Missing teeth can be replaced by removable dentures, fixed prostheses such as bridges or, in recent years, implants. Table 5.6 reports on the average number of missing teeth that had been replaced by removable dentures and fixed prostheses among dentate people. Only 60 implants were seen in the 5,505 examinations and they have not been included in this table.

The average number of missing and replaced teeth per person is related to access to care (as those who obtain dental care late in the disease process are more likely to have an extraction), the type of dental treatment (as extractions were more common in earlier times) and the need and desire for replacement to restore function.

The number of missing teeth replaced on average per person in the Australian population was 1.3. This number was strongly associated with age. In the most recent generation no teeth were replaced on average and in the 1950–69 generation 0.6 teeth were missing and replaced. Among those born in 1930–49 there were 3.6 teeth missing and replaced, six times that of the 1950–69 cohort, while people in the pre-1930 generation had 7.1 replaced teeth, 11.8 times that of people born in 1950–69.

Table 5.6: Average number of missing teeth replaced by prostheses per person in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**mean**	**1.3**	**0.0**	**0.6**	**3.6**	**7.1**
	95%C [b]	*1.2–1.5*	*0.0–0.1*	*0.4–0.7*	*3.2–4.0*	*6.0–8.3*
Sex						
Male	mean	1.3	0.1	0.5	3.4	8.6
	95%CI	*1.1–1.5*	*0.0–0.1*	*0.3–0.7*	*2.9–3.9*	*6.9–10.2*
Female	mean	1.4	0.0	0.7	3.8	6.1
	95%CI	*1.2–1.6*	*0.0–0.1*	*0.5–0.9*	*3.3–4.4*	*4.6–7.5*
Indigenous identity						
Indigenous	mean	1.4	0.0	0.2	6.7	n.p.
	95%CI	*0.4–2.5*	*0.0–0.0*	*0.0–0.6*	*3.3–10.1*	*n.p.*
Non-Indigenous	mean	1.3	0.0	0.6	3.6	7.2
	95%CI	*1.2–1.5*	*0.0–0.1*	*0.5–0.8*	*3.2–3.9*	*6.1–8.3*
Residential location						
Capital city	mean	1.1	0.0	0.5	3.2	6.5
	95%CI	*1.0–1.3*	*0.0–0.1*	*0.3–0.6*	*2.7–3.7*	*5.1–7.8*
Other places	mean	1.7	0.1	0.8	4.3	8.3
	95%CI	*1.5–2.0*	*0.0–0.1*	*0.5–1.1*	*3.7–4.9*	*6.4–10.3*
Year level of schooling						
Year 9 or less	mean	3.5	n.p.	1.7	4.7	8.5
	95%CI	*2.9–4.1*	*n.p.*	*0.9–2.6*	*3.9–5.6*	*6.4–10.5*
Year 10 or more	mean	1.1	0.1	0.5	3.3	6.5
	95%CI	*0.9–1.2*	*0.0–0.1*	*0.4–0.7*	*2.8–3.7*	*5.2–7.8*
Eligibility for public dental care						
Eligible	mean	2.8	0.0	0.6	4.9	8.1
	95%CI	*2.5–3.2*	*0.0–0.0*	*0.3–1.0*	*4.3–5.5*	*6.7–9.5*
Ineligible	mean	0.8	0.1	0.6	2.6	5.5
	95%CI	*0.7–1.0*	*0.0–0.1*	*0.4–0.8*	*2.1–3.1*	*3.7–7.3*
Dental insurance						
Insured	mean	1.1	0.1	0.5	2.8	5.8
	95%CI	*0.9–1.2*	*0.0–0.1*	*0.3–0.6*	*2.3–3.2*	*3.9–7.7*
Uninsured	mean	1.6	0.0	0.7	4.6	7.8
	95%CI	*1.4–1.9*	*0.0–0.1*	*0.5–0.9*	*4.0–5.2*	*6.4–9.1*
Usually visit dentist						
For a check-up	mean	1.0	0.0	0.4	2.8	5.5
	95%CI	*0.9–1.2*	*0.0–0.0*	*0.2–0.5*	*2.3–3.2*	*4.2–6.9*
For a dental problem	mean	1.8	0.1	0.9	4.7	9.4
	95%CI	*1.5–2.0*	*0.0–0.2*	*0.6–1.1*	*4.1–5.3*	*7.5–11.2*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated mean.

Among people of all ages the average number of missing and replaced teeth was associated with residential location, year of schooling, eligibility for public dental care, dental insurance and usual reason for dental visiting. The highest average number of missing and replaced teeth was seen in people who had left school at year 9 or earlier (3.5) and the lowest among people ineligible for public dental care (0.8).

Those eligible for public dental care had 3.5 times more replaced teeth (2.8) than ineligible people (0.8). The differences across the generations were small except in the 1930–49 generation, where eligible people had 1.9 times more replaced teeth than ineligible people (4.9 versus 2.6).

Years of schooling was also associated with numbers of missing and replaced teeth, with people with less schooling having 3.2 times more replaced teeth (3.5) than people who left school later (1.1). The difference was not seen in the pre–1930 generation but was evident in the 1950–69 generation, where people who completed year 9 or less at school had 3.4 times more replaced teeth (1.7) than those who left school at year 10 or later (0.5). It was also evident in the 1930–49 generation where people who left school earlier had 1.4 times more replaced teeth than people who left school later (4.7 versus 3.3).

People who usually made a dental visit because of a problem had 1.8 times more replaced teeth than those who visited for a check-up (1.8 versus 1.0). This association was evident in all generations except the most recent. In the 1950–69 generation there was a 2.3-fold relative difference between people who visited for a problem (0.9) and people who visited for a check-up (0.4), and in the 1930–49 generation a 1.7-fold relative difference (4.7 versus 2.8 replaced teeth). The association in the pre–1930 generation was similar where people who visited for a problem had 1.7 times more missing and replaced teeth than people who visited for a check-up (9.4 versus 5.5).

Smaller relative differences were seen between people who lived in areas other than capital cities (1.7) and people who lived in capital cities (1.1), a 1.5 times difference. A 1.3-fold relative difference was seen in the 1930–49 generation between people outside capital cities (4.3) and capital city dwellers (3.2).

Similarly, people without dental insurance had 1.5 times more missing and replaced teeth (1.6) compared to those with insurance (1.1). Again this was evident in the 1930–49 generation, where there was a 1.6-fold relative difference between people without insurance (4.6) and people with insurance (2.8).

In addition, an association between average number of missing and replaced teeth and sex was seen in the pre-1930 generation, where males had 1.4 times more replaced teeth (8.6) than females (6.1).

In summary, the average number of missing and replaced teeth was strongly associated with generation of birth. It was also associated with eligibility for public dental care, years of schooling, usual reason for making a dental visit, residential location, dental insurance and sex.

Summary of findings regarding tooth loss

Complete tooth loss was reported by 6.4% of Australians but 11.4% had fewer than 21 natural teeth. Of dentate people 14.9% reported wearing dentures replacing an average of 1.3 teeth. The average number of missing teeth per person was 6.1, with 4.5 missing due to caries or periodontal disease.

Table 5.7: Summary of tooth loss and tooth replacement

	% of people with:			Average number of teeth:		
	Complete tooth loss	<21 teeth	Dentures	Missing for any reason	Missing due to pathology	Missing and replaced
Generation						
Ref[(a)] = 1970–90						
1950–69	↑	↑	↑	↑	↑	↑
1930–49	↑↑	↑↑	↑↑	↑	↑↑	↑
Pre–1930	↑↑	↑↑	↑↑	↑↑	↑↑	↑↑
Sex						
Ref = Male						
Female	↑	~	~	~	~	~
Indigenous identity						
Ref = Non-Indigenous						
Indigenous	~	~	~	~	~	~
Residential location						
Ref = Capital Cities						
Other places	↑	↑	↑	↑	↑	↑
Year level of schooling						
Ref = Year 10 or morel						
Year 9 or less	↑↑	↑↑	↑↑	↑	↑	↑
Eligibility for public dental						
Ref = Ineligible						
Eligible	↑↑	↑↑	↑↑	↑	↑	↑
Dental Insurance						
Ref = Insured						
Uninsured	↑	↑	↑	↑	↑	↑
Usually visit dentist						
Ref = For a check-up	..					
For a dental problem	..	↑	↑	↑	↑	↑

(a) Ref: reference group; ↓↓: markedly lower; ↓: lower; ~: not sig. different; ↑: higher; ↑↑: markedly higher

As summarised in Table 5.7, age was strongly associated with all measures of tooth loss presented in the previous six tables. Compared with the 1970–90 generation, each preceding generation had markedly higher percentage measures of tooth loss and tooth replacement reported, and for the pre–1930 generation, there were markedly greater average numbers of teeth missing or replaced. Markedly higher percentage measures of tooth loss and tooth replacement were observed also for people eligible for public dental care compared to ineligible people, and for people with year 9 schooling or less compared to people who had completed at least year 10. Differences between other groups were less pronounced. Females were more likely to have

complete tooth loss compared with males. People living in places other than capital cities had higher prevalence and extent of tooth loss and higher rate of tooth replacement. A consistent association was observed with dental insurance status and usual reason for dental visit.

5.2 Experience of dental decay

Dental decay is a process in which the hard mineral structure of teeth is dissolved by acids produced by bacteria. The process produces a cavity on the crown of the tooth or a softening of the root surface. In its early stages the damage can be reversed with use of fluoride. Once a cavity has formed a filling is needed to restore the form and function of the tooth. If decay is left untreated pain and infection may occur. Coronal decay may be asymptomatic in its early stages and without regular dental care people are often unaware of the condition, whereas those who usually seek dental care for a check-up are more likely to have dental decay treated in a timely manner.

Dental decay can occur on any tooth surface and is a health issue for all age groups. The decay-causing bacteria accumulate in dental plaque and when they are exposed to sugar in the mouth, they produce the acids that dissolve the tooth's minerals. High sugar intake leads to both an increase in the number of decay-causing bacteria and destructive acid formation. Protective factors such as saliva and the use of fluorides can limit the decay process.

Prevalence of untreated coronal decay

The prevalence of untreated coronal dental decay is reported in Table 5.8 as the percentage of dentate people who have one or more decayed surfaces on the crowns of their teeth. Untreated coronal dental decay reflects both the prevalence of dental decay in the population and access to dental care for treatment.

The prevalence of untreated coronal decay in the Australian adult population was 25.5%; that is one in every four adults had at least one tooth with untreated dental decay (Table 5.8). The prevalence varied only to a small extent between generations, with the 1950–69 generation having the highest proportion of untreated decay (27.1%) compared to people born pre-1930 with the lowest (22.0%).

Among people of all ages Indigenous Australians had the highest proportion of people with untreated coronal decay (57.0%) and people who usually visited for a check-up the lowest (16.3%). There was variation in the prevalence of untreated coronal decay by usual reason for making a dental visit, Indigenous identity, dental insurance, residential location, and eligibility for public dental care and sex.

The prevalence of untreated coronal decay among people who usually visit for a problem was 2.3 times that of people who usually visit for a check-up (37.0% versus 16.3%) in people of all ages. In the 1970–90 generation a two-fold relative difference in prevalence of decay was seen between people who usually visit for a problem (36.4%) and people who visit for a check-up (18.5%). There was a 2.6-fold relative difference in

the prevalence of coronal decay between people who visit for a problem (39.7%) and people who visit for a check-up (15.2%) in the 1950–69 generation. A 2.3-fold relative difference in prevalence was seen between the two groups in the 1930–49 generation, (33.1% versus 14.7%) and a 2.8-fold relative difference in the pre–1930 generation between those who visit for a problem (35.0%) and those who visit for a check-up (12.5%).

The prevalence of untreated coronal decay varied by Indigenous identity, with a 2.3-fold difference between Indigenous Australians where more than half the population had the condition (57.0%) and non-Indigenous Australians (25.1%) among adults of all ages. There was a 2.7-fold relative difference in the prevalence of decay between Indigenous (68.9%) and non-Indigenous Australians (25.3%) in the 1970–90 generation and a 2.2-fold relative difference in the 1950–69 generation (58.2% versus 26.6%). Among those born between 1930 and 1949 Indigenous adults had twice the prevalence of decay as non-Indigenous Australians (44.2% versus 22.4%). In all generations the 95% CIs for the Indigenous figure are wider than for the non-Indigenous Australians, meaning that there is less confidence in the accuracy of those numbers than for the non-Indigenous population, and therefore the differences may be less marked or even greater than those shown here.

Table 5.8: Percentage of people with untreated coronal decay of in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**25.5**	**25.8**	**27.1**	**22.6**	**22.0**
	95%CI [b]	*23.7–27.3*	*22.4–29.5*	*24.6–29.8*	*20.1–25.4*	*17.4–27.4*
Sex						
Male	% of people	28.2	25.1	34.3	23.5	26.9
	95%CI	*25.5–31.1*	*20.1–30.8*	*29.9–38.9*	*20.0–27.3*	*19.0–36.7*
Female	% of people	22.7	26.6	20.1	21.7	18.2
	95%CI	*20.5–25.0*	*22.2–31.5*	*17.3–23.2*	*18.3–25.5*	*12.7–25.4.*
Indigenous identity						
Indigenous	% of people	57.0	68.9	58.2	44.2	n.p.
	95%CI	*40.3–72.2*	*37.0–89.3*	*34.0–79.0*	*25.8–64.4*	*n.p.*
Non-Indigenous	% of people	25.1	25.3	26.6	22.4	22.2
	95%CI	*23.3–26.9*	*22.0–29.0*	*24.1–29.3*	*19.8–25.1*	*17.5–27.7*
Residential location						
Capital city	% of people	21.5	20.4	23.2	21.1	20.3
	95%CI	*19.5–23.8*	*16.7–24.7*	*20.3–26.3*	*17.8–24.9*	*14.5–27.7*
Other places	% of people	32.8	37.0	34.4	25.1	25.1
	95%CI	*29.6–36.1*	*30.5–44.1*	*29.7–39.4*	*21.4–29.3*	*18.5–33.2*
Year level of schooling						
Year 9 or less	% of people	29.2	n.p.	42.7	25.8	21.9
	95%CI	*24.6–34.2*	*n.p.*	*30.5–55.8*	*20.7–31.7*	*14.6–31.5*
Year 10 or more	% of people	25.0	25.6	26.2	21.8	22.1
	95%CI	*23.1–27.0*	*22.1–29.5*	*23.5–29.0*	*19.0–24.8*	*16.2–29.3*
Eligibility for public dental care						
Eligible	% of people	32.9	37.8	40.2	26.3	25.0
	95%CI	*29.2–36.7*	*29.3–47.0*	*33.6–47.2*	*22.6–30.3*	*18.9–32.4*
Ineligible	% of people	22.9	22.8	24.6	20.0	17.0
	95%CI	*20.9–25.1*	*19.2–26.9*	*21.8–27.6*	*16.8–23.5*	*10.2–26.8*
Dental insurance						
Insured	% of people	19.4	21.9	19.7	15.8	18.3
	95%CI	*17.0–22.2*	*16.4–28.5*	*16.6–23.3*	*12.8–19.4*	*11.2–28.6*
Uninsured	% of people	31.1	30.4	33.7	30.4	23.8
	95%CI	*28.6–33.8*	*25.9–35.3*	*29.7–37.9*	*26.6–34.5*	*18.3–30.5*
Usually visit dentist						
For a check-up	% of people	16.3	18.5	15.2	14.7	12.5
	95%CI	*14.1–18.6*	*14.4–23.4*	*12.5–18.5*	*11.9–18.0*	*7.5–20.1*
For a dental problem	% of people	37.0	36.4	39.7	33.1	35.0
	95%CI	*34.3–39.9*	*30.7–42.7*	*35.7–43.8*	*29.1–37.5*	*26.6–44.4*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

A 1.6-fold relative difference in prevalence of untreated coronal decay was evident between people who had private dental insurance (19.4%) and people who had no insurance (31.1%) among all ages. This relative difference was 1.7-fold in the 1950–69 generation and almost two-fold in the 1930–49 generation. In both cases the group without dental insurance had a higher percentage of people with untreated decay. Private dental insurance is a well-recognised enabler of access to dental services, assisting people in meeting the costs of dental care and facilitating more regular visiting patterns (Brennan et al. 1997).

Among all ages people who lived outside capital cities had 1.5 times the prevalence of untreated coronal decay (32.8%) compared to people who lived in capital cities (21.5%). In the most recent generation people residing outside capital cities had 1.8 times the prevalence of capital city dwellers (37.0% versus 20.4%). In the 1950–69 generation people outside capital cities had 1.5 times the prevalence of decay compared to people in capital cities (34.4% versus 23.2%).

A 1.4-fold relative difference in prevalence of untreated coronal decay was evident between people who were eligible for public dental care (32.9%) and people who were ineligible (22.9%). There was a 1.6-fold relative difference in the 1950–69 generation, with 40.2% prevalence among eligible and 24.6% among ineligible adults. The relative difference was 1.7-fold difference in 1970–90 generation.

Among all ages, males had 1.2 times the prevalence of untreated decay compared to females (28.2% versus 22.7%). In the 1950–69 generation males had 1.7 times the prevalence of females (34.3% versus 20.1%).

In the 1950–69 generation a 1.6-fold relative difference in prevalence of untreated coronal decay was seen in relation to education, with 42.7% of people who left school at year 9 or earlier having decay compared to 26.2% of people who left at year 10 or later.

In summary, usual reason for making a dental visit, Indigenous identity, dental insurance, residential location, eligibility for public dental care and sex were associated with prevalence of untreated dental decay.

Severity of untreated dental decay

The average number of decayed tooth surfaces per person reflects the burden of untreated disease in people with at least one natural tooth (dentate people). In this survey, all teeth were subdivided into five coronal surfaces, and each was assessed for untreated decay, defined as a cavity that had broken the enamel or visibly undermined it. Higher average numbers of decayed teeth reflect both rates of new disease and a lack of dental treatment. Timely and effective dental care reduces levels of untreated decay.

Among all dentate people the average number of decayed tooth surfaces was 0.8 (Table 5.9), with somewhat higher average numbers in the more recent generations

(0.9) and lower average numbers in the earlier generations (0.6 in 1930–49 and 0.5 in pre-1930).

Among all ages the lowest average number of decayed surfaces occurred in people who usually made a dental visit for a check-up (0.4 surfaces) and the highest in the Australian Indigenous adult population (2.7). There were differences according to sex, residential location, eligibility for public dental care, dental insurance.

People who usually made a dental visit because of a problem had 3.5 times more decayed tooth surfaces (1.4) than those who visited for a check-up (0.4). The relative difference was over five-fold in the 1950–69 generation between people who usually visit for a dental problem (1.6 surfaces) and people who usually make a visit for a check-up (0.3 surfaces). In the 1970–90 generation people who visit for a dental problem had three times the average number of decayed surfaces (1.5) as people who visit for a check-up (0.5). A similar three-fold relative difference was seen in the 1930–49 generation. Less regular dental treatment for people who usually seek dental care because of a dental problem may result in a higher average number of decayed tooth surfaces as early diagnosis and treatment of asymptomatic decay is less likely.

People without dental insurance had over twice the number of decayed surfaces (1.1) as those with insurance (0.5). In the 1950–69 and the 1930–49 generations people without insurance had 2.6 times more decayed surfaces than people with insurance (1.3 versus 0.5 and 0.8 versus 0.3 respectively).

People eligible for public dental care had 1.7 times the number of decayed surfaces as people ineligible for public care (1.2 versus 0.7) This relative difference was also seen in the 1950–69 generation where eligible people had 2.6 times more decayed surfaces than ineligible people (1.8 versus 0.7) and in the 1930–49 generation eligible people had 1.7 times the number of decayed surfaces of their ineligible counterparts.

A 1.6-fold relative difference in decayed surfaces was seen between people residing outside capital cities (1.1 surfaces) and people in capital cities (0.7). In the 1970–90 generation people living outside capital cities had twice the number of decayed surfaces (1.4) as those living in capital cities (0.7). Rationing in public dental services, lack of dental insurance and non-capital city location are all factors which reduce access to dental care and thus result in higher rates of untreated disease.

Males had more decayed surfaces than females. In all ages males had 1.4 times more decayed surfaces than females (0.7). This difference was slightly higher in the 1950–69 generation where a two-fold relative difference was seen between males (1.2) and females (0.6). This probably relates to the difference in use of dental services between males and females.

Table 5.9: Average number of decayed tooth surfaces per person in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**mean**	**0.8**	**0.9**	**0.9**	**0.6**	**0.5**
	95%CI [b]	*0.7–0.9*	*0.7–1.1*	*0.7–1.1*	*0.5–0.6*	*0.4–0.7*
Sex						
Male	mean	1.0	0.9	1.2	0.6	0.7
	95%CI	*0.8–1.1*	*0.6–1.2*	*0.9–1.5*	*0.5–0.8*	*0.4–1.1*
Female	mean	0.7	0.9	0.6	0.5	0.4
	95%CI	*0.6–0.8*	*0.6–1.2*	*0.5–0.7*	*0.4–0.6*	*0.2–0.6*
Indigenous identity						
Indigenous	mean	2.7	1.7	4.1	1.4	n.p.
	95%CI	*0.6–4.8*	*0.3–3.1*	*0.1–8.1*	*0.4–2.4*	*n.p.*
Non-Indigenous	mean	0.8	0.9	0.8	0.5	0.6
	95%CI	*0.7–0.9*	*0.7–1.1*	*0.7–1.0*	*0.5–0.6*	*0.4–0.7*
Residential location						
Capital city	mean	0.7	0.7	0.8	0.5	0.5
	95%CI	*0.6–0.8*	*0.5–0.9*	*0.6–1.0*	*0.4–0.6*	*0.3–0.7*
Other places	mean	1.1	1.4	1.1	0.6	0.6
	95%CI	*0.9–1.3*	*1.0–1.8*	*0.8–1.5*	*0.5–0.7*	*0.4–0.9*
Year level of schooling						
Year 9 or less	mean	1.1	n.p.	2.0	0.8	0.6
	95%CI	*0.8–1.4*	*n.p.*	*0.9–3.2*	*0.6–1.0*	*0.3–0.9*
Year 10 or more	mean	0.8	0.9	0.8	0.5	0.5
	95%CI	*0.7–0.9*	*0.7–1.1*	*0.7–1.0*	*0.4–0.6*	*0.3–0.7*
Eligibility for public dental care						
Eligible	mean	1.2	1.4	1.8	0.7	0.6
	95%CI	*1.0–1.4*	*0.9–2.0*	*1.3–2.4*	*0.6–0.8*	*0.4–0.9*
Ineligible	mean	0.7	0.8	0.7	0.4	0.4
	95%CI	*0.6–0.8*	*0.6–1.0*	*0.6–0.9*	*0.4–0.5*	*0.2–0.6*
Dental insurance						
Insured	mean	0.5	0.7	0.5	0.3	0.3
	95%CI	*0.4–0.6*	*0.4–0.9*	*0.4–0.6*	*0.2–0.4*	*0.2–0.5*
Uninsured	mean	1.1	1.2	1.3	0.8	0.6
	95%CI	*0.9–1.3*	*0.9–1.5*	*0.9–1.6*	*0.7–0.9*	*0.4–0.9*
Usually visit dentist						
For a check-up	mean	0.4	0.5	0.3	0.3	0.4
	95%CI	*0.3–0.4*	*0.3–0.7*	*0.2–0.3*	*0.2–0.3*	*0.1–0.6*
For a dental problem	mean	1.4	1.5	1.6	0.9	0.8
	95%CI	*1.2–1.6*	*1.1–1.9*	*1.2–1.9*	*0.8–1.1*	*0.5–1.1*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated mean.

The average number of decayed tooth surfaces varied also by Indigenous identity with Indigenous Australians having higher average numbers of decayed surfaces in all except the oldest generation. The greatest apparent difference was seen in the 1950–69 generation where Indigenous Australians had an average of 4.1 decayed surfaces

compared to 0.8 for non-Indigenous Australians (a more than five-fold difference). Smaller differences were seen in the 1930–49 generation (0.9 surfaces) and the 1970–90 generation (0.8). Poor access to dental care due to poverty and/or residential location is consistent with these differences. However caution must be used in interpreting these results as in all generations the 95% CI for the estimate among Indigenous Australians is wider than for the estimate for non-Indigenous, meaning that there is less confidence in the accuracy of those numbers than for the non-Indigenous population, and therefore the differences may be less marked or even greater than those shown here.

Smaller differences were seen in other population groups. However, in the 1950–69 generation notable differences were seen between people with year 9 schooling or less (2.0 surfaces) and those with year 10 or more (0.8 surfaces), between those eligible for public dental care (1.8) and those ineligible (0.7), and between those with insurance (0.5 surfaces) and those without insurance (1.3). In the 1970–90 generation a difference of 0.7 surfaces was noted by residential location, with those in capital cities having an average of 0.7 decayed surfaces and those living elsewhere an average of 1.4 decayed surfaces. Rationing in public dental services, lack of dental insurance and non-capital city location are all factors which reduce access to dental care and thus result in higher rates of untreated disease.

In summary, usual reason for making a dental visit was strongly associated with higher average numbers of decayed tooth surfaces. The average number of decayed surfaces was also associated with sex, residential location, eligibility for public dental care and dental insurance. The data also suggests that Indigenous Australians had higher numbers of decayed surfaces.

Prevalence of untreated root decay

The prevalence of untreated root decay is reported as the percentage of people who had at least one natural tooth and who had one or more surfaces of the roots of their teeth decayed. Decay of the root surface of the tooth requires that the root surface be exposed to factors which cause dental decay and thus root caries is associated with recession of the gums or gum disease. Such recession is usually associated with increased age and therefore decay of root surfaces of teeth is more common in older people. Timely access to dental care enables early intervention in the treatment of root decay, conversely poor access may result in untreated disease so that people with less access to dental care will have higher percentages of people with untreated disease.

The prevalence of untreated root decay in the Australian adult population was 6.7% (Table 5.10) which was lower than the prevalence of untreated decay of the tooth crown (Table 5.8). The prevalence varied between generations with the pre-1930 generation having the highest proportion with decay (17.3%) compared to those with the lowest who were born between 1970 and 1990 (1.6%).

Among people of all ages, adults with year 9 or less of education had the highest proportion of people with untreated decay (13.0%) and those who usually visit for a check-up the lowest (4.0%). The differences between population groups were seen for

usual reason for making a dental visit, years of schooling, eligibility for public dental care and dental insurance.

A 2.6-fold relative difference in prevalence of untreated root decay was seen by usual reason for visiting the dentist where the proportion of people who usually visit for a problem with untreated decay (10.2%) was higher than of those who usually visit for a check-up (4.0%) in people of all ages. The greatest relative difference in this population grouping was seen in the 1970–90 generation with a 6.4-fold relative difference was evident between people who usually visit a dentist for a problem (3.2%) and people who usually visit for a check-up (0.5%). More of people who visit for a problem than visit for a check-up had untreated root decay with a 2.9-fold relative difference seen in the 1950–69 generation (10.9% versus 3.8%), and an almost two fold relative difference in the 1930–49 generation (17.2% versus 9.0%). Root decay itself may be asymptomatic in its early stages as is gingival recession with which it is associated, and without regular dental care people are often unaware of the condition, whereas those who usually seek dental care for a check-up are more likely to have dental decay treated in a timely manner.

The prevalence of untreated root decay varied by educational attainment. People who had completed year 9 or less (13.0%) had more than twice the prevalence of root decay of those who attained year 10 or more (6.0%). In the 1950–69 generation there was a 2.8-fold relative difference between those who had completed year 9 or less (17.9%) and those who attained year 10 or more (6.5%).

Almost a two fold relative difference in the prevalence of root decay was evident between people who were eligible for public dental care (10.5%) and those who were not (5.4%) among all ages. In the 1950–69 generation eligible people had twice the prevalence of root decay as ineligible people (12.8% versus 6.1%).

Uninsured people had 1.8 times the prevalence of root decay compared with insured people among people of all ages (8.7% versus 4.8%). Differences in the prevalence of decayed roots was seen in the younger generations with uninsured adults in the youngest generation having 6.5 times the prevalence of insured adults (2.6% versus 0.4%) and uninsured people in the 1950–69 generation having more than twice the prevalence of insured people (9.8% versus 4.5%).

In summary, usual reason for making a dental visit, years of schooling, eligibility for public dental care and dental insurance were associated with prevalence of untreated root decay.

Table 5.10: Percentage of people with untreated root decay in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**6.7**	**1.6**	**7.1**	**12.6**	**17.3**
	95%CI [b]	*6.0–7.6*	*1.0–2.6*	*5.8–8.8*	*10.7–14.7*	*12.9–22.9*
Sex						
Male	% of people	7.8	1.3	8.7	14.5	25.0
	95%CI	*6.6–9.3*	*0.6–2.7*	*6.6–11.4*	*11.9–17.6*	*17.2–34.9*
Female	% of people	5.6	1.9	5.6	10.5	11.5
	95%CI	*4.6–6.7*	*1.0–3.6*	*4.1–7.7*	*8.1–13.5*	*7.1–18.0*
Indigenous identity						
Indigenous	% of people	7.7	0.0	2.6	17.1	n.p.
	95%CI	*2.2–23.6*	—	*0.4–14.0*	*5.0–44.5*	*n.p.*
Non-Indigenous	% of people	6.7	1.6	7.2	12.5	16.7
	95%CI	*5.9–7.6*	*1.0–2.7*	*5.9–8.8*	*10.6–14.6*	*12.4–22.2*
Residential location						
Capital city	% of people	6.0	1.5	6.5	11.6	14.2
	95%CI	*5.1–7.0*	*0.8–2.8*	*4.9–8.6*	*9.2–14.4*	*9.1–21.4*
Other places	% of people	8.1	1.7	8.3	14.2	23.2
	95%CI	*6.7–9.7*	*0.7–4.2*	*6.2–11.1*	*11.4–17.5*	*15.9–32.6*
Year level of schooling						
Year 9 or less	% of people	13.0	n.p.	17.9	14.8	15.6
	95%CI	*10.1–16.6*	*n.p.*	*9.9–30.1*	*10.9–19.8*	*8.9–25.7*
Year 10 or more	% of people	6.0	1.4	6.5	12.1	18.2
	95%CI	*5.2–6.8*	*0.8–2.3*	*5.2–8.1*	*10.0–14.4*	*12.5–25.6*
Eligibility for public dental care						
Eligible	% of people	10.5	2.1	12.8	13.7	17.9
	95%CI	*8.8–12.6*	*0.8–5.8*	*8.3–19.1*	*11.2–16.6*	*12.7–24.6*
Ineligible	% of people	5.4	1.5	6.1	11.7	16.5
	95%CI	*4.6–6.3*	*0.8–2.6*	*4.8–7.7*	*9.4–14.6*	*9.6–26.8*
Dental insurance						
Insured	% of people	4.8	0.4	4.5	10.2	11.0
	95%CI	*3.9–5.9*	*0.1–1.3*	*3.1–6.6*	*8.0–13.1*	*5.7–20.0*
Uninsured	% of people	8.7	2.6	9.8	15.2	20.4
	95%CI	*7.5–10.1*	*1.5–4.5*	*7.7–12.5*	*12.4–18.6*	*14.7–27.7*
Usually visit dentist						
For a check-up	% of people	4.0	0.5	3.8	9.0	11.8
	95%CI	*3.2–5.0*	*0.1–1.7*	*2.6–5.5*	*7.1–11.5*	*6.8–19.6*
For a dental problem	% of people	10.2	3.2	10.9	17.2	24.9
	95%CI	*8.8–11.7*	*1.9–5.5*	*8.7–13.5*	*14.2–20.8*	*17.5–34.0*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Those who did not have dental insurance had twice as many decayed root surfaces as those with insurance among people of all ages (0.2 versus 0.1). A four-fold difference was seen in the 1930–49 generation (0.4 surfaces in uninsured and 0.1 in insured) and a three fold difference in the 1950–69 generation (0.3 versus 0.1).

In summary, the average number of decayed root surfaces was associated with age, eligibility for public dental care, usual reason for a dental visit and dental insurance.

Percentage of people with filled teeth

Fillings for the treatment of tooth decay leave a permanent mark on the tooth and are one measure of people's experience of dental decay. Filled teeth also indicate patterns of dental treatment and access to dental care. In the Australian population the vast majority (83.9%) of adults had one or more filled teeth (Table 5.11). This percentage was markedly lower in the 1970–90 generation (65.4%) but was near or over 90% for the other generations (Table 5.11).

Among people of all ages the proportion of people with at least one filled tooth was highest for people with dental insurance (87.5%) and lowest for people with year 9 or less of schooling (78.4%). There was remarkably little difference in the prevalence of filled teeth between population groups.

Among those born in 1930–49 slightly more of those who usually make a dental visit for a check-up (99.2%) had fillings than those who visit for a problem (92.1%). In the pre-1930 generation a similar pattern was evident with 96.9% of those who visit for a check-up having a filled tooth compared with 79.6% of those who visit because of a problem. This may be related to numbers of teeth and patterns of treatments as people in the pre-1930 generation who visited for a problem had more missing teeth.

In summary, the percentage of people with at least one filled tooth differed little between population groups except that the youngest generation had a much lower prevalence than other generations.

Table 5.11: Percentage of people with one or more filled teeth in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**83.9**	**65.4**	**94.8**	**96.2**	**89.5**
	95%CI[b]	*81.9–85.6*	*61.2–69.4*	*93.1–96.0*	*94.6–97.3*	*84.8–92.9*
Sex						
Male	% of people	82.3	63.1	93.7	95.8	86.1
	95%CI	*79.0–85.1*	*56.4–69.3*	*91.0–95.7*	*93.4–97.4*	*77.3–91.8*
Female	% of people	85.4	67.8	95.7	96.5	92.2
	95%CI	*83.3–87.3*	*62.8–72.4*	*94.1–97.0*	*93.9–98.0*	*85.9–95.8*
Indigenous identity						
Indigenous	% of people	82.5	78.2	82.2	87.1	n.p.
	95%CI	*62.9–92.9*	*46.8–93.6*	*41.1–96.8*	*68.8–95.4*	*n.p.*
Non-Indigenous	% of people	83.9	65.3	95.0	96.3	89.5
	95%CI	*81.9–85.7*	*61.1–69.3*	*93.4–96.2*	*94.6–97.4*	*84.7–92.9*
Residential location						
Capital city	% of people	83.7	66.1	94.2	96.6	91.5
	95%CI	*81.4–85.7*	*61.4–70.6*	*91.9–95.8*	*94.2–98.1*	*85.1–95.3*
Other places	% of people	84.1	63.9	95.8	95.3	86.0
	95%CI	*80.2–87.4*	*55.5–71.6*	*93.3–97.4*	*93.1–96.9*	*77.9–91.5*
Year level of schooling						
Year 9 or less	% of people	78.4	n.p.	89.4	94.9	86.1
	95%CI	*72.2–83.6*	*n.p.*	*75.1–95.9*	*92.1–96.8*	*76.7–92.1*
Year 10 or more	% of people	84.5	67.5	95.1	96.5	91.2
	95%CI	*82.3–86.5*	*63.0–71.7*	*93.5–96.3*	*94.5–97.8*	*84.9–95.1*
Eligibility for public dental care						
Eligible	% of people	83.7	62.8	95.3	92.5	87.8
	95%CI	*80.2–86.6*	*53.6–71.2*	*90.3–97.7*	*89.1–94.9*	*81.6–92.1*
Ineligible	% of people	84.0	66.4	94.6	98.8	92.4
	95%CI	*81.5–86.3*	*61.3–71.0*	*92.8–96.0*	*97.4–99.5*	*82.3–97.0*
Dental insurance						
Insured	% of people	87.5	69.1	96.4	98.1	88.5
	95%CI	*84.9–89.7*	*62.5–75.1*	*94.4–97.6*	*95.8–99.1*	*79.0–94.0*
Uninsured	% of people	82.4	65.9	93.2	93.9	90.0
	95%CI	*79.6–84.9*	*60.1–71.2*	*90.4–95.2*	*91.2–95.9*	*83.9–93.9*
Usually visit dentist						
For a check-up	% of people	83.1	62.9	94.2	99.2	96.9
	95%CI	*80.2–85.7*	*57.0–68.3*	*92.0–95.9*	*98.6–99.5*	*91.4–98.9*
For a dental problem	% of people	85.5	70.0	96.1	92.1	79.6
	95%CI	*82.7–87.8*	*63.8–75.5*	*94.0–97.5*	*88.6–94.7*	*71.0–86.2*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Average number of filled tooth surfaces

In this survey, all five coronal surfaces of each tooth were assessed for presence of a filling placed to treat decay. The assessment was made for up to 160 tooth surfaces. The average number of filled surfaces per person reflects both the history of tooth decay and adequacy of dental treatment. Filled surfaces leave a permanent mark of the experience of dental decay.

Among all dentate people the average number of filled tooth surfaces per person was 19.8 (Table 5.12). The average number of filled tooth surfaces was strongly related to age. People in the 1970–90 generation had 5.7 filled surfaces, whereas people in the 1950–69 generation had 4.3 times more (24.4), people born between 1930 and 1949 6.1 times more (34.6) and people in the pre-1930 generation 5.3 times more filled surfaces (30.4). This increase across the generations to 1930–49 is related to the accumulation of dental decay across the lifetime.

Among people of all ages the highest average number of filled surfaces was seen in people with dental insurance (23.9) and the lowest in people who usually make a dental visit because of a problem (17.9). Associations of the number of filled surfaces were seen with sex, dental insurance and usual reason for dental visit.

People with dental insurance had 1.4 times more filled surfaces than people without insurance (23.9 versus 16.9). This association was seen in all generations except the most recent, with insured people in the 1950–69 generation having 1.3 times more filled surfaces than uninsured people (27.3 versus 21.8), insured people in the 1930–49 generation having 1.5 times more than those uninsured (40.9 versus 27.5) and those born pre-1930 with insurance having 1.4 times more filled surfaces than uninsured people born in that era (37.8 versus 26.9). Having dental insurance is associated with greater access to dental care.

People who usually make a dental visit for a check-up had 1.2 times more filled surfaces than those who usually visit for a problem (21.4 versus 17.9). This relationship was seen in all generations except the most recent. In the 1950–69 generation people who usually visit for a check-up had 1.2 times more filled surfaces than people who visit for a problem (26.3 versus 22.5), in the 1930–49 generation 1.5 times (40.3 versus 27.2), and in the pre-1930 generation 1.8 times more filled surfaces than people who visit for a problem (37.4 versus 20.9).

Females had 1.2 times more filled tooth surfaces than males in all age groups (21.3 versus 18.3). This relationship was also seen in the 1930–49 generation, where females had 1.2 times more filled surfaces than males (38.1 versus 31.3). In all other generations the differences were very small. The difference was bigger in pre-1930 but not significant.

Among people in the 1930–49 generation associations of numbers of filled surfaces were seen with eligibility for public dental care, with ineligible people having 1.4 times more filled surfaces than eligible people (39.1 versus 28.7). There were also associations with years of schooling where people who have completed year 10 or more had 1.3 times more filled surfaces than people who left school earlier (36.5 versus 27.5); and

residential location, with people living in capital cities having 1.1 times more filled surfaces than people living elsewhere (36.3 versus 31.9).

Table 5.12: Average number of filled tooth surfaces per person in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**mean**	**19.8**	**5.7**	**24.4**	**34.6**	**30.4**
	95%CI [b]	*18.9–20.7*	*4.9–6.4*	*23.3–25.5*	*33.1–36.2*	*26.9–33.9*
Sex						
Male	mean	18.3	5.8	23.0	31.3	25.3
	95%CI	*17.1–19.6*	*4.6–7.1*	*21.3–24.7*	*29.3–33.3*	*20.4–30.2*
Female	mean	21.3	5.5	25.8	38.1	34.3
	95%CI	*20.1–22.5*	*4.8–6.1*	*24.4–27.2*	*36.1–40.2*	*29.9–38.7*
Indigenous identity						
Indigenous	mean	16.6	8.0	15.9	26.5	n.p.
	95%CI	*11.5–21.6*	*2.5–13.4*	*9.3–22.5*	*18.2–34.7*	*n.p.*
Non-Indigenous	mean	19.9	5.6	24.5	34.7	30.3
	95%CI	*19.0–20.8*	*4.9–6.4*	*23.4–25.6*	*33.2–36.3*	*26.7–33.8*
Residential location						
Capital city	mean	19.9	5.6	24.6	36.3	32.3
	95%CI	*18.8–21.1*	*4.7–6.4*	*23.2–25.9*	*34.1–38.4*	*27.9–36.6*
Other places	mean	19.6	5.8	24.1	31.9	27.0
	95%CI	*18.2–21.0*	*4.4–7.2*	*22.3–25.9*	*30.0–33.9*	*21.5–32.5*
Year level of schooling						
Year 9 or less	mean	20.3	n.p.	23.2	27.5	24.3
	95%CI	*17.9–22.7*	*n.p.*	*18.4–28.0*	*24.6–30.4*	*19.5–29.1*
Year 10 or more	mean	19.8	5.8	24.5	36.5	33.4
	95%CI	*18.8–20.7*	*5.1–6.5*	*23.3–25.6*	*34.9–38.2*	*29.1–37.7*
Eligibility for public dental care						
Eligible	mean	20.0	6.1	21.9	28.7	25.9
	95%CI	*18.5–21.5*	*4.0–8.2*	*19.6–24.3*	*26.5–30.8*	*22.0–29.8*
Ineligible	mean	19.8	5.6	24.9	39.1	37.9
	95%CI	*18.7–20.8*	*4.8–6.3*	*23.7–26.1*	*37.1–41.0*	*31.9–44.0*
Dental insurance						
Insured	mean	23.9	6.1	27.3	40.9	37.8
	95%CI	*22.5–25.4*	*5.0–7.2*	*25.8–28.9*	*38.9–43.0*	*32.0–43.7*
Uninsured	mean	16.9	5.7	21.8	27.5	26.9
	95%CI	*15.9–17.8*	*4.7–6.7*	*20.3–23.2*	*25.8–29.3*	*22.9–30.9*
Usually visit dentist						
For a check-up	mean	21.4	4.9	26.3	40.3	37.4
	95%CI	*20.1–22.8*	*4.1–5.7*	*24.8–27.9*	*38.5–42.1*	*32.8–42.0*
For a dental problem	mean	17.9	6.8	22.5	27.2	20.9
	95%CI	*16.9–19.0*	*5.5–8.2*	*21.0–24.1*	*25.3–29.1*	*16.0–25.7*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Among people born pre-1930, the average number of filled surfaces was associated with eligibility for public dental care, with ineligible people having 1.5 times more filled surfaces than eligible person (37.9 versus 25.9), and with years of schooling, where people who had completed year 10 or more had 1.4 times more filled surfaces than people who completed year 9 or less (33.4 versus 24.3).

In summary, the average number of filled surfaces per person was strongly related to age. It was also associated with dental insurance, usual reason for a dental visit and sex. In the earlier generations, associations were also seen with residential location, years of schooling and eligibility for public dental care.

Severity of dental decay experience—DMFT

The number of decayed, missing and filled teeth (DMFT) reflects a person's lifetime experience of dental caries. This is because cavities in enamel cannot 'heal', and because treatment of dental decay leaves a permanent mark, either through the presence of a filling or the loss of the affected tooth by extraction. Each people' total number of teeth (T) that are decayed (D), missing because of pathology (M) or filled (F), is a measure that is widely referred to as the DMFT. In this survey all missing teeth in people 45 years and over were counted as missing due to pathology, while for people aged less than 45 years, the count included only teeth where the examiner judged that dental decay or gum disease was the likely reason for extraction. The DMFT index was only calculated among examined people who had at least one natural tooth.

The average number of decayed, missing and filled teeth per person for the Australian population was 12.8 teeth (Table 5.13). The average number of affected teeth increased markedly with each generation, from an average of 4.5 teeth in the 1970–90 generation, 14.4 teeth in the 1950–69 generation (a three-fold increase), 22.2 teeth in the 1930–49 generation (almost a five-fold increase) to 24.3 in the pre-1930 generation (more than a five-fold increase). This increase across the generations reflects both an increase in caries experience with age and a difference in exposure to both risk factors and protective factors (for example, fluoride) during the lifetime of people in each generation.

Among people of all ages there was variation in the average number of decayed, missing and filled teeth according to residential location, year level of schooling, eligibility for public dental care and usual reason for dental visit. Among various population groups the highest average number of decayed, missing and filled teeth was seen in those people who had completed year 9 or less of schooling (17.2) and the lowest was among those ineligible for public dental care (11.8).

Table 5.13: Average number of decayed, missing or filled teeth per person in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**mean**	**12.8**	**4.5**	**14.4**	**22.2**	**24.3**
	95%CI[b]	*12.4–13.3*	*4.1–5.0*	*13.9–14.8*	*21.9–22.5*	*23.7–25.0*
Sex						
Male	mean	12.4	4.6	13.9	21.5	23.5
	95%CI	*11.8–13.1*	*3.9–5.4*	*13.2–14.5*	*21.0–21.9*	*22.3–24.8*
Female	mean	13.3	4.4	14.9	23.0	25.0
	95%CI	*12.7–13.8*	*4.0–4.9*	*14.3–15.4*	*22.6–23.4*	*24.3–25.7*
Indigenous identity						
Indigenous	mean	14.8	7.0	15.8	23.3	n.p.
	95%CI	*12.2–17.3*	*3.4–10.5*	*13.4–18.2*	*21.7–24.9*	*n.p.*
Non-Indigenous	mean	12.8	4.5	14.3	22.2	24.4
	95%CI	*12.4–13.3*	*4.1–5.0*	*13.9–14.8*	*21.9–22.5*	*23.7–25.0*
Residential location						
Capital city	mean	12.3	4.2	14.0	21.9	24.1
	95%CI	*11.8–12.8*	*3.7–4.7*	*13.4–14.5*	*21.5–22.3*	*23.1–25.1*
Other places	mean	13.8	5.2	15.1	22.7	24.8
	95%CI	*13.1–14.6*	*4.2–6.1*	*14.3–15.8*	*22.3–23.1*	*24.2–25.4*
Year level of schooling						
Year 9 or less	mean	17.2	n.p.	17.8	22.7	24.3
	95%CI	*15.9–18.5*	*n.p.*	*16.2–19.3*	*22.0–23.3*	*23.2–25.4*
Year 10 or more	mean	12.3	4.6	14.1	22.1	24.4
	95%CI	*11.8–12.7*	*4.1–5.1*	*13.7–14.6*	*21.7–22.4*	*23.5–25.2*
Eligibility for public dental care						
Eligible	mean	15.8	4.8	15.4	22.8	24.2
	95%CI	*15.0–16.6*	*3.7–5.8*	*14.3–16.5*	*22.3–23.2*	*23.5–24.9*
Ineligible	mean	11.8	4.5	14.2	21.8	24.6
	95%CI	*11.3–12.3*	*4.0–5.0*	*13.7–14.6*	*21.5–22.2*	*23.2–25.9*
Dental insurance						
Insured	mean	13.5	4.6	14.6	22.4	24.9
	95%CI	*12.9–14.2*	*3.9–5.4*	*14.0–15.2*	*22.0–22.7*	*24.0–25.8*
Uninsured	mean	12.6	4.8	14.3	22.1	24.1
	95%CI	*12.1–13.2*	*4.2–5.3*	*13.6–14.9*	*21.6–22.6*	*23.2–25.0*
Usually visit dentist						
For a check-up	mean	12.2	3.8	14.0	22.1	24.1
	95%CI	*11.6–12.8*	*3.4–4.3*	*13.4–14.6*	*21.7–22.5*	*23.1–25.2*
For a dental problem	mean	13.7	5.6	14.9	22.5	24.7
	95%CI	*13.1–14.3*	*4.8–6.3*	*14.3–15.6*	*22.0–23.0*	*24.0–25.4*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

The largest difference between population groups was between education groups, with people who left school at year 9 or earlier having 1.4 times the average number of teeth with caries experience (17.2) than people who completed year 10 or more (12.3). The effect of education was largely a result of the different age profiles in the different educational groups. There was little difference seen between people who left school at year 9 or earlier and people who left at year 10 or later in older generations, except in the 1950–69 generation where there was a 1.3-fold difference between education groups. In the most recent generation people who usually made a dental visit because of a problem had 1.5 times the average number of decayed, missing and filled teeth than people who usually visit for a check-up. The only other difference within generations was seen in relation to sex in the 1930–49 generation, where females had slightly more teeth with caries experience than males.

In summary, the major differences in the average number of decayed, missing and filled teeth related to age. Smaller differences were seen according to residential location, year of schooling, eligibility for public dental care, usual reason for making a dental visit and sex.

People with no experience of dental decay in permanent teeth

People whose survey examination revealed no untreated decay, no fillings and no teeth missing due to pathology were classified as having no experience of dental decay. Such people have a DMFT index of zero. They have experienced no fillings and no extractions of diseased teeth, and the dental examination found no cavities.

Almost one in ten Australians (9.9%) had no experience of dental decay (Table 5.14). This percentage was much higher among people in the 1970–90 generation, where almost a quarter had no decay experience (24.1%). This percentage was ten times that of the 1950–70 generation (2.4%). The percentage then declined to zero in the 1930–49 generation and almost zero in the pre-1930 generation. This pattern is likely to be due partly to increasing caries experience with age but also partly to the fluoride exposure over a greater proportion of their lifetime that young adults have had.

Among different population groups in people of all ages, people who usually visit for a check-up had the highest percentage with no caries experience (11.9%) whereas Indigenous Australians had the lowest (3.8%). Usual reason for making a dental visit was the only factor associated with no caries experience among people of all ages.

Among people of all ages the prevalence of having no caries experience was 1.7 times more among people who usually visit for a check-up (11.9%) compared with people who usually visit because of a dental problem (6.9%). This increased to 3.8 times in the most recent generation between those who usually make a dental visit for a check-up (27.1%) and those who visit for a problem (19.1%). People who usually visit for a check-up may be more dentally aware and more oriented towards prevention of oral disease and thus more of them have no experience of dental caries. In addition, clinical preventive treatments (for example, fissure sealants) can contribute to prevention of dental caries.

Table 5.14: Percentage of people in the Australian population and in four generations with no experience of dental decay in the permanent teeth

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**9.9**	**24.1**	**2.4**	**0.0**	**0.8**
	95%CI[b]	*8.5–11.6*	*20.6–28.0*	*1.6–3.7*	—	*0.1–5.6*
Sex						
Male	% of people	10.8	26.1	2.3	0.0	1.9
	95%CI	8.5–13.6	20.5–32.6	1.2–4.2	—	0.3–12.2
Female	% of people	9.1	22.1	2.6	0.0	0.0
	95%CI	*7.5–11.0*	*18.2–26.6*	*1.7–4.0*	—	—
Indigenous identity						
Indigenous	% of people	3.8	11.2	0.7	0.0	n.p.
	95%CI	*1.2–11.6*	*2.7–36.2*	*0.1–5.0*	—	*n.p.*
Non-Indigenous	% of people	10.0	24.3	2.5	0.0	0.8
	95%CI	*8.5–11.7*	*20.8–28.2*	*1.6–3.8*	—	*0.1–5.6*
Residential location						
Capital city	% of people	11.0	25.5	2.9	0.0	1.3
	95%CI	*9.1–13.1*	*21.3–30.3*	*1.7–4.8*	—	*0.2–8.5*
Other places	% of people	8.0	21.3	1.7	0.0	0.0
	95%CI	*5.7–11.1*	*15.5–28.5*	*0.9–3.2*	—	—
Year level of schooling						
Year 9 or less	% of people	10.3	n.p.	0.6	0.0	0.0
	95%CI	*6.3–16.4*	*n.p.*	*0.1–4.2*	—	—
Year 10 or more	% of people	9.9	22.8	2.6	0.0	1.2
	95%CI	*8.3–11.7*	*19.3–26.9*	*1.7–3.9*	—	*0.2–8.2*
Eligibility for public dental care						
Eligible	% of people	7.0	22.6	1.1	0.0	0.0
	95%CI	*4.8–10.3*	*15.5–31.9*	*0.4–2.9*	—	—
Ineligible	% of people	10.8	24.2	2.7	0.0	2.2
	95%CI	*9.0–12.8*	*20.3–28.6*	*1.7–4.3*	—	*0.3–14.0*
Dental insurance						
Insured	% of people	8.7	23.6	2.5	0.0	0.0
	95%CI	*6.8–11.1*	*18.4–29.6*	*1.4–4.4*	—	—
Uninsured	% of people	9.2	21.0	2.4	0.0	1.2
	95%CI	*7.3–11.6*	*16.7–26.1*	*1.3–4.3*	—	*0.2–8.1*
Usually visit dentist						
For a check-up	% of people	11.9	27.1	3.4	0.0	1.4
	95%CI	*9.9–14.2*	*22.4–32.3*	*2.3–5.1*	—	*0.2–9.4*
For a dental problem	% of people	6.9	19.1	0.9	0.0	0.0
	95%CI	*5.2–9.3*	*14.3–25.0*	*0.3–2.1*	—	—

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

The largest apparent difference between population groups occurred for Indigenous identity, with 3.8% of Indigenous Australians having no caries experience compared to 10.0% of non-Indigenous Australians. Among adults born between 1970 and 1990, about half as many Indigenous Australians (11.2%) had no caries experience compared to 24.3% of non-Indigenous adults. However, the 95% CIs are wider for the Indigenous estimate, meaning that the difference in results between Indigenous and non-Indigenous may be smaller or larger than discussed. Younger Indigenous Australians may have greater exposure to risk factors for caries such as foods and drinks with high sugar content. Alternatively, they may have lower exposure to fluorides through less use of toothpaste with fluoride or less access to fluoridated water, possibly due to more Indigenous than non-Indigenous Australians living in rural and remote areas.

There was little variation in the percentage of people with no caries experience among other groups.

In summary, the major difference in percentages of people with no caries experience was seen between the 1970–90 generation and the older generations. Smaller differences were seen between those who usually make a dental visit for a check-up and those who visit for a problem.

Summary of findings regarding experience of dental decay

Untreated tooth decay was experienced by one in four Australians. The average number of tooth surfaces affected was almost one per person (0.8). Untreated decay of tooth roots was strongly associated with age, being more prevalent in earlier generations. The most recent generation had less experience of dental caries and more of them had no experience of dental decay.

Findings from six of the preceding tables are summarised in Table 5.15. Components of dental decay experience varied differently between the generations. The percentage of people with untreated disease did not differ between generations however, the average number of decayed tooth surfaces was lower among the older generations. This difference can be partly explained by lower number of remaining tooth surfaces among older people. Filled tooth surfaces and mean DMFT represent an historical record of accumulation of dental decay, and hence both were markedly higher among the older generations.

Table 5.15: Summary of dental decay experience

	Coronal decay		Root decay	Coronal fillings		
	% of people	Mean no. of surfaces	% of people	% of people	Mean no. of surfaces	Mean DMFT
Generation						
Ref[(a)] = 1970–90						
1950–69	~	~	↑	↑	↑↑	↑
1930–49	~	↓	↑↑	↑	↑↑	↑
Pre–1930	~	↓	↑↑	↑	↑↑	↑↑
Sex						
Ref = Male						
Female	↓	↓	~	~	↑	~
Indigenous identity						
Ref = Non-Indigenous		~	~	~	~	~
Indigenous	↑↑	~	~	~	~	~
Residential location						
Ref = Capital cities						
Other places	↑	↑	~	~	~	↑
Year level of schooling						
Ref = Year 10 or more						
Year 9 or less	~	~	↑	~	~	↑
Eligibility for public dental care						
Ref = Ineligible						
Eligible	↑	↑	↑	~	~	↑
Dental insurance						
Ref = Insured						
Uninsured	↑	↑	↑	↓	↓	~
Usually visit dentist						
Ref = For a check-up						
For a dental problem	↑	↑↑	↑	~	↓	↑

(a) Ref: reference group; ↓↓: markedly lower; ↓: lower; ~: not sig. different; ↑: higher; ↑↑: markedly higher

Females had less evidence of untreated disease and higher numbers of fillings, on average, than males. Indigenous Australians were more likely to have untreated decay. The population outside of capital cities had higher levels of untreated decay as well as higher mean DMFT values. Duration of schooling was associated with root decay prevalence and with mean DMFT. Eligibility for public dental care was associated with both untreated decay and mean DMFT values. People who had no dental insurance had higher levels of untreated disease and fewer fillings. Likewise, people who visited for dental problem had more untreated disease, fewer fillings, but overall greater mean DMFT values.

5.3 Gum diseases

People examined in NSAOH were assessed for gum diseases provided they had no medical conditions that precluded measurements being made of the gums (see Table 2.2, page 18). Two types of diseases were assessed: gingivitis and periodontitis.

- Gingivitis, or inflammation of the gums, occurs in response to the bacteria in plaque that accumulates near the gum line. It is characterised by redness, swelling or bleeding of the gums. NSAOH examiners assessed gingivitis by visual inspection and by application of pressure to the gum closest to the neck of the teeth. Usually, gingivitis is a painless condition.

- Periodontitis is inflammation of the tissues surrounding the tooth affecting the gum, the ligaments and the bone. It is caused by a bacterial infection. In some instances, the infection can cause an abscess and become painful (see Box 5.2). In its severe forms there can be loss of bone that supports the tooth, resulting in the tooth becoming loose and even causing tooth loss. The loss of supporting structures can result in the formation of 'pockets' between the gum and the tooth. The depth of the pocket, measured in millimetres using a periodontal probe, is an indication of the severity of the destructive process. In NSAOH gum recession and pocket depth were measured at three sites on each tooth. Regular dental treatment can prevent moderate periodontitis from progressing to the severe form.

The underlying cause of both gingivitis and periodontitis is bacteria that accumulate in dental plaque, the sticky film that adheres to teeth. When plaque accumulates, typically due to infrequent or ineffective oral hygiene, the risk of both conditions increases. However, aspects of general health play additional roles in the severity of inflammation in response to plaque, and poor general health is a critical determinant of progression of disease from gingivitis to periodontitis. One such aspect of general health is smoking, which plays a prominent role in the development of periodontitis. The 2004 US Surgeon General's report on the health consequences of smoking included periodontitis as one of the nine health conditions added to the list of diseases caused by smoking (Surgeon General 2004). Medical conditions such as diabetes and osteoporosis increase the risk of periodontitis.

Box 5.2 Severe periodontitis

Fiona Morris relates the experience of a family member who probably has severe periodontitis.

My husband also has teeth problems.... He's gotta get five teeth pulled; he's got some sort of disease in one of his gums, and now they're saying we've gotta go to a specialist, which has been put off for three months. It's ridiculous. He's gonna end up losing a few teeth before then, but what do you do? I know sometimes he doesn't eat because his tooth's hurting and he's taking pain killers and applying oil of cloves to numb the pain. I know the feeling; it's absolutely horrible because you don't want to be around anybody, so it's also affecting the kids.

–Excerpt from oral history of Fiona Morris (see Chapter 4.2, page 66)

In order to permit comparison with other studies that have used a range of indices when reporting gingivitis and periodontitis, the following sections contain multiple tables that report subtly different aspects of each disease.

Prevalence of moderate or severe periodontitis

A case definition of periodontitis has been developed jointly by the US Centers for Disease Control and Prevention (CDC) and the American Academy of Periodontology (AAP) to describe prevalence of moderate and severe periodontitis in health surveys (Slade in press). The CDC/AAP defines moderate periodontitis as the presence of either two sites between adjacent teeth where the gum has lost its attachment to the tooth for 4 mm or more, or at least two such sites that have pockets of 5 mm or more. Severe periodontitis has been defined as having at least two sites between adjacent teeth where the gum has lost its attachment to the tooth for 6 mm or more, and there is at least one pocket of 5 mm or greater depth.

The prevalence of moderate or severe periodontitis in the Australian population was 22.9% (Table 5.16). (Although not tabulated, 2.4% had severe disease, while 20.5% had moderate disease.) Periodontitis was strongly related to age, with the most recent generation having markedly lower prevalence (7.4%), than the 1950–69 generation (24.5%), the 1930–49 generation (43.6%) and the pre-1930 generation (60.8%). Periodontal disease occurs in bursts of destruction, and the older a person is the more likely they are to have had this destructive activity.

Among people of all ages those with the highest prevalence were people who completed year 9 of schooling or less (38.7%) and the lowest prevalence was seen in females (19.0%) and people who usually visit for a check-up (19.0%). The percentage of people with moderate or severe periodontal disease was associated with years of schooling, eligibility for public dental care, usual reason for making a dental visit, dental insurance and sex.

Table 5.16: Percentage of people with moderate or severe periodontitis in the Australian population and in four generations

		Population: periodontally examined people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**22.9**	**7.4**	**24.5**	**43.6**	**60.8**
	95%CI[b]	*21.3–24.7*	*5.4–9.9*	*21.9–27.4*	*40.2–47.0*	*52.6–68.5*
Sex						
Male	% of people	26.8	9.9	30.4	48.7	62.6
	95%CI	*24.1–29.6*	*6.8–14.1*	*26.3–34.9*	*43.5–53.9*	*50.4–73.5*
Female	% of people	19.0	4.7	18.6	38.5	59.5
	95%CI	*17.2–21.0*	*3.1–7.1*	*15.9–21.6*	*34.4–42.7*	*48.9–69.3*
Indigenous identity						
Indigenous	% of people	29.0	13.5	30.9	42.3	n.p.
	95%CI	*16.7–45.5*	*2.9–45.0*	*13.9–55.3*	*17.5–71.7*	*n.p.*
Non-Indigenous	% of people	22.9	7.3	24.4	43.6	60.4
	95%CI	*21.2–24.6*	*5.3–9.9*	*21.8–27.3*	*40.2–47.1*	*52.1–68.1*
Residential location						
Capital city	% of people	22.2	5.7	25.7	42.8	64.0
	95%CI	*20.1–24.3*	*3.8–8.6*	*22.3–29.4*	*38.8–47.0*	*53.8–73.1*
Other places	% of people	24.4	10.8	22.4	44.9	55.8
	95%CI	*21.5–27.5*	*7.0–16.3*	*18.6–26.7*	*39.0–50.8*	*42.6–68.2*
Year level of schooling						
Year 9 or less	% of people	38.7	n.p.	41.1	48.8	59.5
	95%CI	*33.0–44.8*	*n.p.*	*29.5–53.7*	*41.4–56.2*	*46.2–71.5*
Year 10 or more	% of people	21.1	6.8	23.5	42.5	61.5
	95%CI	*19.5–22.9*	*4.9–9.3*	*20.9–26.3*	*38.8–46.2*	*50.9–71.2*
Eligibility for public dental care						
Eligible	% of people	33.6	11.4	31.9	46.6	69.6
	95%CI	*29.8–37.6*	*6.3–19.6*	*25.0–39.6*	*41.7–51.5*	*59.8–77.9*
Ineligible	% of people	19.5	6.3	23.2	41.4	46.2
	95%CI	*17.9–21.2*	*4.5–8.9*	*20.6–25.9*	*37.1–45.9*	*33.1–59.9*
Dental insurance						
Insured	% of people	19.4	4.0	20.9	37.4	47.3
	95%CI	*17.3–21.7*	*2.1–7.5*	*17.6–24.6*	*33.0–42.0*	*33.2–61.8*
Uninsured	% of people	27.0	10.5	28.5	50.9	67.4
	95%CI	*24.7–29.5*	*7.5–14.3*	*24.9–32.4*	*46.0–55.7*	*58.0–75.6*
Usually visit dentist						
For a check-up	% of people	19.0	5.8	18.0	40.6	56.2
	95%CI	*17.1–21.0*	*3.8–8.9*	*15.0–21.5*	*36.5–44.9*	*45.3–66.5*
For a dental problem	% of people	28.1	9.5	31.8	47.6	67.1
	95%CI	*25.4–30.9*	*6.2–14.1*	*27.9–36.0*	*42.3–53.0*	*55.7–76.7*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

People of all ages who completed year 9 or less of schooling had 1.8 times the prevalence of moderate or severe periodontitis of those who completed year 10 or more (38.7% versus 21.1%). This relative difference was also seen in the 1950–69 generation, where those who left school earlier had 1.7 times the prevalence of periodontitis of those who left later (41.1% versus 23.5%).

Eligibility for public dental care was associated with prevalence of moderate or severe periodontitis. Eligible people had 1.7 times the prevalence of ineligible people (33.6% versus 19.5%). No relative differences by eligibility were seen in the various generations, indicating that age may account for the difference associated with eligibility.

People who usually make a dental visit for a problem had 1.5 times the prevalence of periodontitis of people who visit for a check-up (28.1% versus 19.0%). This relative difference was also evident in the 1950–69 generation, where there was a 1.8-fold relative difference in prevalence between people who visit for a problem (31.8%) and those who usually visit for a check-up (18.0%). People who usually make a dental visit for a check-up may be more preventively oriented and have better self-care and/or non-problem dental visits may assist in preventing periodontitis.

Relative differences in prevalence associated with dental insurance were also seen. Among people of all ages uninsured people had 1.4 times the prevalence of periodontitis of insured people (27.0% versus 19.4%). This same relative difference was evident in the 1950–69 generation (28.5% versus 20.9%) and in the 1930–49 generation (50.9% versus 37.4%) and pre-1930 generation (67.4% versus 47.3%). Regular access to dental care facilitated by dental insurance may assist in reducing periodontitis or those who hold dental insurance may have a more preventive orientation and have more effective self-care.

A higher percentage of males had periodontitis (26.8%) than females (19.0%) among people of all ages, which was a 1.4-fold relative difference. In the 1950–69 generation males had 1.6 times the prevalence of moderate or severe periodontitis of females (30.4% versus 18.6%), and in the 1930–49 generation there was a 1.3-fold relative difference in the prevalence among males (48.7%) and females (38.5%).

In summary, the percentage of people with moderate or severe periodontitis was associated with age, years of schooling, eligibility for public dental care, usual reason for making a dental visit, dental insurance and sex.

Prevalence of periodontitis defined by the US National Centre for Health Statistics

The US National Center for Health Statistics (NCHS) uses the following as the case definition for periodontitis: at least one periodontal pocket with a probing depth of 4 mm or more and a loss of gum attachment to the tooth for 3 mm or more at the same place. In NSAOH measurements of gum recession and periodontal pocketing were carried out at three sites per tooth.

The prevalence of periodontitis according to the NCHS definition was 19.0% among Australian adults (Table 5.17). The prevalence was similar in the three older generations (23.2%, 23.5% and 25.9%) but was markedly lower in the youngest generation (12.0%).

Among Australians of all ages the highest prevalence was seen in people who usually visit the dentist for a problem (24.3%) and the lowest among people who usually visit for a check-up (14.9%). Associations were noted between prevalence of periodontitis and usual reason for making a dental visit and sex.

Australian adults who usually make a dental visit for a problem had 1.6 times the prevalence of periodontitis according to the NCHS definition as people who usually visit for a check-up (24.3% versus 14.9%). This relative difference was evident in the more recent generations where, among those born in 1970–90 people who visit for a problem had more than twice the prevalence of periodontitis as those who visit for a check-up (18.0% versus 7.8%). Among those born in 1950–69 a 1.5-fold relative difference in prevalence of periodontitis existed between visitors for a problem (28.0%) and visitors for a check-up (18.8%).

Males had a 1.5-fold relative difference in prevalence of periodontitis according to the NCHS definition compared to females among people of all ages (22.5% versus 15.4%). A similar relative difference was also evident in the 1950–69 generation, where males had a prevalence of 28.3 % and females 18.0%.

In summary, prevalence of periodontitis according to the NCHS definition was associated with age, usual reason for making a dental visit and sex.

Table 5.17: Percentage of people with periodontitis by NCHS case definition in the Australian population and in four generations

		Population: periodontally examined people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**19.0**	**12.0**	**23.2**	**23.5**	**25.9**
	95%CI[b]	*17.2–21.0*	*9.2–15.6*	*20.5–26.1*	*20.8–26.4*	*18.4–35.0*
Sex						
Male	% of people	22.5	15.7	28.3	25.3	23.3
	95%CI	*19.7–25.7*	*11.1–21.7*	*24.1–32.9*	*21.6–29.4*	*14.2–35.9*
Female	% of people	15.4	8.1	18.0	21.7	27.6
	95%CI	*13.7–17.3*	*5.8–11.2*	*15.3–21.1*	*18.1–25.6*	*18.6–39.0*
Indigenous identity						
Indigenous	% of people	21.2	17.5	26.7	17.0	n.p.
	95%CI	*11.6–35.5*	*4.6–48.3*	*12.3–48.8*	*5.2–43.3*	*n.p.*
Non-Indigenous	% of people	19.0	11.9	23.1	23.6	26.1
	95%CI	*17.1–21.0*	*9.1–15.6*	*20.5–26.0*	*20.9–26.5*	*18.7–35.3*
Residential location						
Capital city	% of people	19.7	12.0	24.9	25.0	23.0
	95%CI	*17.5–22.0*	*8.8–16.2*	*21.6–28.7*	*21.5–28.9*	*13.8–36.0*
Other places	% of people	17.8	12.0	20.0	21.1	30.3
	95%CI	*14.6–21.5*	*7.0–19.6*	*16.1–24.5*	*17.1–25.6*	*19.5–43.8*
Year level of schooling						
Year 9 or less	% of people	23.2	n.p.	27.3	23.4	32.1
	95%CI	*18.1–29.2*	*n.p.*	*17.2–40.5*	*18.0–29.9*	*21.3–45.2*
Year 10 or more	% of people	18.6	11.7	23.0	23.7	22.9
	95%CI	*16.7–20.6*	*8.8–15.5*	*20.3–25.8*	*20.8–26.9*	*13.9–35.3*
Eligibility for public dental care						
Eligible	% of people	20.9	13.3	25.6	21.3	32.9
	95%CI	*17.7–24.5*	*8.1–21.3*	*19.6–32.6*	*17.5–25.7*	*22.7–45.0*
Ineligible	% of people	18.4	11.7	22.7	25.1	14.2
	95%CI	*16.4–20.6*	*8.5–15.9*	*20.0–25.8*	*21.7–28.8*	*7.2–26.0*
Dental insurance						
Insured	% of people	17.7	8.4	23.0	23.0	15.2
	95%CI	*15.4–20.3*	*4.8–14.2*	*19.5–26.9*	*19.7–26.7*	*7.8–27.4*
Uninsured	% of people	20.8	15.7	23.6	23.8	30.9
	95%CI	*18.3–23.6*	*11.6–20.8*	*20.2–27.5*	*19.9–28.2*	*21.3–42.6*
Usually visit dentist						
For a check-up	% of people	14.9	7.8	18.8	21.7	18.9
	95%CI	*13.1–16.9*	*5.4–11.3*	*15.8–22.2*	*18.5–25.4*	*11.5–29.6*
For a dental problem	% of people	24.3	18.0	28.0	25.8	35.1
	95%CI	*21.3–27.5*	*12.8–24.6*	*24.2–32.2*	*21.8–30.3*	*24.5–47.3*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Prevalence of deep periodontal pockets

Deep periodontal pockets have been defined as 4 mm or more. The depth of the pocket, measured in millimetres using a periodontal probe, is an indication of the severity of the destructive process.

Table 5.18 reports on the percentage of people who had at least one site in their mouths with a periodontal pocket of 4 mm or more.

The prevalence of periodontal pocketing of 4+ mm in the Australian population was 19.8%, that is almost one person in five. Prevalence was lowest in the most recent generation (13.1%), and there was little relative difference between the older age groups: 23.9% in the 1950–69 generation, 23.7% in the 1930–49 generation and 26.0% in the pre-1930 generation.

The highest prevalence of periodontal pocketing of 4+ mm was seen in people who make a dental visit because of a problem (25.1%) and the lowest among people who visit for a check-up (15.6%). Periodontal pocketing was associated with usual reason for making a dental visit and sex.

A 1.6-fold relative difference in prevalence of periodontal pocketing was seen between those who visit for a problem (25.1%) and people who visit for a check-up (15.6%) among people of all ages. In the 1970–90 generation a 2.3-fold relative difference was seen (19.7% versus 8.5%) and in the 1950–69 generation there was a 1.4-fold relative difference in prevalence of periodontal pocketing between people who visit for a problem (28.5%) and people who visit for a check-up (19.8%). Regular dental care and periodontal maintenance may reduce the prevalence of periodontal pocketing, or people who visit for a check-up may be more oriented towards prevention and have better self-care.

Males had 1.4 times higher prevalence of periodontal pocketing than females (22.8% versus 16.7%) in people of all ages. A similar relative difference was seen between males and females in the 1950–69 generation, where there was a 1.5-fold relative difference in the prevalence.

Differences in all other population groups were very small.

In summary, the prevalence of periodontal pocketing of 4+ mm was related to age, usual reason for making a dental visit and sex.

Table 5.18: Percentage of people with 4+ mm periodontal pocket depth in the Australian population and in four generations

		Population: periodontally examined people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**19.8**	**13.1**	**23.9**	**23.7**	**26.0**
	95%CI[b]	*17.9–21.8*	*10.2–16.7*	*21.2–26.9*	*21.1–26.7*	*18.6–35.1*
Sex						
Male	% of people	22.8	15.9	28.6	25.5	23.3
	95%CI	*19.9–26.0*	*11.3–21.9*	*24.4–33.2*	*21.8–29.7*	*14.2–35.9*
Female	% of people	16.7	10.1	19.2	21.9	28.0
	95%CI	*14.9–18.6*	*7.4–13.5*	*16.4–22.4*	*18.4–25.9*	*18.9–39.3*
Indigenous identity						
Indigenous	% of people	21.4	17.5	27.3	17.0	n.p.
	95%CI	*11.8–35.7*	*4.6–48.3*	*12.6–49.3*	*5.2–43.3*	*n.p.*
Non-Indigenous	% of people	19.7	13.0	23.9	23.8	26.3
	95%CI	*17.9–21.8*	*10.1–16.7*	*21.2–26.8*	*21.1–26.8*	*18.8–35.5*
Residential location						
Capital city	% of people	20.6	13.3	26.1	25.1	23.3
	95%CI	*18.4–23.0*	*10.0–17.6*	*22.6–29.9*	*21.6–29.0*	*14.0–36.2*
Other places	% of people	18.2	12.6	20.1	21.5	30.3
	95%CI	*14.9–21.9*	*7.6–20.3*	*16.2–24.6*	*17.5–26.1*	*19.5–43.8*
Year level of schooling						
Year 9 or less	% of people	23.3	n.p.	27.5	23.4	32.4
	95%CI	*18.1–29.3*	*n.p.*	*17.3–40.6*	*18.0–29.9*	*21.6–45.5*
Year 10 or more	% of people	19.4	12.9	23.7	24.0	23.0
	95%CI	*17.5–21.5*	*9.8–16.7*	*21.0–26.7*	*21.1–27.2*	*14.0–35.4*
Eligibility for public dental care						
Eligible	% of people	21.8	15.7	25.9	21.4	33.0
	95%CI	*18.6–25.5*	*10.0–24.0*	*20.0–32.9*	*17.6–25.8*	*22.8–45.1*
Ineligible	% of people	19.1	12.4	23.6	25.4	14.5
	95%CI	*17.1–21.4*	*9.2–16.6*	*20.7–26.7*	*22.0–29.2*	*7.4–26.2*
Dental insurance						
Insured	% of people	18.3	8.7	24.1	23.3	15.5
	95%CI	*16.0–20.9*	*5.1–14.4*	*20.6–27.9*	*20.0–27.0*	*8.1–27.6*
Uninsured	% of people	21.7	17.4	24.1	24.1	31.0
	95%CI	*19.2–24.5*	*13.2–22.5*	*20.6–28.0*	*20.1–28.5*	*21.4–42.7*
Usually visit dentist						
For a check-up	% of people	15.6	8.5	19.8	22.2	19.1
	95%CI	*13.8–17.6*	*6.0–12.0*	*16.8–23.3*	*18.9–25.8*	*11.6–29.8*
For a dental problem	% of people	25.1	19.7	28.5	25.8	35.3
	95%CI	*22.1–28.4*	*14.4–26.3*	*24.6–32.8*	*21.8–30.3*	*24.7–47.5*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Prevalence of gingival recession

Receding gums is a problem which may be caused by a number of factors but most commonly by incorrect tooth brushing. It is a problem because it exposes the more susceptible root surface to decay-causing risk factors for disease, and in very severe cases may jeopardise the tooth itself. In NSAOH gingival recession was measured using a periodontal probe at three sites on each tooth.

The prevalence of gingival recession of 2 mm or more in the Australian population was 52.9% (Table 5.19). Prevalence of gingival recession increased across the generations. It was 20.8% in the 1970–90 generation, 64.7% in the 1950–69 generation, 85.7% in the 1930–49 generation and 95.2% in the pre-1930 generation, a four-fold difference relative to the most recent group.

Among people of all ages prevalence of gingival recession was highest in people who left school at year 9 or lower (63.3%) and lowest among people who usually make a dental visit for a check-up (50.7%). Gingival recession was associated with years of schooling and eligibility for public dental care.

Among adults of all ages the prevalence of gingival recession in people who left school at year 9 or earlier was 1.2 times that of people who left at year 10 or later (63.3%versus 51.6%). This may reflect the age distribution in these two groups as far more people in older generations had less education than in the younger generations.

People eligible for public dental care had a higher prevalence of gingival recession (59.0%) than ineligible people (50.9%) a 1.2-fold relative difference. A small relative difference was also seen in the 1930–49 generation, where eligible people had a prevalence of 89.7% and ineligible people 82.9%.

In the 1930–49 generation there was also a small relative difference in the prevalence of gingival recession between uninsured and insured people (89.7% versus 82.3%).

Apparently large differences were also seen between Indigenous and non-Indigenous Australians in some generations but the wide CIs relating to the Indigenous estimates mean that the difference could be much larger or smaller than the estimate given.

In summary, prevalence of gingival recession of 2+ mm was related to age, years of schooling and eligibility for public dental care.

Table 5.19: Percentage of people with 2+ mm gingival recession in the Australian population and in four generations

		Population: periodontally examined people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**52.9**	**20.8**	**64.7**	**85.7**	**95.2**
	95%CI[b]	*50.3–55.4*	*17.3–24.7*	*61.8–67.5*	*83.0–88.1*	*89.5–97.9*
Sex						
Male	% of people	54.3	23.2	66.9	86.9	96.5
	95%CI	*50.5–58.1*	*17.9–29.4*	*62.2–71.3*	*83.1–90.0*	*84.2–99.3*
Female	% of people	51.4	18.2	62.5	84.5	94.3
	95%CI	*48.4–54.3*	*14.4–22.8*	*59.1–65.7*	*80.8–87.6*	*86.2–97.8*
Indigenous identity						
Indigenous	% of people	56.1	37.8	60.4	74.1	n.p.
	95%CI	*37.6–73.0*	*11.3–74.2*	*35.5–80.8*	*46.2–90.5*	*n.p.*
Non-Indigenous	% of people	52.8	20.6	64.8	85.8	95.1
	95%CI	*50.3–55.3*	*17.1–24.6*	*61.9–67.6*	*83.1–88.2*	*89.4–97.8*
Residential location						
Capital city	% of people	53.1	21.9	67.2	85.2	94.4
	95%CI	*50.2–56.1*	*17.9–26.5*	*63.7–70.5*	*81.8–88.0*	*85.1–98.0*
Other places	% of people	52.3	18.4	60.2	86.7	96.5
	95%CI	*47.7–57.0*	*12.4–26.5*	*55.1–65.1*	*81.6–90.5*	*89.2–98.9*
Year level of schooling						
Year 9 or less	% of people	63.3	n.p.	72.0	85.6	94.0
	95%CI	*56.3–69.8*	*n.p.*	*58.4–82.5*	*78.6–90.6*	*83.3–98.0*
Year 10 or more	% of people	51.6	21.4	64.3	85.7	95.8
	95%CI	*48.9–54.3*	*17.7–25.5*	*61.2–67.3*	*82.7–88.2*	*88.9–98.5*
Eligibility for public dental care						
Eligible	% of people	59.0	17.8	59.8	89.7	95.8
	95%CI	*54.6–63.4*	*11.5–26.5*	*52.0–67.2*	*86.8–92.0*	*88.0–98.6*
Ineligible	% of people	50.9	21.6	65.7	82.9	94.2
	95%CI	*48.0–53.8*	*17.5–26.4*	*62.5–68.7*	*79.0–86.3*	*81.9–98.3*
Dental insurance						
Insured	% of people	54.4	19.3	66.4	82.3	95.9
	95%CI	*50.7–57.9*	*14.3–25.5*	*62.7–69.9*	*78.4–85.6*	*84.7–99.0*
Uninsured	% of people	53.0	22.5	63.8	89.7	94.8
	95%CI	*49.7–56.3*	*17.8–27.9*	*59.7–67.7*	*86.4–92.2*	*88.0–97.8*
Usually visit dentist						
For a check-up	% of people	50.7	20.0	62.4	85.1	93.4
	95%CI	*47.5–53.9*	*16.0–24.8*	*58.5–66.2*	*81.5–88.1*	*83.8–97.5*
For a dental problem	% of people	55.7	22.0	67.3	86.7	97.5
	95%CI	*52.1–59.3*	*16.5–28.6*	*62.7–71.5*	*83.1–89.6*	*90.0–99.4*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Prevalence of periodontal clinical attachment loss

Clinical attachment loss (CAL) is the loss of supporting periodontal structure around the tooth. Attachment may be lost through gum recession or the development of periodontal pocketing from the inflammatory disease periodontitis. In NSAOH CAL was measured using a combination of gum recession and periodontal probing depth on three sites per tooth.

The percentage of the Australian population with CAL of 4 mm or more was 42.5% (Table 5.20). The prevalence of CAL of 4+ mm was lowest in the most recent generation (17.4%) and increased across the generations, with 48.8% prevalence in the 1950–69 generation, 73.0% in the 1930–49 generation and 80.5% in the pre-1930 generation.

Among Australians of all ages the highest prevalence of CAL of 4+ mm was 55.3% in people who had completed year 9 or less of schooling and the lowest was 38.2% among people who usually visit the dentist for a check-up. CAL of 4+ mm was associated with years of schooling, usual reason for making a dental visit, eligibility for public dental care and sex.

People who completed year 9 or less of schooling had 1.4 times the prevalence of CAL of 4+ mm as people who finished year 10 or more (55.3% versus 40.9%) among people of all ages. However, within generations there was no difference between schooling levels, indicating that the effect observed among all ages combined was largely a consequence of the older age distribution of people with lower levels of schooling.

People who usually make a dental visit because of a problem had 1.3 times the prevalence of those who usually visit for a check-up (48.2% versus 38.2%) among people of all ages. In the 1950–69 generation a similar relative difference was seen, with visitors for a problem having a prevalence of 54.3% and those for a check-up 44.1%.

Among people of all ages there was a 1.3-fold relative difference in prevalence of CAL of 4+ mm between people eligible for public dental care (52.1%) and those ineligible (39.4%). A similar relative difference was evident in the pre-1930 generation, with eligible people having a prevalence of 89.4% and people ineligible for public dental care 65.8%.

Males of all ages had a higher prevalence of CAL of 4+ mm (46.6%) than females (38.3%), a 1.2-fold relative difference. This same relative difference was seen, in the 1930–49 generation where males' prevalence of CAL of 4+ mm was 79.1% and females' 66.9%.

In summary, prevalence of clinical loss of attachment of 4 mm or more was associated with age, years of schooling, usual reason for making a dental visit, eligibility for public dental care and sex.

Table 5.20: Percentage of people with 4+ mm clinical attachment loss in the Australian population and in four generations

		Population: periodontally examined people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**42.5**	**17.4**	**48.8**	**73.0**	**80.5**
	95%CI[b]	*40.1–44.9*	*14.0–21.3*	*45.7–51.9*	*69.8–76.0*	*72.4–86.7*
Sex						
Male	% of people	46.6	21.7	52.9	79.1	86.7
	95%CI	*42.7–50.5*	*16.3–28.3*	*48.0–57.7*	*75.0–82.7*	*74.3–93.6*
Female	% of people	38.3	12.8	44.6	66.9	76.1
	95%CI	*35.7–40.9*	*9.9–16.5*	*41.0–48.3*	*62.4–71.2*	*64.5–84.8*
Indigenous identity						
Indigenous	% of people	52.0	24.3	66.4	59.4	n.p.
	95%CI	*33.4–70.1*	*7.1–57.3*	*41.7–84.5*	*26.0–85.8*	*n.p.*
Non-Indigenous	% of people	42.3	17.3	48.5	73.2	80.3
	95%CI	*40.0–44.8*	*13.9–21.3*	*45.4–51.6*	*70.0–76.2*	*72.0–86.6*
Residential location						
Capital city	% of people	41.1	17.0	48.5	71.9	78.1
	95%CI	*38.3–43.9*	*13.2–21.6*	*44.6–52.4*	*67.9–75.6*	*67.5–85.9*
Other places	% of people	45.1	18.2	49.3	74.9	84.3
	95%CI	*40.7–49.5*	*12.1–26.5*	*44.2–54.4*	*69.4–79.7*	*69.5–92.7*
Year level of schooling						
Year 9 or less	% of people	55.3	n.p.	55.9	73.8	81.3
	95%CI	*48.5–62.0*	*n.p.*	*42.4–68.5*	*66.4–80.0*	*67.2–90.2*
Year 10 or more	% of people	40.9	17.2	48.3	72.7	80.1
	95%CI	*38.4–43.5*	*13.7–21.4*	*45.1–51.5*	*69.1–75.9*	*69.5–87.6*
Eligibility for public dental care						
Eligible	% of people	52.1	16.4	53.2	76.6	89.4
	95%CI	*47.7–56.5*	*10.3–25.0*	*45.4–61.0*	*72.5–80.2*	*81.9–94.0*
Ineligible	% of people	39.4	17.7	48.0	70.5	65.8
	95%CI	*36.8–42.0*	*14.0–22.3*	*44.7–51.2*	*66.0–74.7*	*51.5–77.7*
Dental insurance						
Insured	% of people	42.1	15.2	48.1	70.1	69.4
	95%CI	*38.8–45.5*	*10.4–21.7*	*44.2–51.9*	*65.7–74.1*	*52.1–82.5*
Uninsured	% of people	44.1	19.8	50.0	76.6	85.5
	95%CI	*41.1–47.1*	*15.4–25.0*	*45.9–54.2*	*72.2–80.6*	*76.9–91.2*
Usually visit dentist						
For a check-up	% of people	38.2	13.9	44.1	71.0	73.7
	95%CI	*35.2–41.1*	*10.5–18.1*	*40.1–48.1*	*66.8–74.9*	*61.2–83.3*
For a dental problem	% of people	48.2	22.5	54.3	76.0	89.6
	95%CI	*44.6–51.9*	*16.7–29.6*	*49.6–58.8*	*71.5–79.9*	*81.8–94.3*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Extent of deep periodontal pockets

Table 5.21 shows the percentages of all measured tooth sites with 4 mm or more of periodontal pocket depth (PPD).

Of all tooth sites measured 1.0% had PPD of 4 mm or more. This percentage varied between the most recent generation with a low of 0.6% of sites, and the earlier generations: 1.3% in the 1950–69 and 1930–49 generations and 1.6% of sites with 4 mm or more of PPD in the pre-1930 generation.

Among Australians of all ages the highest percentage of sites with 4 mm or more of PPD was seen in people who had completed year 9 or less of schooling (1.7%) and the lowest among those who usually make a dental visit for a check-up (0.7%). PPD was associated with usual reason for making a dental visit, eligibility for public dental care, sex and dental insurance.

A more than two-fold relative difference in percentage of sites with PPD of 4 mm or more was seen between people of all ages who usually visit for a problem and those who visit for a check-up (1.5% versus 0.7%). A similar relative difference was seen in the 1930–49 generation (2.0% versus 0.9%). In the pre-1930 generation a 4.4-fold relative difference in the percentage of sites with PPD of 4 mm or more was seen between those who visit for a problem and those who visit for a check-up (3.1% versus 0.7%).

A 1.7-fold relative difference in percentage of sites with PPD of 4 mm or more was evident between people eligible for public dental care (1.5%) and those ineligible for such care (0.9%) in people of all ages. An almost four-fold relative difference was seen in the pre-1930 generation between eligible and ineligible people (2.3% versus 0.6%) in relation to PPD of 4 mm or more.

Australian adult males had 1.6 times higher percentage of sites with PPD than females in people of all ages (1.3% versus 0.8%). In the 1950–69 generation the relative difference between males and females was two fold (1.8% versus 0.9%).

Uninsured people of all ages had 1.6 times the percentage of sites with PPD of 4 mm or more than insured people (1.3% versus 0.8%). The relative difference in the 1970–90 generation was 4.5 fold between uninsured and insured people (0.9% versus 0.2%).

In summary, the percentage of sites with PPD of 4 mm or more was associated with age, usual reason for visiting the dentist, eligibility for public dental care, sex and dental insurance.

Table 5.21: Percentage of tooth sites with 4 mm or more of periodontal pocket depth in the Australian population and in four generations

		Population: periodontally examined people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of sites**	**1.0**	**0.6**	**1.3**	**1.3**	**1.6**
	95%CI [b]	*0.9–1.2*	*0.4–0.8*	*1.1–1.6*	*1.1–1.6*	*1.0–2.2*
Sex						
Male	% of sites	1.3	0.7	1.8	1.5	1.3
	95%CI	*1.0–1.5*	*0.4–1.1*	*1.4–2.2*	*1.1–1.8*	*0.5–2.2*
Female	% of sites	0.8	0.5	0.9	1.2	1.7
	95%CI	*0.6–0.9*	*0.2–0.7*	*0.7–1.1*	*0.9–1.5*	*0.9–2.6*
Indigenous identity						
Indigenous	% of sites	1.4	1.3	1.7	1.2	n.p.
	95%CI	*0.4–2.5*	—	*0.4–3.1*	—	*n.p.*
Non-Indigenous	% of sites	1.0	0.6	1.3	1.3	1.6
	95%CI	*0.9–1.2*	*0.4–0.8*	*1.1–1.6*	*1.1–1.6*	*1.0–2.2*
Residential location						
Capital city	% of sites	1.0	0.5	1.4	1.4	1.7
	95%CI	*0.8–1.1*	*0.3–0.7*	*1.1–1.6*	*1.1–1.8*	*0.9–2.6*
Other places	% of sites	1.1	0.9	1.3	1.2	1.3
	95%CI	*0.8–1.4*	*0.3–1.5*	*0.9–1.7*	*0.9–1.5*	*0.6–2.0*
Year level of schooling						
Year 9 or less	% of sites	1.7	n.p.	1.8	1.4	2.2
	95%CI	*0.8–2.6*	*n.p.*	*0.7–2.9*	*0.7–2.1*	*1.0–3.4*
Year 10 or more	% of sites	1.0	0.5	1.3	1.3	1.3
	95%CI	*0.8–1.1*	*0.3–0.7*	*1.1–1.5*	*1.0–1.6*	*0.6–2.0*
Eligibility for public dental care						
Eligible	% of sites	1.5	0.9	2.3	1.4	2.3
	95%CI	*1.1–1.9*	*0.1–1.6*	*1.4–3.2*	*0.9–1.9*	*1.4–3.2*
Ineligible	% of sites	0.9	0.5	1.2	1.3	0.6
	95%CI	*0.8–1.0*	*0.3–0.7*	*0.9–1.4*	*1.0–1.5*	*0.1–1.0*
Dental insurance						
Insured	% of sites	0.8	0.2	1.2	1.0	0.7
	95%CI	*0.6–0.9*	*0.1–0.4*	*0.9–1.4*	*0.8–1.2*	*0.2–1.2*
Uninsured	% of sites	1.3	0.9	1.5	1.8	2.0
	95%CI	*1.1–1.5*	*0.5–1.3*	*1.2–1.9*	*1.2–2.3*	*1.2–2.9*
Usually visit dentist						
For a check-up	% of sites	0.7	0.4	1.0	0.9	0.7
	95%CI	*0.6–0.8*	*0.2–0.6*	*0.7–1.3*	*0.7–1.1*	*0.4–1.1*
For a dental problem	% of sites	1.5	0.9	1.7	2.0	3.1
	95%CI	*1.2–1.8*	*0.5–1.4*	*1.3–2.1*	*1.4–2.5*	*1.7–4.5*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Extent of periodontal clinical attachment loss

Clinical attachment loss (CAL) is a measure of the loss of the supporting structures attached to the tooth. CAL is measured by adding together the amount of gum recession and the depth of the periodontal pocket at each site. This was measured in millimetres using a periodontal probe. In NSAOH three sites were measured per tooth. Table 5.22 shows the percentages of all measured tooth sites with 4 mm or more CAL.

Of all tooth sites measured 3.5% had CAL of 4 mm or more. This percentage varied by generation, with a low of 0.7% of sites having CAL in the 1970–90 generation, 3.7% in the 1950–69 generation, 8.7% in the 1930–49 generation and a high of 15.5% of sites with 4 mm or more of clinical attachment loss in the pre-1930 generation.

Among Australians of all ages the highest percentage of sites with 4 mm or more of CAL was seen in people who had completed year 9 or less of schooling (6.7%) and the lowest among females and people ineligible for public dental care (2.8%). CAL was associated with eligibility for public dental care, years of schooling, usual reason for making a dental visit, sex and dental insurance.

A more than two-fold relative difference in CAL was seen between people eligible for public dental care (6.1%) and those ineligible for such care (2.8%) in people of all ages. In the 1950–69 generation eligible people had 1.8 times the percentage of sites with CAL of 4 mm or more of ineligible people (5.8% versus 3.3%). A 1.5-fold relative difference was seen in the 1930–49 generation and an almost two fold relative difference in the pre-1930 generation between eligible and ineligible people (10.9% versus 7.4% and 19.3% versus 10.3% respectively) in relation to CAL.

Australian adults who left school at year 9 or earlier, had twice the percentage of sites with 4 mm or more of CAL as those who left in year 10 or later (6.7% versus 3.2%). No differences were seen when categorised by generation.

A 1.5-fold relative difference in percentage of sites with CAL was evident between people of all ages who usually visit for a problem and people who visit for a check-up (2.9% versus 4.4%). The same relative difference was seen in the 1950–69 and the 1930–49 generations. In the pre-1930 generation a 1.8-fold relative difference in the percentage of sites with CAL was seen (21.8% versus 12.0%).

Males had 1.5 times higher percentage of sites with CAL than females in people of all ages (4.2% versus 2.8%). In the 1950–69 and in the 1930–49 generations the relative difference between males and females was 1.6-fold.

Uninsured people of all ages had 1.4 times the percentage of sites with CAL than insured people (4.2% versus 2.9%). The relative difference in the 1970–90 generation was 2.3-fold between uninsured and insured people (0.9% versus 0.4%). A 1.8-fold difference in percentage of sites with CAL of 4 mm or more was seen between uninsured and insured people in the 1930–49 generation, and 1.6 fold in the pre-1930 generation.

In summary, the percentage of sites with 4 mm or more CAL was associated with age, eligibility for public dental care, years of schooling, usual reason for visiting the dentist, sex and dental insurance.

Table 5.22: Percentage of tooth sites with 4 mm or more of periodontal attachment loss in the Australian population and in four generations

		Population: periodontally examined people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of sites**	**3.5**	**0.7**	**3.7**	**8.7**	**15.5**
	95%CI[b]	*3.2–3.8*	*0.5–0.8*	*3.2–4.2*	*7.9–9.6*	*12.5–18.4*
Sex						
Male	% of sites	4.2	0.8	4.6	10.7	17.5
	95%CI	*3.7–4.7*	*0.6–1.1*	*3.8–5.4*	*9.4–12.1*	*13.1–21.8*
Female	% of sites	2.8	0.5	2.8	6.7	14.1
	95%CI	*2.5–3.1*	*0.3–0.7*	*2.3–3.2*	*5.8–7.6*	*10.3–17.9*
Indigenous identity						
Indigenous	% of sites	3.8	0.9	4.0	9.0	n.p.
	95%CI	*1.9–5.7*	—	*1.8–6.2*	*1.0–17.0*	*n.p*
Non-Indigenous	% of sites	3.5	0.7	3.7	8.7	15.5
	95%CI	*3.2–3.8*	*0.5–0.8*	*3.2–4.2*	*7.9–9.6*	*12.5–18.4*
Residential location						
Capital city	% of sites	3.3	0.5	3.5	8.3	15.1
	95%CI	*2.9–3.6*	*0.4–0.7*	*2.9–4.1*	*7.2–9.4*	*11.7–18.5*
Other places	% of sites	4.0	0.9	4.0	9.5	16.0
	95%CI	*3.5–4.6*	*0.5–1.3*	*3.3–4.7*	*8.2–10.8*	*10.6–21.5*
Year level of schooling						
Year 9 or less	% of sites	6.7	n.p.	6.3	10.0	16.8
	95%CI	*5.3–8.1*	*n.p.*	*3.3–9.4*	*8.0–12.0*	*10.9–22.8*
Year 10 or more	% of sites	3.2	0.6	3.6	8.4	14.9
	95%CI	*2.9–3.5*	*0.4–0.8*	*3.1–4.0*	*7.5–9.3*	*11.6–18.3*
Eligibility for public dental care						
Eligible	% of sites	6.1	0.7	5.8	10.9	19.3
	95%CI	*5.2–6.9*	*0.3–1.1*	*4.2–7.4*	*9.3–12.5*	*15.5–23.0*
Ineligible	% of sites	2.8	0.7	3.3	7.4	10.3
	95%CI	*2.5–3.1*	*0.5–0.9*	*2.9–3.7*	*6.5–8.3*	*6.6–13.9*
Dental insurance						
Insured	% of sites	2.9	0.4	3.1	6.6	11.1
	95%CI	*2.6–3.3*	*0.2–0.5*	*2.6–3.7*	*5.8–7.5*	*6.9–15.4*
Uninsured	% of sites	4.2	0.9	4.3	11.6	17.7
	95%CI	*3.8–4.6*	*0.6–1.2*	*3.6–5.0*	*10.0–13.1*	*14.1–21.4*
Usually visit dentist						
For a check-up	% of sites	2.9	0.5	3.0	7.4	12.0
	95%CI	*2.6–3.3*	*0.3–0.7*	*2.4–3.6*	*6.5–8.4*	*9.0–15.0*
For a dental problem	% of sites	4.4	0.9	4.6	10.8	21.8
	95%CI	*3.9–4.9*	*0.6–1.3*	*3.9–5.2*	*9.3–12.4*	*16.6–27.0*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Prevalence of gingival inflammation

The gingival index is a measure of gingivitis, inflammation of the gums. Gingivitis occurs as a response to the bacteria in plaque accumulation near the gum line. In NSAOH gingivitis was assessed on six index teeth. A gingival index score of two or more indicated bleeding on probing or spontaneous bleeding (see Chapter 2: Methods) and was classified as indicating gingival inflammation (gingivitis).

Australian adults had a prevalence of a gingival index score of two or more of 19.7% (Table 5.23). There was little difference in the prevalence across the generations, with the range being from 19.1% among people in the youngest generation to 23.7% in the oldest.

The highest percentage of people with gingivitis was seen in Indigenous Australians (26.8%) and the lowest among insured adults (15.9%). Gingivitis was associated with dental insurance, usual reason for making a dental visit and eligibility for public dental care.

Uninsured people had 1.5 times the prevalence of gingivitis as insured people (23.2% versus 15.9%) among people of all ages. The same relative difference by insurance was seen in the 1950–69 and 1930–49 generations (23.3% versus 15.4% and 25.7% versus 16.9% respectively).

Among adults of all ages those who make a dental visit for a problem had 1.4 times the prevalence of gingivitis of those who visit for a check-up (23.4% versus 16.8%) although there was no significant difference within generations.

Adults eligible for public dental care had 1.3 times the prevalence of gingivitis of ineligible people (24.2% versus 18.3%), although there was no significant difference within generations.

In summary, prevalence of a gingival index score of two or more was associated with dental insurance, usual reason for making a dental visit and eligibility for public dental care.

Table 5.23: Percentage of people with gingival inflammation in the Australian population and in four generations

		Population: periodontally examined people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**19.7**	**19.1**	**19.3**	**21.0**	**23.7**
	95%CI[b]	*17.8–21.8*	*15.8–22.9*	*16.9–21.9*	*18.3–24.0*	*17.2–31.7*
Sex						
Male	% of people	22.2	21.0	21.7	24.0	31.4
	95%CI	*19.5–25.1*	*16.3–26.7*	*18.0–25.9*	*19.8–28.7*	*20.8–44.5*
Female	% of people	17.2	17.0	16.9	18.0	18.3
	95%CI	*15.1–19.6*	*13.2–21.7*	*14.1–20.0*	*14.9–21.6*	*11.7–27.5*
Indigenous identity						
Indigenous	% of people	26.8	22.9	37.6	8.5	n.p.
	95%CI	*13.7–45.8*	*4.2–66.7*	*17.6–63.0*	*1.8–31.5*	*n.p.*
Non-Indigenous	% of people	19.6	19.0	19.0	21.1	24.0
	95%CI	*17.7–21.7*	*15.7–22.8*	*16.6–21.7*	*18.4–24.2*	*17.4–32.0*
Residential location						
Capital city	% of people	19.5	19.8	18.3	21.0	19.9
	95%CI	*17.1–22.0*	*15.8–24.5*	*15.5–21.5*	*17.4–25.1*	*12.6–30.1*
Other places	% of people	20.2	17.6	21.0	21.1	29.6
	95%CI	*17.1–23.7*	*12.5–24.3*	*16.8–26.0*	*17.1–25.7*	*18.6–43.6*
Year level of schooling						
Year 9 or less	% of people	25.2	n.p.	25.5	28.4	27.6
	95%CI	*20.4–30.8*	*n.p.*	*15.7–38.5*	*22.6–35.1*	*17.3–40.9*
Year 10 or more	% of people	19.1	18.9	18.9	19.4	21.9
	95%CI	*17.1–21.2*	*15.6–22.8*	*16.5–21.6*	*16.4–22.8*	*14.4–31.7*
Eligibility for public dental care						
Eligible	% of people	24.2	21.9	26.9	23.2	28.9
	95%CI	*20.7–28.2*	*15.2–30.4*	*20.2–34.9*	*19.0–27.9*	*20.2–39.5*
Ineligible	% of people	18.3	18.4	17.9	19.6	15.0
	95%CI	*16.2–20.6*	*14.9–22.6*	*15.4–20.6*	*16.1–23.5*	*7.7–27.5*
Dental insurance						
Insured	% of people	15.9	16.0	15.4	16.9	14.1
	95%CI	*13.5–18.7*	*11.5–21.9*	*12.4–18.9*	*13.4–21.1*	*6.6–27.6*
Uninsured	% of people	23.2	21.4	23.3	25.7	28.2
	95%CI	*20.6–26.0*	*17.1–26.5*	*19.6–27.4*	*21.5–30.5*	*19.7–38.7*
Usually visit dentist						
For a check-up	% of people	16.8	16.8	15.8	18.2	18.0
	95%CI	*14.5–19.3*	*12.9–21.6*	*12.9–19.3*	*15.1–21.7*	*10.8–28.4*
For a dental problem	% of people	23.4	22.4	22.9	24.8	31.1
	95%CI	*20.7–26.4*	*17.4–28.5*	*19.2–26.9*	*20.5–29.6*	*20.6–43.9*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Summary of findings regarding gum diseases

Destructive periodontal disease was observed in one in five Australians. Half of the adult population had gingival recession and one in five had gingivitis. There was a strong and consistent association between age and the prevalence and extent of destructive periodontal disease (Table 5.24). Compared to the 1970–90 generation, successively earlier generations had higher prevalence and extent of periodontitis. For the pre-1930 generation, the rates tended to be notably higher. Notably, however, gingivitis did not vary among generations.

Table 5.24: Summary of gum disease

	Prevalence: % of people with periodontitis case definitions[a]					Extent: % of sites		% of people with gingivitis
	CDC/AAP	NCHS	4+mm PPD	2+mm REC	4+mm CAL	4+mm PPD	4+mm CAL	
Generation								
Ref[b] = 1970–90								
1950–69	↑	↑	↑	↑	↑	↑	↑	~
1930–49	↑↑	↑	↑	↑↑	↑	↑	↑↑	~
Pre-1930	↑↑	↑	↑	↑↑	↑↑	↑	↑↑	~
Sex								
Ref = Male								
Female	↓	↓	↓	~	↓	↓	↓	↑
Indigenous identity								
Ref = Non-Indigenous								
Indigenous	~	~	~	~	~	~	~	~
Residential location								
Ref = Capital cities								
Other places	~	~	~	~	~	~	~	~
Year level of schooling								
Ref = Year 10 or more								
Year 9 or less	↑	~	~	↑	↑	~	↑	~
Eligibility for public dental care								
Ref= Ineligible								
Eligible	↑	~	~	↑	↑	↑	↑	↑
Dental insurance								
Ref = Insured								
Uninsured	↑	~	~	~	~	↑	↑	↑
Usually visit dentist								
Ref = For a check-up								
For a dental problem	↑	↑	↑	~	↑	↑	↑	↑

(a) CDC/AAP = Centers for Disease Control and Prevention/American Academy of Periodontology moderate or severe case definition (see page 119); NCHS = National Center for Health Statistics case definition (see page 121); PPD = probing pocket depth; REC = gingival recession; CAL = clinical attachment loss

(b) Ref: reference group; ↓↓: markedly lower; ↓: lower; ~: not sig. different; ↑: higher; ↑↑: markedly higher

Females consistently had lower levels of periodontitis despite having higher prevalence of gingivitis. People who were eligible for public dental care or who visited for a dental problem had higher rates of both conditions, while the uninsured were more likely to have gingivitis, and they had elevated extent of periodontitis.

5.4 Tooth wear

While some tooth wear is inevitable as a consequence of aging and normal oral function, wear can be accelerated by an excessive load on biting and chewing surfaces of teeth that remain following loss of some other teeth. Other factors contribute to excessive wear, for example, habitual biting on hard objects (for example, a tobacco pipe) or consumption of acidic foods in the diet. As more and more people retain teeth into older age severe wear of the teeth may be more common.

Prevalence of enamel wear of lower incisors

In NSAOH, wear of dental enamel was measured on the four lower incisor teeth at the front of the mouth. Enamel wear of lower incisors was defined as the complete loss of tooth enamel on the biting (incisal) surface of the tooth.

There were 25.9% of Australian adults who had enamel wear of lower incisors, but notable differences were seen among generations (Table 5.25). Prevalence was highest in the pre-1930 generation (50.5%) and decreased among more recent generations to 9.5% in the 1970–90 generation.

In adults of all ages the highest prevalence of enamel wear was seen in Indigenous Australians (37.1%) and the lowest in females (20.0%). Among population groups associations were seen with years of schooling, eligibility for public dental care, sex, residential location and usual reason for making a dental visit.

Adults who completed year 9 or less of schooling had 1.4 times the prevalence of full enamel wear as those who completed year 10 or higher for all age groups (35.3% versus 24.6%). Only very small differences were seen across the generations.

Prevalence of enamel wear was among people eligible for public dental care was 1.3 times greater than among people who were ineligible (31.0% versus 24.1%).

Males had higher prevalence of tooth wear than females. Among all ages prevalence was 1.6 times greater for males than females (31.7% versus 20.0%). The largest difference was seen in the 1950–69 generation, where there was a 1.8 fold difference between males (36.8%) compared to females (20.9%). In the 1930–49 generation 1.4 times more males (51.6%) than females (36.2%) had enamel wear of lower incisors.

Among adults of all ages prevalence of enamel wear was 1.5 greater among people who lived outside capital cities (31.8%) compared to residents of capital cities (22.7%).

Table 5.25: Percentage of people with enamel wear of lower incisors in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**25.9**	**9.5**	**28.8**	**44.1**	**50.5**
	95%CI [b]	*23.9–27.9*	*7.3–12.2*	*25.9–31.9*	*40.8–47.4*	*43.4–57.6*
Sex						
Male	% of people	31.7	12.5	36.8	51.6	58.3
	95%CI	*28.8–34.8*	*9.0–17.2*	*32.4–41.5*	*47.1–56.1*	*48.6–67.3*
Female	% of people	20.0	6.3	20.9	36.2	44.6
	95%CI	*18.0–22.2*	*4.3–9.3*	*17.7–24.5*	*32.3–40.3*	*35.6–53.9*
Indigenous identity						
Indigenous	% of people	37.1	0.0	56.4	57.0	n.p.
	95%CI	*21.5–56.0*	—	*31.7–78.3*	*33.0–78.1*	*n.p.*
Non-Indigenous	% of people	25.7	9.6	28.4	43.9	50.9
	95%CI	*23.8–27.7*	*7.4–12.4*	*25.5–31.4*	*40.6–47.2*	*43.8–57.9*
Residential location						
Capital city	% of people	22.7	7.0	27.2	40.0	42.8
	95%CI	*20.7–24.8*	*5.0–9.8*	*24.0–30.6*	*36.3–43.8*	*34.2–51.9*
Other places	% of people	31.8	14.6	31.8	50.8	64.5
	95%CI	*27.7–36.1*	*9.9–21.0*	*26.2–37.9*	*44.8–56.9*	*53.1–74.4*
Year level of schooling						
Year 9 or less	% of people	35.3	10.3	40.1	42.7	50.4
	95%CI	*30.2–40.6*	*4.3–22.7*	*28.7–52.8*	*36.7–49.0*	*39.3–61.4*
Year 10 or more	% of people	24.6	9.4	28.1	44.2	50.6
	95%CI	*22.6–26.7*	*7.2–12.2*	*25.1–31.2*	*40.5–48.0*	*41.4–59.6*
Eligibility for public dental care						
Card holder	% of people	31.0	7.3	30.2	45.1	51.3
	95%CI	*27.8–34.4*	*3.9–13.2*	*24.1–37.2*	*40.5–49.7*	*42.4–60.1*
Non card-holder	% of people	24.1	10.1	28.5	43.2	49.1
	95%CI	*21.9–26.4*	*7.6–13.3*	*25.5–31.7*	*39.0–47.6*	*37.3–61.1*
Dental insurance						
Insured	% of people	24.2	7.2	27.0	40.6	41.4
	95%CI	*21.7–26.9*	*4.4–11.7*	*23.3–31.1*	*36.5–44.9*	*30.3–53.5*
Uninsured	% of people	28.1	11.7	31.0	47.8	55.0
	95%CI	*25.6–30.8*	*8.8–15.5*	*26.8–35.4*	*43.3–52.3*	*46.0–63.7*
Usually visit dentist						
For a check-up	% of people	21.6	7.1	23.9	40.2	39.8
	95%CI	*19.3–24.0*	*4.8–10.4*	*20.4–27.8*	*36.1–44.5*	*31.3–49.0*
For a dental problem	% of people	31.5	13.0	34.3	49.4	65.1
	95%CI	*28.5–34.6*	*9.3–18.0*	*29.9–38.9*	*44.7–54.1*	*53.5–75.2*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).
(b) 95%CI = 95% confidence interval for estimated percentage.

Those who usually make a dental visit for a dental problem had a 1.5 times higher prevalence of full enamel tooth wear (31.5%) than those who usually visit for a check-up (21.8%). A larger difference (1.7 times the prevalence) was seen in the 1930–49 generation between those who usually visit the dentist for a problem (65.1%) and those who visit for a check-up (39.8%).

In the 1950–69 generation a two-fold difference was noted in the prevalence of full enamel wear between Indigenous Australians (56.4%) and non-Indigenous Australians (28.4%). Among all adults and in the 1930—1949 generation apparent differences between Indigenous and non-Indigenous Australians can be seen, although the 95%CIs are wide for Indigenous Australians, meaning that the true estimate for Indigenous Australians could be much larger or smaller.

In summary, full enamel tooth wear was associated with age, years of schooling, eligibility for public dental care, sex, residential location and usual reason for making a dental visit.

Prevalence of severe wear of lower incisors

While some wear is inevitable as a consequence of aging and normal oral function, wear of incisors can be accelerated by an excessive load on the front teeth following loss of back teeth. Other factors can cause excessive wear, for example, habitual biting on hard objects (for example, a tobacco pipe) or consumption of acidic foods in the diet. In this survey, severe tooth wear is defined (Table 5.26) as complete loss of enamel from the incisal surface and a remaining height of the tooth crown in the bottom 5% of all crown heights. The definition does not seek to attribute the wear to any particular cause. To classify severe wear, tooth wear was measured on the lower four incisor teeth by visually assessing the amount of enamel on the biting surface and measuring the height of the crown of the tooth at the mid-point of the tooth. Teeth that had a filling on the biting surface were excluded from this assessment.

Box 5.3 Severe tooth wear

Dawn Barbour recalls her father's experience of severe tooth wear, attributing it to effects of ageing and normal oral function.

Me father wore his out. He wore his bottom teeth right down to the gum. He lived to be 80 years old. They wore right down 'til there was nothing. But then he had done a lot of eating.

–Excerpt from oral history of Dawn Barbour (see Chapter 4.2, page 73)

Severe tooth wear was seen in 3.3% of the Australian population (Table 5.26). It was strongly related to age, with very few people in the 1970–90 generation (0.5%) having severe wear but an increasing prevalence across the generations, with 2.3% in the 1950–69 generation, 7.8% in the 1930–49 generation and 12.0% in the pre-1930 generation.

Among Australians of all ages the highest prevalence of severe tooth wear was seen in Indigenous adults (10.9%) and the lowest among females (1.8%). Tooth wear was associated with sex, years of schooling, eligibility for public dental care, residential location and usual reason for making a dental visit.

Males had 2.6 times the prevalence of severe tooth wear of females (4.7% versus 1.8%) in people of all ages. This relative difference was also seen in the older generations, where a three-fold relative difference in prevalence was seen in the pre-1930 generation (19.3% versus 6.4%) and a 2.6 fold relative difference in the 1930–49 generation between males (11.1%) and females (4.3%).

People who had completed year 9 or less of schooling had 2.3 times the prevalence of severe tooth wear of those who completed year 10 or more (6.6% versus 2.9%) among adults of all ages. However, no differences were seen when categorised by generation. This may reflect the effect of age as different education attainment is not evenly spread across the generations, with those with fewer years of education concentrated in the older generations.

Adults of all ages who live outside Australian capital cities had more than twice the prevalence of severe tooth wear of those who live in capital cities (5.0% versus 2.4%). This relative difference was also evident in the 1950–69 generation, where non-capital city residents had 2.8 times the prevalence of severe tooth wear of capital city residents (3.9% versus 1.4%).

Eligibility for public dental care was associated with severe tooth wear, with eligible people having more than twice the prevalence as ineligible people (5.4% versus 2.5%) in Australian adults of all ages. However, no significant differences were seen when categorised by generation.

Australian adults who usually make a dental visit because of a problem had twice the prevalence of severe tooth wear as those who visit for a check-up (4.5% versus 2.3%). A three-fold relative difference was evident in the pre-1930 generation, with a prevalence of 19.5% among those who visit for a problem and 6.5% among those who visit for a check-up. People who make regular dental visits may be more likely to have had treatment for severe wear and treated teeth were excluded from this assessment.

In summary, the percentage of people with full enamel wear and a crown height below the fifth percentile was associated with age, sex, years of schooling, residential location, eligibility for public dental care and usual reason for making a dental visit.

Table 5.26: Percentage of people with severe wear of lower incisors in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**3.3**	**0.5**	**2.3**	**7.8**	**12.0**
	95%CI[b]	*2.8–3.8*	*0.2–1.3*	*1.6–3.4*	*6.5–9.3*	*8.6–16.5*
Sex						
Male	% of people	4.7	0.9	3.3	11.1	19.3
	95%CI	*3.9–5.7*	*0.3–2.4*	*2.1–5.1*	*8.9–13.7*	*12.9–27.9*
Female	% of people	1.8	0.1	1.4	4.3	6.4
	95%CI	*1.3–2.4*	*0.0–0.9*	*0.7–2.7*	*3.1–6.0*	*3.5–11.5*
Indigenous identity						
Indigenous	% of people	10.9	0.0	16.3	17.5	n.p.
	95%CI	*2.8–34.2*	—	*2.4–60.1*	*6.7–38.4*	*n.p.*
Non-Indigenous	% of people	3.2	0.5	2.1	7.7	12.1
	95%CI	*2.7–3.7*	*0.2–1.3*	*1.5–3.0*	*6.4–9.2*	*8.7–16.6*
Residential location						
Capital city	% of people	2.4	0.2	1.4	6.8	8.2
	95%CI	*1.9–2.9*	*0.1–0.9*	*0.9–2.3*	*5.3–8.8*	*5.3–12.6*
Other places	% of people	5.0	1.2	3.9	9.3	18.9
	95%CI	*3.9–6.3*	*0.4–3.5*	*2.4–6.6*	*7.4–11.8*	*11.6–29.2*
Year level of schooling						
Year 9 or less	% of people	6.6	n.p.	6.1	9.1	11.5
	95%CI	*4.6–9.2*	*n.p.*	*2.3–15.1*	*6.1–13.3*	*6.8–18.8*
Year 10 or more	% of people	2.9	0.6	2.1	7.5	12.3
	95%CI	*2.4–3.5*	*0.2–1.4*	*1.4–3.1*	*6.1–9.2*	*8.0–18.5*
Eligibility for public dental care						
Eligible	% of people	5.4	1.1	2.0	8.9	12.6
	95%CI	*4.4–6.6*	*0.2–4.8*	*1.0–4.0*	*6.9–11.3*	*8.4–18.5*
Ineligible	% of people	2.5	0.4	2.4	7.0	11.0
	95%CI	*2.0–3.2*	*0.1–1.2*	*1.6–3.6*	*5.3–9.2*	*6.0–19.3*
Dental insurance						
Insured	% of people	3.0	0.4	2.4	6.7	8.0
	95%CI	*2.3–3.9*	*0.1–2.8*	*1.5–3.9*	*5.1–8.9*	*3.7–16.7*
Uninsured	% of people	3.6	0.7	2.2	8.9	13.9
	95%CI	*2.9–4.5*	*0.3–1.7*	*1.2–4.0*	*7.0–11.3*	*9.5–20.0*
Usually visit dentist						
For a check-up	% of people	2.3	0.4	1.7	6.1	6.5
	95%CI	*1.8–3.0*	*0.1–1.4*	*0.9–3.1*	*4.6–8.1*	*3.7–11.2*
For a dental problem	% of people	4.5	0.8	3.1	10.0	19.5
	95%CI	*3.6–5.5*	*0.2–2.6*	*1.9–4.9*	*7.7–12.8*	*12.8–28.6*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Summary of findings regarding tooth wear of lower incisors

Severe tooth wear was seen in 3.3% of Australians, whereas moderate tooth wear involving complete loss of enamel was found in one in four people. Tooth wear of lower incisors was strongly related to age, with those in earlier generations having markedly more wear. A consistent association of the two tooth wear measures was also found with several other population characteristics. Females, those with higher educational attainment and those ineligible for public dental care had less tooth wear. People living outside capital cities and those who usually visit the dentist for a problem had more tooth wear.

Table 5.27: Summary of tooth wear

	% enamel wear	% with severe wear
Generation		
Ref[(a)] = 1970–90		
1950–69	↑	↑
1930–49	↑↑	↑↑
Pre-1930	↑↑	↑↑
Sex		
Ref = Male		
Female	↓	↓
Indigenous identity		
Ref = Non-Indigenous		
Indigenous	~	~
Residential location		
Ref = Capital Cities		
Other places	↑	↑
Year level of schooling		
Ref = Year 10 or more		
Year 9 or less	↑	↑
Eligibility for public dental care		
Ref = Ineligible		
Eligible	↑	↑
Dental insurance		
Ref = Insured		
Uninsured	~	~
Usually visit dentist		
Ref = For a check-up		
For a dental problem	↑	↑

(a) Ref: reference group; ↓↓: markedly lower; ↓: lower; ~: not sig. different; ↑: higher; ↑↑: markedly higher

6 Dental care

by A John Spencer and Jane Harford

Several approaches are used to describe access to dental care among populations. While the most common approaches are focussed on the last dental visit, how long ago it occurred, and the place of the visit, there is also a strong interest in capturing a longer-term view of people's access to dental care. Another approach asks people about the usual pattern of visits to a dentist. This section uses both approaches, and additionally describes people's experience of financial barriers in obtaining dental care.

6.1 People's most recent dental visit

Dental attendance within the preceding 12 months

Time since last visiting a dentist is a key indicator of access to dental care. Two aspects of the time interval are important. The percentage of adults who last visited within 12 months indicates the recency of the last visit. Some of those visits will be for a regular check-up; while other visits will be for dental treatment as a result of experiencing a dental problem. Visiting within the last 12 months for a check-up is widely recommended by the dental profession. Such visits provide the opportunity for provision of specific preventive services, early diagnosis and prompt treatment of dental disease.

On the other hand not having visited in the last 5 years can be regarded as effectively not being within the dental care system. The reasons for not visiting within the last 5 years may be varied. They range from no perceived need through to barriers to visiting when there is a perceived need and desire to visit, but either individual factors do not assist visiting, or dental services are not available or obtainable.

In NSAOH the time since last visit was assessed in the interview by asking people 'How long ago did you last visit a dental professional about your teeth, dentures or gums?' People were able to answer 'Less than 12 months', '1–2 years', 2–5 years', '5–10 years' '10+ years', 'Never visited' and 'Don't know'. Table 6.1 presents the percentage of people visiting a dentist within the last 12 months in the Australian population and in the four generations. Some 59.4% of the Australian population aged 15 years or more had visited a dentist within the last 12 months. There was only moderate variation in the percentage of adults visiting within the last 12 months across the four generations (49.4% to 62.7%), with a higher percentage of adults in the 1950–69 and 1930–49 generations (62.7% and 62.0% respectively) visiting than for either the pre-1930 or 1970–90 generations (49.4% and 56.5% respectively).

For people of all ages, a higher percentage of females than males reported visiting within the last 12 months (61.7% versus 57.0%). Within the generations this difference

only existed among the more recent generations, those adults born between 1970–90 and 1950–69. A lower percentage of people who identified themselves as Indigenous compared with non-Indigenous reported visiting within the last 12 months (50.7% versus 59.5%). However 95% CI in the estimate for those of Indigenous identity was wide.

There were more substantial differences among other population groups in the percentage of adults reporting visiting within the last 12 months. There was a three-fold difference in the percentage visiting within the last 12 months between the edentulous and dentate (62.1% versus 19.8%). Except for the most recent generation, this three-fold difference was found in each of the generations. Therefore this difference seemed to be a result of edentulism rather than a mix of age or period effects. This three-fold difference was a more substantial difference than the 1.4 times difference among those who had dental insurance compared to those without insurance (71.6% versus 49.4%), and those who reported usually visiting a dentist for a check-up compared to those who usually visited for a dental problem (77.1% versus 43.4%). There was relatively little variation across the generations in the percentage of adults with dental insurance who reported a visit within the last 12 months, but the percentage of adults who visited among those without insurance was lower among adults in the earliest generation (42.1%). The percentage of adults who visited within the last 12 months among those who usually visit for a check-up increased from the most recent to the earliest generation (70.3%–87.9%). The same trend was apparent among adults who usually visit for a dental problem, from the most recent through to the 1930–49 generation, who had a substantially lower percentage reporting visiting within the last 12 months (35.0%). The low percentage of the earliest generation who usually visit for a dental problem who had visited within the last 12 months is most likely a consequence of a higher percentage of this generation being edentulous and such people's low perceived need for visits.

A higher percentage of those adults who resided in a capital city visited within the last 12 months than those who lived in other places (62.2 versus 54.3%) a higher percentage of those adults with year 10 or more than year 9 or less schooling had visited within the last 12 months (60.7% versus 50.3%) and a higher percentage of those who were ineligible than eligible for public dental care visited within the last 12 months (62.5% versus 50.6%). These differences existed across each generation for each of these population groups.

In summary, just under 60% of Australian adults had visited a dentist within the last 12 months. Being dentate, usually visiting for a check-up, being insured, being ineligible for public dental care, having more years of schooling and residing in a capital city were all associated with having made a recent dental visit.

Table 6.1: Percentage of people visiting dentist within last 12 months in the Australian population and in four generations

		Population: all people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**59.4**	**56.5**	**62.7**	**62.0**	**49.4**
	95%CI [b]	*58.2–60.5*	*54.4–58.6*	*61.0–64.3*	*59.9–64.1*	*45.8–53.0*
Sex						
Male	% of people	57.0	53.3	59.5	60.8	50.6
	95%CI	*55.3–58.7*	*50.0–56.7*	*56.9–62.0*	*57.8–63.6*	*45.1–56.0*
Female	% of people	61.7	59.8	65.8	63.3	48.6
	95%CI	*60.3–63.1*	*57.1–62.3*	*63.8–67.8*	*60.8–65.7*	*44.5–52.8*
Indigenous identity						
Indigenous	% of people	50.7	53.6	43.9	55.1	52.0
	95%CI	*41.6–59.8*	*38.6–68.1*	*29.8–59.1*	*40.7–68.7*	*19.7–82.8*
Non-Indigenous	% of people	59.5	56.5	63.0	62.2	49.4
	95%CI	*58.3–60.7*	*54.4–58.6*	*61.3–64.6*	*60.0–64.3*	*45.8–53.0*
Residential location						
Capital city	% of people	62.2	58.3	64.7	67.6	54.5
	95%CI	*60.7–63.6*	*55.8–60.7*	*62.6–66.7*	*64.9–70.2*	*49.5–59.4*
Other places	% of people	54.3	52.8	59.1	53.6	41.6
	95%CI	*52.4–56.2*	*48.7–56.9*	*56.3–61.7*	*50.2–56.9*	*36.6–46.7*
Year level of schooling						
Year 9 or less	% of people	50.3	65.8	54.9	48.7	38.7
	95%CI	*47.4–53.3*	*56.8–73.9*	*47.4–62.2*	*44.8–52.6*	*33.9–43.7*
Year 10 or more	% of people	60.7	55.7	63.2	66.2	57.9
	95%CI	*59.5–61.9*	*53.6–57.9*	*61.5–64.8*	*64.0–68.4*	*53.3–62.4*
Eligibility for public dental care						
Eligible	% of people	50.6	51.5	54.3	52.6	42.3
	95%CI	*48.6–52.6*	*46.2–56.7*	*50.1–58.5*	*49.7–55.4*	*38.2–46.4*
Ineligible	% of people	62.5	57.5	64.1	69.5	64.5
	95%CI	*61.2–63.8*	*55.2–59.9*	*62.4–65.8*	*66.7–72.1*	*58.7–69.9*
Dental insurance						
Insured	% of people	71.6	69.7	71.6	74.1	69.9
	95%CI	*70.0–73.0*	*66.7–72.6*	*69.4–73.7*	*71.6–76.5*	*64.1–75.0*
Uninsured	% of people	49.4	47.6	53.2	50.5	42.1
	95%CI	*47.9–50.9*	*44.6–50.6*	*50.8–55.5*	*47.7–53.3*	*38.2–46.2*
Usually visit dentist						
For a check-up	% of people	77.1	70.3	78.7	84.6	87.9
	95%CI	*75.8–78.4*	*67.6–72.8*	*76.8–80.5*	*82.5–86.5*	*84.5–90.6*
For a dental problem	% of people	43.4	37.8	46.6	48.9	35.0
	95%CI	*41.7–45.1*	*34.5–41.2*	*44.0–49.1*	*45.8–52.1*	*29.0–41.6*
Oral status						
Dentate	% of people	62.1	56.5	63.4	68.9	65.9
	95%CI	*60.9–63.2*	*54.4–58.6*	*61.7–65.0*	*66.7–70.9*	*61.7–69.9*
Edentulous	% of people	19.8	0.0	21.1	19.8	19.5
	95%CI	*17.2–22.6*	—	*14.2–30.2*	*16.4–23.6*	*15.6–24.1*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Dental attendance 5 years ago or longer

The opposite of people who have visited a dentist within the last 12 months are those adults who have not visited within the last 5 years. These adults are regarded as being 'outside' the dental care system and are described in Table 6.2. Some 11.8% of all Australians 15 years old and over had not visited a dentist within the last 5 years. Across the generations this percentage was lowest for those adults in the 1950–69 generation (8.9%) and increased toward the earliest generation, those born pre-1930 (23.2%). There was nearly a three-fold difference between the percentage of adults who had not visited within the last 5 years in the 1950–69 generation and the percentage of adults who had not visited in the pre-1930 generation. A higher percentage of males than females had not visited within the last 5 years (14.0% versus 9.7%). This difference was greatest among the most recent (1970–90) generation, and diminished across the successively earlier generations to be minimal among the pre-1930 generation.

There was marked variation in the percentage of adults who had not visited within the last 5 years by different population groups. There was a ten-fold difference in the percentage of people who had not visited within the last 5 years between people who usually visit for a check-up and people who visit for a dental problem (1.8% versus 18.4%). People who usually visit for a problem are much more likely to have not made a visit within the last 5 years. This variation was found in each of the generations.

There was also marked variation between dentate and edentulous adults (9.5% versus 44.9%). A 4.7-fold higher percentage of edentulous people had not visited a dentist within the last 5 years. The percentages and difference were similar across the generations, except for the 1970–90 generation, which had too few edentulous people for a reliable estimate.

Among people of all ages combined there was a considerably higher percentage of those uninsured than insured and people who were eligible rather than ineligible for public dental care not visiting within the last 5 years. The greatest difference was between people who were uninsured and insured, where nearly a three-fold higher percentage of the uninsured than the insured had not visited within the last 5 years (16.8% versus 5.9%). This variation was constant across the four generations. Just less than a two-fold difference in the percentage not visiting within the last 5 years existed among those who were eligible and ineligible for public dental care (18.1% versus 9.6%). However, this variation was minimal among the most recent generation, but increased through to the earliest generation, the pre-1930 generation. Those adults with year 9 or less compared to year 10 or more schooling (20.4% versus 10.5%), and those who identified themselves as Indigenous Australians rather than non-Indigenous Australians (14.5% versus 11.8%) had a higher percentage reporting not visiting within the last 5 years.

Table 6.2: Percentage of people whose last dental visit was at least 5 years ago in the Australian population and in four generations

		Population: all people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**11.8**	**11.4**	**8.9**	**13.2**	**23.2**
	95%CI [b]	*11.1–12.5*	*10.0–12.9*	*8.0–9.9*	*11.8–14.6*	*20.4–26.2*
Sex						
Male	% of people	14.0	14.6	11.5	14.0	24.6
	95%CI	*12.9–15.2*	*12.3–17.3*	*10.0–13.2*	*12.2–16.1*	*20.2–29.6*
Female	% of people	9.7	8.1	6.3	12.3	22.3
	95%CI	*8.9–10.5*	*6.7–9.7*	*5.4–7.4*	*10.7–14.1*	*19.1–25.8*
Indigenous identity						
Indigenous	% of people	14.5	9.6	14.2	21.7	40.1
	95%CI	*9.2–22.0*	*4.2–20.5*	*6.1–29.7*	*10.0–40.9*	*12.7–75.5*
Non-Indigenous	% of people	11.8	11.4	8.8	13.0	23.1
	95%CI	*11.0–12.5*	*10.0–12.9*	*8.0–9.8*	*11.7–14.4*	*20.3–26.1*
Residential location						
Capital city	% of people	10.3	11.3	7.6	10.5	17.9
	95%CI	*9.5–11.2*	*9.7–13.2*	*6.5–8.8*	*9.0–12.2*	*14.7–21.7*
Other places	% of people	14.5	11.4	11.3	17.2	31.4
	95%CI	*13.3–15.8*	*9.2–14.1*	*9.7–13.1*	*15.0–19.7*	*26.7–36.6*
Year level of schooling						
Year 9 or less	% of people	20.4	9.9	18.0	20.4	29.4
	95%CI	*18.4–22.6*	*5.2–18.2*	*13.4–23.8*	*17.8–23.4*	*25.1–34.2*
Year 10 or more	% of people	10.5	11.5	8.4	10.8	18.4
	95%CI	*9.8–11.3*	*10.1–13.0*	*7.4–9.4*	*9.5–12.3*	*15.4–21.8*
Eligibility for public dental care						
Eligible	% of people	18.1	13.1	13.5	18.4	28.0
	95%CI	*16.7–19.7*	*9.7–17.5*	*10.6–17.0*	*16.4–20.5*	*24.5–31.8*
Ineligible	% of people	9.6	11.1	8.1	9.1	13.0
	95%CI	*8.8–10.4*	*9.6–12.7*	*7.2–9.2*	*7.7–10.7*	*9.8–17.0*
Dental insurance						
Insured	% of people	5.9	5.1	5.2	7.3	11.3
	95%CI	*5.3–6.7*	*3.9–6.6*	*4.2–6.3*	*6.1–8.8*	*8.3–15.2*
Uninsured	% of people	16.8	15.8	13.0	18.8	27.6
	95%CI	*15.7–17.9*	*13.7–18.1*	*11.5–14.6*	*16.8–21.0*	*24.4–31.2*
Usually visit dentist						
For a check-up	% of people	1.8	2.8	1.1	1.2	2.0
	95%CI	*1.5–2.3*	*2.0–3.9*	*0.8–1.7*	*0.8–1.9*	*1.0–4.0*
For a dental problem	% of people	18.4	22.0	15.8	15.9	25.1
	95%CI	*17.2–19.8*	*19.4–25.0*	*14.1–17.6*	*13.9–18.3*	*19.8–31.2*
Oral status						
Dentate	% of people	9.5	11.4	8.3	7.9	11.9
	95%CI	*8.9–10.2*	*10.0–12.9*	*7.4–9.2*	*6.8–9.1*	*9.4–15.0*
Edentulous	% of people	44.9	0.0	46.0	45.7	43.7
	95%CI	*41.6–48.2*	—	*33.8–58.8*	*40.8–50.8*	*38.6–49.0*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

A similar pattern across the generations was seen among population groups defined by schooling, residence and Indigenous identity. In each case there was either no difference or the opposite trend in the most recent generation in the percentage who had not visited within the last 5 years. Moving back toward the earliest generation a difference emerged among the population groups defined by each sociodemographic characteristic, with the strongest difference seen among the earliest generation, those adults born pre-1930.

In summary, 11.8% of Australian adults had not made a visit to a dentist within the last 5 years. Not visiting was strongly associated with usually visiting for a dental problem and edentulism; and moderately associated with being uninsured, eligible for public dental care, having less schooling, living in places other than capital cities and being Indigenous.

Attendance at private dental practice

The Australian dental care system is predominantly a fee-for-service private practice system. A small percentage of dentists are specialists, also mostly in the private sector. Two main alternative public sector programs exist. School dental services provide dental care to about 50% of primary school-aged children, although the percentage coverage varies between states and territories. The percentage coverage by the school dental service is lower among secondary school aged children. The school dental service has generally been universally available to children, but policies on targeting of services have gradually eroded this organisational characteristic. The second alternative program is public dental care for adults, provided through dental hospitals, community health centres and regional facilities. Public dental services are available only to means tested eligible adults. In practice, eligibility depends on adults holding a government concession card.

In NSAOH people were asked 'Where did you make your last dental visit'. There were a number of categories for responses. These have been collapsed into private practice (general dental practices as well as specialist practices, and dental clinics associated with a health insurance fund) and the remainder. The remainder are predominantly the residual public dental programs, the school dental services and public dental services.

Over four out of five Australian adults (83.1%) reported that their last dental visit was to a private dental practice (Table 6.3). Across the generations the percentage of people who last visited a private dental practice was highest (89.9%) among the 1950–69 generation, lower for the 1970–90 and 1930–49 generations, but lowest for the earliest generation, those born pre-1930 (74.0%). This reflects the possibility of people in the most recent generation reporting their last visit at the school dental service and those age pensioners in the earliest generation who are eligible for public dental services reporting their last visit at a public dental clinic. This pattern was dominant across the generations when population groups were compared Table 6.3.

Table 6.3: Percentage of people who attended a private dental practice at last dental visit in the Australian population and in four generations

		Population: all people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**83.1**	**78.0**	**89.9**	**83.4**	**74.0**
	95%CI [b]	*82.0–84.2*	*75.9–80.0*	*88.6–91.0*	*82.0–84.7*	*71.0–76.8*
Sex						
Male	% of people	82.5	76.5	88.4	84.6	75.7
	95%CI	*81.0–84.0*	*73.2–79.5*	*86.5–90.0*	*82.7–86.3*	*71.2–79.6*
Female	% of people	83.7	79.6	91.4	82.3	72.8
	95%CI	*82.5–84.9*	*77.2–81.8*	*90.0–92.6*	*80.4–84.1*	*68.8–76.4*
Indigenous identity						
Indigenous	% of people	66.2	66.7	67.9	59.9	81.5
	95%CI	*56.7–74.6*	*51.3–79.2*	*51.7–80.7*	*42.1–75.3*	*34.7–97.3*
Non-Indigenous	% of people	83.4	78.3	90.2	83.7	73.9
	95%CI	*82.3–84.4*	*76.1–80.3*	*88.9–91.3*	*82.3–85.0*	*70.9–76.7*
Residential location						
Capital city	% of people	85.7	82.0	91.4	86.1	75.2
	95%CI	*84.4–86.9*	*79.6–84.1*	*90.0–92.6*	*84.3–87.8*	*70.9–79.0*
Other places	% of people	78.6	69.9	87.2	79.4	72.0
	95%CI	*76.5–80.5*	*65.5–73.9*	*84.5–89.5*	*77.2–81.5*	*68.0–75.8*
Year level of schooling						
Year 9 or less	% of people	67.8	58.2	75.7	70.9	64.6
	95%CI	*65.1–70.3*	*49.5–66.3*	*69.2–81.2*	*67.7–73.9*	*59.7–69.2*
Year 10 or more	% of people	85.5	79.5	90.8	87.4	80.9
	95%CI	*84.3–86.5*	*77.3–81.5*	*89.6–91.9*	*85.9–88.7*	*77.1–84.2*
Eligibility for public dental care						
Eligible	% of people	62.7	51.7	59.7	69.2	66.1
	95%CI	*60.5–64.8*	*46.4–57.0*	*55.3–63.9*	*66.6–71.6*	*62.3–69.7*
Ineligible	% of people	90.4	83.7	95.0	94.6	90.6
	95%CI	*89.4–91.4*	*81.4–85.7*	*94.0–95.9*	*93.5–95.6*	*86.9–93.4*
Dental insurance						
Insured	% of people	95.2	91.9	97.7	95.6	91.5
	95%CI	*94.4–95.9*	*89.9–93.6*	*96.8–98.4*	*94.5–96.6*	*87.5–94.3*
Uninsured	% of people	73.6	69.8	81.3	71.6	67.7
	95%CI	*72.0–75.1*	*66.7–72.8*	*79.1–83.3*	*69.4–73.6*	*64.0–71.2*
Usually visit dentist						
For a check-up	% of people	90.7	83.1	96.4	94.6	92.4
	95%CI	*89.5–91.7*	*80.7–85.2*	*95.3–97.3*	*93.2–95.7*	*89.5–94.6*
For a dental problem	% of people	78.0	71.2	83.9	78.6	74.8
	95%CI	*76.3–79.6*	*67.9–74.4*	*81.9–85.7*	*75.9–81.1*	*69.6–79.4*
Oral status						
Dentate	% of people	85.0	78.0	90.5	87.6	85.1
	95%CI	*83.9–86.1*	*75.9–80.1*	*89.2–91.7*	*86.2–88.9*	*82.4–87.5*
Edentulous	% of people	55.4	0.0	53.2	57.4	53.8
	95%CI	*52.0–58.8*	—	*42.8–63.4*	*53.2–61.5*	*48.2–59.3*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Among people of all ages the percentage of adults reporting that their last dental visit was to a private dental practice was higher among the dentate than the edentulous (85.0% versus 55.4%). Edentulism was strongly age-related and hence this result reflects the higher eligibility for public dental care among older, edentulous adults.

For most other population groups there was only a moderate variation. A higher percentage of Australians who were non-Indigenous than Indigenous (83.4% versus 66.2%), resident in capital cities compared with other places (85.7% versus 78.6%), with year 10 or more compared with year 9 or less schooling (85.5% versus 67.8%), ineligible compared with eligible for public dental care (90.4% versus 62.7%), insured compared with uninsured (95.2% versus 73.6%) and who usually visited for a check-up rather than for a dental problem (90.7% versus 78.0%) all reported last visiting a private dental practice. The highest percentage of any group reporting visiting a private dental practice was among the insured, particularly from the 1950–69 generation where almost all people had last visited a private dental practice (97.7%).

In summary, the vast majority of Australian adults last visited a private dental practice. Only a small minority visited other dental clinics, predominantly public dental services. The percentage of all people last visiting a private dental practice was higher for generations with a lower likelihood of last visiting the school dental services or the public dental services. However, even within these two generations having a higher likelihood of visiting public dental services, approximately three-quarters of all people last visited a private dental practice. The percentage last visiting a private dental practice was higher among those residents in capital cities, with more schooling, insured and who usually visit for a check-up.

Payment by patients for dental care

While the place of the last visit was dominated by private practice, it cannot be assumed automatically that all visits were paid for by the individual. Some visits made to private dentists are paid for by public funds, such as the arrangements for veterans (Department of Veterans Affairs, Local Dental Officers Scheme) and the more limited general dental schemes with contracted private dentists funded by state and territory governments. Hence, in general the percentage of people who paid for their last dental visit was expected to be a little lower than the percentage of people who last visited a private dentist.

In NSAOH people eligible for public dental care who had visited within the last 5 years were asked 'Did the government or an insurance fund pay any part of the expense for your last dental visit?' A number of response options were available including 'Paid all own expenses', 'Insurance paid some – patient paid some', 'Insurance paid all', 'Government paid some – patient paid some' and 'Government paid all'. People who reported one of the first three payment mechanisms were classified as having paid for their care. Those who reported 'Government paid some – patient paid some' were excluded as the patient paid component would be a co-payment associated with publicly funded dental care in the majority of cases. Furthermore, those ineligible for public dental care who had visited within the last 5 years were classified as having paid for their dental care and were included in

Table 6.4. Overall 91.4% of people who had seen a dentist within the preceding 5 years paid for that visit. They represented 91.4% of people who had seen a dentist within the preceding 5 years (Table 6.4). Because it is limited to people whose last dental visit was within 5 years, the percentage is higher than the figure of 83.1% of all people whose last visit was to a private dental practice (Table 6.3).

Across the generations the percentage paying for their last dental visit was slightly higher for the more recent generations, 1970–90 (93.3%) and 1950–69 (94.1%), but decreased moderately among the earlier generations to be lowest for the pre-1930 generation (78.0%).

For people of all ages there was no variation by sex in the percentage who paid for their own last dental visit. Within the male and female population groups the pattern across the four generations was similar, with a decrease in the percentage that paid for their last dental visit in the earlier generations.

Among the population groups defined by sociodemographic characteristics the largest variation was between dentate and edentulous people. Approximately 30% more of the dentate population than the edentulous population paid for their last dental visit (92.2% versus 70.3%). Similar differences were seen between the dentate and edentulous within each generation, except the most recent generation, where there were too few edentulous for a robust estimate. As shown in Table 5.1, complete tooth loss was strongly associated with eligibility for public dental care and a lack of insurance. Therefore, the lower percentage of the edentulous who paid for their last dental visit is a reflection of eligibility for the use of public dental care, including specific programs for publicly funded dentures provided by private dentists (dentures for pensioner schemes), and barriers to the use of private dentists without the assistance of insurance.

Among the population groups defined by Indigenous identity, schooling, insurance and reason for visiting there were variations of similar magnitude (12%–19%) in the percentage who paid for their last dental visit. Within each population group the highest percentage generally was observed within the 1950–69 generation, with lower percentages observed in earlier generations.

There was little variation between population groups defined by residential location. However, the variation by generation within those people resident in capital cities and other places followed the dominant pattern. People eligible for public dental care did not follow this pattern with the percentage paying for their last dental visit higher in the earlier generations. This may be due to older adults with pensioner concession cards electing to attend a private practice due to long waiting lists in public dental care. Overall 63.9% of people eligible for public dental care paid for their last dental visit. Of those eligible for public dental care, 63.9% paid for their last visit to a dentist. This may be due to long waiting lists for public dental services. This somewhat surprising finding is consistent with other research – the majority of those adults eligible for public dental care visit a private dentist and pay for their own dental care.

Table 6.4: Percentage of people who paid for their last dental visit in the Australian population and in four generations

		Population: people who visited dentist within last 5 years				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**91.4**	**93.3**	**94.1**	**87.6**	**78.0**
	95%CI[b]	*90.6–92.1*	*92.1–94.4*	*93.1–95.0*	*86.2–88.9*	*74.8–80.9*
Sex						
Male	% of people	91.8	94.5	93.7	88.1	77.0
	95%CI	*90.8–92.8*	*92.6–95.9*	*92.2–95.0*	*86.2–89.8*	*71.7–81.5*
Female	% of people	90.9	92.2	94.4	87.2	78.6
	95%CI	*90.0–91.8*	*90.5–93.7*	*93.4–95.4*	*85.4–88.8*	*74.3–82.4*
Indigenous identity						
Indigenous	% of people	79.8	79.5	84.9	68.8	100.0
	95%CI	*71.4–86.2*	*64.7–89.2*	*70.4–93.0*	*49.8–83.1*	—
Non-Indigenous	% of people	91.5	93.6	94.2	87.9	77.9
	95%CI	*90.7–92.2*	*92.4–94.6*	*93.2–95.1*	*86.5–89.1*	*74.6–80.8*
Residential location						
Capital city	% of people	92.3	94.2	95.0	89.3	76.7
	95%CI	*91.4–93.2*	*92.7–95.4*	*93.8–96.0*	*87.4–90.9*	*72.4–80.6*
Other places	% of people	89.5	91.5	92.4	84.9	80.3
	95%CI	*88.1–90.8*	*89.1–93.4*	*90.4–94.0*	*82.7–86.9*	*75.7–84.2*
Year level of schooling						
Year 9 or less	% of people	78.4	86.7	85.6	75.7	70.5
	95%CI	*75.7–80.9*	*79.6–91.6*	*80.1–89.7*	*72.0–79.1*	*65.1–75.3*
Year 10 or more	% of people	93.1	93.9	94.6	90.9	82.5
	95%CI	*92.3–93.7*	*92.7–94.9*	*93.6–95.4*	*89.5–92.1*	*78.2–86.1*
Eligibility for public dental care						
Eligible	% of people	63.9	59.7	57.1	70.0	65.1
	95%CI	*61.6–66.2*	*53.9–65.4*	*52.4–61.8*	*67.0–72.7*	*60.7–69.2*
Ineligible	% of people	100.0	100.0	100.0	100.0	100.0
	95%CI	—	—	—	—	—
Dental insurance						
Insured	% of people	98.8	98.8	99.6	97.9	95.3
	95%CI	*98.4–99.1*	*97.7–99.4*	*99.2–99.8*	*96.9–98.5*	*92.3–97.2*
Uninsured	% of people	84.2	89.0	87.5	76.3	70.3
	95%CI	*82.8–85.4*	*86.9–90.8*	*85.5–89.3*	*73.9–78.5*	*66.0–74.2*
Usually visit dentist						
For a check-up	% of people	96.2	95.7	98.6	94.8	89.6
	95%CI	*95.6–96.7*	*94.4–96.7*	*98.0–99.1*	*93.4–95.9*	*85.9–92.4*
For a dental problem	% of people	86.1	89.2	88.7	79.6	69.4
	95%CI	*84.6–87.5*	*86.5–91.4*	*86.7–90.4*	*76.6–82.3*	*62.8–75.3*
Oral status						
Dentate	% of people	92.2	93.3	94.3	88.8	82.7
	95%CI	*91.5–92.9*	*92.1–94.4*	*93.3–95.2*	*87.4–90.1*	*79.3–85.6*
Edentulous	% of people	70.3	100.0	72.3	75.1	64.6
	95%CI	*65.7–74.5*	—	*49.2–87.6*	*70.0–79.6*	*56.7–71.8*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage of people.

In summary, the vast majority of Australians paid for their last dental visit. This percentage was higher among the more recent generations with the exception of those eligible for public dental care. More of the dentate paid for their last dental visit than the edentulous. Other variation was smaller, with the non-Indigenous and those with more schooling, with insurance and who usually visit for a check-up all reporting higher percentages paying for their last visit in contrast to their comparison population group.

Summary of findings regarding most recent dental attendance

Table 6.5 presents an overview of aspects of dental attendance based on the last dental visit. Using information from the previous four tables, attendance is compared among population groups defined by sociodemographic and oral health characteristics. The aspects of visiting covered include time since last visit (percentage who attended within the last 12 months and at least five years ago), whether the visit was made to a private dentist and whether people paid for their last dental visit.

Just under 60% of people of all ages visited within the last 12 months while nearly one in eight people last visited five or more years ago. Over four out of five people reported their last visit was to a private dentist, and of those people who visited in the last five years, over nine out of ten paid for their dental care.

Using the most recent generation as a reference group, the percentage attending in the last 12 months was higher for two preceding generations, but lower for the earliest generation. The percentage attending five years ago or more showed the opposite trend. Attending a private dentist was more frequent in the middle two generations, but lower in the earliest generation in comparison to the reference group. Paying for one's own dental care was similar for the two more recent generations, but less frequent for the two earliest generations.

Table 6.5: Summary of dental attendance at the most recent visit

	% who attended ≤12 months ago	% who attended ≥5 years ago	% who attended a private dentist	% who paid for their dental visit
Generations				
Ref[(a)] = 1970–90				
1950–69	↑	↓	↑	~
1930–49	↑	~	↑	↓
Pre-1930	↓	↑	↓	↓
Sex				
Ref = Male				
Female	↑	↓	~	~
Indigenous identity				
Ref = Non-Indigenous				
Indigenous	~	~	↓	↓
Residential location				
Ref = Capital city				
Other places	↓	↑	↓	↓
Year level of schooling Ref = Year 10 or more				
Year 9 or less	↓	↑	↓	↓
Eligibility for public dental care				
Ref = Ineligible				
Eligible	↓	↑	↓↓	↓
Dental insurance				
Ref = Insured				
Uninsured	↓	↑	↓	↓
Usually visit dentist				
Ref = For a check-up				
For a dental problem	↓↓	↑↑	↓	↓
Oral status				
Ref = Dentate				
Edentulous	↓↓	↑↑	↓↓	↓↓

(a) Ref: reference group; ↓↓: markedly lower; ↓: lower; ~: not sig. different; ↑: higher; ↑↑: markedly higher

A higher percentage of females than males visited in the last 12 months and a lower percentage five or more years ago. More non-Indigenous adults last visited a private dentist and paid for their dental care than Indigenous adults. Those people residing in other places than capital cities had a lower percentage who visited within the last 12 months and a higher percentage last visiting five years ago or more. A lower percentage of those people living in other places last visited a private dentist and paid for their dental care. Both more years of schooling and ineligibility for public dental care were associated with a more recent visit, visiting a private dentist and paying for one's own dental care.

The pattern across insurance, usual reason for visiting and oral status was similar, although usual reason and oral health status had more marked variation. Being uninsured, usually visiting for a dental problem and being edentulous were all

associated with less recent visiting, fewer visiting a private dentist and fewer people paying for their own dental care.

6.2 People's usual pattern of dental visits

The last dental visit gives a snapshot of dental attendance patterns. Questions about usual behaviour reflects longer term behaviours and intentions.

Usual pattern of annual dental visits

In NSAOH people who were dentate were asked 'How often on average do you seek care from a dental professional?' The responses included 'Two or more times a year', 'Once a year', 'Once in two years', 'Less often than that', 'Don't know'. The first two response categories have been combined into the percentage of people who usually visit a dentist at least once a year. The results are presented in Table 6.6.

Just over half of the Australian adult dentate population usually visit a dentist at least once a year (53.1%). Very similar percentages of the two more recent generations usually visit at least once a year (51.0% and 51.8%) However, slightly higher percentages of the successively earlier generations reported usually visiting a dentist at least once a year, reaching the highest percentage in the pre-1930 generation (60.9%). This pattern across the generations was repeated within most population groups defined by sociodemographic characteristics.

For people of all ages a similar level of variation existed between most population groups. Females were a little over 20% more likely to report that they usually visit at least once a year than males (58.5% versus 47.7%). The percentage reporting usually visiting at least once a year increased from the two most recent generations to the earliest generation, but the difference between males and females remained similar within each generation. Non-Indigenous people were over 20% more likely than Indigenous Australians people to report usually visiting at least once a year (53.3% versus 43.4%). While the pattern across the generations was similar for non-Indigenous people, there was considerable variation among the generations of Indigenous Australians, but the 95% CIs were wide and the estimates for individual generations less robust.

Table 6.6: Percentage of people who usually visit a dental professional at least once a year in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**53.1**	**51.0**	**51.8**	**57.4**	**60.9**
	95%CI [b]	*51.8–54.5*	*48.8–53.3*	*49.8–53.8*	*55.1–59.7*	*56.6–65.0*
Sex						
Male	% of people	47.7	47.0	44.7	53.1	53.6
	95%CI	*45.7–49.6*	*43.3–50.6*	*41.9–47.5*	*49.8–56.4*	*47.3–59.8*
Female	% of people	58.5	55.2	58.8	61.8	66.5
	95%CI	*56.9–60.1*	*52.4–58.0*	*56.5–61.1*	*59.1–64.4*	*61.1–71.6*
Indigenous identity						
Indigenous	% of people	43.4	49.4	31.6	44.1	79.7
	95%CI	*33.7–53.6*	*34.1–64.8*	*19.0–47.7*	*28.5–61.0*	*28.9–97.5*
Non-Indigenous	% of people	53.3	51.0	52.1	57.6	60.8
	95%CI	*51.9–54.6*	*48.7–53.3*	*50.1–54.0*	*55.2–59.9*	*56.5–65.0*
Residential location						
Capital city	% of people	56.7	53.5	55.4	62.8	66.9
	95%CI	*55.0–58.4*	*50.9–56.0*	*52.9–57.9*	*59.9–65.6*	*61.6–71.8*
Other places	% of people	46.4	46.0	45.2	48.3	50.4
	95%CI	*44.3–48.6*	*41.6–50.4*	*42.2–48.3*	*44.7–52.0*	*43.6–57.3*
Year level of schooling						
Year 9 or less	% of people	47.3	61.8	36.3	43.9	48.2
	95%CI	*43.8–50.9*	*53.2–69.7*	*29.8–43.4*	*39.3–48.6*	*41.3–55.2*
Year 10 or more	% of people	53.8	50.1	52.7	60.8	68.6
	95%CI	*52.4–55.2*	*47.8–52.5*	*50.7–54.7*	*58.5–63.2*	*63.7–73.0*
Eligibility for public dental care						
Eligible	% of people	44.1	42.7	37.2	46.3	52.1
	95%CI	*41.8–46.3*	*37.7–47.9*	*33.3–41.3*	*43.0–49.6*	*46.7–57.5*
Ineligible	% of people	55.8	52.7	54.2	64.8	75.2
	95%CI	*54.3–57.4*	*50.2–55.2*	*52.1–56.3*	*61.8–67.7*	*68.8–80.6*
Dental insurance						
Insured	% of people	67.4	66.3	64.8	71.8	78.9
	95%CI	*65.7–69.1*	*62.6–69.7*	*62.4–67.2*	*69.0–74.4*	*73.2–83.7*
Uninsured	% of people	40.2	39.9	37.6	41.6	51.4
	95%CI	*38.6–41.8*	*37.0–42.9*	*35.2–40.1*	*38.8–44.3*	*46.3–56.5*
Usually visit dentist						
For a check-up	% of people	77.2	71.8	78.8	81.8	88.2
	95%CI	*75.8–78.5*	*69.0–74.4*	*76.8–80.6*	*79.6–83.8*	*84.5–91.1*
For a dental problem	% of people	22.4	21.6	21.7	25.4	21.5
	95%CI	*21.0–23.9*	*18.7–24.8*	*19.7–23.9*	*22.7–28.2*	*16.5–27.5*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).
(b) 95%CI = 95% confidence interval for estimated percentage.

For people of all ages a higher percentage of those residing in capital cities, those ineligible for public dental care and those with year 10 or more schooling reported usually visiting a dentist at least once a year. Those people ineligible were 26% more likely to report usually visiting than those eligible for public dental care, those residing

in capital cities were 22% more likely to report usually visiting than those residing in other places, and those with year 10 or more schooling were 13% more likely to report usually visiting a dentist at least once a year than those with year 9 or less schooling. Across the generations the population groups defined by these characteristics varied in the same way as all people combined. The two most recent generations had similar percentages usually visiting. The percentage usually visiting then increased toward the earliest generation. The pre-1930 generation had the highest percentage reporting usually visiting a dentist at least once a year for all populations defined by residence, schooling and eligibility for public dental care.

Greater variation existed among people of all ages for population groups defined by insurance and usually visiting a dentist for a check-up compared with a dental problem. Insured people were 68% more likely to report usually visiting than those who were uninsured (67.4% versus 40.2%). However, the pattern across the generations was similar to that described above: the percentage usually visiting was similar among the two most recent generations, and then increased across the earlier generations, peaking in the pre-1930 generation. Usually visiting for a check-up was associated with a three-fold higher percentage of people reporting usually visiting at least once a year than those who usually visit for a dental problem (77.2% versus 22.4%). This variation actually increased within the generations, so that for the pre-1930 generation people who usually visit for a check-up had a four times higher percentage reporting usually visiting a dentist at least once a year than people who usually visit for a dental problem. It was notable that among the population group defined by usually visiting for a problem there was very little difference across the four generations in the percentage who usually visit a dentist at least once a year (21.5%–25.4%).

In summary, usually visiting a dentist at least once a year was strongly associated with usual reason for visiting (check-up or dental problem) and moderately associated with insurance. Usually visiting was also higher for non-Indigenous Australians, those residing in capital cities, those with more schooling and those ineligible for public dental care and female.

Usual attendance at the same dentist

A pattern of usual attendance at the same dentist implies an ongoing relationship with a particular dentist and a continuity of dental care. In NSAOH people who were dentate and had made a dental visit within the last 5 years were asked 'Is there a dentist you usually go to for dental care?'. People could answer yes or no, and Table 6.7 presents the percentage who replied 'yes'. For people of all ages just over three-quarters (78.6%) usually attended the same dentist. Across the generations the percentage increased from the most recent generation, the 1970–90 generation (71.6%) to the 1930–49 generation (84.8%) and then was similar for the pre-1930 generation (84.3%). This pattern across the generations was dominant even when examining population groups defined by social characteristics.

Table 6.7: Percentage of people who have a dentist they usually attend in the Australian population and in four generations

		Population: dentate people who visited dentist within last 5 years				
			Generation (decade of birth[a])			
Age at time of survey (years)		All ages	1970–90 15–34	1950–69 35–54	1930–49 55–74	Pre-1930 ≥75
All people	**% of people**	**78.6**	**71.6**	**81.2**	**84.8**	**84.3**
	95%CI[b]	*77.3–79.8*	*69.3–73.8*	*79.6–82.7*	*83.0–86.5*	*81.0–87.1*
Sex						
Male	% of people	75.7	68.2	77.5	84.0	84.2
	95%CI	*73.8–77.6*	*64.3–71.8*	*75.0–79.8*	*81.3–86.4*	*78.6–88.6*
Female	% of people	81.3	74.9	84.6	85.6	84.4
	95%CI	*80.0–82.5*	*72.5–77.2*	*82.9–86.2*	*83.5–87.5*	*80.2–87.8*
Indigenous identity						
Indigenous	% of people	72.1	76.1	60.6	79.1	100.0
	95%CI	*62.7–79.8*	*62.0–86.1*	*44.6–74.6*	*61.9–89.8*	—
Non-Indigenous	% of people	78.7	71.5	81.4	84.9	84.2
	95%CI	*77.4–79.9*	*69.2–73.7*	*79.8–82.9*	*83.0–86.6*	*80.9–87.1*
Residential location						
Capital city	% of people	81.2	75.6	82.7	87.9	85.7
	95%CI	*79.8–82.6*	*73.0–77.9*	*80.9–84.4*	*86.1–89.5*	*81.7–88.9*
Other places	% of people	73.6	63.5	78.3	79.5	81.6
	95%CI	*71.2–75.9*	*59.0–67.8*	*75.2–81.1*	*75.7–82.9*	*75.2–86.7*
Year level of schooling						
Year 9 or less	% of people	73.0	69.1	68.9	76.0	76.3
	95%CI	*69.6–76.2*	*60.6–76.5*	*60.8–76.1*	*71.5–80.0*	*70.0–81.6*
Year 10 or more	% of people	79.3	71.8	81.9	87.0	88.7
	95%CI	*78.0–80.5*	*69.4–74.0*	*80.3–83.4*	*85.2–88.6*	*84.8–91.7*
Eligible for public dental care						
Eligible	% of people	68.2	59.7	63.1	74.2	78.1
	95%CI	*65.6–70.7*	*54.4–64.8*	*58.1–67.8*	*71.1–77.1*	*73.3–82.3*
Ineligible	% of people	81.6	74.1	84.0	91.5	93.0
	95%CI	*80.3–82.9*	*71.6–76.5*	*82.4–85.4*	*89.5–93.2*	*88.9–95.7*
Dental insurance						
Insured	% of people	88.9	83.7	89.7	94.2	91.5
	95%CI	*87.8–89.9*	*81.1–86.0*	*88.1–91.0*	*92.6–95.5*	*87.2–94.5*
Uninsured	% of people	68.8	62.9	70.8	73.5	80.4
	95%CI	*66.9–70.6*	*59.5–66.2*	*68.3–73.2*	*70.6–76.3*	*75.9–84.3*
Usually visit dentist						
For a check-up	% of people	87.5	80.5	90.3	94.1	93.2
	95%CI	*86.3–88.6*	*78.1–82.7*	*88.7–91.6*	*92.6–95.3*	*90.4–95.2*
For a dental problem	% of people	65.0	56.1	69.3	70.4	67.4
	95%CI	*63.0–67.0*	*52.2–60.0*	*66.7–71.7*	*66.8–73.7*	*60.5–73.6*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).
(b) 95%CI = 95% confidence interval for estimated percentage.

For people of all ages the greatest variation in usual attendance at the same dentist was among those who usually visited for a check-up compared to those who usually visited for a dental problem (87.5% versus 65.0%) and for people who were dentally

insured compared to those uninsured (88.9% versus 68.8%). Among people ineligible for public dental care, a higher percentage reported usually attending the same dentist than among those people eligible for public dental care services (81.6% versus 68.2%). Choice of an individual dentist is not possible within most public dental care (81.6% versus 68.2%).

For people of all ages there was less variation in usual attendance at the same dentist among groups classified by sex, Indigenous identity, residential location or schooling. Percentages were only slightly higher for females compared with males (81.3% versus 75.7%), non-Indigenous Australians compared with Indigenous Australians (78.7% versus 72.1%) resident in capital cities compared with other places (81.2% versus 73.6%) and among people with year 10 or more schooling compared with year 9 or less (79.3% versus 73.0%). Across the generations the 95% CIs surrounding the Indigenous estimate were wide and the point estimates were not robust, reducing the possibility of identifying any specific variation among the generations of Indigenous people or comparison by Indigenous identity within any one generation.

In summary, just over three-quarters of Australian adults reported that they usually visit the same dentist. This type of visiting was more frequent among the earlier generations and those who usually visit for a check-up, who are insured, and who are ineligible for public dental care.

Usual dental attendance for a check-up

Intention behind visiting a dentist, whether for a check-up or a dental problem, is a defining characteristic of people's dental care. Intention can be linked to the last dental visit or usual intention behind visiting. The usual reason for visiting a dentist helps characterise the long-term patterns of visiting.

Box 6.1 Twelve monthly dental check-ups

Patrick Wardlaw describes the pattern of annual dental check-ups that he and a family member have maintained through dental care in the RAAF.

I emigrated to Australia and joined the RAAF in 1968 through to 1997; that's 29 years of service. The air force provided all my dental care, 24 hours a day, 365 days a year. My son-in-law is a member of the RAAF and has automatic 12 monthly check-ups. That's covered, of course, at no cost to the individual.

–Excerpt from oral history of Patrick Wardlaw (see Section 4.2, page 78)

In NSAOH dentate people were asked 'Is your usual reason for visiting a dental professional for check-ups or when you have a dental problem?' Table 6.8 presents the percentage of people who usually visit a dentist for a check-up. A little more than half of the Australian adult dentate population usually visit a dentist for a check-up

(56.2%). The percentage of adults usually visiting for a check-up was similar for three of the four generations. Only the 1950–69 generation showed variation, with a lower percentage reporting that they usually visited for a check-up (52.7%).

For people of all ages the percentage usually visiting for a check-up varied between all population groups defined by sociodemographic characteristics. The greatest variation was between those insured and uninsured, where for people of all ages the highest and lowest percentages of adults usually visiting for a check-up occurred among the insured and uninsured population groups (70.0% versus 43.2%). The percentage usually visiting for a check-up was highest for the insured among the most recent generation (74.1%) and lowest for the uninsured among the 1950–69 generation (37.3%). Within the insured population group the 1950–69 generation had the lowest percentage usually visiting a dentist for a check-up (66.8%). Within the uninsured population group the 1950–69 generation also had the lowest percentage usually visiting a dentist for a check-up (37.3%), but the 1930–49 generation had only a slightly higher percentage visiting for a check-up (42.6%).

The percentage of adults usually visiting a dentist for a check-up was higher among females than males (60.5% versus 51.8%), those ineligible rather than eligible for public dental care (59.8% versus 43.7%), those resident in capital cities rather than other places (60.5% versus 48.1%), those with year 10 or more compared with year 9 or less schooling (57.2% versus 47.8%)

Within the population groups defined by these sociodemographic characteristics there was a trend for the most recent generation, the 1970–90 generation, and the two earliest generations, the 1930–49 and pre-1930 generations, to report similar percentages of adults usually visiting a dentist for a check-up. For instance, this pattern existed among males and females. However, there were several exceptions that are notable. Among the Australian Indigenous population group the pre-1930 generation had an equally low percentage visiting for a check-up as the 1950–69 generation (28.3% compared with 27.7%). However, the 95% CI for the Indigenous pre-1930 estimate was wide, so that the estimated percentage is not a robust estimate. Among people resident in capital cities, the pre-1930 generation had the highest percentage visiting for a check-up (67.0%) while among those resident in other places the pre-1930 generation had the lowest percentage visiting for a check-up (45.1%). Among people with year 10 or more schooling the pre-1930 generation had the highest percentage visiting for a check-up (65.3%), while among people with year 9 or less schooling the highest percentage visiting for a check-up occurred in the most recent generation, the 1970–90 generation (66.5%). Among people ineligible for public dental care, the pre-1930 generation reported the highest percentage visiting for a check-up (72.4%). Hence, a theme that emerged was that when sociodemographic characteristics were positively associated with usually visiting for a check-up, the earliest generation, emerged as highly likely to usually visit for a check-up. Among all adults and population groups defined by sociodemographic characteristics the 1950–69 generation was likely to have the lowest percentage visiting for a check-up.

Table 6.8: Percentage of people who usually visit a dentist for a check-up in the Australian population and in four generations

		Population: Dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		All ages	15–34	35–54	55–74	≥75
All people	**% of people**	**56.2**	**58.9**	**52.7**	**56.8**	**59.1**
	95%CI[b]	*54.8–57.5*	*56.7–61.1*	*50.7–54.7*	*54.7–59.0*	*54.7–63.4*
Sex						
Male	% of people	51.8	56.5	46.4	52.5	54.8
	95%CI	*50.0–53.7*	*53.0–60.0*	*43.6–49.2*	*49.6–55.4*	*48.8–60.7*
Female	% of people	60.5	61.4	58.9	61.3	62.4
	95%CI	*58.8–62.2*	*58.5–64.2*	*56.5–61.3*	*58.6–64.0*	*56.8–67.6*
Indigenous identity						
Indigenous	% of people	44.6	55.8	27.7	46.9	28.3
	95%CI	*34.5–55.2*	*40.8–69.9*	*14.6–46.2*	*30.7–63.7*	*5.0–74.7*
Non-Indigenous	% of people	56.4	59.0	53.0	57.0	59.3
	95%CI	*55.0–57.7*	*56.7–61.2*	*51.0–55.0*	*54.8–59.2*	*54.9–63.5*
Residential location						
Capital city	% of people	60.5	62.7	56.7	61.7	67.0
	95%CI	*58.7–62.2*	*59.9–65.4*	*54.2–59.1*	*59.0–64.4*	*61.9–71.8*
Other places	% of people	48.1	51.2	45.4	48.7	45.1
	95%CI	*46.0–50.2*	*47.4–55.0*	*42.0–48.8*	*45.2–52.2*	*38.2–52.2*
Year level of schooling						
Year 9 or less	% of people	47.8	66.5	31.7	44.8	48.7
	95%CI	*44.5–51.2*	*58.5–73.7*	*25.4–38.7*	*40.5–49.1*	*42.2–55.2*
Year 10 or more	% of people	57.2	58.4	53.9	60.0	65.3
	95%CI	*55.7–58.6*	*56.1–60.7*	*51.8–55.9*	*57.6–62.3*	*60.0–70.2*
Eligibility for public dental care						
Eligible	% of people	43.7	47.6	31.0	46.0	51.0
	95%CI	*41.5–45.9*	*42.3–52.9*	*26.8–35.5*	*42.9–49.1*	*45.6–56.4*
Ineligible	% of people	59.8	61.1	56.2	64.0	72.4
	95%CI	*58.4–61.3*	*58.8–63.5*	*54.1–58.3*	*61.3–66.7*	*66.0–78.0*
Dental insurance						
Insured	% of people	70.0	74.1	66.8	70.0	73.0
	95%CI	*68.4–71.6*	*70.7–77.2*	*64.3–69.1*	*67.2–72.6*	*66.3–78.8*
Uninsured	% of people	43.2	47.0	37.3	42.6	51.8
	95%CI	*41.6–44.8*	*44.0–50.0*	*34.9–39.8*	*39.7–45.5*	*46.6–56.8*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95 per cent confidence interval for estimated percentage.

In summary, just over half of the adult population usually visit a dentist for a check-up, with this percentage being slightly lower for those of the 1950–69 generation. Usually visiting for a check-up was moderately associated with insurance, residence in capital cities, having more schooling and being ineligible for public dental care and being female.

Summary of findings regarding usual pattern of dental attendance

Table 6.9 summarises the previous three tables to provide an overview of dental attendance based on usual behaviour. Usual patterns of attendance are compared among generations and between population groups defined by sociodemographic characteristics. The aspects of visiting covered include usually visiting at least once per year, usual attendance at the same dentist and usual attendance for a check-up.

Table 6.9: Summary of usual pattern of dental attendance

	Usually attend at least once a year	Usually attend same dentist	Usually attend for a check-up
Generations			
Ref[(a)] = 1970–90			
1950–69	~	↑	↓
1930–49	↑	↑	~
Pre-1930	↑	↑	~
Sex			
Ref = Male			
Female	↑	↑	↑
Indigenous identity			
Ref = Non-Indigenous			
Indigenous	~	~	~
Residential location			
Ref = Capital city			
Other places	↓	↓	↓
Year level of schooling			
Ref = Year 10 or more			
Year 9 or less	↓	↓	↓
Eligibility for public dental care			
Ref = Ineligible			
Eligible	↓	↓	↓
Dental insurance			
Ref = Insured			
Uninsured	↓↓	↓↓	↓↓
Usually visit dentist			
Ref = For a check-up			..
For a dental problem	↓↓	↓↓	..

(a) Ref: reference group; ↓↓: markedly lower; ↓: lower; ~: not sig. different; ↑: higher; ↑↑: markedly higher

Just over half of all people usually attended at least once a year, over three quarters usually attended the same dentist, and a little over a half usually attended a dentist for a check-up. When these aspects of attendance were considered together 45% of all people usually visit at least once a year, the same dentist and for a check-up (data not tabulated).

Using the most recent generation as a reference group, a similar percentage of the 1950–69 generation, but higher percentages of the earlier generations reported usual

attendance at least once a year. A higher percentage of all more recent generations usually attend the same dentist. A lower percentage of the 1950–69 generation usually attended for a check-up, but the percentage was similar for the earlier generations as the most recent generation.

The strongest associations were with insurance and usual reason for attendance, with all three indicators being markedly less frequent among people who were uninsured. Not surprisingly, a markedly lower percentage of adults who usually visit for a dental problem reported that they usually visit at least once a year or the same dentist.

All three aspects of usual dental attendance were lower among people who lived in places other than capital cities, who had year 9 or less of schooling, and who were eligible for public dental care. All three aspects of usual visiting were positively associated with being female.

6.3 Financial barriers to dental care

Financial barriers may reduce the likelihood of dental attendance and it can adversely influence the timeliness and comprehensiveness of care that is sought and provided. Reported avoidance or delay in seeking dental care because of cost represents a barrier prior to seeking care, while foregoing treatment due to cost is an indicator of a barrier to the receipt of treatment that is needed. Difficulty paying a $100 dental bill provides an indication that a person would face a financial barrier if they soon had a need for dental care. Such a barrier would be substantial if treatment was paid for out-of-pocket in the private dental sector. Additionally, some public dental services now impose fees or 'co-payments' that can reach $100 for general dental services, even for people who hold a health concession card making them eligible for public services.

Dental care avoided or delayed due to cost

In NSAOH cost as a barrier to receipt of dental care was assessed with the question 'During the last 12 months, have you avoided or delayed visiting a dental professional because of the cost?' People who answered 'Yes' were classified as having delayed or avoided dental care due to cost and they represented 30.0% of the Australian population aged 15 years or more (Table 6.10). There was some variation in the percentage reporting cost as a barrier to receipt of dental care, with 33.1% of the 1970–90 and 1950–69 generations reporting that they had avoided or delayed care due to cost compared with only 16.1% of the pre-1930 generation.

For people of all ages there was variation in the prevalence of having avoided or delayed dental care due to cost according to usual reason for making a dental visit, dental insurance status, oral status, eligibility for public dental care and sex. The population group with the highest percentage of avoiding or delaying care was those who usually visit for a dental problem (45.3%), while the percentage was lowest among those who usually visit for a check-up (19.2%), followed closely by those who had dental insurance (19.1%).

Box 6.2 Delayed treatment due to cost

Greg Pulcinzki claims to have enjoyed good oral health – although he admits to sensitive teeth due to decay – but his wife's dental problems have caused considerable financial strain.

I've always taken pride having nice, white, clean teeth. I, sort of, feel good about the fact I'm about to get me teeth checked. I'd like to think my teeth maintain their condition..... We know there's at least $2000 worth of dental work that's required for my wife. Now, if that wasn't such a financial burden – with having two kids and a mortgage etc. – then, personally, I'd certainly get it done sooner than later. But, as it is, it's something that will have to wait until we can afford to pay for it. Of course, government assistance or anything along those lines would help.

–Excerpt from oral history of Greg Pulcinzki (see Chapter 4.2, page 79)

People who usually visit for a dental problem were 2.4 times more likely to report avoiding or delaying dental care than those who usually visit for a check-up (45.3% versus 19.2%). The relative difference was greatest in the pre-1930 generation (24.9% versus 6.3%) and smallest in the 1950–69 generation (48.1% versus 21.6%)

There was a two-fold relative difference in the percentage delaying or avoiding receipt of dental care due to cost between people without dental insurance (40.0%) and people with dental insurance (19.1%). The difference was greatest in the 1930–49 generation (33.5% versus 14.1%) and smallest in the pre-1930 generation (18.2% versus 9.8%).

Dentate people were 1.4 times more likely to avoid or delay visiting due to cost than were edentulous people (30.6% versus 22.0%). People who were eligible for public dental care were 1.3 times more likely than those who were ineligible to avoid or delay dental care due to cost (35.4% versus 28.2%). The relative difference was smallest in the 1970–90 generation (39.8% versus 31.8%), increased across the generations and was largest in the pre-1930 generation (20.3% versus 7.4%).

Women were 1.3 times more likely than men to report avoiding or delaying care due to cost (33.4% versus 26.6%). Relative differences were stable across the generations, apart from the generation born pre-1930, in which there was no difference.

In summary, usual reason for visiting a dentist and dental insurance were strongly associated with having avoided or delayed receipt of dental care due to cost. There was a moderate association with oral health status, eligibility for public dental care and sex. As reported elsewhere, these characteristics were associated with several other measures of oral health. Chapter 9 discusses reasons that are thought to account for the influence of those characteristics on oral health.

Table 6.10: Percentage of people who avoided or delayed dental care in the Australian population and in four generations

		Population: all people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**30.0**	**33.1**	**33.9**	**23.9**	**16.1**
	95%CI [b]	*28.9–31.2*	*30.9–35.3*	*32.3–35.6*	*22.3–25.6*	*13.7–18.8*
Sex						
Male	% of people	26.6	28.6	30.6	20.3	14.8
	95%CI	*25.0–28.2*	*25.6–31.8*	*28.1–33.1*	*18.1–22.7*	*11.6–18.7*
Female	% of people	33.4	37.7	37.3	27.5	17.0
	95%CI	*32.0–34.9*	*34.8–40.7*	*35.2–39.4*	*25.5–29.6*	*13.8–20.6*
Indigenous identity						
Indigenous	% of people	37.7	35.4	45.9	30.7	30.6
	95%CI	*29.1–47.3*	*22.6–50.7*	*31.0–61.6*	*18.6–46.2*	*7.8–69.8*
Non-Indigenous	% of people	29.9	33.1	33.7	23.9	16.0
	95%CI	*28.8–31.1*	*30.9–35.3*	*32.1–35.4*	*22.2–25.6*	*13.6–18.7*
Residential location						
Capital city	% of people	29.5	33.1	33.0	22.3	15.0
	95%CI	*28.1–31.0*	*30.5–35.8*	*31.0–35.1*	*20.2–24.6*	*12.1–18.6*
Other places	% of people	31.0	33.0	35.5	26.3	17.7
	95%CI	*29.2–32.8*	*29.3–36.9*	*32.8–38.4*	*23.9–28.9*	*14.0–22.1*
Year level of schooling						
Year 9 or less	% of people	26.7	23.9	42.5	28.7	15.6
	95%CI	*24.3–29.2*	*17.4–31.9*	*35.7–49.7*	*25.4–32.2*	*12.3–19.6*
Year 10 or more	% of people	30.5	33.7	33.4	22.4	16.1
	95%CI	*29.3–31.8*	*31.4–36.0*	*31.7–35.1*	*20.6–24.4*	*12.9–20.0*
Eligibility for public dental care						
Eligible	% of people	35.4	39.8	52.8	31.7	20.3
	95%CI	*33.6–37.3*	*35.2–44.5*	*48.4–57.1*	*29.2–34.2*	*17.0–24.0*
Ineligible	% of people	28.2	31.8	30.7	17.9	7.4
	95%CI	*27.0–29.5*	*29.5–34.2*	*29.0–32.5*	*16.0–19.9*	*4.9–10.9*
Dental insurance						
Insured	% of people	19.1	19.7	22.6	14.1	9.8
	95%CI	*17.9–20.4*	*17.1–22.6*	*20.7–24.5*	*12.4–16.0*	*6.9–13.9*
Uninsured	% of people	40.0	44.4	46.4	33.5	18.2
	95%CI	*38.4–41.6*	*41.4–47.4*	*43.9–48.9*	*31.1–36.0*	*15.3–21.5*
Usually visit dentist						
For a check-up	% of people	19.2	21.5	21.6	14.3	6.3
	95%CI	*17.9–20.5*	*19.1–24.1*	*19.8–23.4*	*12.5–16.3*	*4.3–9.2*
For a dental problem	% of people	45.3	49.7	48.1	36.9	24.9
	95%CI	*43.6–47.0*	*46.3–53.2*	*45.6–50.6*	*34.1–39.9*	*19.8–30.8*
Oral status						
Dentate	% of people	30.6	33.1	34.1	24.1	13.9
	95%CI	*29.4–31.8*	*30.9–35.3*	*32.4–35.8*	*22.3–25.9*	*11.3–17.1*
Edentulous	% of people	22.0	0.0	25.8	23.2	19.9
	95%CI	*19.1–25.2*	—	*17.5–36.3*	*19.4–27.5*	*15.5–25.2*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Recommended dental treatment foregone due to cost

Foregoing recommended dental treatment due to cost occurs when, after making an initial dental visit, cost prevents people from proceeding with needed care. It indicates the likelihood of ongoing dental damage caused by untreated disease due to financial barriers to accessing dental care.

In NSAOH treatment foregone due to cost was assessed with the question 'Has the cost prevented you from having any dental treatment that was recommended during the last 2 years?'. People who answered 'Yes' were classified as having foregone dental treatment due to cost and they represented 20.6% of the Australian population aged 15 years or more (Table 6.11). There was some variation in the percentage who had foregone treatment due to cost, with 26.2% of the 1950–69 generation reporting that they had foregone treatment due to cost. In the generation born before 1930 the percentage was 7.8%.

For people of all ages there was variation in the percentage of having foregone recommended dental treatment due to cost according to usual reason for making a dental visit, dental insurance status, Indigenous identity, oral status and eligibility for public dental care. The population group with the highest percentage of having foregone recommended dental care was those who usually visit for a dental problem (36.3%), while the percentage was lowest among those who usually visit for a check-up (12.6%). In contrast, the percentage differed to only a small degree (less than 5% in absolute terms) between the sexes, between people living in capital cities and other places, according to level of schooling.

There was an almost three-fold difference in the percentage of having foregone recommended dental treatment due to cost between people who usually visit for a dental problem (36.3%) and those who usually visit for a check-up (12.6%). The relative difference was greatest in the 1970–90 generation (38.4% versus 10.6%) and the generation born before 1930 (15.5% versus 4.6%), and the smallest relative difference was in the 1950–69 generation (41.1% versus 16.6%) and the 1930–49 generation (27.6% versus 11.8%).

People without dental insurance were 1.7 times more likely than people with dental insurance to have foregone recommended dental treatment due to cost (26.8% versus 15.4%). The relative difference was greatest in the 1970–90 generation (26.3% versus 12.0%) and there was no difference in the generation born pre-1930.

Indigenous Australians were 1.6 times more likely to have foregone recommended dental treatment than non-Indigenous Australians (33.7% versus 20.5%). The relative difference was largest in the 1950–69 generation (57.9% versus 25.9%).

People who were eligible for public dental care were 1.2 times more likely than those who were ineligible for public dental care to forego recommended dental treatment due to cost (24.4% versus 19.5%). The relative difference was greatest in the 1950–69 generation (40.2% versus 24.1%), and there was no difference in the generation born before 1930.

Table 6.11: Percentage of people who reported that cost had prevented recommended dental treatment in the Australian population and in four generations

		Population: people who visited dentist within last 2 years				
			Generation (decade of birth[a])			
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**20.6**	**19.0**	**26.2**	**17.2**	**7.8**
	95%CI [b]	*19.5–21.8*	*17.0–21.2*	*24.5–28.0*	*15.6–19.1*	*5.7–10.7*
Sex						
Male	% of people	19.3	16.6	25.7	15.2	9.3
	95%CI	*17.6–21.1*	*13.6–20.0*	*22.9–28.7*	*13.0–17.7*	*5.9–14.3*
Female	% of people	21.8	21.3	26.7	19.2	6.9
	95%CI	*20.6–23.2*	*18.7–24.0*	*24.8–28.6*	*17.1–21.6*	*4.7–10.1*
Indigenous identity						
Indigenous	% of people	33.7	23.2	57.9	22.3	0.0
	95%CI	*24.0–44.9*	*11.5–41.2*	*40.3–73.7*	*11.4–39.1*	—
Non-Indigenous	% of people	20.5	19.0	25.9	17.2	7.9
	95%CI	*19.3–21.7*	*17.0–21.1*	*24.1–27.7*	*15.5–19.0*	*5.7–10.7*
Residential location						
Capital city	% of people	20.4	18.6	25.9	17.0	8.3
	95%CI	*18.9–21.9*	*16.3–21.2*	*23.8–28.1*	*14.8–19.4*	*5.7–11.8*
Other places	% of people	21.2	19.9	26.9	17.7	7.0
	95%CI	*19.4–23.2*	*16.3–24.0*	*23.9–30.1*	*15.1–20.5*	*3.8–12.7*
Year level of schooling						
Year 9 or less	% of people	18.7	15.0	34.7	19.0	8.3
	95%CI	*16.2–21.5*	*9.9–22.0*	*27.0–43.4*	*15.5–23.0*	*5.1–13.3*
Year 10 or more	% of people	20.9	19.2	25.8	16.9	7.3
	95%CI	*19.6–22.1*	*17.1–21.5*	*24.0–27.6*	*15.0–19.0*	*4.8–10.9*
Eligibility for public dental care						
Eligible	% of people	24.4	26.4	40.2	20.6	9.4
	95%CI	*22.1–26.8*	*20.9–32.8*	*35.4–45.2*	*18.1–23.4*	*6.6–13.2*
Ineligible	% of people	19.5	17.6	24.1	15.1	5.5
	95%CI	*18.3–20.9*	*15.5–20.0*	*22.4–25.9*	*13.1–17.4*	*3.0–10.0*
Dental insurance						
Insured	% of people	15.4	12.0	19.2	14.4	7.6
	95%CI	*14.1–16.7*	*9.9–14.5*	*17.2–21.3*	*12.2–16.8*	*4.4–13.0*
Uninsured	% of people	26.8	26.3	35.7	20.8	8.0
	95%CI	*25.0–28.7*	*23.2–29.7*	*32.7–38.9*	*18.3–23.6*	*5.5–11.5*
Usually visit dentist						
For a check-up	% of people	12.6	10.6	16.6	11.8	4.6
	95%CI	*11.6–13.7*	*8.8–12.7*	*14.8–18.4*	*10.2–13.6*	*2.6–7.9*
For a dental problem	% of people	36.3	38.4	41.1	27.6	15.5
	95%CI	*34.0–38.6*	*33.9–43.0*	*37.8–44.4*	*24.2–31.4*	*9.7–24.0*
Oral status						
Dentate	% of people	20.8	19.0	26.1	17.3	7.7
	95%CI	*19.6–22.0*	*17.0–21.2*	*24.3–27.9*	*15.5–19.2*	*5.3–11.0*
Edentulous	% of people	15.8	—	46.3	16.8	8.6
	95%CI	*12.4–20.0*	—	*28.3–65.3*	*12.1–22.8*	*4.7–15.2*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

In summary, having foregone recommended dental treatment due to cost was strongly associated with usual reason for visiting a dentist. There was a moderate association with dental insurance and Indigenous identity. As reported elsewhere, these characteristics were associated with several other measures of oral health.

Difficulty paying a $100 dental bill

Many people who have difficulty paying a $100 dental bill would be unable to afford to pay for a routine dental care visit. As a routine dental visit currently costs approximately $150, this is a conservative measure of a financial barrier or hardship in purchasing dental care. This captures both people who have and have not made a recent dental visit.

Box 6.3 Difficulty paying for dental care

Nicolette Manduca describes the difficulties that she and a family member experience in meeting the costs of dental care.

For people on the pension it's a little bit expensive. It takes for me fifty dollars because I give in cash money because I'm on the pension. And the lady – because I already go so many years – she understands me, and she take only fifty dollars. My brother-in-law is on the pension. It still one hundred and twenty dollar for cleaner. See, for me fifty is OK, so thank you for the lady – not much money take. But too expensive, yes. I told you, sometime I go [after] eight months, sometime one year. You know, depends. Because when you all by yourself you must pay all the bill, too many bill for the home. You must look after yourself, nobody give something. All the pension I got, well, I must look after my money. I must look at this money every two week. When I have the pension I must say, 'All this for the bill. This for this.' And see, that's why I go later.

–Excerpt from Nicolette Manduca's oral history (see Section 4.2, page 63)

In NSAOH difficulty paying for dental care was assessed with the question 'At most times of the year, how much difficulty would you have paying a $100 dental bill? Would you say none, hardly any, a little, a lot of difficulty, don't know?'. People who answered 'A lot' were classified as having difficulty paying a $100 dental bill and they represented 18.2% of the Australian population aged 15 years or more (Table 6.12) There was some variation in the percentage that would have difficulty paying a $100 dental bill, with 20.6% of the 1970–90 generation reporting that they would have difficulty paying $100 for dental care. In the generation born before 1930 the percentage was 16.6%.

For people of all ages there was variation in the percentage who would have difficulty paying a $100 dental bill according to eligibility for public dental care, dental insurance, usual reason for a dental visit, sex, Indigenous identity, schooling and oral status. There was no association with residential location.

There was an almost three-fold difference in the percentage who would have difficulty paying a $100 dental bill between people who were eligible for public dental care (34.1%) and those who were not (12.5%). The relative difference was largest in the 1950–69 generation (50.6% versus 11.4%), closely followed by the 1930–49 generation (29.5% versus 6.9%). The difference was smallest in the generation born before 1930 (20.0% versus 9.3%).

There was a greater than two-fold relative difference in the percentage who would have difficulty paying a $100 dental bill between those without dental insurance (24.4%) and those with dental insurance (10.5%). The difference was greatest in the 1930–49 generation (26.6% versus 6.8%) and smallest in the 1970–90 generation (24.0% versus 15.1%).

There was a two-fold difference in the percentage who would have difficulty paying a $100 dental bill between people who usually visit for a dental problem (24.4%) compared to those who usually visit for a check-up (12.6%). The relative difference was greatest in the 1930–49 generation (23.9% versus 8.9%) and smallest in the 1970–90 generation (25.1% versus 17.3%)

Women were 1.5 times more likely than men to have difficulty paying a $100 dental bill (21.7% versus 14.6%). Differences were stable across the generations, apart from the generation born pre-1930, in which the difference was not significant.

Indigenous Australians were 1.5 times more likely to have difficulty paying a $100 dental bill than were non-Indigenous Australians (26.9% versus 18.1%). The relative difference was greatest in the 1930–49 generation (38.3% versus 16.6%).

People who completed year 9 or less of schooling were 1.5 times more likely than those who completed year 10 or more to have difficulty paying a $100 dental bill (25.8% versus 17.0%). The relative difference was largest in the 1950–69 generation (33.5% versus 15.9%) and there was no difference in the generation born pre-1930.

Edentulous people were 1.4 times more likely than dentate people to have difficulty paying a $100 dental bill (24.2% versus 17.8%). The difference was greatest in the 1950–69 generation (37.1% versus 16.7%) and there was no difference in the generation born before 1930.

In summary, eligibility for public dental care, dental insurance and usual reason for visiting a dentist were strongly associated with having a lot of difficulty paying a $100 dental bill. There was a moderate association with sex, Indigenous identity, schooling and oral status.

Table 6.12: Percentage of people who would have a lot of difficulty paying a $100 dental bill in the Australian population and in four generations

		Population: all people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**18.2**	**20.6**	**17.0**	**16.8**	**16.6**
	95%CI [b]	*17.3–19.1*	*18.9–22.4*	*15.8–18.4*	*15.4–18.4*	*14.5–18.9*
Sex						
Male	% of people	14.6	16.4	14.0	12.7	13.9
	95%CI	*13.3–15.9*	*14.0–19.1*	*12.1–16.2*	*10.9–14.8*	*10.9–17.6*
Female	% of people	21.7	24.9	20.0	20.9	18.4
	95%CI	*20.5–22.9*	*22.5–27.5*	*18.4–21.7*	*19.0–22.9*	*15.4–21.8*
Indigenous identity						
Indigenous	% of people	26.9	16.1	33.0	38.3	47.6
	95%CI	*20.1–35.1*	*9.0–27.3*	*20.7–48.2*	*24.5–54.4*	*15.4–81.9*
Non-Indigenous	% of people	18.1	20.7	16.8	16.6	16.4
	95%CI	*17.1–19.0*	*19.0–22.6*	*15.6–18.1*	*15.1–18.1*	*14.3–18.8*
Residential location						
Capital city	% of people	17.3	19.2	16.5	15.8	15.3
	95%CI	*16.1–18.5*	*17.3–21.3*	*14.9–18.2*	*13.9–17.9*	*12.6–18.5*
Other places	% of people	19.9	23.5	18.0	18.4	18.5
	95%CI	*18.4–21.4*	*20.2–27.2*	*16.0–20.1*	*16.3–20.7*	*15.3–22.2*
Year level of schooling						
Year 9 or less	% of people	25.8	30.0	33.5	26.8	16.4
	95%CI	*23.4–28.4*	*22.5–38.8*	*27.7–39.9*	*23.5–30.5*	*13.4–20.1*
Year 10 or more	% of people	17.0	20.0	15.9	13.7	16.3
	95%CI	*16.1–18.0*	*18.2–21.9*	*14.7–17.3*	*12.2–15.3*	*13.5–19.6*
Eligibility for public dental care						
Eligible	% of people	34.1	39.9	50.6	29.5	20.0
	95%CI	*32.2–36.2*	*35.0–45.1*	*46.2–55.1*	*27.0–32.0*	*17.1–23.2*
Ineligible	% of people	12.5	16.4	11.4	6.9	9.3
	95%CI	*11.6–13.5*	*14.7–18.3*	*10.3–12.5*	*5.7–8.2*	*6.8–12.8*
Dental insurance						
Insured	% of people	10.5	15.1	9.5	6.8	8.0
	95%CI	*9.5–11.5*	*12.7–17.8*	*8.3–10.9*	*5.6–8.2*	*5.5–11.5*
Uninsured	% of people	24.4	24.0	25.2	26.6	19.6
	95%CI	*23.2–25.7*	*21.6–26.5*	*23.1–27.5*	*24.3–29.0*	*16.9–22.5*
Usually visit dentist						
For a check-up	% of people	12.6	17.3	9.8	8.9	10.6
	95%CI	*11.5–13.7*	*15.2–19.6*	*8.6–11.2*	*7.5–10.5*	*7.8–14.3*
For a dental problem	% of people	24.4	25.1	24.2	23.9	21.7
	95%CI	*22.9–25.9*	*22.3–28.2*	*22.1–26.5*	*21.2–26.7*	*17.3–27.0*
Oral status						
Dentate	% of people	17.8	20.6	16.7	15.3	15.2
	95%CI	*16.8–18.8*	*18.9–22.5*	*15.4–18.0*	*13.8–17.0*	*12.6–18.2*
Edentulous	% of people	24.2	0.0	37.1	26.2	19.0
	95%CI	*21.6–26.9*	—	*26.4–49.3*	*22.2–30.8*	*15.5–23.2*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Summary of findings regarding financial barriers to dental care

Affordability and hardship in purchasing private dental care are barriers to visiting a dentist and obtaining treatment when visits are made. Table 6.13 presents an overview of barriers to dental attendance including avoiding or delaying visiting because of cost and cost preventing recommended treatment, as well as difficulty in paying a $100 dental bill.

Table 6.13: Summary of financial barriers to dental care

	Avoid or delayed visiting because of cost	Cost prevented recommended treatment	Difficulty paying a $100 dental bill
Generations			
Ref[(a)] = 1970–90			
1950–69	~	↑	↓
1930–49	↓	~	↓
Pre-1930	↓↓	↓	~
Sex			
Ref = Male			
Female	↑	~	↑
Indigenous identity			
Ref = Non-Indigenous			
Indigenous	~	↑	↑
Residential location			
Ref = Capital city			
Other places	~	~	~
Year level of schooling			
Ref = Year 10 or more			
Year 9 or less	↓	~	↑
Eligibility for public dental care			
Ref = Ineligible			
Eligible	↑	↑	↑↑
Dental insurance			
Ref = Insured			
Uninsured	↑↑	↑	↑
Usually visit dentist			
Ref = For a check-up			
For a dental problem	↑↑	↑↑	↑
Oral status			
Ref = Dentate			
Edentulous	↓	~	↑

(a) Ref: reference group; ↓↓: markedly lower; ↓: lower; ~: not sig. different; ↑: higher; ↑↑: markedly higher

Just less than one third of all people avoided or delayed dental visits because of cost, slightly more than one in five people reported that cost prevented them receiving recommended dental treatment, and just less than one in five people reported they would have a lot of difficulty paying a $100 dental bill.

Compared with the most recent generation, indicators of financial barriers differed among generations born before 1970. A similar percentage of the two most recent generations avoided or delayed visiting because of cost. However, the percentage increased across the earlier generations and was markedly higher in the earliest generation, the pre-1930 generation. Cost prevented recommended dental treatment in a higher percentage of the 1950–69 generation, but was similar, then lower in the two earlier generations. Difficulty in paying a $100 dental bill was lower in the 1950–69 and 1930–49 generations, but similar in the earliest generation to that of the reference group, the 1970–90 generation.

Cost was a greater barrier for females than males, but was a greater barrier for Indigenous Australians than non-Indigenous Australians. There was no difference in cost as a barrier between residents in capital cities and other places. There was a mixed pattern between groups with different levels of schooling. Nine or fewer years of schooling was associated with a lower percentage of people avoiding or delaying visiting because of cost, but a higher percentage who would have a lot of difficulty in paying a $100 dental bill. There was no association with cost preventing recommended dental treatment.

Eligibility for public dental care was associated with a higher percentage of people facing cost barriers, particularly difficulty in paying a $100 dental bill. Being uninsured and usually visiting for a dental problem were both associated with higher percentages, some markedly higher, reporting avoiding or delaying visiting because of cost, cost preventing recommended dental treatment and difficulty in paying a $100 dental bill. Finally, edentulous people were less likely to report that they delayed or avoided dental visits due to cost, but they were more likely to report a lot of difficulty in paying a $100 dental bill. Oral health status was not associated with cost preventing recommended dental treatment.

7 Oral health perceptions

by Jane Harford and A John Spencer

Oral health examination surveys measure visible signs of oral disease and its treatment, providing indicators of impairment. Yet, there are many aspects of oral health that cannot be assessed systematically during a standardised oral epidemiological examination, including pain, function and quality of life (Slade & Sanders 2003). This chapter adds to the examination findings presented in Chapter 5 by describing rates of pain and difficulty eating due to oral problems. In addition, perceived needs for the most common dental treatments are presented to provide an additional indicator of subjective oral health in the Australian adult population.

7.1 Oral health problems

Avoidance of foods because of oral health problems

Avoiding food due to dental problems is an impact of poor oral health and may reflect an inability to chew properly. This reduces enjoyment of food and could affect the ability to maintain a healthy nutritional status.

In NSAOH avoiding foods because of oral health problems was assessed in the interview by asking people 'How often have you had to avoid eating some foods because of problems with your teeth, mouth or dentures during the last 12 months? Was it: Very often, Often, Sometimes, Hardly Ever, Never, Don't know?'. People who answered 'Very often', 'Often' or 'Sometimes' were classified as having avoided certain foods and they represented 17.4% of the Australian population aged 15 years or more (Table 7.1). There was some variation in the prevalence of avoiding certain foods across the generations, with 14.7% of the 1970–90 generation reporting that they avoided some foods. In the pre-1930 generation the percentage of people avoiding some foods was 21.1%.

Box 7.1 Avoiding steak because of dental problems

Apparently I've just got horrible teeth. They don't like fillings. I've bitten apples and my teeth have broken. The small, yellow lolly bananas as well. I mean fairly insignificant little things, but I've actually cracked teeth with those. There's nothing to be done apart from just ripping them out or trying to repair them....I mean, they're all just falling out naturally, so when they've all fallen out I think we'll go and do something. But in the meantime I'll keep just eating me yoghurt and jelly. I can't eat steak. Um, thin steak is OK. I eat a lot of stir fry and such, so it's not too bad. I can get stuck into that. But the old, bloody, sit-down-to-a-huge-kilo-bloody-chunk-of-steak-on-your-plate is few and far between these days.

–Excerpt from oral history of Wade Lang (see Chapter 4.2, page 75)

For all age groups there was variation in the percentage of people avoiding certain foods according to usual reason for making a dental visit, Indigenous identity, eligibility for public dental care, oral status, dental insurance, schooling, sex and residential location. The population group with the highest prevalence of avoiding some foods was Indigenous Australians (34.9%) while the percentage was lowest among people who usually make a dental visit for a check-up (10.3%).

There was a greater than two-fold difference in the percentage of people avoiding some foods between those who usually made a dental visit for a problem (24.1%) compared to those who usually visited for a check-up (10.3%). The relative difference between the two groups was largest among people born within the 1950–69 generation (25.8% versus 9.7%) and smallest among those in the pre-1930 generation (23.7% versus 11.9%).

There was a two-fold relative difference in the percentage of people avoiding some foods between Indigenous Australians (34.9%) and non-Indigenous Australians (17.1%). The relative difference is largest within the 1950–69 generation (48.9% versus 17.2%).

There was an almost two-fold difference in the percentage of people avoiding some foods between people who were eligible for public dental care (26.7%) and those who were ineligible for public dental care (14.1%). The relative difference was largest in the 1950–69 generation (33.2% versus 15.1%) and there was no difference in the pre-1930 generation.

There was a similar almost two-fold relative difference in the percentage of people avoiding some foods between edentulous (31.9%) and dentate people (16.4%). The difference between the two groups was greatest in the 1950–69 generation (39.7% versus 17.3%) and smallest in the pre-1930 generation (29.0% versus 16.6%).

Uninsured people were 1.6 times more likely to avoid some foods (20.9%) than were insured people (13.4%). There was no significant variation in the relative difference between the two groups across the generations.

Table 7.1: Percentage of people avoiding foods due to dental problems in the Australian population and in four generations

		Population: all people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**17.4**	**14.7**	**17.7**	**19.8**	**21.1**
	95%CI [b]	*16.5–18.2*	*13.1–16.4*	*16.4–19.1*	*18.2–21.4*	*18.7–23.7*
Sex						
Male	% of people	14.4	12.2	14.7	16.5	18.4
	95%CI	*13.2–15.7*	*10.0–14.8*	*12.8–16.9*	*14.4–18.8*	*14.7–22.9*
Female	% of people	20.2	17.2	20.6	23.1	22.8
	95%CI	*19.1–21.3*	*15.2–19.5*	*18.9–22.4*	*21.0–25.2*	*20.0–26.0*
Indigenous identity						
Indigenous	% of people	34.9	24.3	48.9	36.1	33.7
	95%CI	*26.7–44.1*	*14.3–38.1*	*33.4–64.6*	*22.3–52.6*	*9.8–70.4*
Non-Indigenous	% of people	17.1	14.5	17.2	19.5	21.0
	95%CI	*16.2–18.0*	*12.9–16.3*	*16.0–18.6*	*18.0–21.2*	*18.6–23.6*
Residential location						
Capital city	% of people	16.3	13.8	16.3	19.2	20.5
	95%CI	*15.2–17.4*	*12.0–15.8*	*14.8–17.9*	*17.2–21.3*	*17.5–24.0*
Other places	% of people	19.3	16.5	20.2	20.7	21.9
	95%CI	*17.8–20.8*	*13.5–19.9*	*17.8–22.9*	*18.2–23.4*	*18.3–25.9*
Year level of schooling						
Year 9 or less	% of people	24.0	21.0	23.6	26.1	23.0
	95%CI	*21.8–26.3*	*15.1–28.5*	*18.5–29.6*	*23.0–29.5*	*19.2–27.3*
Year 10 or more	% of people	16.4	14.2	17.3	17.8	19.8
	95%CI	*15.5–17.4*	*12.6–16.0*	*16.0–18.7*	*15.9–19.7*	*16.8–23.2*
Eligibility for public dental care						
Eligible	% of people	26.7	25.5	33.2	25.9	23.2
	95%CI	*24.9–28.6*	*21.0–30.5*	*29.1–37.5*	*23.7–28.3*	*20.2–26.7*
Ineligible	% of people	14.1	12.4	15.1	15.0	16.5
	95%CI	*13.2–15.0*	*10.9–14.2*	*13.8–16.5*	*13.2–17.1*	*12.8–21.0*
Dental insurance						
Insured	% of people	13.4	11.5	13.8	14.9	14.9
	95%CI	*12.4–14.5*	*9.7–13.8*	*12.2–15.4*	*13.1–17.0*	*11.3–19.2*
Uninsured	% of people	20.9	17.4	21.8	24.5	23.4
	95%CI	*19.7–22.2*	*15.1–19.9*	*19.9–23.9*	*22.3–26.9*	*20.4–26.6*
Usually visit dentist						
For a check-up	% of people	10.3	10.1	9.7	11.4	11.9
	95%CI	*9.5–11.3*	*8.6–11.9*	*8.5–11.1*	*10.0–13.0*	*8.8–15.9*
For a dental problem	% of people	24.1	21.0	25.8	25.8	23.7
	95%CI	*22.6–25.6*	*18.2–24.1*	*23.7–28.1*	*23.0–28.8*	*19.1–29.0*
Oral status						
Dentate	% of people	16.4	14.7	17.3	17.7	16.6
	95%CI	*15.5–17.3*	*13.1–16.4*	*16.0–18.7*	*16.1–19.4*	*13.8–19.9*
Edentulous	% of people	31.9	100.0	39.7	32.9	29.0
	95%CI	*28.8–35.1*	—	*28.2–52.5*	*28.3–37.9*	*24.5–33.9*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

People who completed no more than year 9 of school were approximately 1.5 times more likely than those who completed at least year 10 to avoid some foods (24.0% versus 16.4%). The relative difference between the two groups was largest in the 1930–49 generation (26.1% versus 17.8%).

Females were approximately 1.4 times more likely than males to avoid some foods (20.2% versus 14.4%). The relative difference between the two groups was approximately 1.4 for all generations except the pre-1930 generation in which there was no difference.

In summary, avoiding some foods because of problems with teeth, mouth or dentures was strongly associated with usual reasons for visiting a dentist, Indigenous identity, eligibility for public dental care and oral status. There was a moderate association with years of schooling, dental insurance and sex.

Perception of fair or poor oral health

Self-reported global measures of oral health reflect an individual's own experience of their oral health. Single-item, self-rated oral health measures are associated with functional impairment and discomfort as well as clinical measures of oral health. They are used widely in research and provide a summary measure of oral symptoms and functioning (Sanders & Slade 2006).

In NSAOH self-rated oral health was assessed in the interview by asking dentate people 'And how would you rate your own DENTAL health. Would you say that it is: Excellent, Very good, Good, Fair, Poor, Don't know?'. People who answered 'Fair' or 'Poor' were classified as having fair or poor self-rated oral health and they represented 16.4% of the Australian dentate population aged 15 years or more (Table 7.2). There was some variation in the percentage reporting fair or poor oral health across the generations, with 13.4% of the 1970–90 generation reporting fair or poor oral health compared with 18% in the other generations.

For all ages there was variation in the prevalence of fair or poor self-rated oral health according to eligibility for public dental care, dental insurance and usual reason for making a dental visit. The population group with the highest percentage of fair or poor self-rated oral health was those people who usually made a dental visit for a problem (28.0%), while the prevalence was lowest among people who usually make a dental visit for a check-up (7.3%). In contrast, percentage differed to only a small degree (less than 5% in absolute terms) between the sexes and between those who resided in capital cities compared to other places.

Table 7.2: Percentage of people rating their oral health fair or poor in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**16.4**	**13.4**	**18.2**	**18.1**	**18.0**
	95%CI [b]	*15.5–17.4*	*11.9–15.1*	*16.8–19.7*	*16.4–20.0*	*15.1–21.3*
Sex						
Male	% of people	17.0	13.9	19.1	18.2	21.4
	95%CI	*15.7–18.4*	*11.7–16.5*	*17.0–21.3*	*15.8–20.8*	*16.8–26.8*
Female	% of people	15.8	13.0	17.4	18.1	15.3
	95%CI	*14.7–16.9*	*11.2–15.0*	*15.8–19.3*	*16.1–20.3*	*12.2–19.2*
Indigenous identity						
Indigenous	% of people	25.1	15.4	39.0	27.9	12.2
	95%CI	*17.6–34.4*	*8.2–27.0*	*24.1–56.3*	*15.0–45.9*	*1.4–56.8*
Non-Indigenous	% of people	16.3	13.4	18.0	18.0	18.0
	95%CI	*15.4–17.3*	*11.9–15.1*	*16.6–19.5*	*16.3–19.9*	*15.1–21.4*
Residential location						
Capital city	% of people	15.8	13.1	17.6	17.6	17.4
	95%CI	*14.8–16.9*	*11.4–15.1*	*16.0–19.2*	*15.5–19.9*	*13.7–21.8*
Other places	% of people	17.5	14.1	19.5	19.1	19.0
	95%CI	*15.8–19.4*	*11.4–17.4*	*16.8–22.5*	*16.3–22.1*	*14.6–24.4*
Year level of schooling						
Year 9 or less	% of people	23.2	13.7	32.0	25.8	20.2
	95%CI	*20.5–26.2*	*8.3–21.9*	*25.7–39.1*	*21.9–30.1*	*15.3–26.2*
Year 10 or more	% of people	15.6	13.4	17.4	16.1	16.6
	95%CI	*14.7–16.6*	*12.0–15.1*	*16.1–18.9*	*14.3–18.0*	*13.2–20.7*
Eligibility for public dental care						
Eligible	% of people	25.1	22.0	31.7	25.3	20.2
	95%CI	*23.1–27.2*	*17.7–27.0*	*27.3–36.4*	*22.6–28.2*	*16.3–24.6*
Ineligible	% of people	13.9	11.7	16.0	13.4	14.4
	95%CI	*12.9–14.8*	*10.2–13.4*	*14.7–17.5*	*11.6–15.4*	*10.4–19.6*
Dental insurance						
Insured	% of people	11.7	8.0	12.8	14.0	15.5
	95%CI	*10.7–12.7*	*6.3–10.2*	*11.4–14.3*	*12.1–16.2*	*11.2–20.9*
Uninsured	% of people	20.9	17.5	24.4	22.5	19.4
	95%CI	*19.6–22.3*	*15.4–19.9*	*22.1–26.8*	*20.1–25.2*	*15.7–23.7*
Usually visit dentist						
For a check-up	% of people	7.3	5.1	7.6	9.8	12.1
	95%CI	*6.6–8.2*	*4.0–6.5*	*6.5–8.9*	*8.2–11.6*	*9.1–16.0*
For a dental problem	% of people	28.0	25.1	30.1	29.2	26.2
	95%CI	*26.4–29.6*	*22.2–28.2*	*27.7–32.6*	*26.4–32.2*	*21.4–31.7*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

There was an almost four-fold difference in the percentage with fair or poor self-rated oral health between people who usually made a dental visit for a problem (28.0%) compared to those who usually visited for a check-up (7.3%). The difference between

the two groups was largest among people born between 1970–90 (25.1% versus 5.1%) and smallest among those born pre-1930 (26.2% versus 12.1%).

There was an almost two-fold relative difference in the prevalence of fair or poor self-rated oral health between people who were eligible for public dental care (25.1%) and people who were not (13.9%). The difference was approximately two-fold for all generations apart from those born before 1930.

There was a similar almost two-fold relative difference in the prevalence of fair or poor self-rated oral health between people without dental insurance (20.9%) and people with dental insurance (11.7%). The difference between the two groups was greatest in the cohort born 1970–90 (17.5% versus 8.0%) and there was no difference in the cohort born before 1930.

People who completed no more than year 9 of schooling were approximately one and a half times more likely than people who completed at least year 10 to rate their oral health as fair or poor (23.2% versus 15.6%). There was no difference in the 1970–90 and pre-1930 generations. The relative difference was greatest between the two schooling groups was reflected in the 1950–69 cohort (32.0% versus 17.4%) and the 1930–49 generation (25.8% versus 16.1%).

Indigenous Australians were one and a half times more likely than non-Indigenous Australians to rate their oral health as fair or poor (25.1% versus 16.3%). There was a two fold difference between Indigenous Australians and non-Indigenous Australians in the 1950–69 generation (30.9% versus 18.0%).

In summary, fair or poor self-rated oral health was strongly associated with usual reasons for visiting a dentist, eligibility and dental insurance. There was a moderate association with years of schooling and Indigenous identity.

Experience of toothache

Toothache can be caused by dental diseases, including dental decay and gum disease that cause pain directly, or that create a painful infection. Other causes of toothache include broken (fractured) teeth, or severe sensitivity of the nerves inside the tooth to hot or cold foods or drinks. While some forms of toothache are short-lived, others can persist and become disabling (see Box 7.2). In NSAOH, experience of toothache was assessed in the interview by asking dentate people ‘During the last 12 months how often have you had toothache? Was it: Very often, Often, Sometimes, Hardly ever, Never, Don't know?’. This represents a global question about oral pain that cannot be attributed to any single cause among those cited above (Slade 2001).

Box 7.2 Disabling toothache

I had a lot of problems with my teeth when I was about 17 or 18 years of age. I'd moved out of home and had a young child and things were quite bleak. I wasn't looking after my teeth at all and I wasn't eating very well, so obviously my teeth started deteriorating. I was constantly getting abscesses. The whole top of my mouth would be full of them, which were just horrible. I was not eating because of the pain and I didn't realise that you had to go to the doctor at that stage to get antibiotics. I thought it was something that would go away. I just put oil of cloves on it and I ended up becoming quite ill.

–Excerpt from oral history of Fiona Morris (see Section 4.2, page 66)

For this report, people who answered 'Very often', 'Often' or 'Sometimes' to the question about toothache were classified as having experienced toothache and they represented 15.1% of the Australian dentate population aged 15 years or more (Table 7.3). There was some variation in the percentage of people reporting toothache across the generations, with 18.7% of the 1970–90 generation reporting toothache, but among the pre-1930 generation the percentage was only 6.4%.

For all ages there was variation in the prevalence of toothache according to usual reason for making a dental visit, Indigenous identity, eligibility for public dental care and dental insurance. The population group with the highest percentage reporting toothache was Indigenous Australians (27.0%), while the percentage was lowest among people who usually make a dental visit for a check-up (9.3%). In contrast, the percentage differed to only a small degree (less than 5% in absolute terms) between the sexes, those who lived in capital cities compared to other places and those who had completed year 9 or less of compared to those who completed year 10 or more schooling.

Table 7.3: Percentage of people experiencing toothache in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**15.1**	**18.7**	**15.3**	**10.6**	**6.4**
	95%CI [b]	*14.2–16.1*	*16.9–20.6*	*14.1–16.6*	*9.4–11.9*	*4.7–8.6*
Sex						
Male	% of people	14.1	16.5	15.3	9.6	5.3
	95%CI	*12.8–15.5*	*14.1–19.2*	*13.4–17.4*	*8.0–11.5*	*3.1–8.9*
Female	% of people	16.2	20.9	15.4	11.7	7.3
	95%CI	*15.1–17.3*	*18.8–23.2*	*14.0–16.9*	*10.0–13.5*	*5.0–10.5*
Indigenous identity						
Indigenous	% of people	27.0	25.7	38.9	11.0	0.0
	95%CI	*19.5–36.0*	*15.1–40.3*	*24.6–55.4*	*4.4–25.2*	—
Non-Indigenous	% of people	15.0	18.6	15.0	10.6	6.5
	95%CI	*14.1–16.0*	*16.8–20.5*	*13.8–16.3*	*9.4–11.9*	*4.8–8.7*
Residential location						
Capital city	% of people	15.2	18.6	15.2	11.1	6.3
	95%CI	*14.1–16.4*	*16.5–20.8*	*13.7–16.8*	*9.6–12.8*	*4.3–9.0*
Other places	% of people	15.0	18.9	15.6	9.8	6.7
	95%CI	*13.4–16.7*	*15.8–22.4*	*13.5–17.9*	*8.0–11.9*	*4.0–11.0*
Year level of schooling						
Year 9 or less	% of people	15.4	21.3	22.6	12.3	6.2
	95%CI	*13.2–17.8*	*15.2–29.2*	*17.3–28.9*	*9.9–15.3*	*3.7–10.2*
Year 10 or more	% of people	15.1	18.5	14.9	10.2	6.7
	95%CI	*14.2–16.2*	*16.7–20.4*	*13.6–16.2*	*8.8–11.7*	*4.6–9.6*
Eligibility for public dental care						
Eligible	% of people	19.9	28.1	27.7	13.3	7.9
	95%CI	*18.0–22.0*	*23.6–33.2*	*23.9–31.9*	*11.2–15.6*	*5.6–11.1*
Ineligible	% of people	13.7	16.7	13.3	8.8	3.9
	95%CI	*12.7–14.7*	*14.9–18.7*	*12.0–14.7*	*7.4–10.4*	*2.1–7.2*
Dental insurance						
Insured	% of people	12.1	16.3	11.5	8.4	6.9
	95%CI	*11.0–13.4*	*13.8–19.1*	*10.1–13.1*	*7.0–10.0*	*4.3–10.9*
Uninsured	% of people	17.9	21.0	19.3	12.9	6.2
	95%CI	*16.7–19.3*	*18.6–23.6*	*17.6–21.2*	*11.1–14.9*	*4.2–9.1*
Usually visit dentist						
For a check-up	% of people	9.3	12.3	8.3	6.4	5.4
	95%CI	*8.4–10.3*	*10.6–14.4*	*7.2–9.7*	*5.2–7.8*	*3.5–8.3*
For a dental problem	% of people	22.5	27.6	23.1	16.2	7.9
	95%CI	*21.0–24.1*	*24.6–30.7*	*21.2–25.2*	*14.2–18.4*	*5.2–12.0*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

People who usually made a dental visit for a problem were 2.4 times more likely to report toothache (22.5%) compared to those who usually visited for a check-up (9.3%). The relative difference between the two groups was largest among the 1950–69 generation (23.1% versus 8.3%).

Indigenous Australians were 1.8 times more likely than non-Indigenous Australians to report toothache (27.0% versus 15.0%). The relative difference was largest in the 1950–69 generation (38.9% versus 15.0%) and there was no difference in the 1930–49 generation or the 1970–90 generation.

People without dental insurance were 1.5 times more likely to report toothache then people with dental insurance (17.9%verus 12.1%). The relative difference between the two groups was greatest in the 1950–69 generation (19.3% versus 11.5%).

Those eligible for public dental care were approximately 1.5 times more likely than those who were ineligible to report toothache (19.9% versus 13.7%). The relative difference between the two groups was largest in the 1950–69 generation (27.7% versus 13.3%). The smallest relative difference was in 1930–49 generation (13.3% versus 8.8%).

In summary, experience of toothache was strongly associated with usual reasons for visiting a dentist and Indigenous identity. There was a moderate association with eligibility for public dental care and dental insurance.

Experience of orofacial pain

Orofacial pain can have many causes, ranging from toothache (see page 178) to chronic jaw pain, also called temporomandibular disorder (see Box 7.3). In NSAOH orofacial pain was assessed in the interview by asking people 'During the last month, have you had pain in the face, jaw, temple, in front of the ear, or in the ear?'. The question is intended primarily to capture episodes of temporomandibular disorder (Aggarwal et al. 2003). People who answered 'Yes' were classified as having orofacial pain and they represented 22.6% of the Australian population aged 15 years or more (Table 7.4). There was some variation in the experience of orofacial pain across the generations, with 25.7% of the 1970–90 generation reporting that they had orofacial pain, progressively declining to 13.7% in the pre-1930 generation.

Box 7.3 Temporomandibular disorder as a cause of orofacial pain

Melissa Williams describes painful symptoms that are consistent with temporomandibular disorder developing some time after experiencing pain from a broken tooth.

In 1999, my dentist picked up a small crack, and he sort of monitored it, but then in 2005 – six years down the track – I went and had an Indian meal, and must have chewed too hard. Anyway, the tooth cracked all the way down, so I had root canal treatment, from the end of 2005 all the way through this year basically.....They picked up that I've got some muscular jaw problem, and the pain associated is not due to the tooth. It's a jaw problem which women can get, but I still associate the pain subconsciously with having the treatment done on the teeth.

–Excerpt from oral history of Melissa Williams (see Section 4.2, page 72)

For all age groups there was variation in the percentage reporting orofacial pain according to sex, usual reason for making a dental visit and oral status. The population group with the highest percentage reporting orofacial pain was those who usually visit for a problem (27.2%) followed closely by Indigenous people (27.1%) while the percentage was lowest amongst edentulous people (17.5%).

Females were approximately 1.5 times more likely than males to experience orofacial pain (26.9% versus 18.2%). The relative difference between the two groups was largest in the pre-1930 generation (16.7% versus 9.4%) and smallest in the 1950–69 generation (28.2 versus 20.1%).

People who usually visit for a problem were 1.4 times more likely to experience orofacial pain than people who usually visit for a check-up (27.2% versus 19.8%). There was little variation in the relative difference between the two groups across the generations.

Table 7.4: Percentage of people experiencing orofacial pain in the Australian population and in four generations

		Population: all people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**22.6**	**25.7**	**24.2**	**18.2**	**13.7**
	95%CI [b]	*21.6–23.6*	*23.8–27.7*	*22.8–25.6*	*16.8–19.7*	*11.8–16.0*
Sex						
Male	% of people	18.2	20.3	20.1	14.2	9.4
	95%CI	*16.8–19.7*	*17.6–23.3*	*18.0–22.3*	*12.2–16.5*	*6.8–12.9*
Female	% of people	26.9	31.2	28.2	22.2	16.7
	95%CIS	*25.7–28.1*	*28.6–33.8*	*26.4–30.2*	*20.3–24.2*	*13.9–19.9*
Indigenous identity						
Indigenous	% of people	27.1	21.1	36.8	26.0	18.5
	95%CI	*20.0–35.5*	*12.1–34.2*	*23.3–52.7*	*13.2–45.0*	*2.7–65.4*
Non-Indigenous	% of people	22.5	25.7	24.0	18.1	13.7
	95%CI	*21.5–23.5*	*23.8–27.7*	*22.6–25.5*	*16.7–19.6*	*11.7–16.0*
Residential location						
Capital city	% of people	22.9	26.4	23.6	18.5	13.9
	95%CI	*21.7–24.1*	*24.2–28.8*	*21.8–25.5*	*16.7–20.5*	*11.5–16.6*
Other places	% of people	22.1	24.1	25.2	17.8	13.6
	95%CI	*20.4–23.8*	*20.6–27.9*	*23.1–27.4*	*15.7–20.1*	*10.2–17.8*
Year level of schooling						
Year 9 or less	% of people	20.4	25.8	29.5	18.9	13.1
	95%CI	*18.4–22.5*	*19.5–33.2*	*23.2–36.7*	*16.5–21.5*	*10.3–16.4*
Year 10 or more	% of people	22.9	25.6	23.9	17.9	14.2
	95%CI	*21.8–24.0*	*23.7–27.7*	*22.4–25.3*	*16.3–19.6*	*11.6–17.3*
Eligibility for public dental care						
Eligible	% of people	24.4	29.0	33.8	21.4	15.7
	95%CI	*22.8–26.2*	*24.4–34.1*	*29.8–37.9*	*19.4–23.6*	*13.3–18.5*
Ineligible	% of people	22.0	25.1	22.6	15.7	9.6
	95%CI	*20.8–23.2*	*23.0–27.3*	*21.1–24.1*	*14.0–17.6*	*6.9–13.4*
Dental insurance						
Insured	% of people	21.2	24.5	21.7	17.0	15.7
	95%CI	*19.9–22.5*	*21.8–27.4*	*19.9–23.6*	*15.2–19.0*	*11.8–20.5*
Uninsured	% of people	24.1	27.5	27.0	19.3	12.9
	95%CI	*22.7–25.5*	*24.9–30.2*	*25.0–29.2*	*17.4–21.3*	*10.6–15.6*
Usually visit dentist						
For a check-up	% of people	19.8	22.2	21.0	15.6	12.4
	95%CI	*18.7–21.1*	*20.0–24.5*	*19.2–22.8*	*13.8–17.6*	*9.6–15.9*
For a dental problem	% of people	27.2	31.2	27.9	21.5	16.4
	95%CI	*25.6–28.9*	*28.1–34.6*	*25.7–30.1*	*19.2–24.1*	*11.9–22.3*
Oral status						
Dentate	% of people	22.9	25.7	24.1	18.1	14.0
	95%CI	*21.9–24.0*	*23.7–27.7*	*22.7–25.6*	*16.6–19.6*	*11.4–17.0*
Edentulous	% of people	17.5	n.p.	27.4	19.2	13.3
	95%CI	*15.3–20.0*	*n.p.*	*18.9–38.0*	*16.0–22.9*	*10.3–17.1*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Dentate people were 1.3 times more likely to experience orofacial pain than edentulous people (22.9% versus 17.5%). However, this seems to be due to the 1970–90 generation, which had few edentulous people.

In summary, the experience of orofacial pain was moderately associated with sex, usual reason for visiting a dentist and oral status.

Summary of perceived oral health problems

Adverse impacts of oral health among Australian adults reported in previous tables are summarised in Table 7.5. The summary compares generations and population groups defined by sociodemographic and oral health characteristics. Seventeen per cent of people of all ages reported that they avoided food, 15.1% had experienced toothache, 16.4 reported having poor or fair oral health and 22.6% had experienced orofacial pain.

Relative to people in the most recent generation, preceding generations were more likely to report that they avoided food or had fair/poor oral health, but they were less likely to report toothache and orofacial pain. While males and females made similar rating of their overall oral health, females were more likely than males to report avoiding food, and experiencing orofacial pain. Indigenous Australians were more likely to report that they avoided food, had fair to poor oral health or had experienced toothache. The only difference between people residing in capital cities verses other places was in the latter's increased reporting that they avoided food. Those with less schooling were more likely to report avoiding food and having fair or poor oral health. Those who were eligible for public care were more likely than the ineligible to report that they avoided food, had fair/poor oral health or experienced toothache. Being uninsured was associated with higher prevalence of all four negative impacts, as was usually visiting for a dental problem. Edentulous adults reported more avoidance of food, but less orofacial pain than dentate adults.

Table 7.5: Summary of findings regarding impact of oral health

	Avoid food	Fair/poor self-rated oral health	Toothache	Orofacial pain
Generations				
Ref[(a)] = 1970–90				
1950–69	~	↑	↓	~
1930–49	↑	↑	↓	↓
Pre-1930	↑	~	↓	↓
Sex				
Ref = Male				
Female	↑	~	~	↑
Indigenous identity				
Ref = Non-Indigenous				
Indigenous	↑	↑	↑	~
Residential location				
Ref = Capital city				
Other places	↑	~	~	~
Year level of schooling				
Ref = Year 10 or more				
Year 9 or less	↑	↑	~	~
Eligibility for public dental care				
Ref = Ineligible				
Eligible	↑	↑	↑	~
Dental insurance				
Ref = Insured				
Uninsured	↑	↑	↑	↑
Usually visit dentist				
Ref = For a check-up				
For a dental problem	↑	↑↑	↑	↑
Oral status				
Ref = Dentate				
Edentulous	↑	..	..	↓

(a) Ref: reference group; ↓↓: markedly lower; ↓: lower; ~: not sig. different; ↑: higher; ↑↑: markedly higher

7.2 Perceived need for dental treatment

People's perception of their need for dental care is regarded as a factor in their visiting a dentist. For this reason perceived need has been included in a number of models that endeavour to predict the probability of dental visits. Dental attendance should reduce people's perceived needs, whereas onset of oral disease or other disorders may produce symptoms that create a perception that treatment is needed.

Perceived need for different types of dental care gives an indication of the dental services that could be required. However, the actual services provided in a dental visit are the result of a professional diagnosis and negotiated treatment plan, where both the professional judgement of a dentist and the perceptions of the 'patient' are both weighed in a cost-benefit assessment.

In NSAOH people were asked 'Currently which of the following dental treatments do you think that you need to have?' at the time of the interview. The possible response categories varied for dentate and edentulous people. All people were asked if they felt they need dentures. Dentate people were asked about additional dental services including an extraction, a restoration or a check-up. Further, those people who reported a need for an extraction or restoration were asked about the urgency of their need for those dental treatments.

Perceived need for dentures

For people of all ages only a small minority (7.2%) perceived themselves to be in need for dentures (Table 7.6). Across the generations the perceived need for dentures increased 17-fold from the lowest percentage in the 1970–90 generation (1.2%) to the highest percentage in the pre-1930 generation (20.4%). Such a pattern was similar to that seen for complete tooth loss (Table 5.1) or the number of missing teeth (Table 5.5). As dentures are a treatment to replace missing teeth, this trend is readily understandable. However, there is no direct relationship between tooth loss and the perceived need for dentures, as many people choose not to replace teeth and many who have a denture will be satisfied with its function and not perceive a need for further treatment.

When perceived need for dentures was examined between population groups defined by sociodemographic characteristics, considerable variation was found, except by sex. There was no substantial variation between males and females for people of all ages or within any of the four generations. The greatest variation between population groups in perceived need for dentures was between dentate and edentulous people. For people of all ages the edentulous had a greater than seven-fold higher percentage reporting that they perceived a need for dentures than the dentate (38.1% versus 5.1%). Within the generations this variation was greatest for the 1950–69 generation, where it approached a ten-fold difference (43.6% versus 4.4%). This set a pattern whereby the greatest variation in perceived need for dentures between population groups defined by sociodemographic characteristics was seen within the 1950–69 generation, and the variation was lower for both the most recent and earlier generations.

Table 7.6: Percentage of people who need dentures in the Australian population and in four generations

		Population: all people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**7.2**	**1.2**	**5.0**	**15.7**	**20.4**
	95%CI [b]	*6.7–7.8*	*0.8–1.9*	*4.3–5.9*	*14.2–17.2*	*17.9–23.2*
Sex						
Male	% of people	6.8	1.4	4.9	15.3	17.5
	95%CI	*6.0–7.6*	*0.7–2.6*	*3.8–6.3*	*13.4–17.5*	*14.2–21.4*
Female	% of people	7.7	1.1	5.1	16.0	22.4
	95%CI	*7.0–8.4*	*0.7–1.8*	*4.2–6.2*	*14.2–17.9*	*19.0–26.2*
Indigenous identity						
Indigenous	% of people	15.8	0.0	21.7	40.2	25.8
	95%CI	*10.2–23.6*	—	*10.9–38.6*	*25.7–56.5*	*5.8–66.3*
Non-Indigenous	% of people	7.1	1.3	4.8	15.3	20.4
	95%CI	*6.6–7.6*	*0.8–1.9*	*4.1–5.6*	*13.9–16.9*	*17.9–23.1*
Residential location						
Capital city	% of people	5.9	1.2	3.9	12.9	19.1
	95%CI	*5.3–6.5*	*0.8–1.8*	*3.1–4.8*	*11.1–14.9*	*15.7–23.0*
Other places	% of people	9.7	1.4	7.1	19.8	22.4
	95%CI	*8.8–10.7*	*0.6–3.2*	*5.7–8.8*	*17.5–22.3*	*19.0–26.3*
Year level of schooling						
Year 9 or less	% of people	19.0	1.4	16.4	26.3	22.0
	95%CI	*17.0–21.2*	*0.4–4.4*	*11.7–22.5*	*23.1–29.9*	*18.3–26.3*
Year 10 or more	% of people	5.5	1.2	4.3	12.3	18.9
	95%CI	*5.0–6.0*	*0.8–1.9*	*3.7–5.1*	*10.8–13.9*	*15.5–22.9*
Eligibility for public dental care						
Eligible	% of people	16.3	1.5	12.1	24.2	22.9
	95%CI	*14.9–17.7*	*0.8–2.8*	*9.5–15.4*	*21.9–26.7*	*19.5–26.6*
Ineligible	% of people	4.1	1.2	3.8	9.0	15.2
	95%CI	*3.6–4.6*	*0.7–2.0*	*3.2–4.6*	*7.6–10.7*	*11.8–19.5*
Dental insurance						
Insured	% of people	4.0	1.1	2.3	8.6	13.4
	95%CI	*3.4–4.5*	*0.6–2.1*	*1.7–3.2*	*7.1–10.4*	*10.0–17.9*
Uninsured	% of people	10.1	1.4	8.0	22.4	22.8
	95%CI	*9.3–11.0*	*0.8–2.5*	*6.8–9.4*	*20.2–24.8*	*19.7–26.2*
Usually visit dentist						
For a check-up	% of people	1.9	0.5	1.2	4.2	7.5
	95%CI	*1.6–2.3*	*0.3–1.2*	*0.8–1.9*	*3.2–5.5*	*5.3–10.5*
For a dental problem	% of people	9.2	2.3	7.9	20.7	22.9
	95%CI	*8.4–10.2*	*1.4–3.8*	*6.7–9.3*	*18.4–23.3*	*18.2–28.5*
Oral status						
Dentate	% of people	5.1	1.2	4.4	11.3	13.7
	95%CI	*4.7–5.6*	*0.8–1.9*	*3.7–5.1*	*10.1–12.7*	*11.1–16.9*
Edentulous	% of people	38.1	0.0	43.6	42.3	32.4
	95%CI	*35.1–41.2*	—	*32.5–55.4*	*38.0–46.7*	*27.3–37.9*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage of people.

For people of all ages perceived need for dentures was higher among those who were Indigenous than non-Indigenous (15.8% versus 7.1%), people resident in other places than capital cities (9.7% versus 5.9%), people with year 9 or less compared with year 10 or more schooling (19.0% versus 5.5%), people eligible compared with ineligible for public dental care (16.3% versus 4.1%), people uninsured compared with those insured (10.1% versus 4.0%) and people who usually visit for a dental problem rather than a check-up (9.2% versus 1.9%). Among the generations the variation between populations groups defined by these characteristics was greatest for the 1950–69 generation and was reduced for both the more recent generation and the earlier generations.

In summary, the perceived need for dentures followed a pattern reflecting that observed for complete loss of teeth and numbers of missing teeth. However, the actual level of perceived need for dentures was considerably lower than implied by these underlying impairments. Perceived need for dentures was strongly associated with edentulism and moderately associated with usually visiting for a dental problem, eligibility for public dental care, a lack of dental insurance, less schooling, Indigenous identity and residence in places other than a capital city. Within the generations the variation was greatest among those in the 1950–69 generation and lower among the most recent generation and the earlier generations, the 1930–49 and pre-1930 generations.

Perceived need for dental extraction or filling

Other response options to the question in the NSAOH interview about which dental treatments people thought they needed to have were 'Any extractions' and 'Any fillings'. These responses have been analysed for dentate respondents only. The response options have been combined so that the respondents are indicating that they perceive a dental problem for which one or other of these two aspects of routine dental care is thought to be required. Extractions and fillings (sometimes with additional dental services like endodontics and advanced restorative services like crowns) are alternative treatments for teeth affected by dental caries and its sequelae. Just which treatment people proceed with would be determined frequently by fees in the private sector and resource scarcity in the public dental services.

The results on perceived need for an extraction or filling are presented in Table 7.7. About one-third of people of all ages perceived they were in need of an extraction or filling (32.9%). Across the four generations the percentage of people who perceived a need for an extraction or filling increased from the most recent generation, the 1970–90 generation (33.6%) to the 1950–69 generation (36.1%), then decreased across both earlier generations to the lowest percentage in the pre-1930 generation (20.7%). This pattern of perceived need may to a reasonable extent follow two trends: first, the burden of past caries experience across the two most recent generations, and then the decrease in the number of teeth retained which reduces the probability of dental problems across the earliest generations. This pattern persisted across the four generations within population groups defined by sociodemographic characteristics. However, there was sometimes little variation between the two most recent

generations, but always a lower perceived need for extractions and fillings in the two earlier generations.

Table 7.7: Percentage of people who need an extraction or filling in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**32.9**	**33.6**	**36.1**	**28.7**	**20.7**
	95%CI [b]	*31.7–34.0*	*31.6–35.6*	*34.5–37.7*	*26.9–30.6*	*17.6–24.2*
Sex						
Male	% of people	33.8	33.3	38.2	29.5	20.1
	95%CIS	*32.1–35.5*	*30.3–36.4*	*35.8–40.7*	*26.7–32.6*	*15.5–25.7*
Female	% of people	32.0	33.9	34.0	27.9	21.1
	95%CI	*30.5–33.5*	*31.2–36.7*	*31.9–36.1*	*25.6–30.2*	*17.2–25.6*
Indigenous identity						
Indigenous	% of people	48.8	40.6	72.3	31.5	8.5
	95%CI	*39.1–58.6*	*27.0–55.8*	*58.4–82.9*	*19.4–46.8*	*0.9–47.8*
Non-Indigenous	% of people	32.6	33.5	35.6	28.7	20.8
	95%CI	*31.5–33.8*	*31.5–35.6*	*34.0–37.3*	*26.8–30.5*	*17.6–24.3*
Residential location						
Capital city	% of people	31.7	32.6	34.5	27.3	21.6
	95%CI	*30.4–33.1*	*30.3–35.0*	*32.6–36.5*	*24.9–29.8*	*17.8–26.0*
Other places	% of people	35.0	35.6	38.9	31.1	19.1
	95%CI	*33.0–37.0*	*31.9–39.5*	*36.0–41.8*	*28.4–33.8*	*13.9–25.6*
Year level of schooling						
Year 9 or less	% of people	32.9	29.6	46.3	31.6	25.1
	95%CI	*30.0–35.9*	*22.7–37.5*	*39.4–53.4*	*27.9–35.7*	*20.0–31.0*
Year 10 or more	% of people	32.9	33.9	35.5	28.0	18.2
	95%CI	*31.7–34.1*	*31.9–36.1*	*33.8–37.2*	*25.9–30.2*	*14.6–22.6*
Eligibility for public dental care						
Eligible	% of people	38.3	42.1	50.3	33.7	23.0
	95%CI	*36.1–40.6*	*36.8–47.5*	*45.6–55.1*	*30.9–36.6*	*19.1–27.5*
Ineligible	% of people	31.3	31.9	33.7	25.4	16.9
	95%CI	*30.0–32.6*	*29.7–34.2*	*32.0–35.5*	*23.0–28.0*	*12.6–22.3*
Dental insurance						
Insured	% of people	26.4	26.4	29.2	22.5	18.7
	95%CI	*25.0–27.9*	*23.6–29.5*	*27.0–31.4*	*20.2–25.0*	*14.1–24.4*
Uninsured	% of people	39.1	39.7	43.7	35.6	21.8
	95%CI	*37.5–40.7*	*37.0–42.4*	*41.3–46.1*	*33.0–38.3*	*17.9–26.4*
Usually visit dentist						
For a check-up	% of people	19.3	20.8	19.7	17.3	13.0
	95%CI	*18.1–20.5*	*18.8–23.0*	*18.1–21.5*	*15.5–19.3*	*9.8–17.1*
For a dental problem	% of people	50.5	52.4	54.4	43.9	31.9
	95%CI	*48.8–52.2*	*49.2–55.6*	*51.9–56.8*	*41.0–46.9*	*26.1–38.4*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage of people.

For people of all ages there was no difference in the perception of need for an extraction or filling by sex, residential location or years of schooling. Perceived need for extractions or fillings was higher among people who identified themselves as Indigenous than non-Indigenous (48.8% versus 32.6%); eligible than ineligible for public dental care (38.3% versus 31.3%) and uninsured than insured (39.1% versus 26.4%). This variation was greatest between those population groups defined by reason for visiting. There was a 2.5-fold difference between people who usually visited for a dental problem (50.5%) and people who usually visited for a check-up (19.3%). This indicated the benefit of regular asymptomatic dental care in managing dental diseases and disorders.

In summary, approximately one-third of Australian adults perceived a need for an extraction or filling. The percentage perceiving a need for an extraction or filling was highest among the 1950–69 generation and decreased across the earlier generations to be lowest in the pre-1930 generation. Perceived need for an extraction or filling was strongly associated with usual reason for visiting. People who usually visited for a dental problem reported a much higher need for extractions or fillings.

Perceived need for a dental check-up

Perceived need for a check-up is an indicator of an acceptance of the recommendation from dentists to visit regularly when not suffering any symptoms (that is, asymptomatic) so as to receive preventive services and the early diagnosis and prompt treatment of any oral disease. It is therefore related to the indicators of access described in Chapter 6 such as reported frequency of visiting for a check-up and usually visiting at least once a year.

In NSAOH people who were dentate were asked 'Currently which of the following dental treatments do you think you need to have?'. The responses included 'A dental check-up'. These responses have been analysed for dentate people only and are presented in Table 7.8. Very similar percentages of adults in Australia perceived they needed a check-up as reported usually visiting for a check-up and usually visiting a dentist at least once a year. A little more than half of all dentate adults (59.6%) reported that they perceived a need for a check-up. Across the four generations the percentage was highest for the most recent generation, the 1970–90 generation (65.6%), and decreased through to the earliest generation, the pre-1930 generation (39.5%). As this question was being asked only of those who were dentate the difference across the generations does not mix any effect due to edentulism.

The pattern of the most recent generation reporting the highest percentage perceiving a need for a check-up and this percentage decreasing across the three earlier generations repeated itself in most of the population groups defined by the sociodemographic characteristics. However, there was little variation either among people of all ages or within each generation between population groups defined by these sociodemographic characteristics. For people of all ages there were similar percentages of males and females (59.6% versus 59.7%), Indigenous and non-Indigenous Australians (58.1% versus 59.6%), those resident in capital cities and in

other places (59.5% versus 59.9%) and those eligible and ineligible for public dental care (58.1% versus 60.1%) reporting a perceived need for a check-up.

Table 7.8: Percentage of people perceiving a need for a check-up in the Australian population and in four generations

		Population: dentate people				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**59.6**	**65.6**	**61.4**	**50.7**	**39.5**
	95%CI [b]	*58.4–60.8*	*63.4–67.7*	*59.7–63.1*	*48.4–53.0*	*36.0–43.2*
Sex						
Male	% of people	59.6	63.9	63.0	50.5	37.7
	95%CS	*57.7–61.4*	*60.5–67.1*	*60.3–65.5*	*46.9–54.1*	*32.0–43.7*
Female	% of people	59.7	67.4	59.9	50.8	41.0
	95%CI	*58.2–61.2*	*64.8–69.8*	*57.8–62.0*	*48.2–53.4*	*35.9–46.3*
Indigenous identity						
Indigenous	% of people	58.1	58.1	73.6	35.3	7.4
	95%CI	*47.8–67.8*	*41.7–72.8*	*57.6–85.1*	*22.7–50.3*	*0.9–42.8*
Non-Indigenous	% of people	59.6	65.8	61.3	50.8	39.7
	95%CI	*58.4–60.8*	*63.5–67.9*	*59.5–63.0*	*48.5–53.1*	*36.2–43.3*
Residential location						
Capital city	% of people	59.5	65.2	61.0	49.7	42.2
	95%CI	*58.0–60.9*	*62.6–67.7*	*58.9–63.1*	*46.6–52.9*	*37.9–46.6*
Other places	% of people	59.9	66.4	62.2	52.2	34.9
	95%CI	*57.9–62.0*	*62.4–70.2*	*59.1–65.2*	*49.1–55.3*	*28.9–41.4*
Year level of schooling						
Year 9 or less	% of people	53.6	59.0	59.8	53.1	40.6
	95%CI	*50.3–56.9*	*50.9–66.7*	*52.2–66.9*	*49.0–57.3*	*34.6–46.9*
Year 10 or more	% of people	60.3	66.1	61.5	49.9	38.9
	95%CI	*59.1–61.6*	*63.8–68.3*	*59.8–63.2*	*47.3–52.4*	*34.3–43.6*
Eligibility for public dental care						
Eligible	% of people	58.1	67.7	67.3	50.8	43.0
	95%CI	*55.8–60.4*	*62.3–72.7*	*63.0–71.3*	*47.7–53.9*	*38.4–47.7*
Ineligible	% of people	60.1	65.2	60.5	50.5	33.9
	95%CI	*58.8–61.4*	*62.9–67.5*	*58.6–62.3*	*47.6–53.4*	*28.5–39.7*
Dental insurance						
Insured	% of people	54.8	60.7	56.4	47.1	33.3
	95%CI	*53.0–56.5*	*57.3–64.1*	*54.0–58.7*	*44.2–50.2*	*27.4–39.8*
Uninsured	% of people	64.1	69.6	66.8	54.5	42.8
	95%CI	*62.4–65.7*	*66.6–72.5*	*64.4–69.1*	*51.5–57.5*	*38.2–47.5*
Usually visit dentist						
For a check-up	% of people	52.0	59.5	50.9	44.2	35.4
	95%CI	*50.5–53.5*	*56.7–62.3*	*48.5–53.2*	*41.5–47.0*	*31.0–40.2*
For a dental problem	% of people	69.7	75.0	73.2	59.2	45.5
	95%CI	*68.1–71.2*	*71.7–78.0*	*71.0–75.4*	*56.1–62.3*	*39.1–52.0*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).

(b) 95%CI = 95% confidence interval for estimated percentage.

Only with population groups defined by three of the sociodemographic characteristics did the reported perceived need for a check-up vary. A higher percentage of those with year 10 or more than with year 9 or less schooling perceived a need for a check-up (60.3% versus 53.6%). There were two unexpected differences between population groups defined by dental insurance and usual reason for visiting. Those people who were uninsured reported a higher percentage perceiving a need for a check-up than those insured (64.1% versus 54.8%), and there was even more variation between those who usually visited for a dental problem and those who usually visited for a check-up (69.7% versus 52.0%). The unexpected findings might be explained by higher percentages of the insured and those who usually visit for a check-up having recently visited for a check-up and hence perceiving a lower need to do so at the time of the NSAOH interview.

In summary, approximately six out of ten dentate people perceived themselves to be in need of a check-up. The percentage was higher in the most recent generation and decreased across the earlier generations to be lowest in the pre-1930 generation. The perceived need for a check-up was higher among those with more schooling, those who were uninsured and those who usually visited for a dental problem. These later two associations may be confounded by time since last visit.

Perceived urgency of dental treatment needs

Another aspect of perceived need for dental care is the urgency with which dental treatment is perceived to be required. Some dental problems are acute in the urgency with which treatment is required. These problems include dental trauma, swelling in or around the jaws and bleeding (usually as a complication of surgical dental treatment). However, these are reasonably rare events. For many more dental problems the urgency of dental treatment is not acute but is certainly desirable in a short period of time. Then there is a hierarchy in the priority of urgency which falls away to those dental problems which are not urgent at all.

In NSAOH people were asked 'How soon do you think you need this dental treatment?'. The responses included a wide range of time periods. For this report only dentate people who perceived that they needed an extraction or filling were included and the response categories have been collapsed into those who considered that they needed dental treatment within 3 months and those who could not wait longer than 3 months.

The results on urgency of dental treatment are presented in Table 7.9. For people of all ages just less than seven out of ten (69.3%) considered that they needed an extraction or filling within 3 months. This percentage was similar across the four generations.

Table 7.9: Percentage of people perceiving a need for treatment within 3 months in the Australian population and in four generations

		Population: dentate people who need an extraction or filling				
		Generation (decade of birth[a])				
			1970–90	1950–69	1930–49	Pre-1930
Age at time of survey (years)		**All ages**	**15–34**	**35–54**	**55–74**	**≥75**
All people	**% of people**	**69.3**	**68.6**	**68.6**	**71.7**	**75.4**
	95%CI[b]	*67.4–71.3*	*64.6–72.2*	*65.6–71.5*	*68.1–75.0*	*66.2–82.8*
Sex						
Male	% of people	67.4	68.2	65.4	69.9	71.3
	95%CI	*64.1–70.6*	*61.6–74.2*	*60.7–69.9*	*64.6–74.8*	*55.8–83.0*
Female	% of people	71.3	68.9	72.1	73.7	78.4
	95%CI	*68.9–73.6*	*64.4–73.1*	*68.5–75.5*	*68.8–78.1*	*66.1–87.2*
Indigenous identity						
Indigenous	% of people	82.9	76.9	87.9	83.5	100.0
	95%CI	*71.8–90.2*	*54.5–90.3*	*71.9–95.4*	*50.8–96.1*	—
Non-Indigenous	% of people	69.1	68.4	68.2	71.6	75.4
	95%CI	*67.1–71.0*	*64.4–72.1*	*65.1–71.1*	*68.0–75.0*	*66.2–82.7*
Residential location						
Capital city	% of people	71.9	71.4	70.8	74.2	79.8
	95%CI	*69.6–74.0*	*66.9–75.4*	*67.1–74.2*	*69.3–78.6*	*68.7–87.7*
Other places	% of people	65.0	63.2	65.1	68.1	65.5
	95%CI	*61.3–68.5*	*55.5–70.3*	*59.8–70.1*	*62.9–72.8*	*48.1–79.6*
Year level of schooling						
Year 9 or less	% of people	68.9	74.5	63.9	69.9	68.0
	95%CI	*63.6–73.7*	*59.4–85.4*	*52.6–73.9*	*62.9–76.1*	*53.2–79.9*
Year 10 or more	% of people	69.4	68.1	69.1	72.1	82.3
	95%CI	*67.3–71.4*	*64.1–72.0*	*66.0–72.0*	*67.9–75.9*	*71.2–89.7*
Eligibility for public dental care						
Eligible	% of people	71.3	72.0	72.2	68.3	76.4
	95%CI	*67.7–74.6*	*64.5–78.4*	*65.3–78.2*	*63.2–72.9*	*65.3–84.7*
Ineligible	% of people	68.7	67.8	67.7	74.8	73.4
	95%CI	*66.3–71.0*	*63.3–71.9*	*64.4–70.9*	*69.7–79.2*	*54.9–86.2*
Dental insurance						
Insured	% of people	72.8	76.1	69.2	74.7	82.1
	95%CI	*69.9–75.5*	*70.5–81.0*	*64.8–73.3*	*68.7–79.9*	*62.9–92.5*
Uninsured	% of people	67.6	65.6	68.5	69.6	72.3
	95%CI	*65.0–70.1*	*60.6–70.3*	*64.6–72.1*	*65.0–73.9*	*61.0–81.3*
Usually visit dentist						
For a check-up	% of people	71.1	68.1	71.6	74.8	83.2
	95%CI	*67.7–74.3*	*61.5–74.0*	*66.6–76.0*	*68.1–80.6*	*68.4–91.9*
For a dental problem	% of people	68.5	68.8	67.5	69.9	70.8
	95%CI	*66.0–70.8*	*64.0–73.2*	*63.7–71.0*	*65.6–73.8*	*58.7–80.5*

(a) Columns are arranged by age at time of survey. Generations represent approximate decade of birth (see p. 28).
(b) 95%CI = 95% confidence interval for estimated percentage.

For people of all ages there was little variation between population groups defined by sociodemographic characteristics. There were no differences between the sexes, by schooling, eligibility for public dental care, insurance status or usual reason for visiting a dentist. Indigenous Australians reported a slightly higher percentage considering

that they needed dental treatment within 3 months than non-Indigenous Australians (82.9% versus 69.1%). This also occurred within two of the four generations; however, there were too few Indigenous Australians in the earliest generation for this comparison to be robust. A slightly higher percentage of people living in capital cities than in other places (71.9% versus 65.0%) and who were insured rather than uninsured (72.8% versus 67.6%) also reported a need for treatment within 3 months.

In summary, nearly seven out of ten people who perceived a need for an extraction or filling considered that they needed treatment within 3 months. This percentage was similar across the four generations. Slightly higher percentages of Australians who were Indigenous, resident in capital cities considered that they needed the extraction or filling within 3 months.

Summary of findings regarding perceived treatment needs

The Australian population's perceived need for dental care was measured using indicators presented in the preceding four tables and summarised in Table 7.10. Just under 60% of people of all ages reported that they needed a check-up and 7.2% needed dentures. Almost one-third needed an extraction or filling and nearly 70% reported that this was need within the next three months. The summary focuses on variation across the generations and between population groups defined by sociodemographic and oral health characteristics.

For people of all ages there was little variation between population groups defined by sociodemographic characteristics. There were no differences between the sexes, by schooling, eligibility for public dental care, insurance status or usual reason for visiting a dentist. Indigenous Australians reported a slightly higher percentage considering that they needed dental treatment within 3 months than non-Indigenous Australians (82.9% versus 69.1%). This also occurred within two of the four generations; however, there were too few Indigenous Australians in the earliest generation for this comparison to be robust. A slightly higher percentage of people living in capital cities than in other places (71.9% versus 65.0%) and who were insured rather than uninsured (72.8% versus 67.6%) also reported a need for treatment within 3 months.

In summary, nearly seven out of ten people who perceived a need for an extraction or filling considered that they needed treatment within 3 months. This percentage was similar across the four generations. Slightly higher percentages of Australians who were Indigenous, resident in capital cities considered that they needed the extraction or filling within 3 months.

Table 7.10: Summary of findings regarding perceived need for dental care

	Need dentures	Need extraction or filling	Need check-up	Need treatment within 3 months
Generations				
Ref[(a)] = 1970–90				
1950–69	↑		↓	~
1930–49	↑	↓	↓	~
Pre-1930	↑	↓	↓↓	~
Sex				
Ref = Male				
Female			~	
Indigenous identity				
Ref = Non-Indigenous				
Indigenous	↑	↑	~	↑
Residential location				
Ref = Capital city				
Other places	↑		~	↓
Year level of schooling				
Ref = Year 10 or more				
Year 9 or less	↑	~	↓	~
Eligibility for public dental care				
Ref = Ineligible				
Eligible	↑	↑	~	~
Dental insurance				
Ref = Insured				
Uninsured	↑	↑	↑	
Usually visit dentist				
Ref = For a check-up				
For a dental problem	↑	↑↑	↑	~
Oral status				
Ref = Dentate				
Edentulous	↑↑	..	..	..

(a) Ref: reference group; ↓↓: markedly lower; ↓: lower; ~: not sig. different; ↑: higher; ↑↑: markedly higher

8 Trends in oral health 1987–2006

by Gary Slade and Anne Sanders

This chapter evaluates trends in oral health in the Australian population over a 17-year period. The aims are to describe the degree of change in oral health and to assess whether observed trends can be attributed to changes during the 17-year interval or to different historical experiences of generations, or to a combination of both effects of time.

Australia has completed two oral health examination surveys of nationally representative samples of Australian adults: the National Oral Health Survey of Australia (NOHSA), conducted in 1987–88, and the current National Survey of Adult Oral Health (NSAOH), conducted in 2004–2006. Each survey collected similar information from different samples of people. Each survey measured clinical oral health status of the adult population and collected supplementary information on their use of dental services and their perceived need for dental care.

The methods used to analyse trends are described in detail in Chapter 2. In summary, the degree of change is described in this chapter using age group analysis and additional birth cohort analyses are undertaken to explain change. Birth cohorts, also called generations, are born into the same period in time, move through the life course together and encounter the same events at the same point in time. As events unfold members of one cohort are exposed to risk and protective factors at different times in their lives. For example, the introduction of fluorides at one period in life may have a different effect on the oral health of a middle-age birth cohort compared with earlier and later birth cohorts. As Ryder (1965) observed, 'Successive cohorts are differentiated by the changing content of formal education, by peer-group socialisation, and by idiosyncratic historical experience' (Ryder 1965). This chapter uses the method of birth cohort analysis to identify between-generation effects that have affected oral health.

Box 8.1 Methods used to analyse change

Age group analysis describes the degree of change between surveys in population oral health for a selected age group.

Birth cohort analysis seeks to explain reasons for any observed changes.

- Within-generation birth cohort analysis identifies effects of events occurring between surveys, including disease onset or progression, ageing, provision of dental care and changes to population health determinants.
- Between-generation birth cohort analysis identifies effects of historical circumstances that selectively influenced the levels of oral health in different generations prior to the first survey.

The effects of different historical imprints can be seen very clearly when one generation is exposed to an epidemic that leaves lasting functional deficits whereas another is not. For example, Australia experienced a polio epidemic in the 1940s and 1950s, and many children who survived the disease at that time continued through adult life with persisting disability and reliance on functional aids such as leg callipers. In contrast, children born in the following generation were immunised against the polio virus and did not develop the disease. When they reached adulthood, this generation did not have the same signs of disability that were evident in their parents' generation when they reached adulthood.

This example of a polio epidemic is just one illustration of a historical influence on a population that leaves a lasting 'imprint' on population health. The four cohorts studied in this chapter were born over a period of 67 years of the twentieth century. Throughout their lives the oldest members were served by 19 of the nation's 25 prime ministers. The members of the earliest cohort were born during World War I and the youngest members of the latest cohort were born in 1983—the year Australia won the America's Cup boat race. The collective experience of each separate cohort was diverse historically, socially and economically, fashioning a unique profile for each cohort.

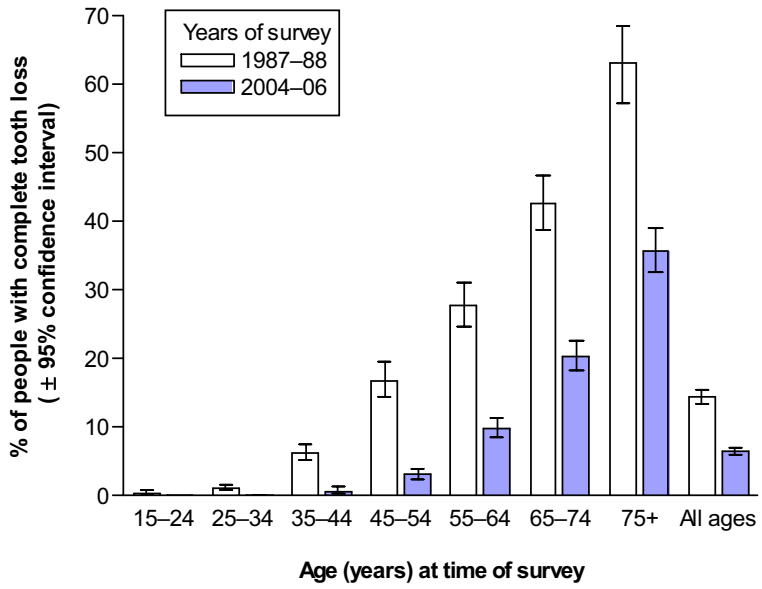
8.1 Trends in oral health status

Prevalence of complete tooth loss

Age group analysis

Complete tooth loss is an objective population marker of oral status, reflecting past experience of dental disease and a surgical approach to its treatment. In the 17 years to 2004–06, the proportion of people who had no natural teeth halved, from 14.4% in 1987–88 to 6.4% in 2004–06 (Figure 8.1). The trends are presented by comparing the height of the white bars (1987–88 NOHSA) relative to the blue bars (2004–06 NSAOH)

for each age group. There were dramatic reductions over time in prevalence of complete tooth loss in every 10-year age group above the age of 24 years (Figure 8.1). In relative terms the reduction was greater among younger age groups. Among the 35–44-year-olds, there was a ten-fold reduction in prevalence from 6.2% in 1987–88 to 0.6% in 2004–06. The relative reduction among adults in the 45–54 years age group was six-fold, and among adults in the 55–64 year age group was three fold. An approximate halving in prevalence of complete tooth loss was observed between the two oldest age groups. In absolute terms reduction in prevalence was most pronounced among the older age groups. Prevalence reduced by 6 percentage points in the 35–44 years age group, and by 28 percentage points among adults in the 75 years and older age group.



	15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	0.2	1.1	6.2	16.8	27.8	42.7	63.1	14.4
2004–06	0.0	0.0	0.5	3.0	9.8	20.3	35.7	6.4

Figure 8.1: Age group trends in percentage of Australian adults with complete tooth loss, 1987–88 to 2004–06

The preceding age group analysis identified substantial reductions within age groups. Logically, this cannot be attributable to events occurring between surveys because permanent teeth, once extracted, do not grow back. Instead, inter-generational effects must be the cause, that is the replacement of an age group in the first survey with

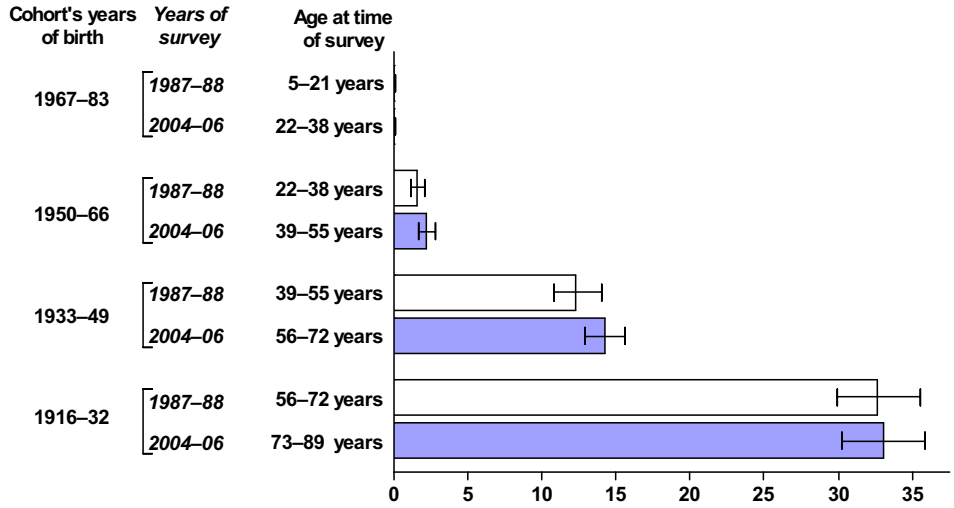
members of a later generation who reach the same age in the second survey. Intergenerational effects are explored in Figure 8.2 by examining birth cohorts.

Birth cohort analysis

Within-generation analysis of the trend in complete tooth loss addresses a new question, 'What was the pattern of change in edentulism for each birth cohort?' This latter analysis investigates whether changes in the prevalence of edentulism over the 17-year period between surveys were equivalent among members of one generation compared with their children's generation in the same 17-year period.

Within-generation analysis first considers the youngest birth cohort in the 1987–88 survey. These were people born between 1967 and 1983. Their prevalence of edentulism was then compared with prevalence is the same birth cohort in 2004–06 when they were aged 22–38 years. This was repeated for the three earlier birth cohorts born in 1950–66, 1933–49 and 1916–32. Each birth cohort spans 17 years, and the time interval between the two surveys was also 17 years. This poses a third question, 'Were adults aged 22–38 years in the first survey, the same or different to adults aged 22–38 years in the second survey?'

Figure 8.2 shows four pairs of bars along the vertical axis, each pair shaded white or blue. In each pair the white bar presents prevalence of complete tooth loss for the 1987–88 survey and the blue bar presents prevalence for the 2004–06 survey. Importantly, each pair compares the same birth cohort at the two survey times.



Cohort	1916–32	1933–49	1950–66	1967–83
1987–88	32.6	12.3	1.6	0.0
2004–06	33.0	14.2	2.2	0.0

Figure 8.2: Birth cohort trends in percentage of Australian adults with complete tooth loss, 1987–88 to 2004–06

Individuals born in the period 1967–83 were aged 5 to 21 years at the time of the 1987–88 NOHSA survey. Prevalence of complete tooth loss for this cohort was virtually non-existent in the first survey (0.02%). When surveyed 17 years later in 2004–06 members this same birth cohort were aged 22–38 years and prevalence of edentulism was unaltered (0.03%).

This seemingly unspectacular finding needs to be understood within its historical context: adults who aged through the same stage of life during the first half of the twentieth century were exposed to a virtual 'epidemic' of complete tooth loss (Sanders et al. 2004). The 'epidemic' can be attributed to a predominant surgical approach adopted by dentists in which all teeth were extracted to treat dental disease, even when the disease was relatively mild or affected only some of a patient's teeth. Ray Barker was one survey participant who experienced such a fate (see Box 8.2).

Box 8.2 Complete tooth loss as a teenager

Born in the early 1920s, Ray Barker has lived on banana farms in or near Gympie, Queensland, for most of his life. He had all his teeth extracted before 20 years of age, probably due to tooth decay and because dental services were expensive and difficult to access in rural Queensland during the Depression.

I had very bad teeth [as a child]. I can remember having bad toothaches and even putting strong brandy on them to stop the ache in the early days, 'cause we had nothing else then. When I was 18 or 19 years of age – I'm not entirely sure – I had all my teeth removed under anaesthetic. My father paid a shilling for the first tooth and five cents for the rest. I've had false teeth ever since. I've never regretted having my teeth out. No more toothache.

–Excerpt from Ray Barker's oral history (see Chapter 4.2, page 64)

The second youngest birth cohort (1950–66) was aged 22–38 years at the time of the first survey. This was the same age as the youngest cohort at the time of the second survey. When surveyed 17 years later when aged 39–55 years, prevalence of complete tooth loss among the 1950–66 cohort had not changed significantly. The prevalence estimate of 2.2% falls within the margin of uncertainty indicated by the 95% CI for the same cohort in the 1987–88 survey.

In contrast to the lack of change within generations, the between-generation analysis revealed a marked difference between the two most recent birth cohorts when they were of the same age: prevalence at the age of 23–38 years was 1.6% for the 1950–66 birth cohort, compared with 0% for the 1967–83 birth cohort. This between-generation effect demonstrates that year of birth had a profound effect on edentulism. In contrast to the within-generation comparison, differences between generations revealed that the passage of time between surveys, including any age-related effects of oral disease, did not bring about an increase in prevalence of complete tooth loss within birth cohorts.

The observation that prevalence of complete tooth loss was affected more by year of birth than passage of time is strikingly illustrated by comparing adults aged 39–55 years in the 1933–49 cohort with the subsequent cohort born in 1950–66. Prevalence was 2.2% in this age group for those born in 1950–66, but 12.3% for those born in the earlier cohort. When the results for the 1933–49 cohort were followed over time, prevalence of complete tooth loss increased but not significantly so. An even more dramatic effect was noticed in comparing adults aged 56–72 years in the 1933–49 cohort with the 1916–32 cohort.

One in three adults (32.6%) born between 1916 and 1932 had complete tooth loss in the 1987–88 survey when they were aged 56–72 years. The important point to note is that after ageing 17 years, prevalence remained constant at 33.0% in this cohort. This constancy was not confined to the oldest cohort, but rather was a feature of all four cohorts.

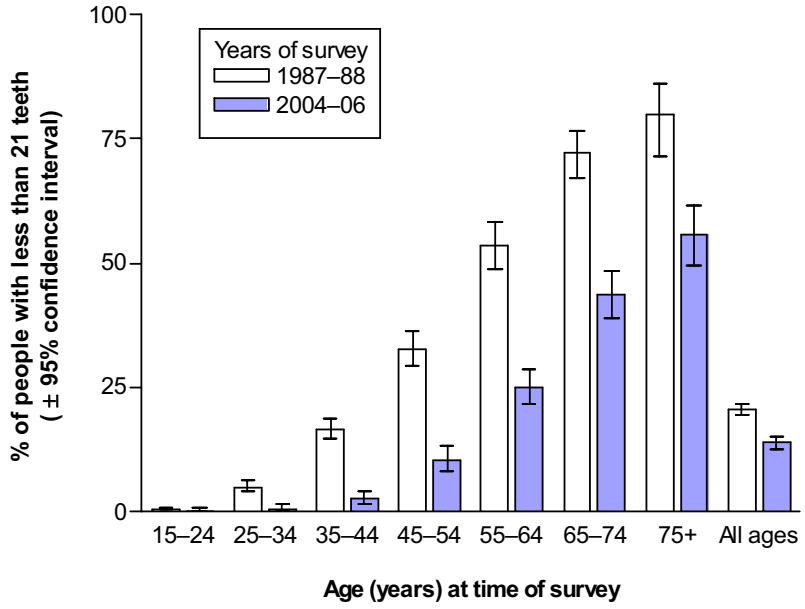
In Australia today complete tooth loss is an ailment associated with historical circumstances near the middle of the twentieth century. Over the 17 years between surveys there were dramatic reductions in prevalence of complete tooth loss for people of the same age. Yet for each birth cohort, prevalence of complete tooth loss did not change, and is not increasing as people get older.

Inadequate natural dentition among dentate people

Age group analysis

With pronounced reductions in prevalence of complete tooth loss occurring in all age groups, the importance of edentulism as a marker of population oral health is losing value. An alternative marker of oral status is retention of less than 21 teeth. As a marker of oral status, this represents loss of one-third or more of the complete dentition of permanent teeth. As described in Chapter 4, retention of fewer than 21 teeth has clinical and public health significance (see page 84).

Figure 8.3 reports the percentage of dentate people who had retained some, but fewer than 21, of their own natural teeth in seven 10-year age groups in 1987–88 (NOHSA) and in 2004–06 (NSAOH). (The results from 2004–06 are from people who participated in the NSAOH oral examination, and they therefore differ slightly from the results in Table 5.2, page 86, describing the percentage of interviewed dentate people who had fewer than 21 teeth. Among all ages, there was a modest net decrease (6.8%) in the percentage of people with fewer than 21 teeth. The proportion fell from 20.6% in 1987–88 to 13.8% over 17 years.



	15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	0.5	5.0	16.6	32.7	53.5	72.1	79.8	20.6
2004–06	0.1	0.4	2.5	10.5	24.9	43.7	55.6	13.8

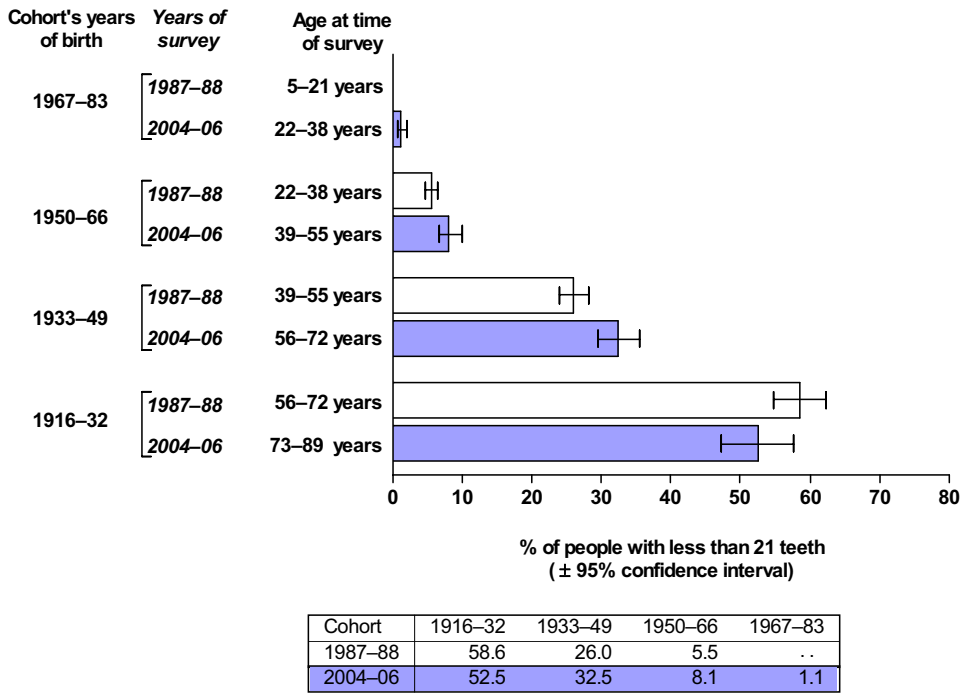
Figure 8.3: Age-group trends in percentage of dentate Australian adults with fewer than 21 natural teeth, 1987–88 to 2004–06

Considerably more striking were the trends for specific age groups. Greatest decreases in prevalence were achieved among the 55–64- and 65–74-year-old age groups, where retention of less than 21 teeth decreased by 28 percentage points in absolute terms for both age groups in the 17-year period between surveys. Prevalence decreased by more than 20 percentage points also for the 45–54-year-old and 75+-year-old groups. Among the 55–64-year-old age group retention of less than 21 teeth decreased from more than half (53.5%) to one-quarter (24.9%). For the 65–74-year-old age group, retention of 21 teeth decreased from more than three-quarters (79.8%) to about half (55.6%). In summary, Figure 8.3 demonstrates that fewer adults in each age group are falling below the threshold number of teeth for adequate function and quality of life. As noted for the analysis of complete tooth loss, extracted permanent teeth do not regrow, suggesting that the trends observed in Figure 8.3 are due to different historical circumstances of generations. The reasons underlying these age-related changes are examined in Figure 8.4.

Birth cohort analysis

Figure 8.4 shows change in prevalence of an inadequate natural dentition among three consecutive 17-year birth cohorts in the 1987–88 and 2004–06 surveys. Because the most recent cohort (1967–83) was first examined at an age when their permanent teeth were still erupting, this cohort is not discussed. The within-generation comparison revealed small increases in prevalence for the 1950–66 cohort and the 1933–49 cohorts in the 17 years between surveys. A within-generation comparison of the paired bars for the 1950–1966 birth cohort showed that the percentage of people who retained less than 21 teeth increased by 2.6 percentage points from 5.5% in 1987–88 to 8.1% in 2004–06 (Figure 8.4). When first surveyed in 1987–88 the 1933–49 birth cohort was aged 39–55 years. At that time 26.0% of cohort members had retained less than 21 teeth. When surveyed 17 years later in 2004–06 the proportion had increased to 32.5%. This probably represents the ongoing effects of dental disease between surveys, resulting in extractions, which in this small percentage of the cohort, left them with fewer than 21 teeth.

Much more striking were the differences observed between generations. That is, 32.5% of people aged 56–72 years in the 1933–1949 birth cohort had less than 21, teeth which is a substantially lower prevalence than the 58.6% of 56–72-year-olds in the preceding generation, born between 1916 and 1932 (Figure 8.4). The net difference of 26.1% between these two generations when they were aged 56–72 years is considerably greater than the 6.5% net increase in prevalence for the 1933–49 birth cohort due to the passage of time between surveys. Other between-generation comparisons revealed substantial reductions in tooth loss among same-aged adults. For example, the proportion of 39–55-year-olds with 21 or more teeth was 26.0% for the 1933–49 birth cohort compared with 8.1% for the 1950–66 birth cohort.



Cohort	1916–32	1933–49	1950–66	1967–83
1987–88	58.6	26.0	5.5	. .
2004–06	52.5	32.5	8.1	1.1

Figure 8.4: Birth cohort trends in percentage of dentate Australian adults with fewer than 21 natural teeth, 1987–88 to 2004–06

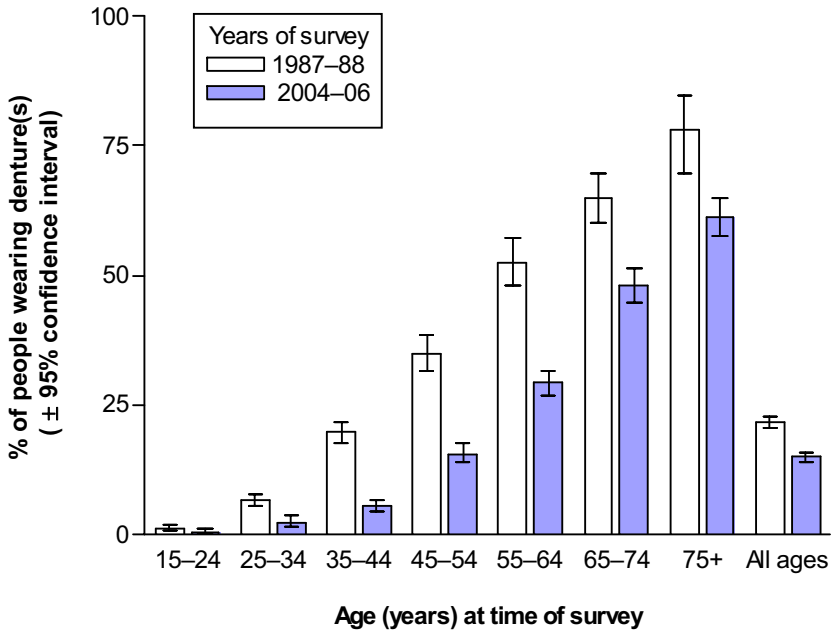
In conclusion, dramatic reductions were observed in the percentage of dentate adults with an inadequate natural dentition. Birth cohort analysis revealed that this change occurred despite modest increases within generations over the 17-year period. Instead, the reason for age-group differences could be attributed to much larger between-generation effects, confirming that historical circumstances have a greater impact on observed patterns of tooth retention within the Australian population than the relatively small effects of accumulation of disease between the two surveys.

Denture wearing among dentate people

Virtually all edentulous people wear dentures, so trends in denture wearing for that segment of the Australian population mirror trends in complete tooth loss (see page 197). This section instead focuses on trends in denture wearing among dentate people. As reported elsewhere, dentate people may chose to wear a partial denture to replace a single tooth or larger numbers of teeth and, if they have lost all teeth in one jaw, they usually chose to wear a complete denture in that jaw (see page 87).

Age group analysis

In 1987–88, 21.5% of dentate Australian adults wore one or two dentures (Figure 8.5). The figure declined to 14.9% in the 2004–06 survey, representing an absolute difference of 6.6%. Absolute reductions of at least 10% were observed for age-groups over 35 years, with the largest absolute reduction observed in the 55–64 year age group where the percentage wearing denture(s) reduced from 52.5% in 1987–88 to 29.2% in 2004–06.



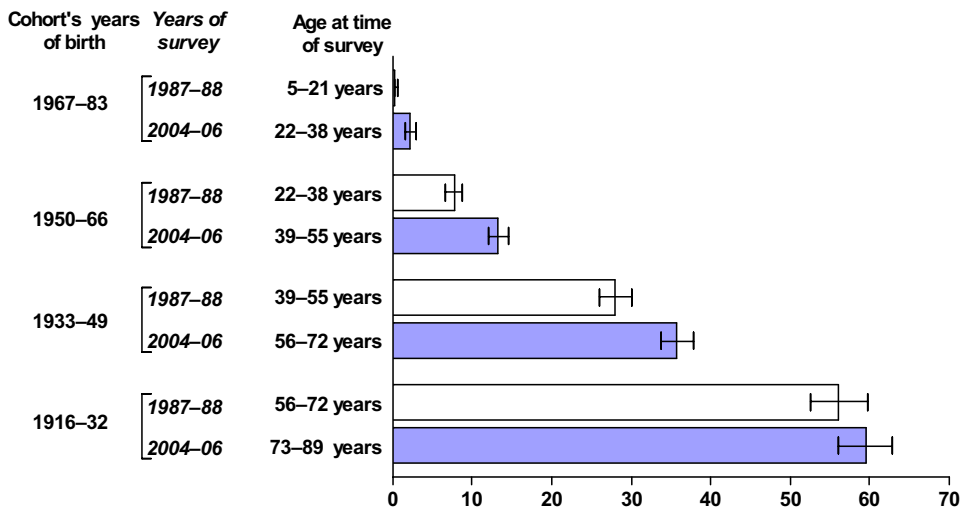
	15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	1.3	6.5	19.7	34.8	52.5	65.0	78.0	21.5
2004–06	0.5	2.4	5.5	15.6	29.2	48.0	61.2	14.9

Figure 8.5: Age-group trends in percentage of dentate Australian adults wearing denture(s), 1987–88 to 2004–06

The trends in denture wearing observed in Figure 8.5 are similar in many regards to the trends observed in frequency of an inadequate dentition among dentate people, where there was a reduction of 6.8%, in absolute terms, for all ages and where the largest reduction was observed among 55–64–year-olds (see Figure 8.3, page 203). The reasons underlying age-related changes in denture wearing are examined in Figure 8.6.

Birth cohort analysis

Figure 8.6 presents findings from the birth cohort analysis of denture wearing among dentate Australian adults. Within each generation, there were small increases in the percentage wearing denture(s) during the 17-years between surveys, with absolute increases ranging from 2% to 8%.



Cohort	1916–32	1933–49	1950–66	1967–83
1987–88	56.1	28.0	7.7	0.3
2004–06	59.5	35.7	13.2	2.2

Figure 8.6: Birth cohort trends in percentage of dentate Australian adults wearing denture(s), 1987–88 to 2004–06

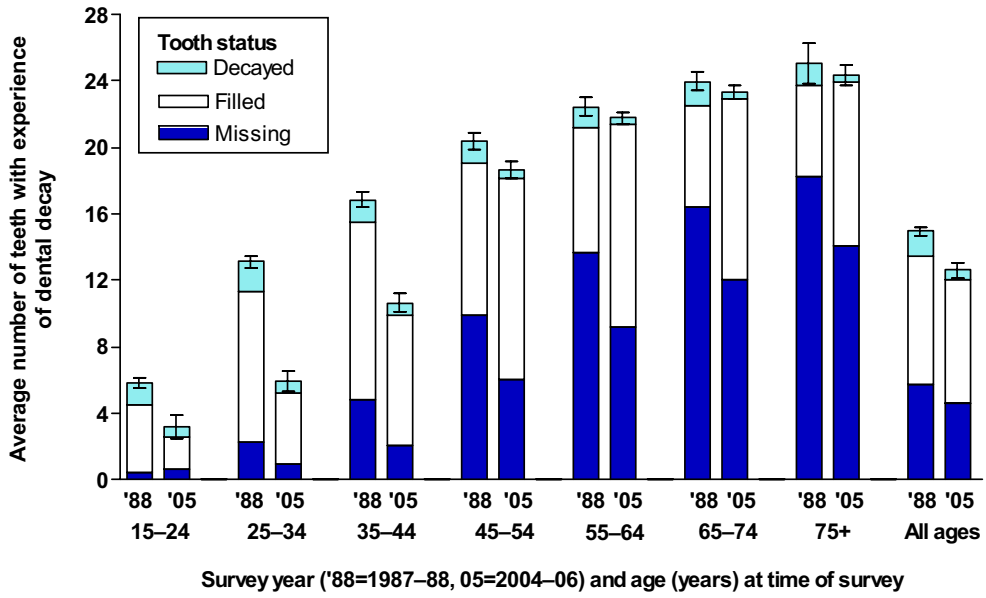
The between-generation changes were much more pronounced. When they were aged 56–72 years, 35.7% of dentate people in the 1933–49 birth cohort wore denture(s), which was 20.4% fewer people, in absolute terms, compared with 56–72-year-olds in the preceding generation, born 1916–32. At the age of 39–55 years, 14.8% fewer people in the 1950–66 generation wore dentures compared with 39–55-year-olds in the preceding generation, born 1933–49. The intergenerational difference was smallest (5.5%, in absolute terms) when the 1967–83 and 1950–66 generations were compared, although that difference was still equivalent to the within-generation effect for the 1950–66 generations. As noted for the age-group analysis, these findings of small within-generation trends and large between-generation trends echoed the birth-cohort findings regarding frequency of an inadequate natural dentition (see Figure 8.4).

In conclusion, marked reductions were observed in the percentage of dentate adults wearing one or two dentures. Birth cohort analysis revealed relatively small within-generation increases that were more than offset by large between-generation reductions in denture wearing. The age-group and birth-cohort trends regarding denture wearing were strikingly similar to the corresponding trends in the percentage of dentate people with an inadequate natural dentition.

Severity of dental decay experience—DMFT

Age group analysis

The stacked vertical bars in Figure 8.7 present the average number of teeth that were affected by dental decay per person. By convention, dental decay experience is quantified as the sum of three components: decayed (D), missing (M) and filled (F) teeth (T). The index is cumulative, so an individual's DMFT index cannot decrease over time. For example, a decayed tooth that contributes to the index in early adulthood continues to contribute in later years even if the tooth becomes filled or is extracted. However, individual components of the index may change in either direction. For instance, a single tooth may be recorded as decayed when first surveyed, but recorded as missing or filled in subsequent surveys. The lowest segment of each stacked bar shows the average number of teeth missing (M) due to dental disease. The white segment shows the average number of teeth that have been filled (F) and the top segment shows the average number of teeth with untreated decay (D). The error bars illustrate the imprecision of the DMFT estimate as a whole – not just the decayed component.



		15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	Decayed	1.4	1.8	1.4	1.3	1.3	1.4	1.4	1.5
	Filled	4.1	9.1	10.6	9.2	7.5	6.1	5.4	7.8
	Missing	0.4	2.3	4.9	9.9	13.6	16.4	18.3	5.7
	DMFT	5.9	13.1	16.9	20.4	22.4	24.0	25.1	14.9
2004–06	Decayed	0.6	0.8	0.7	0.6	0.4	0.4	0.4	0.6
	Filled	2.0	4.2	7.8	12.0	12.1	10.9	9.8	7.4
	Missing	0.6	1.0	2.1	6.1	9.2	12.0	14.1	4.6
	DMFT	3.2	5.9	10.7	18.7	21.8	23.3	24.3	12.6

Figure 8.7: Age group trends in dental decay experience among dentate Australians, 1987–88 to 2004–06

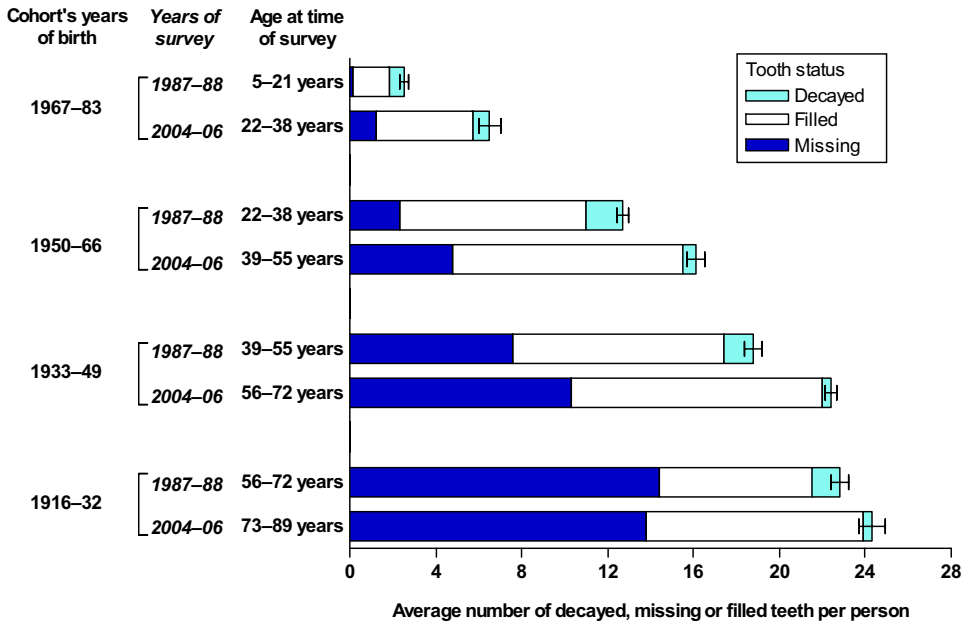
The amount of reduction in dental decay experience is depicted in Figure 8.7 as the difference in height between pairs of vertical bars. In the 17 years between the 1987–88 NOHSA and the 2004–06 NSAOH the average number of teeth with dental decay per person reduced by 16% from 14.9 affected teeth to 12.6 affected teeth. The reduction was most pronounced within the two youngest age groups. Average DMFT per person decreased 46% for the 15–24-year-old age group, (from 5.9 to 3.2 affected teeth) and 45% for the 25–34-year-old age group (from 13.1 to 5.9 affected teeth). A more modest decrease of 37% occurred for adults aged 35–44 from 16.9 to 10.7 affected teeth. The decrease was less than 10% for the 45–54-year-old age group and among older age groups there were only trivial differences in average DMFT of 2 or 3 percentage points.

Most teeth with decay experience were either extracted (represented by the 'missing' component of the DMFT index, as depicted in blue shading within bars in Figure 8.7) or restored (represented by the white 'filled' component). There was a stark contrast between younger and older age groups in the patterns of change observed for these components of DMFT. Among the three age groups below 45 years of age, reductions between surveys were observed both in the average number of missing teeth and the average number of decayed teeth. (An exception was a small increase in the average number of missing teeth in the 15–24-year-old age group, although the numbers were too small to permit reliable interpretation). In contrast, for groups aged 45 years or more, reductions between surveys in the average number of missing teeth tended to be offset by increases in the average number of filled teeth. For example, for the 65–74 years age group the average number of missing teeth decreased by around four teeth per person from 16.4 to 12.0 affected teeth and filled teeth, increased by an average of five teeth per person, from 6.1 to 10.9 affected teeth.

Finally, there was a consistent trend between surveys of reductions in the average number of teeth with untreated decay (represented by the turquoise bars in Figure 8.7). The reduction was observed for all age groups and was somewhat larger in young age groups than older age groups. Part of this decrease reflects the difference in diagnostic criteria employed in the two surveys. Sharp dental explorers were used to probe suspected cavities in the 1987–88 survey, whereas the 2004–06 survey relied solely on visual evidence of a break in enamel. Intergenerational effects are examined in the following section to clarify whether changes in dental decay experience can be mainly explained by ageing or by an exposure to an event between surveys, such as the introduction of fluoride.

Birth cohort analysis

Within-generational trends in dental decay experience are depicted in Figure 8.8 as a comparison of paired bars, while between-generational trends are depicted by a comparison of same-aged adults in consecutive generations. The within-generation comparison shows that the rate of increase in dental decay experience over the 17-year period was approximately equal in three birth cohorts born since 1933. The largest absolute increase occurred in the 1967–83 cohort, where an additional four teeth per person were affected by dental decay during the 17 years between surveys, raising the average DMFT index from 2.5 to 6.4 affected teeth per person. In relative terms this was an increase of 61.5%. Importantly, this is the cohort among which the majority of members were exposed to fluoride since birth, both in toothpaste and in drinking water.



		1916–32	1933–49	1950–66	1967–83
1987–88	Decayed	1.3	1.4	1.7	0.7
	Filled	7.1	9.8	8.7	1.7
	Missing	14.4	7.6	2.3	0.1
	DMFT	22.9	18.8	12.6	2.5
2004–06	Decayed	0.4	0.4	0.6	0.8
	Filled	10.1	11.7	10.7	4.5
	Missing	13.8	10.3	4.8	1.2
	DMFT	24.3	22.4	16.1	6.4

Figure 8.8: Birth cohort trends in dental decay experience among dentate Australians, 1987–88 to 2004–06

The smallest increase in dental decay experience was observed within the 1916–32 cohort, where the average DMFT increased from 22.9 affected teeth in 1987–88 to 24.3 in 2004–06. For the two intervening birth cohorts the average number of affected teeth per person increased by 3.4 teeth (1950–66 cohort) and 3.6 teeth (1933–49 cohort). An average increase of three filled teeth per person accounted for most of the observed change in the 1967–83 and 1916–32 birth cohorts. Increases in the average number of missing teeth accounted for the greatest change in overall DMFT for the 1950–66 cohort (2.5 teeth) and the 1933–49 cohort (2.7 teeth).

Comparison between generations showed that the 1967–83 cohort had markedly less experience of dental decay at 22–38 years of age than people of the same age in their parents' generation, born between 1950 and 1966. This represents a 'generation gap' in

oral status. On average the 1967–83 cohort had 6.4 affected DMF teeth at 22–38 years of age while the 1950–66 cohort had 12.6 DMF teeth at that age. For the later-born cohort this represents a comparative oral health gain of six teeth per person and a halving of decay experience. This gain may be attributable to protective effect of fluorides that were introduced into the water supplies and toothpastes in Australia, predominantly during the 1960s and 1970s.

Box 8.3 Change in DMFT – what does it mean?

The number of decayed (D), missing (M) or filled (F) teeth (DMFT) is an index of decay experience, and not a measure of treatment needs. Increases in the index represent development of decay in previously healthy teeth that had no experience of decay. The DMFT index does not increase when a tooth that is decayed at one examination is found to be filled or missing at a later examination. Similarly, the index does not increase if a filled tooth at one examination is found to have developed additional decay at a subsequent examination.

One consequence is the analysis of within-cohort effects under-estimates the true level of decay activity. Furthermore, it is a poor indicator of treatment needed or provided. An illustration of this underestimation is provided in the oral history of Dan Barlow who had repeated treatments of one tooth (see p62). Because the events occurred in a single tooth, they would not have increased his DMFT index.

Once, though, I lost one tooth through decay at the back and the dentist rebuilt that tooth and anchored it down into my jaw. It has broken off three times and he's persisted in keeping that tooth. The last time it was done he inserted three or four steel rods and a lot of concrete [laughs] and it's perfect.

–Excerpt from Dan Barlow's oral history (see Chapter 4.2, page 62)

By contrast, the between-generation effect was much less apparent for the 1933–49 and the 1950–66 birth cohorts. When aged between 39 and 55 years of age, members of the 1933–49 cohort had an average DMF of 18.8 affected teeth compared with 16.1 affected teeth among the 1950–66 birth cohort at the same age. There was no evidence of a between-generation difference between individuals born into the 1933–49 and 1916–32 birth cohorts. At the comparative age range of 56–72 years the average DMF in the 1933–49 cohort was 22.4 affected teeth, which was no different to the average DMF in the 1916–32 birth cohort of 22.9 affected teeth.

In conclusion, rates of increase in dental decay experience within generations did not differ among the three generations born since 1933. Unlike complete tooth loss, where high prevalence in older age groups reflects a residual effect of disease and treatment from earlier life, the post-fluoride generation (born in 1967–83) had half the dental decay experience at 22–38 years of age than the preceding generation (born 1950–66) when they were aged 22–38 years. Yet most of this difference reflects reduced amounts of decay that developed in childhood and adolescence.

8.2 Trends in dental attendance

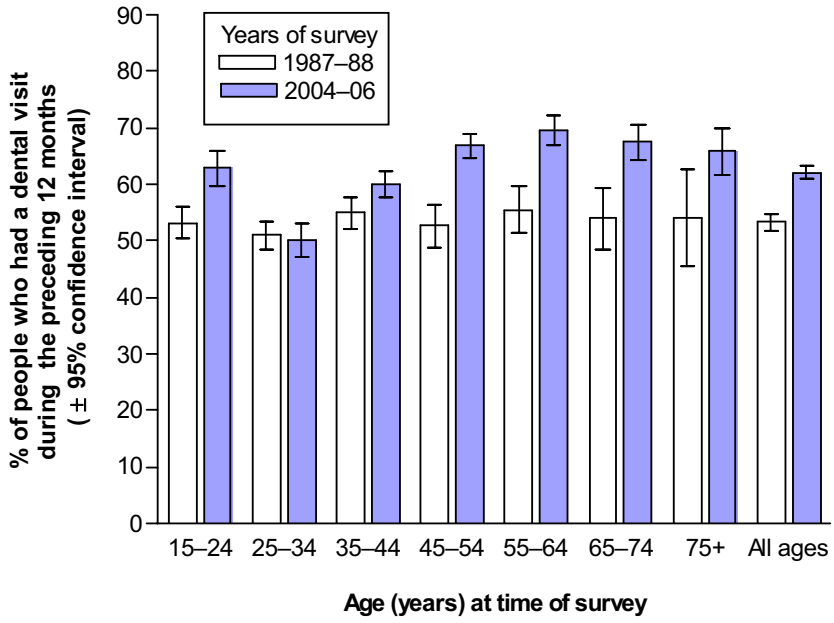
Three aspects of dental attendance were assessed in each of the national oral health examination surveys: attendance during the preceding 12 months, attendance at a private dentist, and dental insurance. The analyses in this section were confined to people who had retained some or all of their natural teeth. People who had no natural teeth are excluded because complete tooth loss is associated with reduced frequency of dental visits. They represented 14% of the adult population in 1987–88 and 6% of the adult population in 2004–06.

Dental attendance during the preceding 12 months

Age group analysis

A comparison of the height of the blue bars (2004–06 NSAOH) relative to the white bars (1987–88 NOHSA) shows that, among all ages, the proportion of adults who attended for dental care during the preceding year rose by 17% in the interval between the two surveys (Figure 8.9). Attendance increased substantially in six of the seven 10-year age groups with the exception of the 25–34-year-old age group which showed no change. In 1987–88 just over one in two adults (53.3%) had made a dental visit in the previous 12 months. In 2004–06 this had risen to almost two out of every three adults (62.1%).

The magnitude of the increase varied between the six age groups where change had occurred. In each of the four age groups of people aged 45 years and older, increase in absolute terms exceeded 10 percentage points. In 1987–88, 52.7% of the 45–54-year-old age groups had utilised dental services in the past year and in 2004–06 utilisation had increased to 66.9%. Among adults in the 55–64-year-old age group utilisation increased from 55.6% to 69.6%. By contrast, in the 35–44-year-old age group the increase was only 5.2 percentage points.



	15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	53.2	51.0	55.0	52.7	55.6	54.0	54.1	53.3
2004–06	63.0	50.1	60.2	66.9	69.6	67.6	65.9	62.1

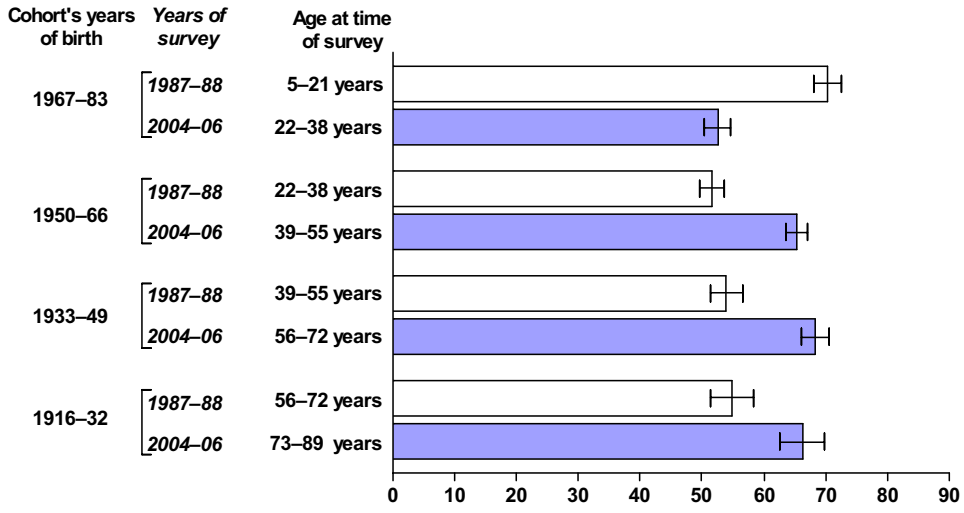
Figure 8.9: Age group trends in dental attendance during the preceding 12 months among dentate Australians, 1987–88 to 2004–06

Birth cohort analysis

Two possible explanations, not necessarily mutually exclusive, might explain the observed increase in dental utilisation noted above. The first is that increased utilisation was tied to advancing age (age-related). The second is that earlier birth cohorts sought dental care more regularly (cohort-specific). To shed light on this change, four birth cohorts were compared (Figure 8.10) to ascertain if individuals born in one 17-year cohort maintained the same pattern of utilisation as they aged over 17 years.

In the four pair of bars in Figure 8.10 the white bars represent a series of four consecutive 17year birth cohorts surveyed in 1987–88 and the blue bars represent these same birth cohorts surveyed 17 years later in 2004–06. Two divergent trends were apparent. There was a 25% reduction in the proportion of the youngest cohort (born in 1967–83) who had utilised dental care in the 12 months preceding the 2004–06 survey compared with the proportion of this same cohort who had utilised dental care in the

year leading up to the 1987–88 survey. This reduction brought their utilisation into line with that consistent with their parents' generation (born in 1950–67) when they had been aged 22–38 years in 1987–88. At the age of 22–38 years, 52% of both birth cohorts had made a dental visit in the previous 12 months.



Cohort	1916–32	1933–49	1950–66	1967–83
1987–88	54.8	54.0	51.6	70.4
2004–06	66.3	68.4	65.3	52.6

Figure 8.10: Birth cohort trends in dental attendance during the preceding 12 months among dentate Australians, 1987–88 to 2004–06

In the divergent trend, utilisation increased as each of the three earlier cohorts aged 17 years between surveys. The magnitude of the increase was similar in each cohort. There was a 27% increase in the proportion of the 1950–66 and the 1933–49 birth cohorts and a 21% increase in the proportion of the 1916–32 birth cohort who had a dental visit in the 12 months before the 2004–06 survey compared with the earlier survey.

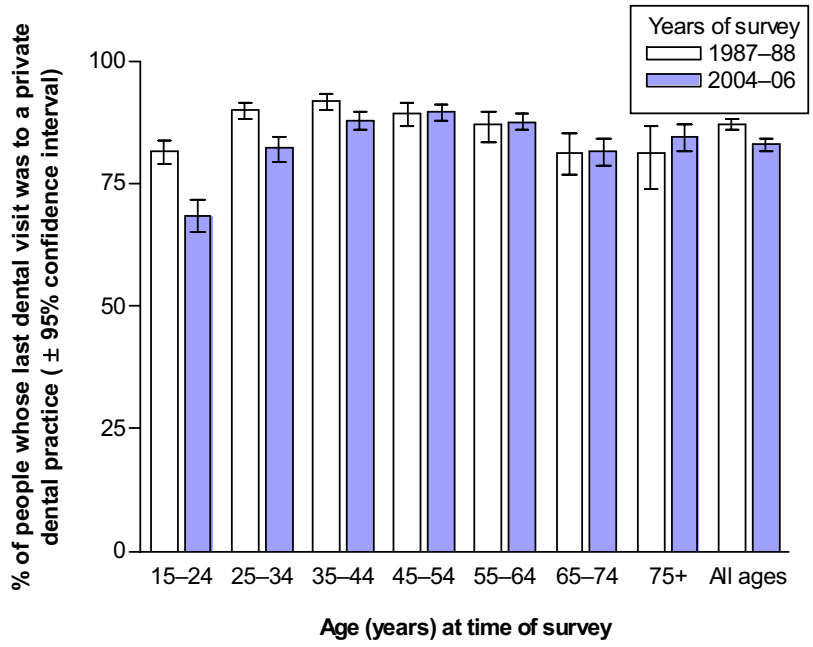
Attendance at private dental practice

Age group analysis

The vast majority of Australian adults obtain their dental care at a private dental practice, but alternate options exist. For example, adults with private dental insurance can attend clinics operated by their health insurance funds. Australian adults on low

income are eligible to receive state-funded public dental care, and the state funded school dental programs provide universal access to dental care for children and adolescents.

Among all ages combined there was a small reduction in the percentage of adults whose most recent dental visit was to a private dental practice (Figure 8.11). The change was brought about by shifts in the three 10-year age groups aged less than 45 years. Of these, the magnitude of change was greatest among adults in 15–24-year-old age group. In absolute terms the decrease was 13 percentage points between 1987–88 (81.5%) and 2004–06 (68.4%). There were less pronounced reductions in the proportion reporting their last visit at a private dental practice among 25–34-year-olds (from 89.9% to 82.2%) and among 35–44-year-olds (from 91.7% to 87.9%) between surveys. For the four 10-year age groups of adults aged 45 years and over, there was little or no change.



	15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	81.5	89.9	91.7	89.4	86.9	81.3	81.2	87.1
2004–06	68.4	82.2	87.9	89.5	87.6	81.4	84.5	82.9

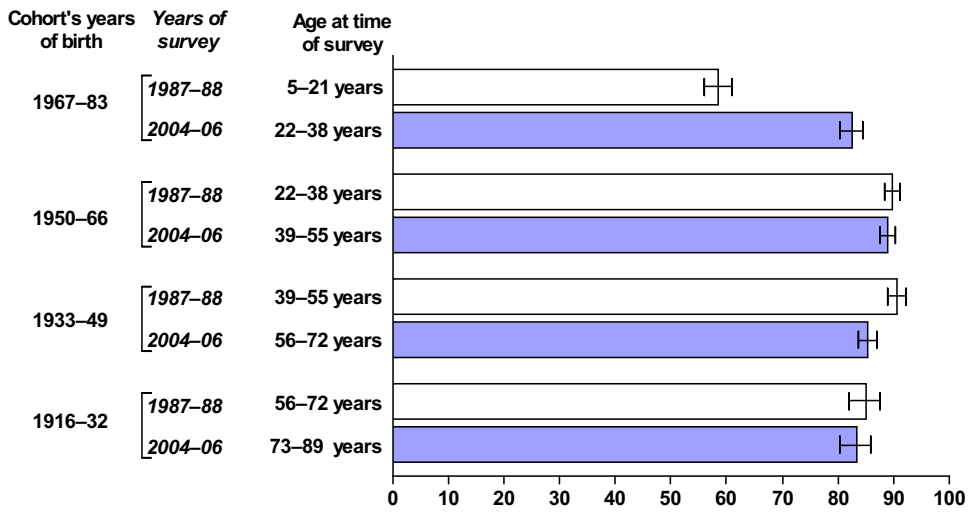
Figure 8.11: Age group trends in attendance at private dental practice among dentate Australians, 1987–88 to 2004–06

In summary, dental services for adults in Australia are available both publicly and privately. At both survey times the vast majority of adults had obtained their most

recent dental care at a private practice although the proportion decreased among adults younger than 45 years.

Birth cohort analysis

The four consecutive birth cohorts in Figure 8.12 compare the proportion of dentate adults whose last dental visit was to a private practitioner prior to the 1987–88 and 2004–06 surveys. A comparison of the length of the paired white and blue bars shows that there was no within-generation change over 17 years for people born in 1950–66 or 1916–32. These cohorts maintained their affiliations with their source of provider and the vast majority (between 85% and 95%) sought care in the private sector at their last visit. There was a small reduction of about 5% in absolute terms in private sector attendance among people born in 1933–49. In this cohort, attendance decreased from 90.7% to 85.4%. In contrast, private sector attendance increased markedly among the youngest cohort (born in 1967 to 1983). The change in absolute terms was 24% between 1987–88 (58.5%) and 2004–06 (82.5%).



Cohort	1916–32	1933–49	1950–66	1967–83
1987–88	85.0	90.7	89.8	58.5
2004–06	83.3	85.4	89.0	82.5

Figure 8.12: Birth cohort trends in attendance at private dental practice among dentate Australians, 1987–88 to 2004–06

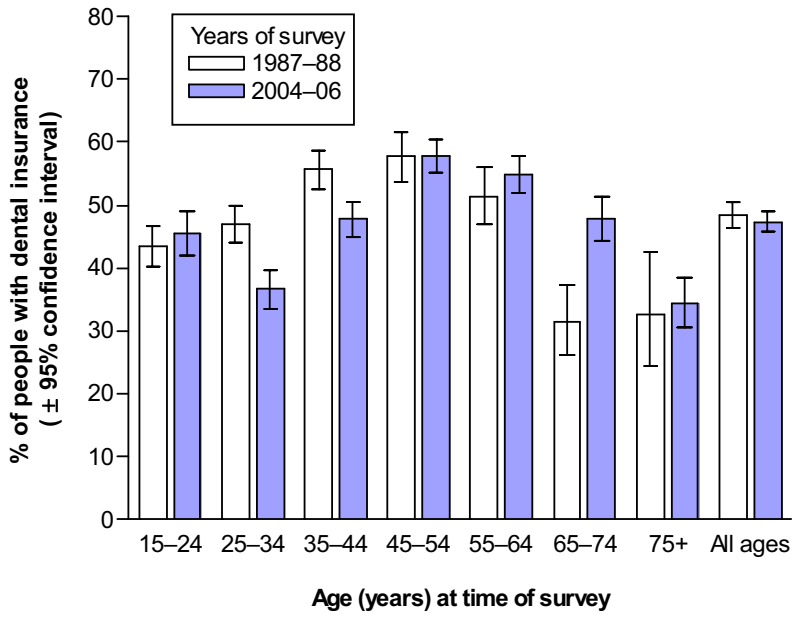
Comparison between generations showed a small decrease in private sector participation for adults aged 22–38 years in the 17 years between the two surveys. In

1987–88, when the 1950–66 birth cohort was aged between 22 and 38 years, 89.8% reported that their last dental visit was made at a private dental practice. Seventeen years later 82.5% of the same-aged counterparts in the 1967–83 birth cohort reported having last attended a private dental practice. This change was the exception. The two other between-generation comparisons showed no change in private sector participation.

Dental insurance

Age group analysis

A comparison of the seven 10-year age groups at the two survey times shows trends in the proportion of same-aged adults who held private dental insurance at the 1987–88 survey (white bars) and the 2004–06 survey (blue bars, Figure 8.13).



	15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	43.4	46.9	55.6	57.8	51.4	31.5	32.7	48.4
2004–06	45.4	36.6	47.7	57.8	54.8	47.8	34.4	47.3

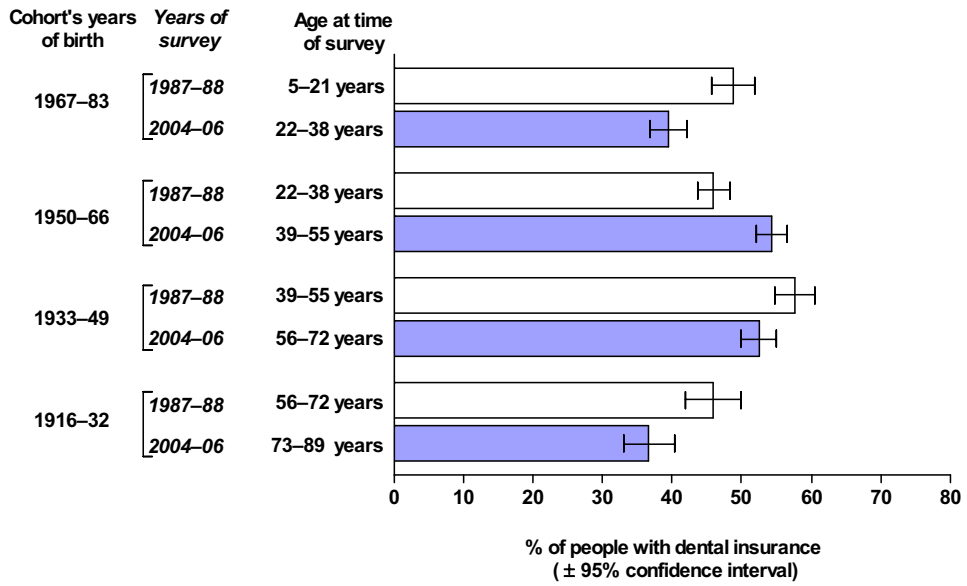
Figure 8.13: Age group trends in dental insurance among dentate Australians, 1987–88 to 2004–06

Overall, dental insurance status remained stable over 17 years, with just below half the dentate adult population covered at both survey times. However, there were shifts in opposing directions between age groups. There was a reduction in insurance coverage among young adults in the 25–34 and 35–44 years age groups. Among those in the 25–34-year-old age group, the proportion with dental insurance reduced by 10 percentage points from 46.9% to 36.6% in the 17-year period and for adults in the 35–44-year-old age group coverage reduced by 8 percentage points from 55.6% to 47.7%. While younger adults moved out of private dental insurance coverage, a trend in the opposite direction was observed among adults in the post-retirement decade (65-74 years). Among these adults the proportion with dental insurance increased by 16 percentage points from 31.5% in 1987–88 to 47.8% in 2004–06. This represented a marked increase in insurance coverage among these early retirees that raised the proportion with coverage from below one-third to almost half.

Birth cohort analysis

Within-generation comparisons of dental insurance coverage shows considerable change over the 17-year period, with shifts in both directions (Figure 8.14). Three cohorts showed small decreases in dental insurance cover. Most apparent was the trend within the youngest (1967–83) and oldest (1916–32) cohorts where there were decreases of 9% in absolute terms. A smaller decrease of approximately 5 percentage points occurred for the 1933–49 birth cohort, reducing coverage from 57.7% in 1987–88 to 52.6% in 2004–06. In contrast to these trends, the 1950–66 birth cohort took up private dental insurance in the 17-year period as they aged from 22–38 years to 39–55 years. The proportion of adults with coverage increased over the 17 year period by 8 percentage points from 46.0% in 1987–88 to 54.3% in 2004–06. The result of these within-generation changes evident in 2004–06 was that more than half the population born between 1933 and 1966 had private dental insurance and less than half the population before and after these cohorts held insurance coverage.

The between-generation comparison of same-aged people in successive generations also showed trends in opposing directions. There was a small net decrease in dental insurance coverage among people aged between 22 and 38 years, from 46.0% in 1987–88 to 39.4% in 2004–06. Among older adults aged between 56 and 72 years there was a small net increase in private dental insurance coverage from 45.8% in 1987–88 to 52.5% in 2004–06. Finally, dental insurance coverage among adults aged 39–55 years in 2004–06 (54.3%) showed no significant change from that of the generation before them in 1987–88 when aged 39–55 years (57.7%).



Cohort	1916–32	1933–49	1950–66	1967–83
1987–88	45.8	57.7	46.0	48.7
2004–06	36.7	52.5	54.3	39.4

Figure 8.14: Birth cohort trends in dental insurance among dentate Australians, 1987–88 to 2004–06

8.3 Trends in perceived dental treatment needs

The following series of figures documents change in the population's perceived need for three common dental services: dental extractions, dental fillings and dentures. The trends were observed over the 17-year period been the 1987–88 and the 2004–06 surveys. The analyses are limited to people who retained some or all of their natural teeth. The 6% of Australians who have no natural teeth are excluded because extractions and fillings are not relevant to them.

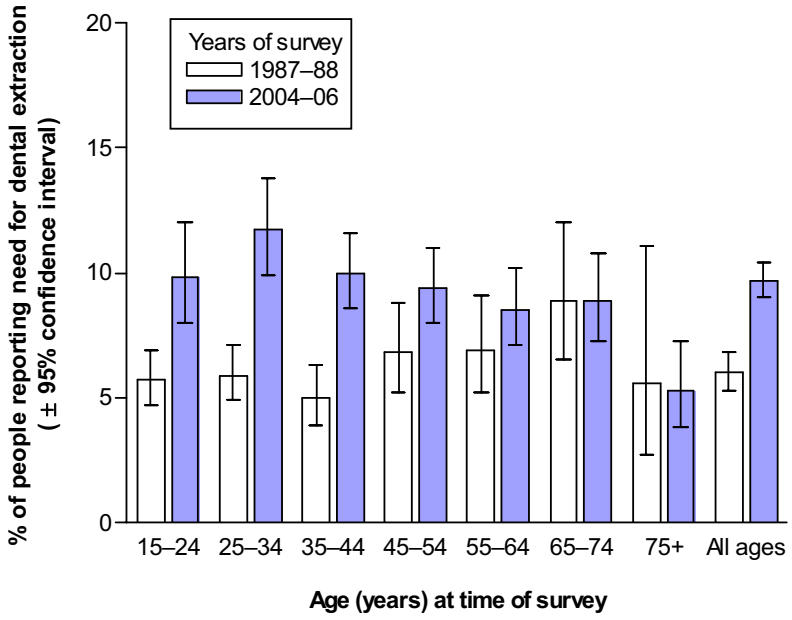
Perceived need for specific dental services was investigated in the 1987–88 NOHSA survey with the question, 'What dental treatment do you think you require?' Respondents could nominate any of the following categories: 'None; Bands or braces to straighten teeth; New or replacement denture(s); Dental filling or crown; Tooth extracted; Gum treated; Other treatment'. A similar question was asked of dentate interviewees in the 2004–06 computer assisted telephone interview, 'Currently which of the following treatments do you think that you need to have…?'. Interviewees

responded with 'Yes', 'No', or 'Don't know' to a series of treatments that included dental extraction, dental filling and denture(s) made.

Perceived need for dental extraction

Age group analysis

Over the 17 years between the 1987–88 NOHSA and the 2004–06 NSAOH surveys there was a marked increase in perceived need for a dental extraction among people aged less than 45 years (Figure 8.15). There was a 1.7-fold increase in the 15–24-year-old age group, and perceived need more than doubled in the 25–34-year-old (5.7% to 9.8%) and 35–44 -year-old (5.0% to 10.0%) age groups. Among the 45–54- and 55–64-year-old age groups the 95% CI intervals meant that differences between surveys were no greater than variability due to sampling. There was no difference in perceived need for an extraction among people aged 65 years and over.



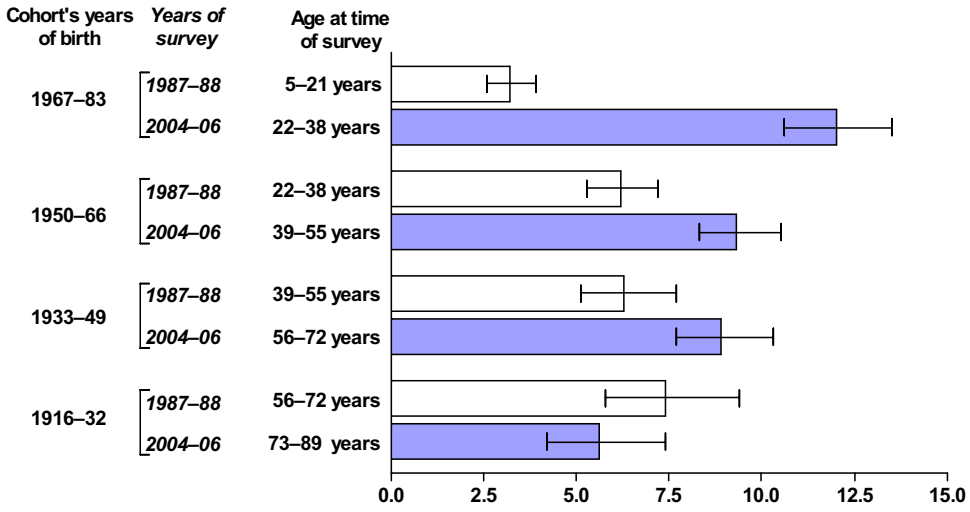
	15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	5.7	5.9	5.0	6.8	6.9	8.9	5.6	6.0
2004–06	9.8	11.7	10.0	9.4	8.5	8.9	5.3	9.7

Figure 8.15: Age group trends in perceived need for dental extraction among dentate Australians, 1987–88 to 2004–06

Birth cohort analysis

The preceding age-specific trends shown in Figure 8.15 suggest an increasing proportion of younger adults (less than 45 years) but not older adults, perceived a need for a dental extraction. Figure 8.16 investigates where the trend can be attributed to effects of ageing or differences in perceptions of generations born at different times in history.

Figure 8.16 shows pronounced within-generation increases in perceived need for dental extraction in three out of four birth cohorts. The trend differed only in the earliest cohort (born in 1916–32), although large 95% CI in each survey meant that there was a high probability that within any cohort differences were due to sampling variability alone.



Cohort	1916–32	1933–49	1950–66	1967–83
1987–88	7.4	6.3	6.2	3.2
2004–06	5.6	8.9	9.3	12.0

Figure 8.16: Birth cohort trends in perceived need for dental extraction among dentate Australians, 1987–88 to 2004–06

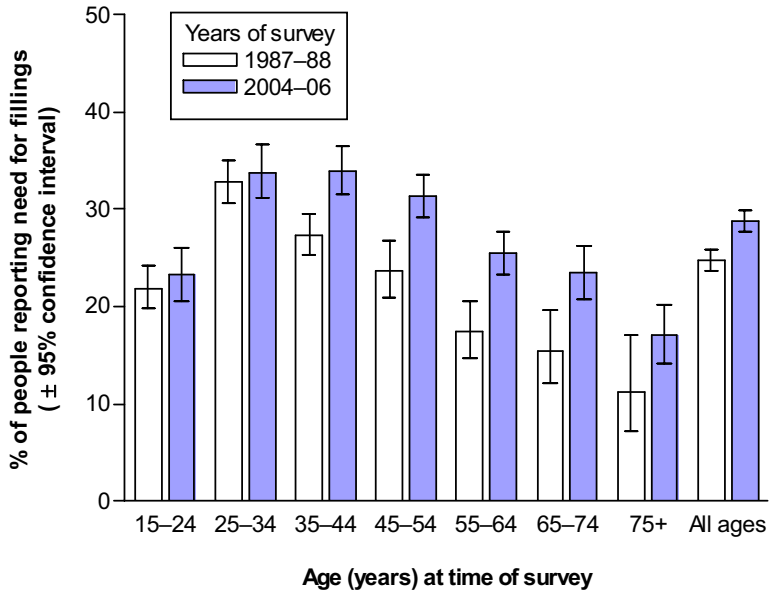
The between-generation comparison showed that the proportion of adults aged 23–38 years who perceived a need for a tooth extraction in 2004–06 (12.0%) was double that of 1987–88 (6.2%, Figure 8.16). A smaller but still substantial increase of approximately 50% per cent was found for the 39–55-year-olds, rising from 6.3% in 1987–88 to 9.3% in 2004–06. Even among adults aged 56–72 years, the proportion with

perceived need for a dental extraction increased on average by 20 percentage points from 1987–88 (7.4%) to 2004–06 (8.9%).

Perceived need for dental fillings

Age group analysis

Perceived need for dental fillings increased in the dentate population in the period between the two surveys by 4 percentage points among all age groups combined (Figure 8.17). There were marked increases in four consecutive groups aged 35–44, 45–54, 55–64 and 65–74 years. No age group perceived a reduced need for dental fillings compared with their perceptions in 1987–88. In absolute terms the greatest increase in perceived need for fillings was recorded in the 55–64-year-old age group, rising 8 percentage points from 17.4% in 1987–88 to 25.4% in 2004–06. Recording increases of similar magnitude, were the 45–54-year-old age group (7.6 percentage points) and the 65–74-year-old group (7.9 percentage points)

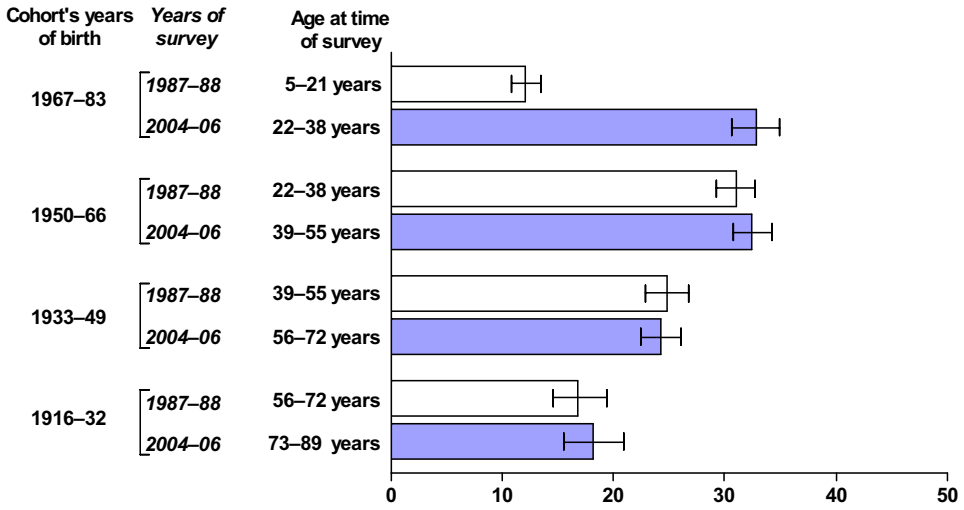


	15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	21.9	32.9	27.4	23.7	17.4	15.5	11.2	24.7
2004–06	23.2	33.8	34.0	31.3	25.4	23.4	17.0	28.7

Figure 8.17: Age group trends in perceived need for dental fillings among dentate Australians, 1987–88 to 2004–06

Birth cohort analysis

There was no within-generation change between the two surveys in the perceived need for fillings among the three birth cohorts born before 1967 (Figure 8.18). The proportion of adults with a perceived need varied in these three cohorts by less than 3 percentage points. The exception was the most recent cohort born between 1967 and 1983. Among this cohort the proportion that perceived a need for one or more fillings rose markedly, representing an almost three-fold increase from 12.1% in 1987–88 to 32.8% in 2004–06.



Cohort	1916–32	1933–49	1950–66	1967–83
1987–88	16.8	24.8	31.0	12.1
2004–06	18.1	24.3	32.5	32.8

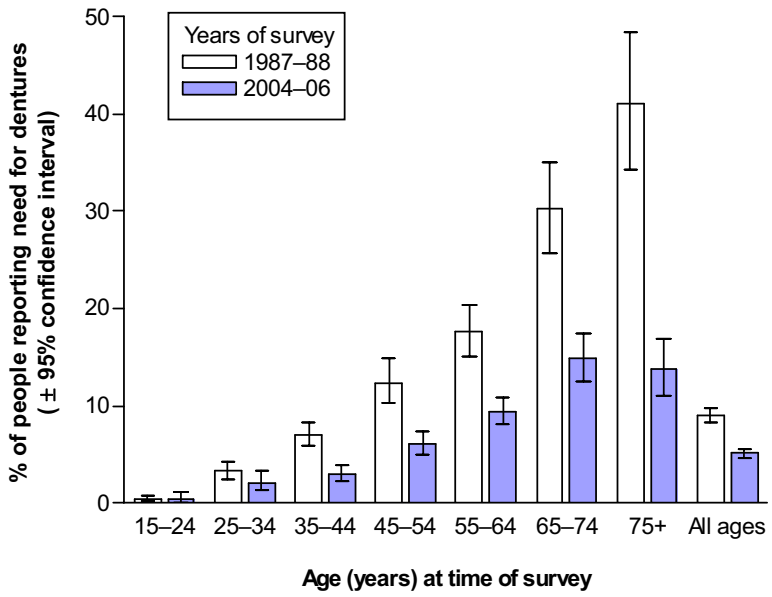
Figure 8.18: Birth cohort trends in perceived need for dental fillings among dentate Australians, 1987–88 to 2004–06

Between-generation comparisons revealed significant increases in perceived need for fillings among adults aged 39–55 years and 56–72 years surveyed in 1987–88 and 2004–06, but not among adults aged 22–38 years. The increase among 39–55-year-olds was 7.6 percentage points, from 16.8% among the 1916–32 birth cohort to 24.3% among the 1933–49 cohort. A similar small but significant increase of 7.7 percentage points occurred among adults aged 56–72 years, from 24.8% among the 1933–49 cohort at the 1987–88 survey to 32.5% among the 1950–66 cohort when surveyed in 2004–06.

Perceived need for dentures

Age group analysis

The perceived need for dentures approximately halved in the dentate Australian adult population in the 17 years between surveys (Figure 8.19). At the time of the first survey in 1987–88 approximately one in ten adults in the 45–54-year-old age group perceived a need for a denture, rising to one in three adults in the 65–74-year-old age group. Seventeen years later, perceived need had halved in these age groups to about one in 20 adults in the 45–54-year-old age group and one in six adults in the 65–74-year-old age group. Generally, perceptions of need for a denture reduced more among older age groups than younger age groups. In fact, there was no reduction in perceived need for a denture among the youngest age group and this is explained by the very low levels of tooth loss among adults in the 15–24-year-old age group. Apart from this exception, marked reductions in perceived need for a denture occurred in all age groups, with absolute and relative reductions between age groups being more pronounced among successive age groups.

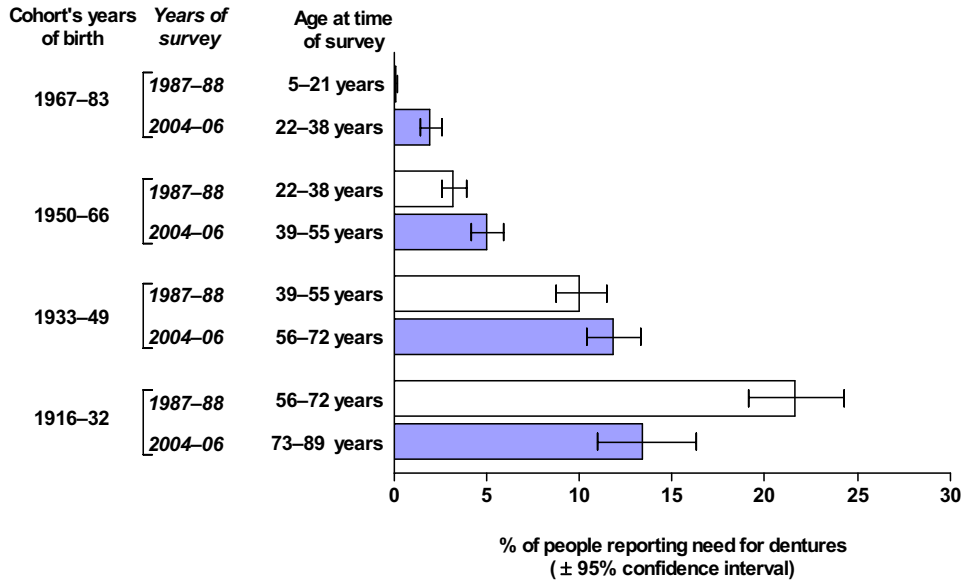


	15–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
1987–88	0.4	3.3	6.9	12.3	17.6	30.2	41.1	9.0
2004–06	0.4	2.1	2.9	6.0	9.4	14.8	13.7	5.1

Figure 8.19: Age group trends in perceived need for dentures among dentate Australians, 1987–88 to 2004–06

Birth cohort analysis

There was a marked within-generation reduction in perceived need for a new or replacement denture among the oldest generation born between 1916 and 1932 (Figure 8.20). However, some caution is required in the interpretation of the magnitude of the reduction since the large 95% CI indicates that sampling variability introduced a high level of uncertainty about the true value in each survey. With this caveat in mind, the estimates obtained at the first and second surveys show the proportion of this cohort who perceived a need for a denture reduced from 21.6% in 1987–88 to 13.4% in 2004–06. In contrast, the perceived need for dentures among adults in the two subsequent birth cohorts did not change meaningfully in the 17-year period between surveys. Of those adults born between 1933 and 1949, 10.0% expressed a need for a new denture in 1987–88; and when surveyed after ageing 17 years, 11.8% of this same cohort expressed a need for a new denture. Perceived need was lower among the cohort born between 1950 and 1966 compared with cohorts born earlier, but the perception of need for a new denture varied by less than 2 percentage points across the two surveys.



Cohort	1916–32	1933–49	1950–66	1967–83
1987–88	21.6	10.0	3.2	0.1
2004–06	13.4	11.8	5.0	1.9

Figure 8.20: Birth cohort trends in perceived need for dentures among dentate Australians, 1987–88 to 2004–06.

8.4 Summary of trends

The preceding pairs of age group and birth cohort analyses document and offer explanations for observed patterns of change in individual indicators of oral health status, dental care and oral health perceptions. This section integrates the findings for age groups and for generations. By necessity, such a summary requires that complex patterns be simplified. The assumptions used in this summary are:

- Population-level evidence of increased oral disease is provided by an increase in one or more of the following six indicators: percentage of people with no natural teeth; percentage of people with fewer than 21 teeth; the average number of decayed teeth; the average number of missing teeth; the average number of filled teeth; and the average number of decayed, missing or filled teeth (DMFT).

- Population-level evidence of increased adequacy of dental care is provided by an increase in one or more of three indicators: the percentage of people who had a dental attendance during the preceding 12 months; the percentage of people who have dental insurance; and the percentage of people who visited a private dentist.

- Population-level evidence of increased perceived dental treatment needs is provided by an increase in one or more of three indicators: the percentage of people who perceive a need for extraction(s); the percentage of people who perceive a need for filling(s); and the percentage of people who perceive a need for denture(s).

In the following summary tables, an increase in all or most of the separate indicators is characterised as a 'marked increase', while a decrease in all or most of the separate indicators is characterised as a 'marked decrease'. Other changes are characterised as 'small' if only some indicators show a consistent direction of change. When no change is observed for most indicators, or if increases and decreases occur with approximately equal frequency, the overall trend is characterised as 'no change'.

These broad trends are intended as a general set of population indicators, recognising that there is no quantitative 'formula' that could summarise these diverse aspects of oral health. For example, there is no unambiguous way to characterise change in oral health status for a group in which levels of decay and missing teeth decrease while numbers of filled teeth increase. From one perspective it is suggestive of a persistent underlying rate of dental disease. From another perspective, the pattern is indicative of a favourable transition in the way in which disease is treated. For other oral health indicators it becomes necessary to make broad assertions as to what constitutes an 'optimal' oral health outcome. For example, these summaries assume that increases in dental attendance and dental insurance, coupled with an increased frequency of visits to private dental care, are all indicative of good access to and use of comprehensive dental care for the adult population. Similarly, when summarising perceptions of treatment need, there can be no certainty that a decrease in the percentage of people reporting a need for treatment is indicative of a true perception that there are fewer conditions requiring treatment, or a false sense of security that may be in contrast to professionally defined treatment needs.

Summary of age group analyses

In the 17 years between these two surveys there were small reductions in levels of oral disease among 15–24-year-olds, coupled with no net change in adequacy of dental care or perceived treatment needs (Table 8.1). The pattern differed for the next two age groups; among 25–34-year-olds and 35–44-year-olds there were marked reductions in levels of disease, a reduction in adequacy of dental care and an increase in perceived treatment needs. Levels of disease also reduced markedly for the next three age groups, aged between 45–54 and 65–74 years, yet adequacy of care increased, while perceptions of need decreased. For the oldest age group, oral disease decreased to a small degree, adequacy of dental care did not change, and there was no overall change in perceived needs.

Table 8.1: Summary of age group trends in oral health status, dental care and perceived need for dental treatment

	Direction[(a)] of trends in oral health among seven age groups and all ages							
	15–24 years	25–34 years	35–44 years	45–54 years	55–64 years	65–74 years	75+ years	All ages
Tooth loss								
% with no natural teeth	..	↓	↓↓	↓↓	↓↓	↓	↓	↓
% with <21 teeth	↓	↓↓	↓↓	↓↓	↓	↓	↓	↓
% wearing denture	↓	↓↓	↓↓	↓↓	↓↓	↓↓	↓↓	↓↓
Decay experience								
Decayed teeth	↓	↓	↓	↓	↓↓	↓↓	↓↓	↓
Missing teeth	~	↓↓	↓↓	↓	↓	↓	↓	↓
Filled teeth	↓↓	↓↓	↓↓	↑	↑	↑	↑	~
DMFT	↓	↓↓	↓	↓	~	~	~	↓
Dental care adequacy								
Dental utilisation	↑	~	~	↑	↑	↑	~	↑
Dental insurance	~	↓	↓	~	~	↑	~	~
Private dentist	↓	↓	~	~	~	~	~	↓
Perceived need for:								
Extraction(s)	↑	↑↑	↑	~	~	~	~	↑
Filling(s)	~	~	↑	↑	↑	↑	~	↑
Denture(s)	~	~	↓↓	↓↓	↓↓	↓↓	↓↓	↓
Age group summary								
Oral disease	↓	↓↓	↓↓	↓↓	↓↓	↓	↓	↓
Dental care adequacy	~	↓	↓	↑	↑	↑	~	~
Perceived needs	~	↑	↑	↓	↓	↓	↓	↑

(a) ↓↓ marked reduction; ↓ small reduction; ~ no change; ↑ small increase; ↑↑ marked increase

One surprising observation in Table 8.1 is that perceived treatment needs increased in some age groups despite reductions in levels of disease. This was the pattern observed in two age groups of young adults: 25–34-year-olds and 35–44-year-olds. A possible explanation may lie in the finding that adequacy of dental care declined among both of those age groups during the same 17-year period. It is tempting to conclude that deterioration in dental care for these age groups contributed to an increased perception that treatment was needed. However, these interpretations remain tenuous, even at a

population level, because age group analysis is unable to isolate the reasons for change in any single component of oral health. Instead, further explanation of these patterns is provided by summarising birth cohort effects.

Summary of birth cohort analyses

Table 8.2 integrates findings for each generation by summarising observed trends for each aspect of oral health, both within and between each generation.

Table 8.2: Summary of birth cohort trends in oral health status, dental care and perceived need for dental treatment

	Direction[(a)] of trends observed in oral health within and between four generations						
	1916–32 generation	1933–49 generation		1950–66 generation		1967–83 generation	
	Within	Between	Within	Between	Within	Between	Within
Tooth loss							
% with no natural teeth	~	↓↓	~	↓↓	~	↓↓	~
% with <21 teeth	~	↓↓	↑	↓↓	↑	↓	. .
% wearing denture	↑	↓↓	↑	↓↓	↑	↓↓	↑
Decay experience							
Decayed teeth	↓	↓	↓	↓	↓	↓	~
Missing teeth	~	↓↓	↑↑	↓↓	↑↑	↓	↑
Filled teeth	↑↑	↑↑	↑	~	↑	↓↓	↑↑
DMFT	↑	~	↑↑	↓	↑↑	↓↓	↑↑
Dental care adequacy							
Dental utilisation	↑	↑	↑	↑	↑	~	↓↓
Dental insurance	↓	↑	↓	~	↑	↓	↓
Private dentist	~	~	↓	~	~	↓	↑↑
Perceived need for:							
Extraction(s)	↓	↑	↑	↑	↑	↑↑	↑↑
Filling(s)	~	↑	~	↑	~	~	↑↑
Denture(s)	↓↓	↓↓	~	↓↓	↑	↓	↑
Within generation summary							
Oral disease	↑		↑↑		↑↑		↑↑
Dental care	~		~		↑		↓↓
Perceived needs	↓		~		↑		↑↑
Between generation summary							
Oral disease		↑↓		↓		↓↓	
Dental care adequacy		↑		↑		↓	
Perceived needs		↑↓		↑↓		↑↓	

(a) ↓↓ marked reduction; ↓ small reduction; ~ no change; ↑ small increase; ↑↑ marked increase

Between-generation trends summarised in Table 8.2 reveal patterns of change that can be attributed primarily to historical events. The most pronounced trend was the marked reduction in oral disease among members of the 1967–83 'fluoride generation' compared with their parents' generation. The reduction was explained both by reduced levels of tooth loss and reduced levels of dental decay experience. Conversely, adequacy of dental care reduced to a small degree between those two generations. These contrasting trends may have accounted for the mixed pattern of change observed between the two generations in their perceived dental treatment needs. Compared with their parents generation, the 1967–83 generation perceived a markedly greater need for extractions but a reduced need for dentures.

Other between-generation trends were similarly mixed. People born between 1950 and 1966 had a small reduction in dental disease and a small increase in adequacy of dental care compared with their parents' generation born in 1933–49. The 1950–66 generation reported small increases in need for extractions and fillings compared with their parents' generation but a marked decrease in need for dentures. Finally, the 1933–49 generation had markedly less tooth loss but markedly more filled teeth than their parents' generation, born between 1916 and 1932. Their adequacy of dental care increased yet there were contrasting trends in treatment needs.

Within-generation trends provided additional explanations for trends observed during the period. Oral disease increased within each generation, and for the three generations born since 1933 the degree of increase in oral disease was categorised as 'marked' (Table 8.2). As noted above there was relatively little within-generation increase in tooth loss. Instead, most of the increase was observed for the DMFT index and its components.

On one hand it is not surprising that oral diseases increase over time within generations. It is virtually inevitable that ageing will contribute to an increase in lifetime markers of disease such as the DMFT index, because each additional event of disease is reflected in this cumulative index. Yet is was noteworthy that the increase in caries experience was of a similar magnitude even in the 'fluoride generation' born in 1967–83. Members of that generation were exposed, since childhood, to more dental prevention than any previous generation, primarily through fluoride in toothpaste and water. Yet, as summarised in Figure 8.8, their rate of newly decayed teeth was similar in magnitude to the rate observed in both their parents' generation and their grandparents' generation as each of those generations aged during the same 17-year period between surveys. (The 1916–32 was the exception, where an average of 1.4 teeth per person developed decay during the interval.) This finding dispels any impression that a generation might be 'immunised' for a lifetime against dental decay after most of its members are exposed to fluoride from birth.

In contrast, the between-generation analysis provided clear evidence that the fluoride generation reached adulthood with substantially less caries experience than the generation before it. As young adults, members of the fluoride generation had about half the level of decay that their parents' generation had developed as young adults. This finding provides evidence that exposure to fluoride in water and in toothpaste during childhood produced substantial benefits for oral health among Australia's

adults. Australia's fluoride generation has substantially better oral health than its parents' generation, but most of the benefit accrued during childhood.

Several caveats about population trends need to be considered when using findings from survey to make inferences about the public health impact of fluorides. First, the majority of people who lived in Australia throughout the 17-year interval between surveys were exposed to fluoride in toothpaste and water regardless of their year of birth. It is plausible that within-generation increases in DMFT would have been larger than the levels observed here if the population had been exposed to lower levels of fluoride. Second, inferences about effects of fluoride exposure necessarily are weakened in these types of population-analyses where there has been no attempt to distinguish between individuals' frequency of fluoride toothpaste usage, or to limit the analysis to lifetime residents of fluoridated areas. NSAOH participants were asked about such exposures, and those finding will be subject to more detailed analyses that are beyond the scope of this report. Thirdly, although it used widely in oral health surveys to measure caries experience, the DMFT index has documented deficiencies (Burt & Eklund 1999). As noted elsewhere, individuals can develop decay yet experience no change in their DMFT index (see Box 8.3, page 212). This measurement limitation is relevant in this analysis, because it remains possible that the degree of underestimation in caries activity may have been more pronounced among earlier generations, thereby creating a spurious impression that within-generation effects were similar between generations. A further unexpected finding was that the 1967–83 generation reported larger increases than any other generation in their perceived needs for dental care as they aged 17 years (Table 8.2). The explanation may lie in the concurrent trend within this generation of marked reduction in adequacy of dental care, a trend that was not observed for other generations. Specifically, the 1950–66 generation displayed a small increase in adequacy of dental care during the 17 years between surveys, which may have been sufficient to partially offset the effect of marked increase in oral disease, resulting in only a small increase in perceived need for dental treatment. Among the two earliest generations, adequacy of dental care remained relatively stable, and perceived needs for treatment either remained stable or even decreased in the 1916–32 generation. The overall pattern was that perceived treatment needs increased most when a marked increase in oral disease was coupled with a marked decrease in adequacy of dental care. Stated another way, stable or increased adequacy of dental care appeared to serve as a buffer against rising perceptions of dental treatment need, even in generations where there were marked increases in oral disease.

8.5 Projections of prevalence of complete tooth loss

Aside from providing insight about historical influences on population oral health, analysis of trends can help to predict future patterns of oral health. Observed trends in edentulism provide a useful illustration of such projections. This is possible because the findings of within-generation stability in prevalence of edentulism coupled with between-generation reductions are so consistent among generations. For example, those two findings mean that it is virtually inevitable that the prevalence of complete tooth loss will continue to decline within the adult population. Furthermore, it is reasonable to expect reductions to be pronounced within the next two decades due to

the passing of the earliest generation, exposed to an epidemic of complete tooth loss in the first half of the twentieth century, and one-third of whom are edentulous. In contrast, later decades should witness more modest reductions with the passing of generations that have lower levels of complete tooth loss.

Inevitably, the rate of reduction must diminish as prevalence of the condition approaches zero. While it remains possible that unforseen circumstances will develop that slow the rate of reduction in prevalence, they seem unlikely. One such circumstance could be a new wave of surgical dental treatment that causes an increase in prevalence of edentulism within generations. Yet there is no reason to believe that such a change is likely. Other scenarios are less plausible, such as a large increase in the number of immigrants, with considerably larger percentages of being edentulous.

The finding that historical, between-generation events, and not age-related effects between surveys, influence edentulism prevalence permits additional quantitative predictions about future levels of complete tooth loss. In principle, quantitative predictions are possible for other conditions, although variability among generations in those trends would require that more complex assumptions be made. Such assumptions would need to be informed by additional evidence aside from these survey findings, and their impact would need to be tested, both of which are beyond the scope of this report. Instead, the following projections regarding edentulism are presented to illustrate the potential value of using data about generations in population health surveys.

This illustration begins with the assumption that there will continue to be negligible change in prevalence of edentulism within generations (see Figure 8.2). Based on that assumption, prevalence of edentulism for any generation observed in the current survey can be expected to remain virtually unchanged as the generation ages. As successive generations die and are replaced by more recent generations, overall population prevalence will decrease. Using demographic projections for the entire population as a base, it is possible to construct generations of people born in five-year intervals. This small interval increases the precision of prediction for the overall population.

Box 8.4 Australia's epidemic of complete tooth loss

The reason for between-generation reductions in complete tooth loss can be attributed to a striking transition in methods of and preferences for dental treatment that occurred during middle decades of the twentieth century. Prior to that time, a surgical philosophy dominated the approach to dental treatment, a philosophy that was fuelled by the theory of focal infection. The theory, which emerged during the second decade of the twentieth century, was based on the assumption that systemic diseases arose as a consequence of chronic dental infections. Hunter and others proposed that dental decay and other oral diseases created reservoirs of bacteria that could spread through the body, causing a wide range of systemic diseases, some of them fatal (Herschfeld 1985). In direct response, full mouth extractions were commonplace from 1920 to the late 1940s as a way to eliminate the source of infection found in heavily restored dentitions. It was not uncommon for healthy and diseased teeth to be removed, in part to eliminate what was regarded as a future risk of focal infection, and in part to permit efficient construction of dentures to replace all teeth, not just some of them. To this day, some elderly Australians recall having teeth removed to make way for a denture, even though some of the teeth were healthy. Dawn Barbour was born in the 1930s and lost all of her top teeth during her teenage years.

After the war, money was less tight for farming families so I went under anaesthetic at about age 16 to have the rest of the top teeth out. I don't know how many good ones went – they weren't all decayed – but they took the lot, all the top teeth. I was the only child at the hostel that had a denture. So that was a bit unpleasant, but my Mum and Dad didn't seem to worry about it.

–Excerpt from oral history of Dawn Barbour (see Chapter 4.2, page 73)

The consequence was an epidemic of complete tooth loss. Although it was not supported by scientific evidence, the theory of focal infection had salience among the emerging dental profession that was eager to discard its roots in the barber's shop and technical trades (Davis 1980a). The theory struck a chord more broadly in a population where there was considerable fear of infections. Penicillin had not been discovered, and epidemics such as polio caused death and disability on a daily basis. The theory of focal infection was discredited scientifically in the 1940s, and its influence on dental practice receded in the next decade. The decline of a predominantly surgical approach to treatment of oral diseases was aided by the development of new technologies to treat them, including powered drills that could efficiently remove decay. Instead of extracting all teeth, whether diseased or healthy, dentists sought to preserve teeth that had a limited amount of disease that by removing the decay and replacing with a filling. Increasingly, patients wanted to retain their healthy teeth and have diseased teeth repaired, rather than removed, a preference that persisted after the 1950s.

The population base used for this illustration was the 'Series B' projection published by the Australian Bureau of Statistics (ABS, 2006) (ABS 2006). Series B refers to projections based on mid-range estimates of fertility, life expectancy, mortality and migration. Table 8.3 contains those projected numbers of Australians within five-year age categories in 2005 (the mid-year of the National Survey of Adult Oral Health), 2021 and 2041. Also tabulated are observed prevalence of edentulism for the corresponding five-year age categories of adults derived from the 2004–06 National Survey of Adult Oral Health. (The table disregards people aged less than 15 years in whom permanent teeth are erupting, and for whom complete tooth loss is not meaningful.) Based on the assumption that prevalence of edentulism will continue to remain constant within generations, prevalence in the adult population is projected to decrease to 2.7% by 2021 and 0.4% by 2041.

Table 8.3: Projected prevalence of complete tooth loss in Australia assuming continued trend of no within-cohort increase in prevalence

	ABS Series B population projection[(a)]: No. of people ('000)			Projected % of edentulous people		
Age (years)	**2005**	**2021**	**2041**	**2004–06**	**2021**	**2041**
15–19	1,378.0	1,398.0	1,477.4	0.0%		
20–24	1,412.8	1,471.3	1,514.7	0.0%		
25–29	1,364.5	1,568.6	1,568.0	0.0%		
30–34	1,513.9	1,605.3	1,637.3	0.0%		
35–39	1,475.7	1,632.2	1,672.0	0.3%		
40–44	1,539.7	1,560.7	1,719.8	0.8%	0.0%	
45–49	1,462.1	1,590.2	1,758.4	2.1%	0.0%	
50–54	1,336.9	1,560.8	1,709.9	3.9%	0.3%	
55–59	1,246.7	1,520.0	1,667.9	7.5%	0.8%	
60–64	945.8	1,453.6	1,546.7	12.9%	2.1%	0.0%
65–69	772.9	1,290.8	1,529.4	17.9%	3.9%	0.0%
70–74	629.3	1,178.7	1,450.2	23.3%	7.5%	0.3%
75–79	554.4	840.4	1,319.8	33.6%	12.9%	0.8%
80–84	400.1	577.6	1,103.7	36.2%	17.9%	2.1%
85+	311.5	584.4	1,293.7	42.7%	23.3%	3.9%
Age 15+	16,344.3	19,832.6	22,968.9	Increase –>	0.00%	0.00%
			Projected no. edentulous ('000)	1,063	533	88
			Projected % edentulous	6.5%	2.7%	0.4%

(a) Australian Bureau of Statistics population projections (ABS 2006).

An alternative is to assume that there will be some within-cohort increase in prevalence of edentulism. This is plausible because, although the results in Figure 8.2 show no net within-cohort change, at least within the margin of sampling error, estimates for three generations were marginally greater in the 2004–06 survey compared with the 1987–88 survey. While there was no measurable level of edentulism for people who aged 17 years into their 30s, net increases were 0.6% for people who

aged into their 40s and 50s, 1.9% for people who aged into their 50s and 60s, and 0.4% for people who aged into their 70s and 80s. That approximates to an average net increase of 1% over 17 years for people ageing into their 40s or older.

A reasonable alternative, then, is to expect that edentulism prevalence will increase by as much as 1% in subsequent 15–20-year intervals. Based on that assumption, the prevalence of edentulism for the population is expected to reduce to 3.1% by 2021 and to 1.0% by 2041 (Table 8.4).

Table 8.4: Projected prevalence of complete tooth loss in Australia assuming within-cohort increase of 1% during 15–20-year intervals

	ABS Series B population projection[(a)]: No. of people ('000)			Projected % of edentulous people		
Age (years)	2005	2021	2041	2004–06	2021	2041
15–19	1,378.0	1,398.0	1,477.4	0.0%		
20–24	1,412.8	1,471.3	1,514.7	0.0%		
25–29	1,364.5	1,568.6	1,568.0	0.0%		
30–34	1,513.9	1,605.3	1,637.3	0.0%		
35–39	1,475.7	1,632.2	1,672.0	0.3%		
40–44	1,539.7	1,560.7	1,719.8	0.8%	0.0%	
45–49	1,462.1	1,590.2	1,758.4	2.1%	0.0%	
50–54	1,336.9	1,560.8	1,709.9	3.9%	1.3%	
55–59	1,246.7	1,520.0	1,667.9	7.5%	1.8%	
60–64	945.8	1,453.6	1,546.7	12.9%	3.1%	1.0%
65–69	772.9	1,290.8	1,529.4	17.9%	4.9%	1.0%
70–74	629.3	1,178.7	1,450.2	23.3%	8.5%	2.3%
75–79	554.4	840.4	1,319.8	33.6%	13.9%	2.8%
80–84	400.1	577.6	1,103.7	36.2%	18.9%	4.1%
85+	311.5	584.4	1,293.7	42.7%	24.3%	5.9%
Age 15+	16,344.3	19,832.6	22,968.9	Increase –>	1.00%	1.00%
Projected no. edentulous ('000)				1,063	623	222
Projected % edentulous				6.5%	3.1%	1.0%

(a) Australian Bureau of Statistics population projections (ABS 2006).

In summary, during the next four decades, with the passing of older generations that experienced an epidemic of tooth loss during the first half of the twentieth century, the prevalence of complete tooth loss is projected to further decrease, reaching 1% or less by the 2040s.

9 Interpretation of findings

by A John Spencer, Paul Sendziuk, Gary Slade and Jane Harford

9.1 Oral health status

Within the Australian adult population oral diseases are pervasive: one in four adults have untreated dental decay and a similar proportion have destructive periodontal disease. They cause symptoms ranging from pain to difficulties eating among as many as one in five people. The frequency of oral disease and related symptoms are inequitably distributed, being greater in groups that are already disadvantaged. Oral disease is disproportionately more frequent among Indigenous Australians, people with less schooling, people residing outside capital cities, people who are uninsured and people eligible for public dental care. Meanwhile, males are more likely than females to have periodontitis and severe tooth wear.

This burden of disease persists despite marked reductions in tooth loss and experience of dental decay observed in the 17 years between national oral examination surveys. Those improvements can be attributed primarily to two influential events in Australia's history:

- An epidemic of extensive tooth loss that occurred during the first half of the twentieth century, the impact of which is diminishing rapidly with the passing of Australia's oldest generations, who reached adulthood during that historical period.

- The emergence of a 'fluoride generation' that, by their third and fourth decades of life, developed decay in only half the number of teeth that were affected by decay at the same age in their parents' generation.

Yet, widespread exposure to fluoride in drinking water and toothpaste has not 'immunised' this generation against decay. As adults during the 17 years preceding this survey, they developed decay in previously healthy teeth at a rate that was equal to that of their parents' generation who generally were not exposed to fluoride in childhood. Meanwhile, older generations that have retained historically high numbers of teeth continued to develop decay in previously healthy teeth as they, too, aged.

These patterns of oral health have implications for four action areas and priority groups identified in Australia's National Oral Health Plan 2004–13 (see Table 1.1, page 6) (NACOH 2004).

Action area 1: Promoting oral health across the population

In this report's analysis of trends that showed historically low levels of dental decay among members of the 'fluoride generation', it was not possible to separate the effects of fluoride in toothpaste and fluoride in drinking water. However, as noted in Chapter 4, water fluoridation remains an unfinished task in Australia. One consequence was that those characterised as the 'fluoride generation' comprise a population that is only partially exposed to fluoridated water (approximately 70%, see Table 4.1). Given the body of scientific evidence supporting the view that fluorides in both toothpaste and drinking water have contributed to population declines in dental decay, it is reasonable to expect that a generation more fully exposed to fluoridated water would develop still lower levels of caries. These findings therefore support the Plan's proposals to broaden availability of fluorides, both by addition to water supplies that serve populations of 1,000 or more people, and by promotion of fluoride toothpaste.

Action area 3: Older people

This report highlights adverse 'consequences of success' for oral health among older Australians. Rates of tooth loss have plummeted: by the 2040s the percentage of people with no natural teeth is projected to reduce to 1% or less for the population. Even among the oldest Australians aged 85 years or more, prevalence of complete loss is projected to be no greater than 6% by the 2040s (see Table 8.3 and Table 8.4). Already, one consequence of that success is apparent in terms of untreated decay, which affected one-quarter of people in all generations including the oldest. Furthermore, people aged ≥75 years had prevalence rates of root decay (Table 5.10) and periodontitis (Table 5.16) that were three times greater than the population at large. The findings therefore support the Plan's emphasis on older adults as a priority group.

Action area 4: Low income and social disadvantage

Virtually all aspects of oral health measured in this study were more frequent and more severe among people who were eligible for public dental care (see tables throughout Chapter 5). In many instances there were three-fold differences between eligible and ineligible people, making this characteristic one of the most consistent and profound correlates of poor oral health identified. While eligibility for public dental care is determined by a means test that is based primarily on income, assets and family composition, educational attainment was another consistent and profound predictor of poor oral health. Income, education and other socially constructed forms of disadvantage have proven to be important risk factors for virtually all diseases that are of public health importance. So, although it should not be surprising that this survey has furnished strong evidence supporting the Plan's focus on disadvantage, the pervasive nature of disadvantage is such that it calls for a range of interventions including efforts to tackle the root causes of disadvantage itself. Those root causes, also termed 'social determinants', are being addressed only in a limited way in most public health interventions. Hence, it remains a challenge to identify effective interventions that can be implemented to achieve the Plan's goal in this area.

The Plan also describes a focus on people in rural and remote areas. This report distinguishes only between capital city and other residential locations, and hence offers no specific insight into the subset of rural and remote localities. Based on this coarse dichotomy, there were relatively few differences observed in oral health between capital cities and other places. Yet, there were only small numbers of people from rural and remote areas selected for this survey due to the sampling plan that selected postcodes with probability proportional to population size.

Action Area 6: Aboriginal and Torres Strait Islander people

Despite the relatively small number of Indigenous Australians interviewed and examined in this survey, the findings provide clear evidence of poorer oral health among Indigenous Australians compared with non-Indigenous. The disadvantage was most apparent regarding tooth loss, untreated decay and tooth wear. The lack of marked differences in periodontitis was surprising, although with periodontal examinations conducted among only 75 Indigenous people, the lack of difference may be due to under-representation and/or limited statistical power to detect differences. Aside from clinically assessed oral health, Indigenous Australians also had poorer self-rated oral health and more toothache, and had more difficulty with eating due to dental problems (see Chapter 7). More research on the oral health of a larger sample of Indigenous Australians is needed to confirm these associations.

9.2 Dental attendance

Dental attendance in NSAOH has been documented by whether people usually visit a dental professional at least once a year, whether people usually visit a regular dentist, the percentage of people visiting in the last 12 months and the percentage who have not visited in the last 5 years.

The dominant pattern of dental attendance observed among Australian adults was one of usually visiting the same practitioner (78.6%) and usually visiting at least once a year (53.1%). The slightly higher percentage of people who visited in the last year (59.4%) reflects the sum of those who usually visit at least once a year and those who usually visit at a lesser frequency but who have made a recent visit. These additional visits occurred primarily among approximately one-third of adults who usually did not visit at least once a year, but who had made a visit within the last 5 years. Only 11.8% of dentate adults could be classified as falling 'outside' the dental care system (i.e. have not visited in last 5 years), together with the 6.4% of edentulous adults.

This pattern of who visits regularly and who make less than regular visits to a dentist is important for its documentation of the quantity and character of those whose visiting behaviour is more or less ideal. While more complex analyses might sharpen the view, about half of the adult population seem to visit the same dentist regularly. This pattern of attendance was of about the same frequency across the generations when only the dentate were compared. However, it was strongly associated with usually visiting for a check-up and moderately associated with insurance. It was more

frequent among non-Indigenous Australians, those residing in capital cities, those with more schooling and ineligible for public dental care.

Those people who make up this 'glass half-full' view of the Australian adult population's dental attendance pattern seek their dental visits at a private dentist and are frequently supported in doing so by dental insurance. They constitute those whose attendance behaviour is closer to that recommended by the dental profession. They visit asymptomatically and regularly, and when they do visit they may receive dental services that are more comprehensive, including an emphasis on preventive services and lower rates of tooth extraction. The dental attendance pattern and experiences of these adults help establish and maintain a positive orientation to dental visiting and oral health, and contribute to less severe impacts of oral diseases and disorders on people's everyday lives. Further, when a dental problem does occur, dental treatment is obtainable and effective.

The 'glass half-empty' view of the Australian adult population's dental attendance pattern presents a striking contrast. For approximately half the adult population, including the edentulous, dental visits are irregular. Whether a visit will be made will depend on perceiving a dental problem and seeking a visit from a private dentist or obtaining an 'emergency' visit from the public dental services. Dental attendance for a problem does not happen frequently, although the actual frequency of such visits (and the time since last visit) can vary greatly. Equally likely is the situation where the person has no contact with a dentist, that is they exist outside the dental system. Irregular problem-oriented visiting or no visiting occurs with similar frequency across the generations when the dentate are compared, but inclusion of the edentulous creates higher percentages in earlier generations. This pattern of attendance is strongly associated with edentulism and usually visiting for a dental problem. It is more frequent among the Indigenous, those with less schooling, those living in other places than capital cities, the uninsured and those eligible for public dental care.

Dental attendance is therefore very divided, with two separate population groups co-existing in the one community. The size of the population group with the more ideal dental attendance pattern is evidence of progress made in the way in which the dental system serves the population. This pattern of attendance is consistent with a more preventive or oral health promotion oriented approach with continuity of care. Equally, however, the size of the population group with a less favourable dental attendance pattern is evidence of the distance yet to be travelled in the way in which the dental system serves the population. It is an episodic, problem-oriented primary health approach with little comprehensive treatment and continuity of care. Improving the dental visiting pattern for this population group, and thereby narrowing the inequality gap in dental visiting, remains a challenge for the dental system in Australia.

9.3 The dental care system

Data from NSAOH can provide a window on characteristics of the provision of dental care in Australia. Dental care in Australia is provided mainly in private dental practice, funded by the individual patient. Private dentists work primarily in solo or small

group practices, while public dental care is provided at a mixture of larger clinics or dental hospitals as well as small community dental clinics.

The public system

State and territory public dental care provides subsidised dental care, primarily targeted to people on low incomes. The care is provided either by salaried staff of the dental program or through fee-for-service reimbursement to private practitioner dentists, with variation among states and territories in the combination of methods used. Many public programs charge patient fees or 'co-payments' for general and emergency dental care. In all States and Territories, eligibility is determined by possession of a Health Concession Card issued by Centrelink, an agency of the Australian Government's Family Assistance Office. People seeking general dental care in state and territory programs typically face long waiting times and often they receive care that is limited by the range of services offered, and which may be further compromised by the extent of disease that develops while people are on a waiting list.

Box 9.1 Access to public dental services

We don't have a dentist out here any more. We haven't had a community dentist, as in a Health Card dentist type one. Used to go to the one at the local school but due to budget cuts and whatever, it's no longer required. And the local dentist, he bloody retired some years ago. You have to travel an hour or so now. Or travel to Adelaide, which is a two-hour drive..... Like now, I'm actually waiting for an appointment about this tooth of mine on the upper left that needs something done about it. So when I get confirmation of what I can do, how I can do it and where, I'll get it fixed—well, get it remedied. The appointment, that'd be the main thing. I'm on a waiting list.

–Excerpt from oral history of Wade Lang (see Chapter 4.2, page 75)

Findings in Chapter 6 demonstrate that people eligible for public dental care were more likely than the rest of the population to experience unfavourable patterns of dental visiting. People who are eligible for public dental care had lower rates of having visited in the last 12 months than non-eligible people (50.6% versus 62.5%) and higher rates of having not visited in the last 5 years than the non-eligible (18.1% versus 9.6%). Only 37.3% of eligible people made their last visit at a public dentist. This averages to about 20% of eligible people being seen by the public system each year. Older eligible people in particular, were more likely to visit a private dentist than a public clinic (66% of 55–64 and 66% of eligible people aged 75 years or more who made a visit did so to a private dentist). On the other hand, eligible individuals were more likely to visit for a problem than non-eligible individuals (46.3%, compared to 40.2%).

Barriers to accessing dental care in the public system were reflected in the relatively poorer oral health of eligible people (Chapter 5). Oral examination results from NSAOH indicate that people eligible for public care were more likely to have teeth missing due to pathology but less likely to have those missing teeth replaced by a

denture or bridge. They were also almost 1.5 times as likely to have untreated dental decay and they had, on average, four more teeth affected by caries than ineligible people.

It should come as no surprise that the provision of public dental care does not bring the oral health experience of eligible people in line with that of the rest of the adult population. Public dental services in most states have been chronically under-funded for the past decade. In 2001–02 a total of $226m was spent by state and territory Governments on public dental services, equating to approximately $32 per eligible adult. This is sufficient for every eligible person to have a basic preventive package consisting of an examination, clean and scale and fluoride treatment once every five years. Overall, this paints a picture of the public system as providing sporadic and problem-oriented care to a small percentage of the eligible population. However, it is unlikely that eligible people who are uninsured fare any better in the private system.

The private system

Australia has one of the most technologically advanced and highly trained private dental care provision systems. Eighty-three per cent of Australians reported seeing a private dentist at their last visit, slightly less than did so in 1987–88 (86% versus 93%). Attendance at a private dentist occurred most frequently for insured adults (95.2% overall) and least frequently for adults who are eligible for public dental care (62.7%).

Box 9.2 Dental visits when needed

Aburizal Bakrie remembers having problems with his baby teeth as a child in Indonesia, and has suffered gum disease, abscesses and two teeth extractions as an adult (both before and after emigrating). Private health insurance now covers most of Aburizal's expenses, including having his three children fitted with braces.

I am on health [insurance] fund. I go to the dentist when I need to. I never had to wait long.

–Excerpt from oral history of Aburizal Bakrie (see Section 4.2, page 77)

The pattern of attendance for the adult population equates to about half of Australia's adults seeing a private dentist each year, down from 57.6% in 1987–88. The private dental system apparently does not currently have the capacity to accommodate the dental profession's recommendation of a dental visit at least once every 12 months. Only 42.7% of people living outside of capital cities and one-third of Indigenous Australians had regular access to a private dentist.

Paying for dental care

In contrast to medical services, of which 12% are funded out-of-pocket, Australians fund 60% of dental care out-of pocket. While just under 10% of all out-of-pocket expenditure pays for medical care, about 20% pays for dental care (AIHW 2006). This reflects the very low amount of public subsidy available for dental care compared to medical care, and its concentration on services for people on low incomes, compared to the universal coverage for medical care. While it may be appropriate that public subsidies are targeted to those who are least able to pay for themselves, considerable financial barriers to appropriate use of dental care remain for people who are not eligible for publicly funded care. This results in widespread avoiding or delaying of care and of recommended treatment.

Dental insurance

Holding private dental insurance appears to provide a buffer against financial barriers to dental care. Across all age groups, people with insurance were 1.5 times more likely to have visited in the last 12 months and uninsured people were three-times more likely to have made their last dental visit within at least 5 years. Having dental insurance was also associated with lower likelihood of avoiding or delaying dental care due to cost and it was associated with foregoing recommended dental care due to cost. Not surprisingly, people were more likely to visit for a check-up if they had dental insurance (70.0%) than if they were uninsured (43.2%). Insured adults were more likely to have a regular source of dental care (87.5%) than the uninsured (65.0%). Other studies have shown that dentally insured people who are eligible for public dental care have similar access to dental care compared to non-eligible people who are insured (Carter & Stewart, 2003).

Box 9.3 Benefits of dental insurance

Even though she finds it expensive, Melissa Williams explains why she retains dental insurance.

It's expensive. We haven't really changed our [insurance] 'extras' cover for some time, so the benefits we get back are pretty dismal. I mean, they're expensive, but it's important. You know, I'm only midway through my life, and I certainly don't want terrible teeth or no teeth down the track. We used to go to Medibank dentists, 'cause I used to work for Medibank before I had the children. You used to be able to get free check-ups – check-ups, scale and clean, that sort of thing – through these dentists that were affiliated with Medibank but we don't do that any more .

–Excerpt from oral history of Melissa Williams (see Chapter 4.2, page 72)

Problem-oriented dental visiting and not having a regular source of care are thought to lead to poorer oral health. Evidence to support this is provided in Chapter 7, where groups with poor access to dental care were more likely to report adverse needs for

both preventive and therapeutic dental care as well as higher levels of fair or poor self-rated oral health, toothache and orofacial pain.

9.4 The dental labour force

Australia currently faces a dental labour force shortage (AHMAC 2001). In order to understand the relevance of this survey's results to that shortage, it is useful to review concepts of labour force supply and demand.

Supply and demand for dental care

The dental profession, like many health professions, has entered a period of aggregate shortage of capacity to supply services against the expected levels of demand for services from the Australian population. The conceptual approach to studies of the supply and demand for dental services has been labelled a demand-based, need-modified approach (De Friese & Baker 1982).

The methodological approaches to estimating supply and demand have been as follows. Supply is based on the head count of the dental labour force (dentists, dental therapists, dental hygienists, dental prosthetists) multiplied by age- and sex-specific estimates of their annual production of visits or services (capacity to supply). Models which track changes in the numbers of practitioners through estimates of inflows and outflows are used to project future head counts, and assumptions are made about practitioners future capacity to produce visits or services across the projection period.

The demand or requirement for dental visits or services is based on the estimated resident population and age-specific estimates of their per capita demand (the mean number of visits per year). Per capita demand has been stratified by dentate status (dentate and edentulous people) as an oral health status modifier of demand. Both population projections and linear time trends in per capita demand by age groups are applied in estimating future visits demanded.

Analysis of the dental labour force has indicated limited growth in capacity to supply visits. This reflects the low graduate dentist inflows to the dental profession across the 1980s and 1990s followed by some growth in the early 2000s, and a time trend for decreasing annual production of dental visits as a result of stable work hours, but increasing length of individual dental appointments.

Demand is indicated to increase moderately on the basis of population growth, ageing of the population, decreasing edentulism and increased tooth retention, and increased expectations driving higher numbers of visits per year (per capita demand), particularly among middle-aged and older adults.

Understanding the dynamics of the dental labour force, appropriately informing policy discussion and coordinating the policy response across levels of government and portfolios are major tasks in the desire to reach a sufficient, sustainable and appropriately skilled labour force to meet identified oral health needs across the

Australian population (AHMAC 2001). The National Survey of Adult Oral Health adds important up-to-date information on a number of key issues for the dental labour force. It is, therefore, highly appropriate to examine the findings against the fundamental elements of the Australian dental labour force.

Implications of the Survey's results for the dental labour force

The NSAOH documents the widespread and extensive experience of oral disease in the Australian adult population. While child oral health had until recently greatly improved in the last 30 years, improvements in adult oral health are more subtle and even contrary to expectation. The most dramatic change in adult oral health revealed in the trends between 1987–88 and 2004–06 is the reduction in tooth loss (either prevalence of edentulism or the number of missing teeth in all age groups). Prevalence of edentulism among adults more than halved, from 14.4% to 6.4% between the two surveys and is projected to be less than 3% by 2021. The number of missing teeth in the dentate was reduced for all age groups, leading to marked increases in the total number of teeth present. Ironically, the increase in teeth saved from extraction can develop repeated episodes of decay or periodontitis. This has been characterised as the adverse 'consequences of success' and is hypothesised to be a substantial contributor to an increase in need and demand for dental services among adults.

NSAOH provides a rich description of not only the burden of past caries experience carried by earlier generations, but the further accumulation of teeth affected by caries, some of which are lost to extraction and some filled, and the accumulation of other destructive conditions on teeth retained, especially periodontal disease and tooth wear.

A quarter of the dentate adult population has untreated decay, or just less than one tooth surface per person, on average. In addition, 7% of people have unfilled root surface decay. The trend analysis demonstrates that decay continues to develop in previously health teeth among adults in all generations, a level of disease activity that underpins a need for dental care across the lifespan. Most adults have some filled teeth, with the average number of filled surfaces just less than 20 for every dentate adult. This creates a lifetime need for maintenance dental care, because restorations have a finite life. Most need replacement or repair at some point, with varying half-lives from approximately 5 to 20 years depending on the filling material. Both the teeth unaffected by caries and those affected and restored with fillings live on to potentially develop other chronic degenerative oral diseases or conditions. In NSAOH this is seen in moderate or severe periodontitis (23%) and enamel wear (12%).

Self-ratings of oral health, either the global rating as fair or poor (Table 7.2) or the reports of experiencing toothache (Table 7.3), are signs that success in retaining teeth can have adverse consequences when those teeth develop disease. One in six adults in the three generations born before 1970 reported fair or poor oral health. These percentages were particularly high among those with less schooling, who were eligible for public dental care or who usually visited for a dental problem.

Perceptions of dental treatment needs are a complex interplay of people's current burden of oral disease, their expectations, and the availability and obtainability of

dental care. Perceived need for an extraction or filling was high among the three most recent generations. Only in the earliest generation, the pre-1930 generation, did this percentage significantly decrease. In the 17 years since 1987–88 there were increases in the percentage of adults who perceived needs for extractions and fillings, while there was a reduction in the perceived need for dentures.

Perceptions of need reflect both the burden of oral disease and its consequences. People's perception of need for dental treatment is also shaped by a desire to be reassured that they are in good oral health, that oral disease is diagnosed early, and that prompt prevention-oriented dental treatment is received. The perceived need for a check-up among dentate adults captures this belief in the value of maintenance of as healthy a dentition as possible through frequent check-ups that involve a range of diagnostic and preventive dental treatments. While not all the 60% of adults in Australia who perceive a need for a check-up will reflect this asymptomatic orientation to oral health maintenance, many will. This acceptance of the recommended check-up at a regular interval contributes to the increase in demand for dental visits.

Limited comparisons in dental attendance across time are available from NOHSA and NSAOH. The percentage who visited in the last 12 months increased from 53% in 1987–88 to 62% in 2004–05. When considered in terms of its impact on the per capita number of visits, this is a substantial increase in effective demand for dental visits. Equally important is how the percentage visiting has changed over time among different age groups. Results in Chapter 8 showed that the percentage of people who visited within the preceding 12 months increased for young adults (15–24 years old) and all middle- and older- adult age groups 35+ years old. However, there was a slight decrease in the percentage of 25–34-year-olds who visited within the last 12 months. At both times the vast majority of these dental visits were to private dentists. Hence, most of the increase in demand for dental care is being expressed in the private sector. In the 17-year interval between surveys, there was some reduction in the percentage who last visited a private dentist. However, changes that contribute to that reduction have occurred among young adults. For example, among 15–24-year-olds the percentage last visiting a private dentist decreased from 81% to 68%. This change may reflect growth in coverage of adolescents within the school dental services. Importantly, despite the increased demand from older adults, most of whom are eligible for public dental care, the reliance on visiting a private dentist has not changed.

Dental insurance is regarded as an enabling factor in visiting a dentist, and more particularly, a private dentist. Dental insurance was held by almost the same percentage of people in 1987–88 and 2004–06 (48% versus 47%). However, there was an increase in middle-aged and older adults with dental insurance, but a decrease among 25–34-year-olds (46% versus 36%). This is a further indicator of the special circumstances of 25–34-year-olds.

One implication for the dental labour force of the pattern of dental attendance is that the predominance of visiting private dentists demands policy responses that pay attention to both this sector of the dental care system and segments of the population dependent on public dental care. This focus is present in background research (Spencer et al. 2003) and the National Oral Health Plan (NACOH 2004). A further implication is the realisation that demand for dental visits has considerable capacity for growth,

particularly growth that would create a narrower gap between sociodemographic groups. If even a small proportion of adults with unfavourable patterns of dental attendance were to seek more frequent and comprehensive care, there would be a substantial increase in demand for dental care. This represents considerable 'latent' demand for dental visits from groups of people who are infrequent users. These people seem to be defined by social characteristics like having less schooling, being uninsured and being eligible for public dental care. Therefore, they are the target of policy in the National Oral Health Plan, especially those actions directed at older, low-income, Aboriginal and special needs Australians. However, it is also evident that there is latent demand for dental visits among particular age groups, 25–34-year-olds, who may not share many of these social characteristics. Narrowing the gap in dental attendance would create new and additional demand for dental visits.

In summary, the NSAOH has documented extensive and widespread experience of oral disease that steadily accumulates across the life-course. This disease experience underpins perceived need for and expectations about dental care, either to support 'healthy' oral ageing and the maintenance of a natural dentition, or to restore form and function lost as a result of dental problems. Dental attendance is increasing, requiring an increase in the dental labour force to supply those required visits, while the private sector dominates as the site for the supply of dental visits. The public dental services play a lesser role. There is a considerable group of people who are less active in dental visiting. Most policy that narrows the inequality gap in their dental visiting will only increase the requirement on the dental labour force, leaving Australia with a significant dental labour force shortage.

9.5 Social and historical determinants of oral health

Chapter 4 highlighted the importance of historical events and lived experience in shaping the contrasting oral health standards of the four generations that feature in this survey. While Australians are unlikely to again endure the deprivations of the Great Depression or World War II, which contributed to the 'epidemic' of tooth extractions before the 1950s, an understanding of the past illuminates present challenges that remain today. History has shown, for example, that the fluoridation of municipal water systems in nearly all Australia's capital cities and large towns before the 1980s substantially reduced the incidence of tooth decay in children and adolescents. Yet significant sections of the population—including most people in Queensland—remain without access to fluoridated public water.

The dominant theme of the history of dentistry in the twentieth century is one of progress, with movement away from tradespeople providing painful, invasive treatment towards the formation of a well-educated and disciplined profession with a commitment to tooth restoration and decay prevention. Yet, as our qualitative interviews suggest, many Australians remain traumatised by past painful experiences in dental surgeries, and these memories prevent them from continuing to access services.

The in-depth interviews with 15 people in the Survey featured in Chapter 4 were revealing in other ways. The majority of the sample was prone to blaming their oral

health problems on diet (mainly 'eating lollies'), genetics ('I've always had brittle teeth') or fate, while overlooking the fact that failure to prevent and treat dental disease in a timely manner led to their problems worsening, and, in some cases, becoming irreparable. In general, they tended to blame themselves or their lifestyle choices for dental problems rather than recognising that their ability to obtain dental care was often constrained by their low income or lack of other resources. Means testing to assess entitlement to a health care card or a pensioner concession card is the criterion used to determine eligibility for most public dental services provided to adults. Similarly, most were unlikely to cite as barriers a lack of private health insurance, geographical isolation from a dentist or a public dental clinic, or, in the case of many women, their position within the family unit. Their perceptions of the cause of their oral health problems are thus, generally, at odds with the data collected in this survey suggesting that 'structural' factors, such as socioeconomic status, significantly affect the prospects of Australians maintaining their oral health. Conversely, many who use public dental services seem resigned to the limited resources that they describe having received, and they quietly endure delays in obtaining care. This is despite several of them providing accounts of fairly minor oral health problems becoming unbearable, and resulting in pain, extractions and consequent impacts on wellbeing.

Appendix

Supplementary tables

Appendix Table 1: Oral health status among 10-year age groups

	Age group (years)							
Indicator	**15–24**	**25–34**	**35–44**	**45–54**	**55–64**	**65–74**	**75–84**	**≥85**
% edentulous	0.0	0.0	0.5	2.9	9.8	20.3	34.5	42.7
% with 21+ teeth	99.9	99.4	96.9	89.0	78.7	58.4	46.4	34.3
% with 1+ decayed teeth	24.4	27.2	29.7	24.3	23.2	21.6	20.8	37.2
% with 1+ filled teeth	51.5	78.8	92.4	97.3	96.7	95.1	89.4	91.4
% with 1+ missing teeth	18.9	31.3	49.3	92.4	96.5	93.8	93.2	73.2
% with DMF 0+	64.1	87.2	95.8	99.5	99.9	99.0	97.8	93.0
% with moderate or severe periodontitis	2.7	11.9	18.5	31.4	40.9	48.9	61.2	56.3
% with CAL 4+ mm	10.5	24.2	38.5	60.5	71.8	75.5	80.7	77.5
% with PPD 4+ mm	8.3	17.8	22.6	25.5	25.4	20.6	26.1	24.8
% with REC 4+ mm	12.0	29.4	54.3	76.6	83.6	89.9	96.0	84.5
% with enamel wear on lower incisors	4.2	12.8	14.7	20.2	28.9	36.9	39.1	55.1
Mean number of teeth missing due to pathology	0.6	1.0	2.1	5.9	9.1	11.9	13.8	17.5
Mean number of replacement teeth	0.0	0.1	0.3	0.9	2.8	5.0	6.9	10.3
Mean number of coronal decayed surfaces	0.8	1.1	1.0	0.8	0.5	0.6	0.5	0.6
Mean number of coronal filled surfaces	3.3	8.0	17.3	32.2	35.5	33.1	30.9	23.6
Mean DMFT	3.1	5.9	10.6	18.5	21.7	23.2	24.3	25.5
Mean number of decayed root surfaces	0.0	0.1	0.1	0.2	0.2	0.4	0.4	0.7
Mean number of filled root surfaces	0.0	0.1	0.3	0.8	1.4	2.3	2.9	3.4

Appendix Table 2: Oral health perceptions among 10-year age groups

	Age group (years)							
Indicator	**15–24**	**25–34**	**35–44**	**45–54**	**55–64**	**65–74**	**75–84**	**≥85**
% who avoided food because of dental problems	13.5	15.8	16.8	18.6	18.2	22.2	21.3	19.4
% with fair/poor self-rated oral health	10.8	16.0	17.5	19.1	18.3	17.9	17.5	21.7
% with toothache	18.4	19.0	16.0	14.6	10.6	10.5	6.9	3.0
% with orofacial pain	26.2	25.2	25.4	22.9	18.9	17.2	14.2	10.9
% who perceive a need for dentures	0.4	2.1	3.1	7.1	12.4	20.7	20.4	20.7
% who perceive a need for extraction or filling	29.2	37.9	37.5	34.5	29.3	27.7	20.9	19.0
% who perceive a need for a dental check-up	61.3	69.8	63.5	59.2	53.1	46.3	40.9	30.1
% who need dental care within 3 months	65.3	71.1	67.4	70.1	71.2	72.7	75.3	76.2

Appendix Table 3: Dental care among 10-year age groups

	Age group (years)							
Indicator	**15–24**	**25–34**	**35–44**	**45–54**	**55–64**	**65–74**	**75–84**	**≥85**
% usually visit 1+ time/yr	59.1	43.1	48.3	55.6	57.9	56.3	60.2	65.9
% dental visit <12 months	63.0	50.1	60.1	65.5	64.3	58.5	50.0	45.7
% dental visit 5+ years	8.0	14.6	10.0	7.7	11.1	16.3	22.4	27.9
% visited private dentist	71.2	84.8	89.4	90.5	86.8	78.1	73.7	75.4
% avoided or delayed dental care due to cost	23.0	42.9	36.2	31.4	24.7	22.7	16.5	13.1
% cost prevented recommended dental treatment	11.6	27.2	27.9	24.5	18.7	14.7	8.8	1.6
% with a lot of difficulty paying $100 dental bill	25.8	15.6	17.9	16.0	15.5	19.0	16.7	15.9
% paid for own dental care	92.0	94.7	93.8	94.4	91.4	81.5	77.7	79.8
% who have a dentist they usually go to for dental care	71.9	71.3	78.4	84.1	85.4	83.8	84.7	81.8

Appendix Table 4: Sample counts of interviewed people

	Age group (years)				
	All ages	**15–34**	**35–54**	**55–74**	**≥75**
All ages	**14,123**	**3,238**	**5,361**	**4,202**	**1,322**
Sex					
Male	5,586	1,280	2,082	1,723	501
Female	8,537	1,958	3,279	2,479	821
Indigenous identity					
Blank but applicable	12	4	4	3	1
Non-Indigenous	13,882	3,156	5,270	4,144	1,312
Indigenous	229	78	87	55	9
Residential location					
Capital city	8,734	2,197	3,310	2,431	796
Other places	5,389	1,041	2,051	1,771	526
Year level of schooling					
Blank but applicable	70	8	17	27	18
Year 9 or less	2,081	213	307	974	587
Year 10 or more	11,972	3,017	5,037	3,201	717
Eligibility for public dental care					
Blank but applicable	21	13	3	4	1
Eligible	4,304	585	854	1,982	883
Ineligible	9,798	2,640	4,504	2,216	438
Dental insurance					
Blank but applicable	147	113	19	12	3
Insured	6,452	1,298	2,781	2,005	368
Uninsured	7,524	1,827	2,561	2,185	951
Dentate					
Dentate	12,861	3,237	5,247	3,541	836
Edentulous	1,262	1	114	661	486
Usually visit dentist					
Intentionally blank	1,295	18	123	666	488
Blank but applicable	39	9	13	12	5
For a check-up	7,067	1,845	2,756	1,975	491
For a dental problem	5,722	1,366	2,469	1,549	338

Appendix Table 5: Sample counts of examined people

		Age group (years)			
	All ages	**15–34**	**35–54**	**55–74**	**≥75**
All ages	**5,505**	**1,125**	**2,186**	**1,875**	**319**
Sex					
Male	2,183	378	829	829	147
Female	3,322	747	1357	1,046	172
Indigenous identity					
Blank but applicable	0	0	0	0	0
Non-Indigenous	5,418	1,105	2,147	1,848	318
Indigenous	87	20	39	27	1
Residential location					
Capital city	3,418	739	1,342	1,134	203
Other places	2,087	386	844	741	116
Year level of schooling					
Blank but applicable	17	1	4	10	2
Year 9 or less	692	72	118	385	117
Year 10 or more	4,796	1052	2,064	1,480	200
Eligibility for public dental care					
Blank but applicable	7	5	1	1	0
Eligible	1,696	235	383	873	205
Ineligible	3,802	885	1,802	1,001	114
Dental insurance					
Blank but applicable	45	31	7	6	1
Insured	2,633	451	1,110	968	104
Uninsured	2,827	643	1,069	901	214
Dentition					
Dentate	5,505	1,125	2,186	1,875	319
Edentulous	. .	. .	. .	. .	. .
Usually visit dentist					
Intentionally blank	6	2	3	1	0
Blank but applicable	15	1	6	7	1
For a check-up	2,997	636	1,125	1,054	182
For a dental problem	2,487	486	1,052	813	136

Appendix Table 6: Sample counts of periodontally examined people

	Age group (years)				
	All ages	15–34	35–54	55–74	≥75
All ages	**4,967**	**1,072**	**2,040**	**1,631**	**224**
Sex					
Male	1,959	368	786	709	96
Female	3,008	704	1,254	922	128
Indigenous identity					
Blank but applicable	0	0	0	0	0
Non-Indigenous	4,892	1,052	2,005	1,612	223
Indigenous	75	20	35	19	1
Residential location					
Capital city	3,065	705	1,253	969	138
Other places	1,902	367	787	662	86
Year level of schooling					
Blank but applicable	16	1	4	9	2
Year 9 or less	583	69	109	321	84
Year 10 or more	4,368	1,002	1,927	1,301	138
Eligibility for public dental care					
Blank but applicable	7	5	1	1	
Eligible	1,462	227	349	736	150
Ineligible	3,498	840	1,690	894	74
Dental insurance					
Blank but applicable	43	30	6	6	1
Insured	2,378	433	1,032	841	72
Uninsured	2,546	609	1,002	784	151
Dentition					
Dentate	4,967	1,072	2,040	1,631	224
Edentulous	. .	. .	. .	. .	. .
Usually visit dentist					
Intentionally blank	6	2	3	1	
Blank but applicable	13	1	6	5	1
For a check-up	2,708	613	1,052	920	123
For a dental problem	2,240	456	979	705	100

State and territory survey personnel

NSW	
Survey manager	Mr Gary Law, Dr Shanti Sivaneswaran
Appointment coordinator	Mr Mitchell Flynn, Ms Kawkab (Kazzie El-Souss)
Dentist examiners	Dr Christopher Harle, Dr Ilana Fisher, Dr Peter Hill, Dr Sue Buchanan, Dr Stephen Chui, Dr Maria Chmielowie, Dr Kartusha Hull, Dr Emily Kyaw, Dr Zhen Mashen, Dr Thomas Hasson, Dr Paul Kotala
Dental recorders	Ms Julie Plimmer, Ms Judy Miekle, Ms Lea Hope, Ms Rowena Palogan, Ms Michelle Woolfe, Ms Veronica Erdes, Ms Sally Newall, Ms Lexie McLaren, Ms Sudha Raju, Ms Muna Aldalo, Ms Racheal Moreau
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Dental recorders	Ms Julie Evans, Ms Julie Kleeson
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Survey manager	Dr Jill Davis
Appointment coordinator	Ms Tracey Watts, Ms Caroline Villaflor, Ms Vera McMahon
Dentist examiners	Dr Jean Cohen, Dr Vivian Mascarenh, Dr Andrew Lee
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Symbols

$	Australian dollars
. .	not applicable
%	per cent
–	nil
n.p.	not published because estimate is statistically imprecise
>	greater than
<	less than
≥	greater than or equal to
≤	less than or equal to

Abbreviations

AAP	American Academy of Periodontology
ABS	Australian Bureau of Statistics
AHMAC	Australian Health Ministers' Advisory Council
AIHW	Australian Institute of Health and Welfare
ARCPOH	Australian Research Centre for Population Oral Health
BRFSS	Behavioural Risk Factor Surveillance System
CAL	Clinical attachment loss
CATI	Computer-assisted telephone interview
CD	Census collectors' district
CDC	US Centers for Disease Control and Prevention
CEJ	Cemento-enamel junction

DHS	Department of Human Services, Melbourne
DMFT	Number of decayed, missing and filled permanent teeth
DoHA	Australian Government Department of Health and Ageing
DSRU	Dental Statistics and Research Unit
DT	Decayed teeth
DVD	Digital Versatile Disc
ERP	Estimated resident population
FT	Filled teeth
ICC	Intra-class correlation coefficient
IQR	Interquartile range
IRSAD	Index of Relative Socioeconomic Advantage/Disadvantage
MT	Missing teeth
NACOH	National Advisory Committee on Oral Health
NCHS	US National Center for Health Statistics
NDTIS	National Dental Telephone Interview Survey
NHANES	US National Health and Nutrition Examination Survey
NHMRC	National Health and Medical Research Council
NOHSA	National Oral Health Survey of Australia
NSAOH	National Survey of Adult Oral Health
PPD	Periodontal pocket depth
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
REC	Gingival recession
SEIFA	Socioeconomic Indices for Areas
WHO	World Health Organization

Place names

ACT	Australian Capital Territory
NSW	New South Wales
NT	Northern Territory
Qld	Queensland
SA	South Australia
Tas	Tasmania
UK	United Kingdom
US	United States
Vic	Victoria
WA	Western Australia

Glossary

95% confidence interval Defines the uncertainty around an estimated value. There is a 95% probability that the true value falls within the range of the upper and lower limits.

Absolute difference The difference between two values calculated by subtracting one value from the other.

Attachment loss The distance in millimetres measured from the edge of the enamel of a tooth to the gum tissue that is adherent to its root.

Birth cohort A group of people born during a particular period or year (also referred to as a generation).

Birth cohort analysis Analysis that evaluates changes within cohorts over time and between cohorts.

Calculus Hard deposit of mineralised material adhering to the tooth surface.

Calibration A procedure to promote standardisation between examiners performing the oral examinations.

Canine One of four 'eye teeth' positioned next to the incisors and used for tearing food.

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

Cemento-enamel junction Point on a tooth surface where the tooth crown joins the tooth root.

Census The Census of Population and Housing conducted every 5 years by the Australian Bureau of Statistics.

Complete tooth loss Loss of all natural teeth (also referred to as edentulism).

Coronal Pertaining to the crown of a tooth.

Crown The portion of tooth covered by white enamel that usually is visible in the mouth.

Dental attendance Behaviour related to the use of dental services.

Dental caries The process in which tooth structure is destroyed by acid produced by bacteria in the mouth. See dental decay.

Dental caries experience The cumulative effect of the caries process through a person's lifetime, manifesting as teeth that are decayed, missing or filled.

Dental decay Cavity resulting from dental caries.

Dental insurance Dental care is not covered under Australia's universal public health insurance vehicle, Medicare, and consequently people seeking cover can elect to carry private dental insurance.

Dentate Having one or more natural teeth.

Dentition The set of teeth. A complete dentition comprises 32 adult teeth.

Denture A removable dental prosthesis that substitutes for missing natural teeth and adjacent tissues.

DMFT An index of dental caries experience measured by counting the number of decayed (D), missing (M), and filled (F) teeth (T).

Edentulous A state of complete loss of all natural teeth.

Enamel Hard white mineralised tissue covering the crown of a tooth.

Epidemiology The study of the distribution and causes of health and disease in populations.

Erupted tooth A tooth that has emerged through the gums into the mouth.

Examination protocol Methods and guidelines for conducting standardised oral examinations conducted in a survey.

Extraction Removal of a natural tooth.

Fluoride A naturally occurring trace mineral that helps to prevent tooth decay.

Fluorosis Discolouration or pitting of the dental enamel caused by exposure to excessive amounts of fluoride during enamel formation.

Generation A group of people born during a defined period of time (also referred to as a birth cohort.).

Gingiva Gum tissue.

Gingivitis Redness, swelling or bleeding of the gums caused by inflammation.

Health care card A concession card issued by the Australian Government that entitles the holder to services including public dental care.

Incisor One of eight front teeth used during eating for cutting food.

Index of Relative Socioeconomic Advantage/Disadvantage (IRSAD) One of four indices measuring area-level disadvantage derived by the Australian Bureau of Statistics. The IRSAD is derived from attributes such as low income, low educational attainment, high unemployment and jobs in relatively unskilled occupations.

Indigenous identity A person who states that they are of Aboriginal and/or Torres Strait Islander descent is an Indigenous Australian.

Interproximal Between the teeth.

Intra-class correlation coefficient A statistical term referring to a measure of agreement between two or more examiners.

Mandible Lower jaw.

Maxilla Upper jaw.

Mean The arithmetic average of a set of values.

Molar One of 12 back teeth used in grinding food.

Natural teeth Refers to a person's own teeth as opposed to artificial teeth.

Orofacial pain Pain located in the face, jaw, temple, in front of the ear or in the ear.

Participation rate The proportion of people from whom survey information is collected from among the total number of people selected as intended study participants.

Periodontal disease Disease of the gums and other tissues that attach to and anchor teeth to the jaws.

Periodontal pocket A space below the gum line that exists between the root of a tooth and the gum surrounding that tooth.

Periodontal recession The shrinkage of gum tissue away from the tooth resulting in exposure of dental roots and creating the appearance of being 'long in the tooth'.

Periodontitis Disease of the gums caused by bacteria, characterised by swelling and bleeding of the gums and loss of tissue that attaches the tooth to the jaw.

Permanent teeth Adult teeth (secondary teeth).

Plaque A film composed of bacteria and food debris that adheres to the tooth surface.

Prevalence The proportion of people with a defined disease within a defined population.

Probing pocket depth The measured depth of the periodontal pocket.

Public dental care state- or territory-funded dental care available to adults with low income or other forms of social disadvantage.

Recorder A person, usually a dental assistant, who recorded the results of an oral examination onto a laptop computer.

Relative difference The difference between two values calculated as a ratio of one value divided by another.

Restoration A filling to repair a tooth damaged by decay or injury.

Retained root A residual fragment of tooth retained in the jaw after extensive decay or following incomplete extraction in which a tooth broke.

Root That part of the tooth below the crown which is anchored to the jaw

Root surface The surface of the root of a tooth.

Sampling bias A flaw in either the study design or selection of participants that leads to an erroneous interpretation.

Socioeconomic Indices for Areas (SEIFA) A set of four indices derived by the Australian Bureau of Statistics from population census data to measure aspects of socioeconomic position for geographic areas.

Socioeconomic position Descriptive term for a position in society and usually measured by attributes such as income, education, occupation or characteristics of residential area.

State/territory Geographic regions of Australia. The nation has six states and two territories.

Statistical significance An indication from a statistical test that an observed association is unlikely (usually less than 5% probability) to be due to chance created when a random sample of people is selected from a population.

Trend The general direction in which change over time is observed.

Unerupted tooth A tooth that has failed to emerge through the gums into the mouth.

Weights Numbers applied to groups of study participants to correct for differences in probability of selection and in participation.

Wisdom tooth One of four molars, each one positioned at the back of the mouth.

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List of tables

List of figures

List of boxes