

Our Oral Health

Key findings of the
2009 New Zealand Oral Health Survey

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MANATŪ HAUORA

Foreword

I am pleased to bring to you this report, *Our Oral Health*, presenting findings from the 2009 New Zealand Oral Health Survey.

Oral health is important for people's health and wellbeing – poor oral health can have physical and psychological impacts on their lives. This is the first national survey on oral health in New Zealand in over 20 years. It provides us with a wealth of reliable and up-to-date information about the oral health of New Zealanders of all ages.

This report represents a significant undertaking by a large group of people over a long period of time. I congratulate the research team and External Technical Advisory Group, and thank them for their time and commitment to this project. I especially wish to thank the 4906 New Zealanders who gave their time to take part in the survey – it would not have been possible without them.

This survey found that we have considerably better oral health than 20 years ago. People are keeping more of their natural teeth, and in better condition, than ever before. I'm encouraged as well to read that children and adolescents have very good access to oral health services. The report also points to where improvements can be made in the future, by identifying areas where disparities currently exist in oral health status in New Zealand.

The information in this report gives an excellent snapshot of oral health in New Zealand, including oral health status, protective behaviours such as toothbrushing, and the use of oral health services. These findings provide a solid evidence base for future work on oral health in New Zealand. However, this report cannot fully do justice to the richness of the information potentially available from the survey data. We encourage researchers, policy analysts, dental professionals and non-governmental organisations to undertake or commission their own more detailed analyses once the confidentialised data set is available.

Andrew Bridgman
Acting Director-General of Health
Ministry of Health

Authors

This report was written by Dr Robyn Haisman, Kylie Mason and Erin Holmes, with statistical analyses conducted by Robert Templeton and Dr Deepa Weerasekera. The authors are in the Health and Disability Intelligence Unit in the Ministry of Health.

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Dental examination team

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See Appendix D

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Executive Summary

Oral health refers to the health of our teeth and mouth, and encompasses more than just having good teeth and a nice smile. It is critical to the good health and wellbeing of children and adults. Oral diseases are among the most prevalent chronic diseases in New Zealand and represent a considerable burden on the public.

The 2009 New Zealand Oral Health Survey is the first nationwide survey to collect information on the oral health status of New Zealand adults and children in 21 years. The survey was carried out from February to December 2009, and consisted of face-to-face interviews and dental examinations. Overall, 4906 New Zealanders aged 2 years and over participated in the survey interview, with 3196 respondents completing a dental examination. The sample included 1961 Māori, 622 Pacific and 755 Asian respondents. The survey was a follow-up to the 2006/07 New Zealand Health Survey, and was a collaborative project between the Ministry of Health, Defence Dental Services of the New Zealand Defence Force, the New Zealand Dental Association, and the Accident Compensation Corporation (ACC).

This report presents the key findings of the 2009 New Zealand Oral Health Survey. Overall, it shows that the oral health of New Zealanders has improved over time. However, it also shows that there are still considerable gains to be made in many areas, particularly in terms of reducing oral health disparities in New Zealand. These results will inform the next steps in progressing the strategic vision for oral health in New Zealand: 'Good oral health for all, for life'.

Children and adolescents

Children and adolescents are a key priority group in the New Zealand oral health vision, and are eligible to receive free, publicly-funded oral health services up until the age of 18 years. The survey showed that large improvements in oral health have occurred for children since the 1980s, with the proportion of 12–13-year-olds who were caries-free almost doubling between 1988 (28.5%) and 2009 (51.6%). The average lifetime experience of dental decay in permanent teeth (DMFT)¹ had also significantly decreased (from 2.4 to 1.3 teeth) for this age group.

In 2009 children and adolescents had relatively good oral health, although it was worse in the older age groups, and there were disparities, particularly by ethnic group and level of socioeconomic deprivation.

¹ DMFT refers to the number of decayed (D), missing (due to dental decay or periodontal disease) (M) or filled (F) permanent teeth (T).

Oral health status

The oral health of most preschool children (aged 2–4 years) was relatively good, although some had dental caries (decay) in their primary teeth:

- four in five (79.7%) 2–4-year-olds were caries-free in their primary teeth
- one in seven (14.9%) had untreated coronal decay in at least one primary tooth
- this age group had, on average, 0.8 decayed, missing (due to dental decay) or filled primary teeth (ie, dmft = 0.8).²

Children aged 5–11 years have a mix of primary and permanent teeth:

- one in two (51.0%) were caries-free in their primary teeth and the majority (77.5%) were caries-free in their permanent teeth
- one in six (17.3%) had untreated coronal decay in at least one primary tooth, while only a very small proportion (2.7%) had untreated coronal decay in one or more permanent teeth
- this age group had, on average, 1.9 decayed, missing or filled primary teeth, and 0.5 decayed, missing or filled permanent teeth.

Adolescents aged 12–17 years had worse oral health than the younger age groups:

- two in five (44.7%) were caries-free in their permanent teeth
- about 12.7% had untreated coronal decay on at least one permanent tooth
- this age group had, on average, 1.9 decayed, missing or filled permanent teeth.

One in six (16.0%) children and adolescents aged 7–17 years had experienced trauma to one or more of their upper six front permanent teeth.

Protective behaviours

The majority of children did not meet the Ministry of Health recommendation of brushing teeth twice a day using fluoride toothpaste:³

- about 63.5% of children and adolescents aged 2–17 years brushed their teeth at least twice a day (with or without toothpaste), with little variation by age group
- however, only 43.0% of 2–17-year-olds brushed twice daily with fluoride toothpaste;³ 2–4-year-olds were less likely to do so (15.3%) than 12–17-year-olds (57.1%).

The proportion of children who had visited a dental professional in the last year was highest among children aged 5–11 years (90.3%). The proportion was lower among 12–17-year-olds (79.9%) and lowest for preschool children aged 2–4 years (59.7%).

² dmft refers to the number of decayed (d), missing (due to dental decay) (m) or filled (f) primary teeth (t).

³ Fluoride toothpaste refers to toothpaste of 1000 ppm fluoride or greater.

Disparities

Significant disparities still exist in oral health status and access to services for children and adolescents, particularly for those of Māori and/or Pacific ethnicity.

Māori and Pacific children and adolescents were less likely to have accessed oral health services in the previous year than non-Māori and non-Pacific children and adolescents, respectively. They were also less likely to have caries-free primary teeth. Māori were less likely to meet toothbrushing recommendations than non-Māori.

Children and adolescents in the most deprived areas were less likely to meet toothbrushing recommendations and had more missing primary teeth due to decay, than those in the least deprived areas. However, past-year access to oral health services did not differ by neighbourhood deprivation.

Adults

Oral health status

Oral health in New Zealand adults has continued to improve over time, with particularly dramatic improvements since 1988 in:

- the prevalence of edentulism (total tooth loss), particularly among 35–44-year-olds (12.8% in 1988, compared with 1.7% in 2009) and 65–74-year-olds (61.6% in 1988, compared with 29.6% in 2009)⁴
- the prevalence of missing one or more teeth due to pathology (ie, dental decay or periodontal disease), with the prevalences almost halving among 20–24-year-olds and 35–44-year-olds from 1988 to 2009
- the lifetime experience of dental decay, which almost halved in people aged 20–24 and 35–44 years from 1988 to 2009.

In 2009 the majority (90.6%) of New Zealand adults aged 18 years and over had some natural teeth (they were dentate), which means about one in eleven (9.4%) were edentulous (had lost all of their natural teeth). Most (88.6%) dentate adults had a functional dentition (defined as 21 or more natural teeth).

However, within this picture of improved tooth retention, there were concerning levels of untreated dental decay. Among dentate adults:

- one in three (35.3%) had untreated coronal decay on one or more teeth
- one in eleven (9.5%) had one or more decayed root surfaces
- the overall lifetime experience of dental decay (the DMFT score) was 13.9 (comprising 0.8 decayed, 4.6 missing teeth and 8.5 filled teeth)
- about 25.4% had experienced pain in their mouth, jaw or face in the previous 4 weeks.

⁴ Prevalences refer to self-reported edentulism; see Chapter 9 for more details.

A large proportion of dentate adults were affected by periodontal disease:

- one in three (33.5%) had periodontal pocketing of 4 mm or more on at least one tooth, while 10.5% had moderate pocketing (of 5 mm or more) and 5.1% had deep pocketing (of 6 mm or more)
- one in two (49.9%) had loss of attachment of 4 mm or more at one or more sites, 27.5% had moderate loss of attachment of 5 mm or more, and 13.4% had severe loss of attachment of 6 mm or more.

Also, one in four (23.4%) dentate adults had experienced trauma to one or more of their upper six front teeth.

New Zealanders have poorer oral health than Australians across a range of clinical oral health indicators. When standardising for age, New Zealand adults were significantly more likely than Australian adults to have lost all of their natural teeth. Among dentate adults, New Zealanders were significantly more likely than Australians to have untreated coronal decay, periodontal pocketing of 4 mm or more or loss of periodontal attachment of 4 mm or more.

Protective behaviours

Two in three (65.3%) New Zealand adults brushed their teeth with fluoride toothpaste at least twice a day, with little variation by age group.

The majority of adult New Zealanders usually used oral health services when they had a dental problem rather than visiting for routine dental check-ups.

- Two in five (38.9%) adults reported usually visiting a dental professional for a check-up rather than for a dental problem.
- One in two (47.1%) adults had visited a dental professional in the previous year.

Cost was a key barrier to accessing oral health services.

- 44.1% of adults had avoided dental care due to cost in the previous year.
- 25.3% had gone without recommended routine dental treatment due to cost in the previous year.

Having no perceived dental problems was also cited as a major reason for not visiting in the last year.

Dentate adults who usually only visited for dental problems had worse oral health over a range of clinical and self-reported indicators, including:

- having over twice the number of decayed teeth, and more teeth missing due to pathology (ie, dental decay or periodontal disease), on average
- having more severe lifetime dental decay experience
- being twice as likely to have experienced oral health impacts on their quality of life in the past year.

There was clear evidence of unmet need for dental care from the survey:

- 55.3% of adults reported feeling that they did not see a dental professional often enough
- 45.9% felt they currently needed dental treatment.

There was the large decrease since 1988 in the proportion of people who had visited a dental professional in the past year, with decreases among 20–24-year-olds (from 54.7% in 1988 to 33.0% in 2009) and 35–44-year-olds (from 55.8% to 43.3%). Dental attendance had increased for the older age group of 65–74-year-olds (from 28.8% to 47.7%). It should be noted that over this time period the proportion of 65–74-year-olds who were dentate significantly increased.

New Zealand adults were significantly less likely to have visited a dental professional in the last 12 months than Australian adults, when standardising for age.

Age groups

Young adults, especially those aged 25–34 years, had worrying levels of dental disease. Nearly one in two (46.5%) 25–34-year-old dentate adults had untreated coronal decay on one or more teeth, the highest prevalence in any adult age group in New Zealand or Australia. They also had the highest mean number of decayed coronal surfaces per person of any age groups in New Zealand or Australia (at 2.0 decayed surfaces per person on average). The prevalence of having one or more teeth missing due to pathology was significantly higher among 25–34-year-olds (34.7%) than among 18–24-year-olds (8.8%). Furthermore, 25–34-year-olds had a similar prevalence of periodontal pocketing (including the prevalence of deep pocketing) to older age groups.

There was also a high degree of unmet need among younger adults, with cost identified as a key barrier to access. Only 36.9% of 18–24-year-olds and 44.6% of 25–34-year-olds had visited a dental professional in the previous year, compared with 79.9% of 12–17-year-olds. The majority of 25–34-year-olds felt that they currently needed dental treatment (59.5%) and had avoided the dentist due to cost in the past year (61.7%).

Dentate adults aged 45–54 years experienced considerably worse oral health than 35–44-year-olds, with the lifetime experience of dental decay (DMFT index score) being significantly different between 35–44-year-olds (10.0) and 45–54-year-olds (18.3). There was a statistically significant difference in the prevalence of root decay between 35–44-year-olds (5.0%) and 45–54-year-olds (13.4%). There was also a significant difference in the prevalence of loss of attachment for all three measures between 35–44-year-olds and 45–54-year-olds.

Older adults had experienced relatively high levels of untreated decay and missing teeth. Edentulism was strongly related to age, with 39.6% of adults aged 75 years and over having lost all of their natural teeth. Among dentate adults aged 65 years and over, only one in two had a functional dentition, and the mean DMFT was over 24.0. For dentate adults aged 75 years and over, the prevalence of untreated coronal decay was similar to other age groups, while the prevalence of untreated root decay was the highest of all age groups (29.3%), as was the prevalence of severe loss of attachment (41.3%).

Men and women

Men had poorer oral health than women over a range of factors, particularly untreated coronal and root decay, periodontal pocketing and loss of attachment, as well as self-care behaviours such as brushing teeth twice daily and visiting dental professionals for check-ups.

Disparities in oral health status and access to services

In 2009, key population groups who experienced disparities in oral health outcomes and access to services included Māori, Pacific people, and people living in high deprivation areas. These population groups generally had higher levels of untreated decay and missing teeth, poorer self-reported oral health, and higher prevalences of having experienced one or more oral-health-related quality-of-life impacts. Furthermore, they were less likely to have visited a dental professional in the previous year or to usually visit for check-ups, and were more likely to report cost being a major barrier to accessing services and receiving treatment.

Māori

Māori experienced significant disparities in oral health compared with non-Māori, in particular with regard to missing teeth and untreated decay. Māori adults were almost twice as likely to be edentulous as non-Māori. Among dentate adults, Māori had higher levels of partial tooth loss and untreated coronal and root decay, and more severe lifetime dental decay experience (higher DMFT) than non-Māori adults. They also had a higher prevalence of periodontal pocketing and loss of attachment, and were significantly less likely to have a functional dentition.

Māori adults also experienced significant access issues. They were less likely to have visited a dental professional in the past year, less likely to visit regularly for check-ups, more likely to have avoided dental care in the past year due to cost, and more likely to have forgone recommended routine dental treatment due to cost.

Pacific people

Pacific adults had poorer oral health for some clinical and self-report indicators than non-Pacific adults. On average, Pacific adults had more teeth with untreated decay, and more teeth missing due to decay or periodontal disease, than non-Pacific adults. Also, Pacific adults had a higher prevalence of pocketing at all three measured depths, and a higher prevalence for the deeper measurements of loss of attachment. However, at the same time, Pacific adults had more sound teeth than non-Pacific adults and a lower mean number of decayed, missing or filled teeth (DMFT).

The use of oral health care services in the previous year was much lower among Pacific than non-Pacific adults. Pacific people were less likely to have visited a dental professional in the past year. They were only about half as likely as non-Pacific adults to usually visit the same dentist for dental care, or to usually visit a dental professional for a check-up. Cost was an important barrier to visiting the dentist for Pacific people, and to receiving recommended routine dental treatment.

People living in high deprivation areas

There are inequalities by socioeconomic status in oral health status, with large disparities in dental decay experience. People living in areas of high deprivation were almost three times as likely to have completely lost all their teeth, and were much more likely to have teeth with untreated coronal decay or teeth missing due to pathology, compared with people in areas of low deprivation.

Furthermore, access to oral health care services was low for people living in areas of higher deprivation, with cost identified as a key reason for not visiting the dentist in the past year, and also for going without recommended routine dental treatment.

People living in areas with fluoridated water

Although this survey was not designed as an in-depth water fluoridation study, data were examined for any protective effect of fluoride against dental decay, as well as for prevalence and severity of dental fluorosis (a possible side-effect of having too much fluoride during early tooth development). Overall, children and adults living in fluoridated areas had significantly lower lifetime experience of dental decay (ie, lower dmft/DMFT) than those in non-fluoridated areas. There was a very low overall prevalence of moderate fluorosis (about 2%; no severe fluorosis was found), and no significant difference in the prevalence of moderate fluorosis (or any of the milder forms of fluorosis) between people living in fluoridated and non-fluoridated areas.

These findings support international evidence that water fluoridation has oral health benefits for both adults and children. In addition, these findings should provide reassurance that moderate fluorosis is very rare in New Zealand, and that the prevalence of any level of fluorosis was not significantly different for people living in fluoridated and non-fluoridated areas.

Conclusion

This report has presented the most up-to-date and comprehensive information on the oral health status of New Zealanders. Overall, the oral health of New Zealanders has improved considerably over the past 20–30 years. However, New Zealand remains a relatively high-caries population. Dental decay remains the most prevalent chronic (irreversible) disease in New Zealand, and there are still disparities in oral health in New Zealand.

Free, publicly-funded oral health care is available for all New Zealand children, with the aim of having equitable access to oral health care and good oral health status among children. Even so, the survey found disparities, with poorer access among Māori and Pacific children, and worse oral health outcomes among these children and among those living in areas of higher socioeconomic deprivation. Attention needs to be focused on addressing these disparities.

Among adults, poorer oral health and lower dental service attendance rates were found among men, younger adults (aged 25–34 years), Māori, Pacific people, and people living in areas of higher deprivation. Given that cost was identified as an important barrier to accessing services, this will be a crucial area for attention in the future. Furthermore, evidence from the survey suggests that a substantial proportion of adults in all age groups remain caries-active and experience a high prevalence of coronal and root decay, although adults are retaining increasing numbers of natural teeth into older age. Increased tooth retention, combined with continued disease activity, will have an impact on the demand on the oral health workforce in the future.

These key findings from the 2009 New Zealand Oral Health Survey and the comparisons with earlier surveys, alongside other data sources, will provide valuable information for the further development of oral health policies and programmes, including New Zealand's strategic vision for oral health: 'Good oral health for all, for life'.

Chapter 1: Introduction

Oral health refers to the health of our teeth and mouth, and encompasses more than just having good teeth and a nice smile. It is critical to the good health and wellbeing of children and adults. Oral diseases are among the most prevalent chronic diseases in New Zealand and represent a considerable burden on the health of the public.

The strategic vision for oral health in New Zealand is ‘Good oral health for all, for life’ (Ministry of Health 2006b). The vision is for high-quality oral health services that promote, improve, maintain and restore good oral health, and that are proactive in addressing the needs of those at greatest risk of poor oral health. The vision also recognises that oral health is integral to general health and wellbeing throughout life. The 2009 New Zealand Oral Health Survey (NZOHS) is an important source of evidence for this strategic vision.

This report presents key findings from the 2009 NZOHS. This is the first nationwide survey in 21 years to collect comprehensive information on levels of oral disease, perceptions of oral health and patterns of dental care since previous oral health surveys in 1976 and 1988.

In particular, this report presents key clinical and self-reported findings from the 2009 NZOHS, focusing on oral health status, protective factors and service utilisation among the New Zealand population. Results are presented by sex, age group, ethnic group, socioeconomic deprivation and, for adults, whether people usually visit a dental professional for a check-up or for a dental problem. All results have been weighted to represent the resident population living in permanent private dwellings. Summary tables of key findings can be found in Appendix A.

Overview of the survey

The 2009 NZOHS was a national representative survey of 4906 New Zealanders aged 2 years and over, with dental examinations completed for 3196 respondents. The survey was carried out from February to December 2009, and was a follow-up to the most recent general health survey, the 2006/07 New Zealand Health Survey. The sample included 1431 children and adolescents aged 2–17 years and 3475 adults aged 18 years and over, and in total included 1961 Māori, 622 Pacific and 755 Asian respondents.

The 2009 NZOHS was made up of two components: a computer-assisted face-to-face interview and a dental examination. The questionnaire measured self-reported oral health status, risk and protective factors for oral health outcomes and the use of oral health care services, among the usually resident New Zealand population living in private dwellings. Information on oral disease (particularly dental decay and periodontal disease) was recorded during dental examinations of the teeth and gums conducted by survey dentists.

The survey was a collaborative project between the Ministry of Health, Defence Dental Services of the New Zealand Defence Force, the New Zealand Dental Association and the Accident Compensation Corporation (ACC). The survey interviews were conducted by trained interviewers from CBG Health Research Ltd, while the dental examinations were conducted by qualified and registered dentists who were specially trained for the survey.

Audience

This report will be of interest to oral health policy makers, dental professionals, oral health care providers, the New Zealand Dental Association, Te Ao Marama (the Māori Dental Association), the New Zealand Dental Therapists Association, the New Zealand Dental Hygienists' Association, District Health Boards (DHBs), universities, and those interested in improving oral health and reducing oral health inequalities.

The Ministry of Health will use the 2009 NZOHS findings for a number of purposes, including:

- to monitor the oral health of New Zealanders
- to inform the development of the strategic vision, oral health policy and service delivery
- to set oral health targets
- to purchase service and health promotion programmes that aim to improve oral health overall and reduce social inequalities in oral health.

Given that publicly-funded oral health services are mainly focused on children and adolescents, the survey findings will also be used as a baseline to monitor the current publicly-funded system, as well as the Government's current investment of \$116 million in capital expenditure and \$36 million per annum in additional operating funding to re-orient child and adolescent oral health services.

The survey findings may also be used by: professional bodies, to support programmes designed to raise public awareness about how to maintain healthy teeth and gums; DHBs, to enhance and support programmes and services (such as oral health education and promotion), and for patient advice and education; and universities, to understand the training needs of the future workforce. The survey data also provide considerable opportunities for researchers at universities and other institutions to conduct further oral health research over a wide range of subjects. In particular, the linking of the 2009 NZOHS and the 2006/07 NZHS will enable further investigation of the associations between oral health and general health.

Outline of this report

This report presents key clinical and self-reported findings from the 2009 NZOHS.

- Chapter 2 provides a background to this report, including recent oral health research in New Zealand.
- Chapter 3 summarises the methods used in the survey and data analysis.
- Chapters 4 and 5 present clinical findings for adults, and children and adolescents.
- Chapter 6 examines protective behaviours (toothbrushing and water fluoridation).
- Chapter 7 describes the use of oral health services, and barriers to accessing these services.
- Chapter 8 presents perceptions and impacts of oral health status.
- Chapter 9 examines changes in oral health status over time.
- Chapter 10 compares the results from the 2009 NZOHS with the Australian National Survey of Adult Oral Health 2004–06.
- Chapter 11 summarises and discusses key findings from this report.

A glossary of key terms, and appendices with summary tables of results and other useful information, can be found at the end of the report.

Results for children and adolescents aged 2–17 years are presented separately from those for adults because they reflect oral health outcomes within the publicly-funded system.

Chapter 2: Background

This chapter provides background information on oral health, sources of oral health data, New Zealand research on oral health (including the results of previous national oral health surveys), disparities in oral health in New Zealand, and water fluoridation.

What is oral health?

Overview of oral health

The World Health Organization (WHO) defines oral health as:

a state of complete physical, mental and social wellbeing, not merely the absence of tooth decay, oral and throat cancers, gum disease, chronic pain, oral tissue lesions, birth defects ... and other diseases and disorders that affect the oral, dental and craniofacial tissues (cited in Beaglehole et al 2009).

Disorders of the teeth and mouth are a common cause of discomfort, pain, disability and poor self-image, and they can be fatal. Poor oral health can affect people physically and psychologically, influencing how they enjoy life, look, speak, chew, taste food and socialise, as well as their feelings of social wellbeing.

Oral disease and its consequences (such as embarrassment, pain and self-consciousness) can have a profound effect on an individual's quality of life (Kandelman et al 2008; Lawrence et al 2008) and their ability to gain employment (Hyde et al 2006). Furthermore, millions of school and work hours are lost globally due to pain and infection from dental diseases or from the time required treating them (Beaglehole et al 2009; Health Canada 2010). Caries can also affect children's development, school performance and behaviour, as well as families and society in general (Casamassimo et al 2009).

In addition, an emerging body of evidence suggests that poor oral health affects general health. In particular, research has shown associations between poor oral health (particularly periodontal disease) and systemic diseases such as diabetes (Teeuw et al 2010), respiratory diseases (Azarpazhooh and Leake 2006; Scannapieco et al 2003), heart disease (Bahekar et al 2007; Ford et al 2007) and premature, low birthweight babies (Heimonen et al 2009; Khader and Ta'ani 2005; Xiong et al 2006). Oral health is integral to general health, primarily because oral diseases have risk factors in common with other chronic diseases, and because, in the case of periodontal diseases, of their inflammatory and infectious nature (Petersen et al 2005; Seymour 2007; Williams et al 2008). Meta-analyses have found that periodontal disease and cardiovascular disease are associated (Janket et al 2003; Khader et al 2004), and that people with periodontal disease may have greater risk of developing coronary heart disease (Bahekar et al 2007), although confirmatory evidence from longitudinal studies has yet to emerge. Additionally, meta-analyses have suggested that periodontal treatment leads to an improvement in glycaemic control in type-2 diabetic patients for at least three months (Teeuw et al 2010).

Oral health is an important global public health issue, as disorders and diseases of the teeth and mouth remain the most common of any of the long-term conditions (Beaglehole et al 2009; Ministry of Health 2008c; Petersen 2003). They are largely preventable, their impact on individuals and society is high, and they are expensive to treat (Petersen 2003; Sheiham 2005). Two current major threats to natural teeth are dental caries and periodontal disease, which have historically been considered the most important global oral health burdens (Petersen 2003; Petersen et al 2005; Sheiham 2005).

What is dental caries?

Dental caries (dental decay) is a chronic disease of the teeth, which affects humans of all ages and is moderated by diet. It is a process in which the hard mineral structure of teeth is dissolved by the acids produced by bacteria in dental plaque. Dental plaque is a biofilm that forms naturally on teeth and is colonised by bacteria found in the mouth. High sugar intake increases the number of decay-causing bacteria and the production of destructive acid.

Dental caries progresses along a continuum, reflecting the degree of demineralisation of the tooth structure. In the early stages, dental caries can be prevented, and even reversed, through altering the dental environment by reducing plaque, reducing sugar exposure, and the use of protective modifiers such as fluoride, and treatment options such as fluoride varnishes, fissure seals and preventive restorations. These measures can reduce the need for fillings or restorations.

However, if dental caries progresses unchecked, the process becomes irreversible and chronic, resulting in a cavity on the crown of the tooth or a softening of the root surface. Once a cavity has formed, a filling or other restoration is needed to restore the form and function of the tooth. If dental caries is left untreated, pain and infection may occur, and the tooth may ultimately be lost.

Risk factors and indicators for dental caries include socioeconomic deprivation, suboptimal fluoride exposure, ethnicity, poor oral hygiene, prolonged infant bottle feeding, poor family dental health, enamel defects, eating disorders, irregular dental care, a high sugar diet, a high carbohydrate diet (in people with complex medical conditions), active orthodontic treatment, and low salivary flow (New Zealand Guidelines Group 2009).

Key ways of preventing dental decay include brushing teeth twice a day with fluoride toothpaste to remove dental plaque, limiting the consumption of sugary food and drinks, and drinking fluoridated water (Beaglehole et al 2009).

What is periodontal disease?

Periodontal disease includes conditions caused by bacterial infection from dental plaque, and is characterised by inflammation of the gums and loss of the tissues that support the natural teeth, including the bone.

Gingivitis (inflammation of the gums) occurs in response to the bacteria in dental plaque that accumulates around the necks of the teeth, near the gum line. It is painless, characterised by redness, swelling or bleeding of the gums, and was not assessed in this survey.

Chronic periodontitis is also caused by a bacterial infection, and occurs when inflammation of the gums extends, leading to progressive loss of the ligament and bone that support the teeth (in its severe forms, the teeth may become loose and may even be lost). Periodontal disease can cause a variety of symptoms, ranging from bleeding gums to bad breath, abscesses and loose teeth. These conditions are usually painless until the disease process has reached an advanced stage. If left untreated, tooth loss may result.

The main cause of periodontal disease is the bacteria in dental plaque, which cause a destructive response in the periodontal tissues (Loesche 2007). If plaque on the necks of the teeth is not removed regularly, it has the potential to accumulate below the gums, placing the periodontal tissues at greater risk of periodontitis.

The biological processes involved in periodontal disease are complex, with several other factors potentially contributing to individual risk, including a complex immune response, various environmental factors and a person's genetic characteristics (Persson 2008). Smoking is a key behavioural risk factor for periodontal disease (Gelskey 1999; Johnson and Hill 2004), with studies also showing that smoking cessation may be associated with a relatively rapid improvement in the periodontal tissues (Thomson et al 2007).

Daily tooth brushing is recommended to remove plaque before it hardens and builds up below the gum line. Other key ways to reduce the risk of periodontal disease include quitting smoking and regularly visiting a dental professional (Beaglehole et al 2009).

The New Zealand oral health system

Oral health policy

The document *Good Oral Health for All, for Life* presents the overall vision and action areas that are the focus of oral health policy work from 2006 to 2016 (Ministry of Health 2006b). The vision is for high-quality oral health services that promote, improve, maintain and restore good oral health, and that are proactive in addressing the needs of those at greatest risk of poor oral health. Furthermore, the vision recognises that oral health is integral to general health and wellbeing throughout life. The overall objective of the vision is to eliminate oral health inequalities.

The strategic vision focuses on four key groups:

- children and adolescents
- people experiencing inequalities in outcome (eg, Māori, Pacific and low-income populations)

- older adults
- people of all ages with physical, intellectual, behavioural or cognitive disabilities, or who are medically compromised.

The strategic vision for oral health is guided by other population strategies, including He Korowai Oranga (the Māori Health Strategy), the Health of Older People Strategy, the New Zealand Disability Strategy, and Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2010–2014.

The vision is currently a work in progress, based on evidence available in 2006. The vision acknowledges that there is a lack of data for many population groups, and that more research is required to build the oral health evidence base. The 2009 New Zealand Oral Health Survey (NZOHS) is a key source of information about the oral health status, behaviours and service utilisation of New Zealand adults and children, to progress the next steps of the strategic vision.

Oral health services in New Zealand

In New Zealand, oral health services are a mixture of privately-funded and government-funded services. Oral health care for most adults is performed by private oral health care professionals on a user-pays basis. Public agencies involved in the provision of funding for oral health services include the Ministry of Health, DHBs, the Accident Compensation Corporation (ACC), Work and Income (a service unit in the Ministry of Social Development), the Department of Corrections, and the Ministry of Defence. Government-funded oral health services are mainly provided through DHBs and contracted dentists and dental providers.

Free or partially publicly-funded basic oral health care is available for the following groups:

- children and adolescents (aged 0–17 years)
- some low-income adults (eg, Community Services Card holders) (where capacity allows)
- special needs and medically compromised patients who cannot access care in a community setting
- prisoners
- children, adolescents and adults who incur dental injuries through accidents.

Children and adolescents are eligible to receive free basic oral health services from birth up to the day before they turn 18 years of age. For children from birth to 12–13 years (Year 8 at school), services are provided through school- and community-based clinics. For adolescents from Year 9 (13–14-year-olds) until their 18th birthday, services are mainly provided by private dentists under the Combined Dental Agreement with DHBs.

Child and adolescent oral health services are currently being re-oriented to a strengthened 'community-based' oral health care system (Community Oral Health Services), to provide seamless care for young people from birth to 18 years of age. This change aims to make oral health a more visible and integrated part of primary care, and to ensure that young people have access to all elements of primary oral health care through Well Child services, school dental clinics, Māori and Pacific health providers, private dental practitioners, health promoters and educators, and primary health organisations (PHOs) (Ministry of Health 2006b). Services have also been substantially strengthened with an investment of \$116 million for a new and flexible infrastructure, including fixed-site and mobile units, equipment and workforce. Services have been re-oriented to focus more on prevention and oral health promotion rather than 'drilling and filling'. The investment was fully agreed with DHBs in 2009 and implementation will continue until 2013.

In addition to services for children and adolescents, DHBs also provide hospital services for people with special needs who are most appropriately treated in a hospital setting or who cannot access appropriate dental care in the community, and, where capacity allows, services for low income adults, such as Community Services Card holders. DHBs also contract with individual dentists, generally for adolescents and for care beyond the scope of dental therapists, but, in some cases, to provide subsidised dental services for low income adults.

In addition, under the ACC regulations, individuals can seek treatment for dental injuries if they satisfy the conditions for ACC cover. Work and Income also provides income support to individuals who need emergency dental treatment for pain relief, although orthodontic services and regular dental care are not covered under this arrangement. Individuals who satisfy the conditions for assistance may be able to receive Special Needs Grants, Advance Payments of Benefits, or Recoverable Assistance Payments towards the urgent treatment of dental problems. Finally, the Department of Corrections contracts private dentists to provide basic pain relief services for prisoners on a fee-for-service basis.

The total system expenditure on oral health services was estimated at over \$1 billion in the year ending June 2008, comprising \$912 million in private expenditure and \$178 million in public expenditure (Chua 2009).

Māori oral health services

Māori oral health must be a focus of the delivery of DHBs' oral health services, to make services and strategies consistent with He Korowai Oranga, the Māori Health Strategy.

In addition to the Government's policies and commitment to improving Māori oral health, organisations involved in oral health practice and education have also instituted policies to address Māori oral health issues. For example, Te Ao Marama (the New Zealand Māori Dental Association) was established in 1996. In 1999 the New Zealand Dental Association, the professional body representing dentists in New Zealand, identified Māori oral health as a key issue and set specific goals and targets for the profession to work towards in partnership with Māori (New Zealand Dental Association Goals Committee 1999). The University of Otago's Māori Strategic Framework

(2007–2012) highlights the University's determination to proactively contribute to Māori development and the realisation of Māori aspirations, and the Faculty of Dentistry held its first hui on oral health in 2010.

Furthermore, Māori health providers have developed and provided oral health services (Mauri Ora Associates 2004; Public Health Advisory Committee 2003; Robson and Harris 2007). A review of 16 Māori health providers with oral health contracts showed that these providers addressed child oral health at a number of levels, including enrolment, attendance and treatment (Mauri Ora Associates 2004). Moreover, they combined *oranga niho* (oral health) services with other health services, in an integrated approach that supported *whānau ora*. Māori providers also provided *kaupapa Māori* services that made Māori more comfortable when receiving oral health treatment. These services delivered additional (but related) services (such as transport, follow-up of missed appointments, and advocacy for Māori clients) to overcome barriers to health care, and were often located in high-needs areas such as low-decile schools and highly deprived areas, as well as having a predominantly Māori workforce (Mauri Ora Associates 2004; Robson and Harris 2007).

New Zealand data sources for oral health

Strategic visions, policies and programmes are based on available evidence. Prior to the 2009 NZOHS, there were two national oral health surveys, in 1976 and 1988, which have provided some of the key evidence on oral health in New Zealand. Other studies have also provided more recent evidence.

Previous national oral health surveys

The first national oral health survey was the 1976 Survey of Adult Oral Health and Attitudes to Dentistry in New Zealand (SAOH). The survey covered adults aged 15 years and over, and included a dental examination and short questionnaire (Cutress et al 1979). The survey was commissioned by the Medical Research Council of New Zealand, following the earlier World Health Organization International Collaborative Study of selected age groups in Canterbury (Hunter and Davis 1982). The survey found a high prevalence of edentulism and a heavily filled dentition among New Zealand adults (Cutress et al 1979). As soon as the initial results of the survey were available, a symposium was held in Dunedin, in which all of the information was presented and discussed. Fifteen months later, in 1978, a national workshop was held in Rotorua to review the state of oral health and to formulate guidelines for the future development of dental services. The dental profession agreed to a number of goals, including adopting simple preventive-care measures, reducing the prevalence of dental disease at specific ages, and improving the co-ordination and delivery of dental services (Hunter 1998).

The second national oral health survey of the New Zealand population was the 1988 World Health Organization Study of Oral Health Outcomes (SOHO), which was the New Zealand section of the nine-country WHO Second International Collaborative Study (ICS II) (Hunter et al 1992). The New Zealand section was undertaken by the Department of Health in late 1988, and was limited to Form 2 children (aged 12–13 years) and three key adult age groups: 20–24 years, 35–44 years and 65–74 years. The survey included dental examinations and a questionnaire. This survey found a much improved level of oral health in New Zealand since 1976, with a low level of treatment need (Hunter et al 1992). These findings confirmed that work achieved after the 1978 workshop had been successful in improving oral health in New Zealand.

Between these two surveys, two other national surveys of child oral health (on five-year-olds and 12–13-year-olds) were conducted in 1977 and 1982 (Hunter 1984a; Hunter 1984b).

Other data sources

Several national surveys have also included self-reported oral health information, including the 2002/03 and 2006/07 New Zealand Health Surveys, and Youth'07, a survey of New Zealand secondary school students in 2007. In addition, School Dental Service data are collected nationally on five-year-olds and Year 8 children (those aged 12–13 years), and reported by the Ministry of Health. Data are available since 1990, with ethnicity data available since 2003 (Ministry of Health 2009b).

Furthermore, evidence about the natural history of oral disease has emerged from the Dunedin Multidisciplinary Health and Development Study. This longitudinal study is following a cohort of over 1000 people born in Dunedin in 1972/73, every few years throughout their life, with the most recently completed assessments being at age 32 years (in 2002/03). The age 38 years assessments are currently being conducted.

New Zealand oral health status

This section provides an overview of the current evidence and evidence gaps, in particular focusing on dental caries, periodontal disease, tooth loss and use of oral health services. This summary provides a context for the findings of the 2009 NZOHS.

Dental caries

Very young children

Children are at risk of dental caries as soon as their teeth begin to break through the gum (around the age of six months). Preventing dental caries in very young children has major benefits. A particularly virulent form of dental caries is early childhood caries (ECC) (Davies 1998). Despite being largely preventable, ECC is one of the most common and costly diseases of childhood (Mouradian 2001). The short-term consequences of untreated ECC are pain, toothache, infection and abscesses. ECC is difficult to manage in the dental surgery, and may require antibiotics, general anaesthesia and hospital admission (Kilpatrick et al 2008).

A systematic review in New Zealand recently identified pre-term birth, a history of neonatal intubation, poor maternal nutrition and exposure to infections as key risk factors for developmental defects of enamel (DDE) in primary teeth, which are associated with ECC (Kilpatrick et al 2008). Furthermore, since ECC has its origins in the first year of life, there was also evidence to support interventions that target maternal oral health directly, or the child's oral health through the mother, in an effort to reduce ECC.

Overall, very little information is known about the oral health of preschool children in New Zealand.

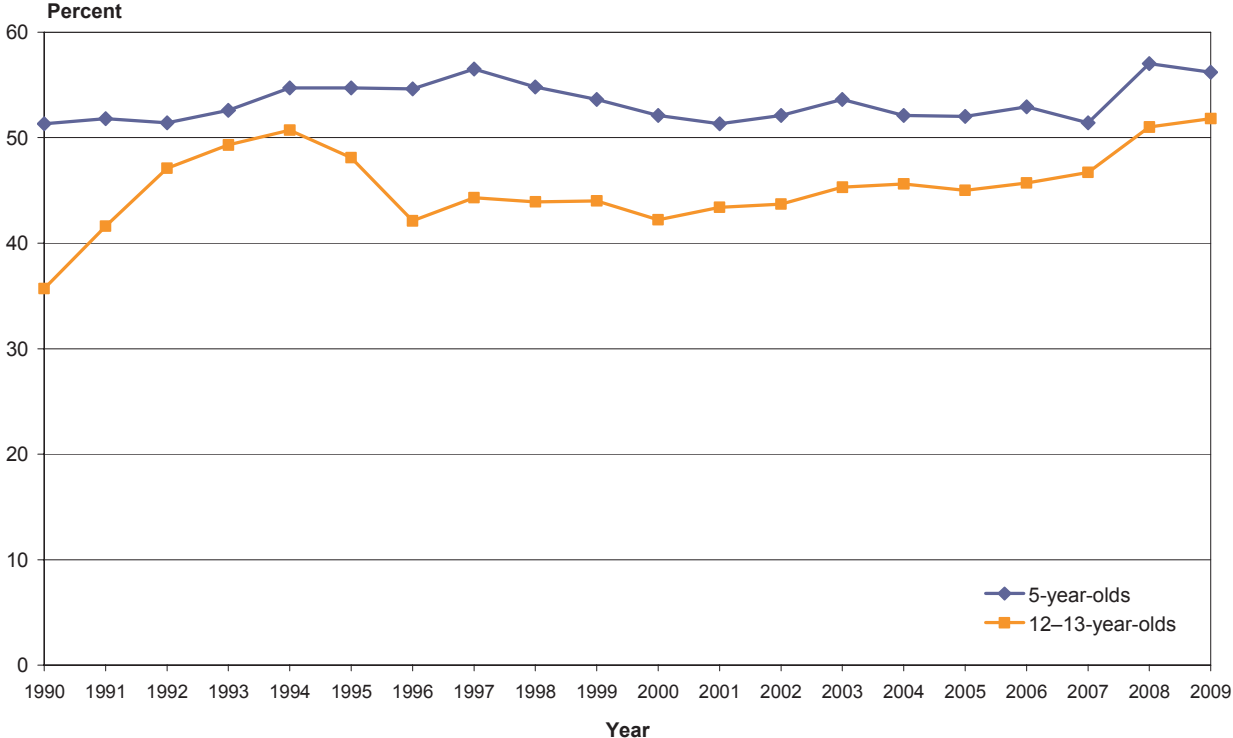
Primary school children

Worldwide, caries is the most common childhood disease (Beaglehole et al 2009; Petersen et al 2005). In the United States, tooth decay is the single most common childhood disease – five times more common than asthma (US Department of Health and Human Resources 2000). Despite great improvements in the oral health of populations globally, WHO statistics suggest that dental caries still affects 60–90% of schoolchildren and the vast majority of adults (Petersen 2003). It is also becoming increasingly clear that a small proportion of children in developed countries carry a disproportionate share of the dental disease burden (Burt 1998; Willems et al 2005).

In New Zealand, the main source of oral health data for children is the School Dental Service, which has routinely collected data for children at age five years and Year 8 (at age 12–13 years). School Dental Service statistics show that children's oral health worsened in the 1990s and 2000s but has recently improved (Ministry of Health 2010d).

Figure 1 shows that the prevalence of being caries-free (ie, having no past or current experience of dental decay) was consistently higher among five-year-olds than 12–13-year-olds from 1990 to 2009. In 1990, 52% of five-year-olds were caries-free. The prevalence was highest in 1997, then decreased in the late 1990s and early 2000s. For 12–13-year-olds there was a dramatic improvement in the caries-free prevalence in the early 1990s, but it worsened after 1994, then remained relatively stable between 1996 and 2007. There have been recent improvements for both age groups.

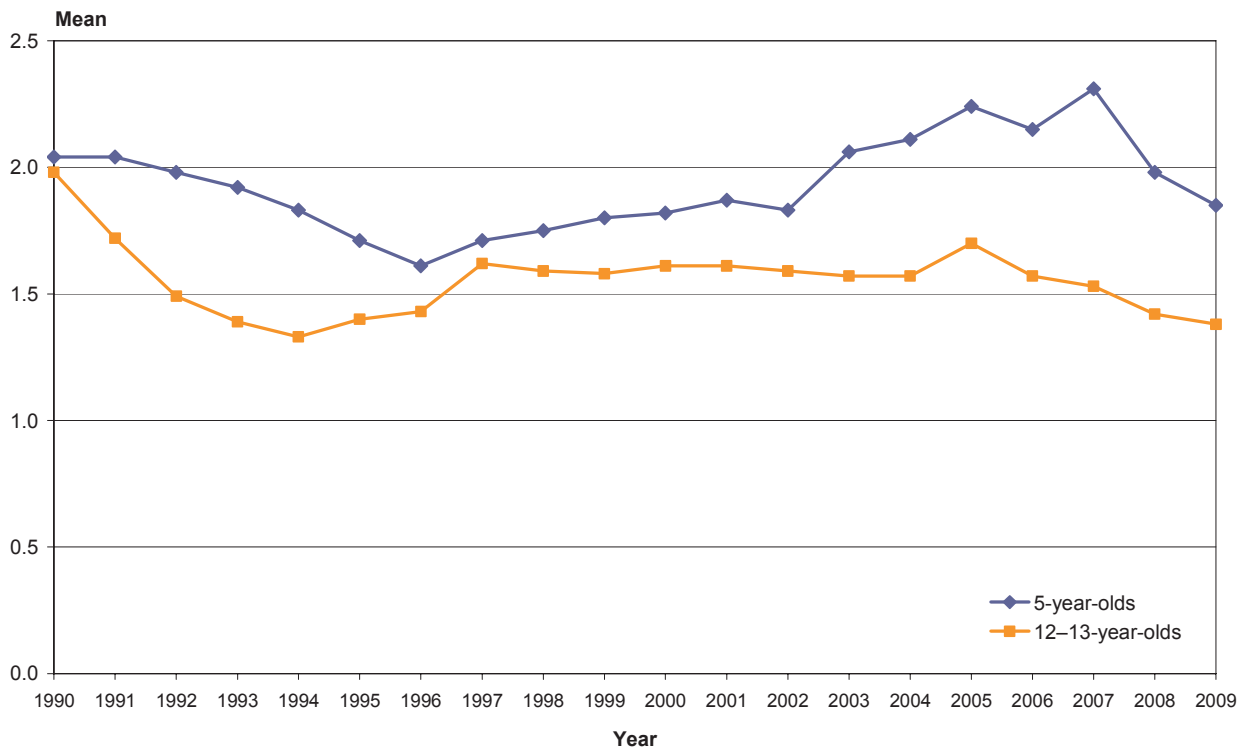
Figure 1: Caries-free prevalence, among five-year-olds and 12–13-year-olds (Year 8), 1990–2009, New Zealand



Source: School Dental Service data, Ministry of Health

Figure 2 shows that, since 1990, the mean dmft (number of decayed, missing or filled primary teeth) has remained higher among five-year-olds than the mean DMFT (decayed, missing or filled permanent teeth) among 12–13-year-olds (Ministry of Health 2010d). For five-year-olds, the mean dmft decreased from 1990 to 1996, but then continued to increase until 2005. For 12–13-year-olds, the DMFT score was lowest in 1994, increased until 1997, remained relatively stable until 2005, then decreased after that.

Figure 2: Mean dmft (for five-year-olds) and mean DMFT (for 12–13-year-olds, Year 8), 1990–2009, New Zealand



Source: School Dental Service data, Ministry of Health

Adolescents

The 1976 national oral health survey found that, regardless of social or ethnic group, teenagers aged 15–19 years had little untreated dental caries and had experienced few extractions of permanent teeth. However, a high number of teeth had been restored, emphasising that the public health programmes at that time focused on dental treatment rather than prevention of dental caries (Cutress et al 1979).

Current information on oral health is less comprehensive for adolescents than for children, as it is not routinely collected. A 2007 national survey of secondary school students (Years 9–13) by the University of Auckland (Youth’07) found a high prevalence of poor self-reported oral health (Adolescent Health Research Group 2008). The survey found that 73.9% of students had ever had a tooth filled, 22.9% had ever had pain in their teeth that kept them awake at night, and 14.1% had ever had a tooth removed due to tooth decay or gum infection.

In addition, regional studies over the past 20 years have provided information about the oral health of adolescents in the area, including a study in the Southern Regional Health Authority in 1996, which found that 76.1% of 15-year-olds had experience of dental caries, and the average number of decayed, missing or filled teeth was 3.7 (Kanagaratnam 1997).

Adults

The 1976 and 1988 national oral health surveys both found a low prevalence of untreated decay in the adult population (Cutress et al 1979; Hunter et al 1992). However, the 1976 survey found very high rates of lifetime dental decay experience (DMFT) and high rates of treatment, particularly in terms of missing teeth due to extraction.

In addition, the Dunedin Multidisciplinary Health and Development Study found that dental caries in young childhood was associated with dental caries experience and tooth loss due to caries by age 26 (Thomson et al 2004). The study also found that, in this cohort, people developed new caries from age 5 through to age 32 at an average rate of 0.8 surfaces per year, with the rate not being higher during childhood or late adolescence as had previously been believed (Broadbent et al 2008).

Very little is known about dental caries in older adults in New Zealand. Until quite recently dental professionals and policy makers perceived that dental caries was generally only active in younger people (Drake and Beck 1992). However, recent New Zealand research has shown that older adults are 'caries-active', experiencing new disease at a rate similar to that of adolescents (about 1.0 surfaces per year). Most new decay in older adults tends to involve the crown of the tooth rather than the root (Thomson 2004).

Regional studies have suggested that older adults have unmet need and are at risk of developing complex oral health problems. For example, a Wanganui study found that 30% of a sample of community-dwelling older adults reported a current problem or dental treatment need (Thomson and Cautley 1996). Also, a study of dentate older people living in the Mosgiel community found high prevalences of coronal decay, root decay and unmet need in study participants, with 89% requiring fillings and some participants requiring advanced restorative treatment, advanced periodontal treatment and root fillings. The main oral health problems of this group related to the simple management of plaque-related disease and the wearing of dentures (Cautley et al 1992).

Older adults in residential aged-care facilities are at even greater risk of developing oral health problems, with studies showing that dependent older adults had a high prevalence and severity of caries (Carter et al 2004), particularly in people with dementia and those who are institutionalised (Chalmers et al 2002, 2003; Chalmers and Ettinger 2008).

Periodontal disease

With an increasing number of older adults retaining their own teeth, older adults are becoming more susceptible to oral diseases affecting the teeth and supporting structures (ie, periodontal disease) than in the past. International evidence shows that, in addition to the issues with dental caries already highlighted, the prevalence of periodontal disease is more common in older adults (Chalmers and Ettinger 2008).

In addition, although the majority of research internationally has focused on periodontal diseases in middle-aged or older people, the Dunedin Multidisciplinary Health and Development Study showed that periodontal disease was well established among a small proportion of younger adults, and that the prevalence of gum recession was higher than expected (Thomson, Hashim et al 2000). This study also showed that oral health in young childhood was associated with periodontal loss of attachment at age 26 (Thomson et al 2004), and that loss of attachment continued among a sizeable proportion of the people from their 20s through to their 30s (Thomson, Broadbent et al 2006). The study also found that smoking in young adults was detrimental to periodontal health, and that smoking cessation was linked to improvements in periodontal health (Thomson et al 2007). Cannabis smoking was also identified as a possible risk factor for periodontal disease, independent of tobacco use (Egan et al 2008).

Tooth loss and edentulism

A key finding from the 1976 national oral health survey was that New Zealand had one of the highest prevalences of total tooth loss (edentulism) in the world. Adults had a very high rate of extraction of permanent teeth, and over one-quarter of the adult population aged 35–44 years had lost all of their natural teeth. Adults aged 65 years and over had had 25 teeth extracted on average, and over 80% of adults in this age group had lost all of their natural teeth. Almost half of all adults had or possessed some type of denture.

The 1988 national survey found a dramatic improvement in oral health in all ages since 1976. In 15 years New Zealand had gone from having one of the highest levels of oral disease in the Western world to a low disease level in children and marked reductions in tooth loss in all but the oldest adult age group.

With New Zealand having had the unfortunate distinction of being a world leader in edentulism, recent research has investigated factors that led to the high prevalence. The key drivers are understood to have been a combination of geography, economics, the oral health care system, and the professional culture of the day, as well as the (flawed) understanding of oral disease at the time (Sussex et al 2010). These drivers were supported by a widespread acceptance of the extraction/denture philosophy in dealing with oral disease, by both the dental profession and the general public. It was concluded that it was unlikely that New Zealand would ever return to having a high prevalence of edentulism, but that groups of lower socioeconomic status had greater risk of future edentulism, and that recent research on the attitudes of adolescents to oral health suggested that edentulism was still a possibility and that we should not be complacent (Fitzgerald et al 2004; Sussex 2008).

There is little recent information on tooth loss or edentulism in New Zealand. The Dunedin Study found that as people aged from their 20s to 30s they experienced ongoing substantial tooth loss, mostly associated with caries (Broadbent et al 2006b). Recently, the 2006/07 New Zealand Health Survey found that half (48.2%) of adults aged 15 years and over reported having had one or more teeth removed due to decay, abscess, infection or gum disease (Ministry of Health 2008c).

Use of health services

Children and adolescents

The 1988 survey found that 99% of 12–13-year-olds had visited a dental nurse in the previous year. The good attendance rates and relatively good oral health of children in this age group demonstrated the effectiveness of the school dental service in reaching and meeting the routine oral health care needs of almost all schoolchildren. The authors of the report predicted that ‘the major improvements in oral health in children and young adults will gradually spread through the population as these cohorts grow older’ (Hunter et al 1992).

More recently, the 2006/07 New Zealand Health Survey showed that four out of five (84.7%) children aged 2–14 years had visited an oral health care worker in the previous 12 months, and a further 9.4% had visited an oral health care worker 1–2 years ago (Ministry of Health 2008c). However, the survey also identified unmet need, with 8.9% of children aged 2–14 years having never seen an oral health care worker, and 3.4% of children being unable to see an oral health care worker when they needed to in the past year.

In 2008, national statistics showed that 60.5% of adolescents had seen a dental professional in the last 12 months. By contrast, in a 2007 national survey of secondary school adolescents (Youth’07), 78.7% of adolescents reported having visited a dentist, dental nurse or other dental health worker in the last 12 months, while 9.7% reported being unable to access dental care when needed (Adolescent Health Research Group 2008). Access to and utilisation of free basic dental care by adolescents is a cause for concern, and one that the Government and DHBs are working towards improving. The aim is to increase the utilisation of services nationally by adolescents to 85%.

A qualitative study exploring Otago adolescents’ views of oral health care identified that adolescents were aware of the pressure to receive free dental care and to engage in oral health care, but held strong preconceptions about the expense of dentists and dental therapists, and viewed the dental surgery environment as a major disincentive (Fitzgerald et al 2004). The findings supported international evidence on the use (or non-use) of dental services once financial barriers are removed. Another study found that unfavourable dental beliefs were related to poorer oral health, and that individuals who held stable favourable beliefs from adolescence through to adulthood about the efficacy of water fluoridation, keeping the mouth clean, avoiding sweet foods, visiting the dentist and using fluoridated toothpaste had fewer teeth missing due to caries, less periodontal disease, better oral hygiene, better self-rated oral health and more restorations (Broadbent et al 2006a).

Given that New Zealand dental care has developed without reference to the changing norms of youth culture, it has been noted that increasing the uptake of free oral health care by adolescents may require innovative approaches (Fitzgerald et al 2004). One such example was a social marketing campaign developed by Canterbury DHB, called It’s Free and It’s All Good, which promoted free dental services for adolescents. This campaign contributed to raising utilisation rates at low-decile schools from 46% to 61% from 2003 to 2006 (Minister of Health 2007).

Adults

The 2006/07 New Zealand Health Survey showed that 51.0% of adults had visited an oral health care worker in the past year, and a further 17.8% had last visited 1–2 years previously (Ministry of Health 2008c). There were indications of unmet need, with 2.3% of adults having never seen an oral health care worker and 10.0% reporting being unable to see an oral health care worker when they needed one in the past year. Two in five adults (40.3%) reported only visiting an oral health care worker when they had a toothache.

Regional studies have also investigated oral health service use in New Zealand. A Dunedin study showed that dental neglect was higher among younger people and those in the lowest occupational group (Jamieson and Thomson 2002). A West Coast study showed that about one in two people were episodic (not regular) users of dental services, and that lower socioeconomic status and self-reported dental anxiety were associated with infrequent use of dental services and poorer self-reported oral health (Dixon et al 1999).

Among older adults, a study of people aged 65–87 years showed that they struggled to afford dental care, received little financial support to access oral health care services and were dependent on developing their own strategies to enable such care (Giddings et al 2008).

The importance of regularly visiting a dental professional

The importance of regularly visiting a dental professional has been demonstrated by findings from the Dunedin Multidisciplinary Health and Development Study. This study found that visiting the dentist for routine check-ups was associated with better long-term oral-health consequences compared with only going when there was a problem (Thomson 2001).

In particular, people who only visited a dental professional for a problem ('episodic users') were more likely to rate their oral health poorly, had a greater caries experience by the age of 26, and had a higher rate at which new dental caries had developed over the previous eight years than routine dental users (Thomson 2001). Episodic users had about three times the odds of having lost a tooth between the ages of 18 to 26 years as routine dental users, with the number of teeth lost, on average, being three times higher among episodic users (Thomson, Poulton et al 2000).

The Dunedin study also found that people were much less likely to routinely visit a dentist when they were 32 years old (28%) than when they were 15 years old (82%). At any given age, routine dental users had better oral health, a lower prevalence of missing teeth due to caries, and a lower caries experience, and the longer that routine attendance was maintained, the stronger the effect (Thomson et al 2010).

Implications for the dental workforce

Results from the previous national oral health surveys have been used by researchers to predict trends and implications for the oral health system and workforce in New Zealand.

Using the findings of the 1976 and 1988 national surveys, researchers forecast a decrease in the need for dental care in the future, due to the continuing decline in dental caries (Cutress and Hunter 1991). However, subsequent research suggested that the predicted decrease in disease had not occurred uniformly across the population, with cost, access, appropriateness and acceptability of dental services identified as factors at least partially responsible for this (Thomson 1993; Whyman et al 1996).

In 1997, predictive modelling of data from the 1976 and 1988 surveys indicated a looming major public health dental crisis in New Zealand in the near future (Thomson 1997). The research highlighted that New Zealand, like other developed countries, was undergoing two transitions:

- a demographic transition, resulting in greater numbers of older people
- a dental transition, in which more older people were keeping their teeth.

It was predicted that the number of older people with natural teeth would increase four-fold from 1991 to 2031. Furthermore, based on the modelling, the middle-aged and older people would become the group to exert the greatest pressure on the oral health system (Thomson 1997). However, it was noted that these predictions were based on the only available data at the time, at the two time points of 1976 and 1988. It was proposed that a third national dental survey, ideally 12 years after the last survey, would provide current oral health information, to allow more accurate predictions of the future caries and treatment needs of an increasingly dentate population.

More recently there has been concern at the oral health of the 'baby-boom' generation, who will start to turn 65 in about 2010. People from this generation have heavily filled dentitions, and after the age of 65 were thought to be unlikely to have the discretionary income to pay for the complex restorative dentistry required to maintain their dentitions.

Behavioural risk factors for poor oral health

Socio-behavioural risk factors for oral health conditions are similar to those for other leading chronic diseases (such as cancer, diabetes and cardiovascular diseases), and include unhealthy diet, tobacco use and harmful alcohol use (WHO 2007).

In particular, high sugar consumption is a key risk factor for dental caries, as well as for other conditions such as type 2 diabetes (Beaglehole et al 2009). Like all carbohydrates, sugar provides an essential source of energy in a balanced diet. However, oral bacteria within dental plaque (such as *Streptococcus mutans*) metabolise sugars into lactic acid, which can cause demineralisation of tooth tissue and tooth decay. Frequent consumption of snacks and beverages containing high sugar levels can therefore increase the risk of tooth decay. In New Zealand, evidence suggests that sugar intake has increased, with soft drink consumption doubling from 2000 to 2006

that New Zealanders consume more sugar per year than Australians, the British and Americans (Beaglehole et al 2009).

Tobacco is another key risk factor for oral disease. Among its most significant effects are oral cancers and pre-cancers, increased severity and extent of periodontal diseases, and poor wound healing. Wound healing time after tooth extraction for smokers is double that for non-smokers, and patients who smoke have a higher failure rate for dental implants (Beaglehole et al 2009).

Disparities in oral health in New Zealand

The following section summarises the current knowledge about disparities in oral health in New Zealand, for children and adults. Health inequalities are defined as ‘differences which are unnecessary and avoidable, but in addition are considered unfair and unjust’ (Whitehead 1992). Inequities in oral health can arise from a variety of factors, including differential distribution of social and economic determinants by ethnicity, and specific factors such as poor nutrition, lack of access to water fluoridation and/or oral health services, and attitudes to oral health (Ministry of Health 2006b; Robson and Harris 2007). The Commission on Social Determinants of Health, set up by the World Health Organization in 2005, has called for global action on the social determinants of health as a matter of social justice, with the aim of reducing health inequities and closing the health gap in a generation (CSDH 2008).

Children

Ethnic inequalities in oral health status among New Zealand children were first reported in the 1980s (Hunter 1984b), and socioeconomic inequalities have also been reported (Evans et al 1984; Thomson et al 2004). School Dental Service data have shown significant differences by ethnicity, region and water fluoridation status (Ministry of Health 2006b). Even within regions with good oral health overall, there are pockets of children with high levels of disease (Ministry of Health 2006b). Furthermore, a 2003 report from the Public Health Advisory Committee to the Minister of Health, called *Improving Child Oral Health and Reducing Child Oral Health Inequalities*, found that clear inequalities existed in the oral health of New Zealand children, especially among Māori and Pacific children and those from low socioeconomic status families (Public Health Advisory Committee 2003).

This section summarises the evidence for inequalities in oral health status experienced by children in New Zealand, by ethnic group and socioeconomic status. Water fluoridation is discussed at the end of this chapter.

Māori children

National surveys have shown disparities in oral health for Māori children compared with other children. The 1988 national oral health survey showed that Māori children aged 12–13 years had poorer oral health than European children (Hunter et al 1992). More recently, analysis of the 2002 National Children’s Nutrition Survey showed that Māori children were more likely to experience dental pain than European/Other children (Jamieson and Koopu 2006). The 2006/07 New Zealand Health Survey found that

(Jamieson and Koopu 2006). The 2006/07 New Zealand Health Survey found that Māori children aged 2–14 years were significantly more likely to have had one or more fillings, and to have had a tooth removed due to pathology (decay, abscess, infection or gum disease), compared with all children (Ministry of Health 2008c).

National School Dental Service data for 5-year-olds and 12–13-year-olds (Year 8 children) support these findings, demonstrating consistent disparities in oral health status over time. In 2008, among 5-year-olds, Māori children were much less likely to be caries-free (38.2%) than all 5-year-olds (57.0%), and also had a much higher dmft (3.5 compared with 2.0). Similar disparities were seen for 12–13-year-olds, with a lower caries-free prevalence for Māori children (37.5%) than all children aged 12–13 years (51.0%), and a much higher DMFT for Māori children (2.2 compared with 1.4).

Numerous other studies and reviews have also found that Māori children have a higher prevalence and severity of dental caries than other New Zealand children (Broughton 1993; Brown and Treasure 1992; Kilpatrick et al 2008; Public Health Advisory Committee 2003; Thomson 1993; Treasure and Dever 1991; Treasure and Whyman 1995). In the early 1990s, a Manawatu–Wanganui study showed that among 5-year-olds, Māori children were three times more likely to have high caries experience (five or more missing or filled teeth) than non-Māori children (Thomson 1993). A recent study in Northland found a low caries-free prevalence among 5–6-year-olds (12%) and 12–13-year-olds (15%), with the problem being particularly acute among northern communities and Māori children (Gowda et al 2009).

Māori children and adolescents also encounter problems in accessing and using oral health services (de Liefde 1988; Fergusson and Horwood 1986; Public Health Advisory Committee 2003; Te Puni Kōkiri 1996; Thomson 1993). Although the 2006/07 New Zealand Health Survey suggested that Māori and non-Māori children were equally likely to have seen an oral health care worker in the previous year, Māori children were more likely to have experienced unmet need for an oral health care worker in the past year (Ministry of Health 2009a).

The Government has introduced adolescent oral health co-ordinators to improve access to dental care for adolescents (Ministry of Health 2002). However, there are concerns among Māori that the emphasis is on enrolling the patient in the system, rather than emphasising the need for the system to reconfigure in order to improve oral health services to Māori (Robson and Harris 2007). A 2006 review of the School Dental Service recommended the need for Māori workforce development, along with the development of unique Māori education programmes alongside population-wide education programmes for children and their families/whānau (DHBNZ 2006).

Pacific children

Studies have also identified strong inequalities in oral health status and access to oral health services for Pacific children compared with other children (Public Health Advisory Committee 2003). The results of the 1988 national oral health survey suggested that Pacific children aged 12–13 years had higher tooth treatment needs than other children in this age group (Hunter et al 1992). More recently, the 2002 National Children's Nutrition Survey found that Pacific children were more likely to have had a tooth

extracted due to decay and to have never received a filling than non-Pacific children (Ministry of Health 2003). The 2006/07 New Zealand Health Survey showed that Pacific boys were significantly more likely to have ever had a filling, and to have had a tooth removed due to pathology, compared with all boys (Ministry of Health 2008c).

Similar inequalities for Pacific children have been consistently evident within the School Dental Service data, particularly for 5-year-olds (Kilpatrick et al 2008). In 2008, only 32.8% of Pacific 5-year-olds were caries-free, compared with 57.0% of all 5-year-olds, and a higher dmft was found among Pacific children (3.3 compared with 2.0). The disparities were not as wide for 12–13-year-olds (Year 8 children), with 48.7% of Pacific children caries-free, compared with 51.0% of all Year 8 children, and a mean DMFT of 1.6 among Pacific children compared with 1.4 among all Year 8 children. Regional studies have identified inequalities for Pacific children in dental caries experience, in Manawatu–Wanganui (Thomson 1993) and in Wellington and Canterbury (Lee and Dennison 2004; Thomson et al 2002).

The 2002 National Children’s Nutrition Survey found that Pacific children were not accessing dental services as regularly as other children (Ministry of Health 2003), while in 2006/07 Pacific children were less likely to have seen an oral health care worker in the previous 12 months than children in the total population (Ministry of Health 2008c).

Asian children

There is little evidence about Asian children’s oral health in New Zealand. However, the 2006/07 New Zealand Health Survey found that Asian children were less likely to have seen an oral health care worker in the previous year than children in the total population (Ministry of Health 2008c).

Socioeconomic status

National surveys have found significant differences in oral health status and use of oral health services by socioeconomic status. The 1988 national oral health survey found significant differences among 12–13-year-olds in the prevalence of untreated decay and severity of dental decay experience by socioeconomic group (father’s occupational group) (Hunter et al 1992). The 2006/07 New Zealand Health Survey found that children in the most deprived areas were less likely to have visited an oral health care worker in the previous year than children in the least deprived areas (Ministry of Health 2008c). The prevalence of having had a tooth removed due to pathology was significantly higher in the most deprived areas than in the least deprived areas for girls, but not for boys.

A 2003 review of child oral health in New Zealand found that socioeconomic differences in oral health reduced during school years, when children generally have access to free dental care, although these inequalities re-emerge in adulthood. This emphasises the impact and importance of access to free oral health services during school years (Public Health Advisory Committee 2003).

A 2006 review of the School Dental Service found that differential access and utilisation played a substantial role in oral health inequalities, with better access experienced by children of higher socioeconomic families (DHBNZ 2006). Although there was high enrolment in preschool years and utilisation by primary and intermediate schoolchildren, it was not evenly distributed across the community.

Other factors

In a 2003 review of child oral health in New Zealand, children in rural areas were identified as being at higher risk of poor oral health than their urban peers (Public Health Advisory Committee 2003). This review also noted that findings from the Dunedin Multidisciplinary Health and Development Study have suggested that factors such as maternal oral health and maternal education levels also influence child oral health, and that adult oral health inequalities are strongly influenced by childhood experiences, such as knowledge of dental hygiene and access to services.

Adults

Inequalities in oral health status in New Zealand were first identified in the 1976 national oral health survey. Teenagers emerged from the state system with a relatively uniform dental experience and state of oral health, but people's oral health status diverged during their 20s. The dentally advantaged and disadvantaged sections of the community came from different socioeconomic and cultural backgrounds, and had differences in attitudes (Cutress et al 1979). Since 1976, other studies have also identified disparities in oral health in New Zealand.

This section summarises the evidence about inequalities for adults in oral health status and access to oral health services in New Zealand, by ethnic group and socioeconomic status.

Māori adults

Oral health surveys in 1976 and 1988 showed significantly poorer oral health for Māori adults. Key features included high levels of untreated decay and missing teeth (including high prevalences of edentulism), as well as lower levels of access to oral health services and treatment.

In 1976 Māori were more likely to have decayed and missing teeth, and were less likely to have filled teeth, than Europeans, among 15–54-year-olds (Hunter 1998). Similarly in 1988, Māori had more caries, a higher extraction need at all ages, and a higher prevalence and severity of periodontal disease, compared with non-Māori. Māori also became edentulous much younger than non-Māori, and were more likely to have early and rapid permanent tooth loss (Broughton 1993; 2000). Evidence also suggested that the disease process for periodontal disease started earlier in Māori and was much more severe (Brown and Treasure 1992).

More recently, the 2006/07 New Zealand Health Survey also found that Māori adults were more likely to have had one or more teeth removed due to pathology than the total population (Ministry of Health 2008c). A report of baseline findings from a randomised controlled trial showed that Māori women were five times more likely than European women to be edentulous, after controlling for age, education, smoking, diabetes, cardiovascular disease history and body mass index (Lawton et al 2008).

Studies have also shown that there are disparities in access to oral health services between Māori and non-Māori, with Māori being less likely to access services and more likely to have unmet need. The 2002/03 and 2006/07 New Zealand Health Surveys showed that Māori adults were less likely to have visited an oral health care worker in the previous year (Ministry of Health 2006c, 2008c). The latter survey also found that Māori adults were significantly more likely to have been unable to see an oral health care worker in the previous year, and to visit an oral health care worker only when they have a toothache, than the total population. The Commonwealth Fund 2001 International Health Policy Survey showed that more Māori adults had gone without needed dental care in the past year due to cost (56%) than European adults (37%) (Schoen et al 2002).

At the regional level, a study at Auckland and Middlemore dental departments in 1994 showed that Māori were over-represented among patients attending for relief of dental pain (Whyman et al 1996). A study in Porirua (Wellington) identified that Māori mothers in this community had significant oral health need, particularly during pregnancy (Makowharemahihi 2006). The research highlighted that the adult dental system was ineffective for these Māori mothers: a system for low-income adults based largely on emergency treatment and providing little opportunity for preventive dental care. Cost was a barrier to timely access to dental care. Despite initiatives designed to support low-income groups, a number of inequities in access to these schemes were identified in this research.

Pacific people

There is also limited recent information on the oral health status of Pacific adults in New Zealand. The 1988 national oral health survey found that, in 20–24- and 35–44-year-olds, Pacific adults had lower levels of filled and missing teeth and similar levels of decayed teeth than other people, as well as a lower DMFT. This was in contrast to Pacific children (aged 12–13 years), who had a higher treatment need than other children. Other analysis from this survey found that periodontal disease appeared to start earlier and be more severe for Pacific adults (Brown and Treasure 1992).

Findings from the 2006/07 New Zealand Health Survey suggest changes have occurred over time, with missing teeth, oral pain and irregular visiting to oral health services becoming more of an issue for Pacific adults. The 2006/07 New Zealand Health Survey found that Pacific adults were more likely to have had one or more teeth removed due to pathology, compared with the total population (Ministry of Health 2008c). Pacific adults were more likely to only visit an oral health care worker when they had a toothache than the total population, while Pacific women were less likely to have visited an oral health care worker in the previous year than women in the total population.

Regional studies have also found disparities in access to oral health services between Pacific and non-Pacific people. A 1994 study on emergency care at Auckland and Middlemore Hospitals showed that, among patients receiving dental treatment for pain relief, Pacific people were over-represented at hospital dental clinics, and under-represented at private emergency dental practices, with the most common reason for attendance at the clinics being for toothache (Whyman et al 1996). More recent research found that, among adults affiliated to the Pacific Trust Canterbury who attended for treatment, most Pacific people were episodic dental attendees, usually presenting because of pain and depending on hospital dental departments for their treatment. Tooth loss was a common occurrence among this population (Petelo et al 2004). Also, the Pacific Islands Families Study (South Auckland), following a cohort of Pacific children born in 2000, showed that many mothers and their Pacific children have poor basic oral hygiene and dietary practices, which increased the oral health risk in these children (Schluter et al 2007).

Asian adults

Although information on the oral health of Asian New Zealanders is limited, the 2006/07 New Zealand Health Survey found that Asian men were significantly less likely to have had at least one tooth removed due to pathology than men in the total population (Ministry of Health 2008c).

However, studies have found that Asian adults have low access to dental services in New Zealand (Ministry of Health 2004, 2006a, 2008c). The 2006/07 New Zealand Health Survey found that Asian adults were less likely to have visited an oral health care worker in the past year, and were more likely to only visit an oral health care worker when they had a toothache, than the total population. However, Asian men were less likely to have reported being unable to see an oral health care worker in the previous year than men in the total population (Ministry of Health 2008c).

A qualitative study among the Chinese community in the greater Wellington area found that Chinese migrants in Wellington had high dental disease prevalence but very low perceived needs and low access to dental services (Zhang 2008). This study identified eight barriers to the receipt of oral health care: cost of dental care, language problems, lack of knowledge of dental health, low priority given to oral health care, mixed attitudes towards dentists, lack of information, difficulties making appointments, and difficulties with transportation.

Socioeconomic status

Previous national oral health surveys and subsequent research have shown that people of low socioeconomic status had poorer oral health (Brown and Treasure 1992; Cutress et al 1979; Hunter et al 1992). The 1988 national oral health survey found that people of low socioeconomic status (ie, low occupational group) had a higher need for tooth and periodontal treatment, more missing and filled teeth, and fewer functional natural teeth (Hunter et al 1992). Similarly, the 2006/07 New Zealand Health Survey found that the prevalence of having had one or more teeth removed due to pathology was higher in areas of high neighbourhood deprivation (measured by NZDep2006) (Ministry of Health 2008c).

Disparities in access to oral health services by socioeconomic status have also been found. In 2006/07 people living in more deprived areas had higher prevalences of having not seen an oral health care worker in the past year, and of having unmet need for an oral health care worker in the past year, than people living in less deprived areas (Ministry of Health 2008c).

Research from the Dunedin Multidisciplinary Health and Development Study has found that socioeconomic inequalities in tooth loss appear to begin early in the life course, and are modified by individuals' socioeconomic status and dental visiting patterns (Thomson, Poulton et al 2000). Furthermore, adult oral health was predicted not only by childhood socioeconomic advantage or disadvantage, but also by oral health in childhood; changes in socioeconomic advantage or disadvantage were associated with differing levels of oral health in adulthood (Thomson et al 2004).

A regional study of Dunedin adults found that the prevalences of edentulism, poor self-rated oral health and having last visited a dentist 2 or more years ago were highest among households of low socioeconomic status who were resident in high deprivation areas. In contrast, people from high socioeconomic status households in the least deprived areas had the lowest prevalence of edentulism, poor-self-rated oral health and having last visited a dentist 2 or more years ago. Those from the other household/area socioeconomic combinations occupied intermediate positions (Jamieson and Thomson 2006).

Water fluoridation

Water fluoridation and oral health status

Fluoridation is the controlled adjustment of fluoride in a public water supply to bring its fluoride concentration up to a level that will best prevent dental caries while avoiding unsightly dental fluorosis. The New Zealand Drinking-water Standards recommend that the level of fluoride in water be adjusted to between 0.7 and 1.0 parts per million (ppm) to provide optimal protection from decay and to minimise the risk of dental fluorosis (Ministry of Health 2008a). There is overwhelming evidence of the effectiveness and safety of water fluoridation in preventing dental decay when present in drinking-water at this level.

The Ministry of Health promotes water fluoridation at the population level, with the benefits being most pronounced for those at risk of poor oral health. Water fluoridation has been described as the most cost-effective preventive method in medicine (Centers for Disease Control and Prevention 1999). The substantial decline in caries experience among children in economically developed nations since the 1960s and 1970s has been largely attributed to the various uses of fluoride (Burt and Pai 2001).

A Public Health Commission review of 15 New Zealand water fluoridation studies found that almost all (13) reported significant benefits from fluoridation (Public Health Commission 1994). At the population level it was estimated that water fluoridation prevents between 58,000 and 267,000 decayed, missing or filled teeth (DMFT) in New Zealand every year (Public Health Commission 1994). In New Zealand, about 52% of people have access to a fluoridated water supply (New Zealand Guidelines Group

2009). This leaves a large proportion of the population without access to water with optimum levels of fluoride, and contributes to inequalities between regions and ethnic groups (Ministry of Health 2006b).

Fluoride has a number of benefits for oral health. When fluoride is ingested regularly when teeth are developing, it is deposited across the tooth's entire surface and this slows down decay. Because of this, tooth decay in fluoridated areas progresses more slowly. While fluoride incorporated into the forming tooth enamel before eruption may help prevent decay, the presence of fluoride at the surfaces of teeth after eruption has been shown to be the main role of action. Fluoride ingested and applied topically (eg, through drinking-water and brushing teeth with fluoridated toothpaste) is effective in helping prevent tooth decay. Sugar constantly flowing past teeth needs good levels of fluoride and saliva to be the 'first line' in tooth decay protection. Kidneys excrete excessive fluoride from the body, and so, to protect teeth over a lifetime it is important to have small, regular amounts, such as is provided in fluoridated water and fluoridated toothpaste (Ministry of Health 2010b).

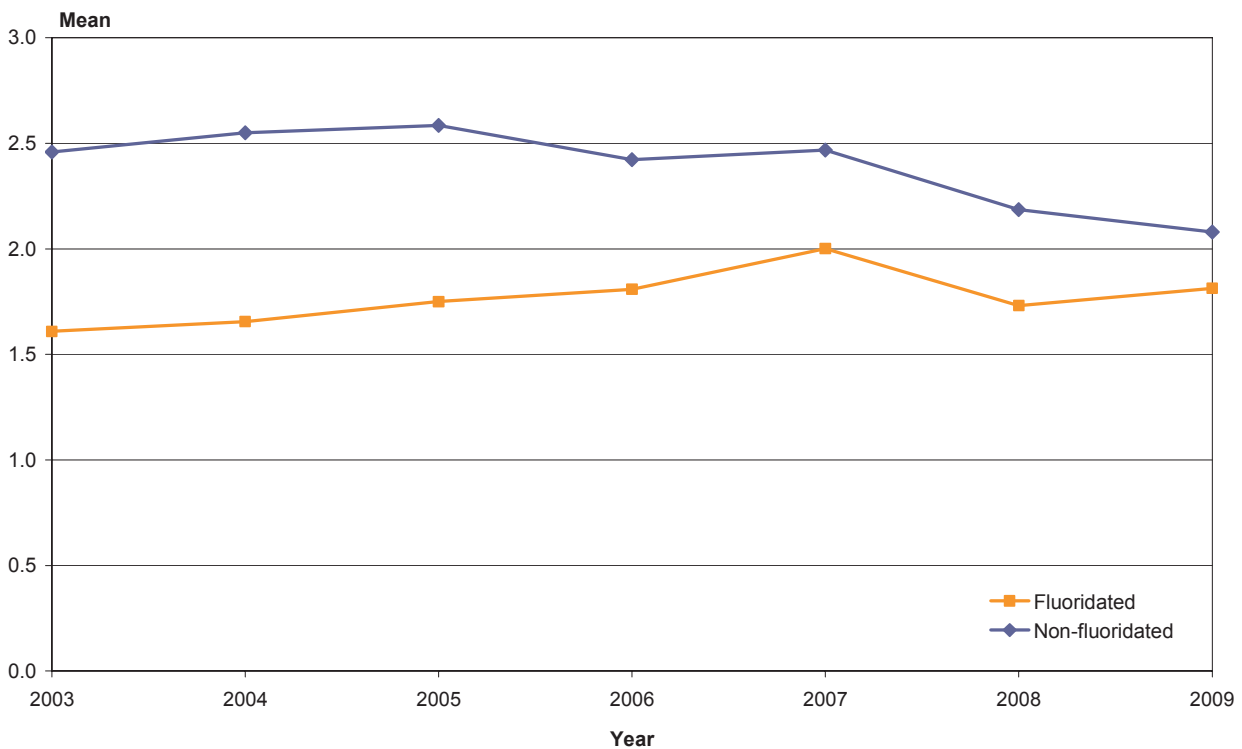
Water fluoridation is not a replacement for toothbrushing with fluoride toothpaste, as brushing helps to remove the bacteria (found in plaque) and keeps gums healthy. Rather, the two work hand in hand to help prevent tooth decay, and provide additional benefits above that of fluoridation or brushing on its own. Studies show that water fluoridation cost-effectively provides benefits above and beyond those from other fluoride sources alone (eg, toothpaste and tablets). Conversely, fluoride toothpastes provide additional benefits beyond water fluoridation (Beaglehole et al 2009).

Children

Evidence of inequalities in oral health status between children in fluoridated and non-fluoridated areas in New Zealand have been seen consistently in the School Dental Service data and in regional studies.

School Dental Service data from 2008 showed that five-year-olds attending schools in non-fluoridated areas had a higher prevalence and severity of dental decay (55.0% were caries-free; dmft = 2.2) than five-year-olds attending schools in fluoridated areas (58.7% were caries-free; dmft = 1.8) (Ministry of Health 2010d). Figure 3 shows that these differences have been seen consistently over time. (While the gap appears to have narrowed since 2007, the timeframe for this change is short. This possible trend requires further monitoring and may warrant further research.) Similarly, among Year 8 children (12–13-year-olds), 45.1% of children attending school in non-fluoridated areas were caries-free (DMFT = 1.7), compared with 56.2% of children attending schools in fluoridated areas (DMFT = 1.2) in 2008.

Figure 3: Mean dmft (for five-year-olds), by water fluoridation status, 2003–2009, New Zealand



Source: School Dental Service data, Ministry of Health

These national findings are supported by regional studies. In Wellington and Canterbury, five-year-olds living in non-fluoridated areas had higher caries experience (dmfs⁵ = 3.8) than those in fluoridated areas (dmfs = 2.6), as did 12-year-olds living in non-fluoridated areas (DMFS⁶ = 2.4) and fluoridated areas (DMFS = 1.4) (Lee and Dennison 2004). Similarly, studies found that 9–10-year-olds continuously exposed to water fluoridation had half the dental caries experience of those who had not, in Auckland (Kanagaratnam et al 2009) and Southland (Mackay and Thomson 2005). Another Auckland study of 9-year-olds similarly found lower levels of dental caries in children in fluoridated areas than non-fluoridated areas (Schluter et al 2008).

New Zealand and international research has shown that water fluoridation and area of residence have moderating effects on the relationship between caries experience and both ethnicity and socioeconomic status (Evans et al 1984; Fergusson and Horwood 1986; Kilpatrick et al 2008; Slade et al 1996; Thomson and Mackay 2004; Treasure and Dever 1991, 1994). School Dental Service data suggest that inequalities in oral health by ethnicity in New Zealand are mediated by fluoridation status, with Māori and Pacific children living in non-fluoridated areas having worse oral health than those in fluoridated areas (Ministry of Health 2009b). In 2008, among Māori five-year-olds, those in non-fluoridated areas had a lower prevalence of being caries-free (32.0%) and a higher mean dmft (4.2) than those in fluoridated areas (40.0%; dmft = 2.9). For Māori

⁵ dmfs refers to the number of decayed, missing (due to dental decay) or filled surfaces of primary teeth.

⁶ DMFS refers to the number of decayed, missing (due to dental decay) or filled surfaces of permanent teeth.

Year 8 children, a similar difference was seen, with those in non-fluoridated areas having a more severe dental decay experience (30.8% caries-free, DMFT = 2.7) than those in fluoridated areas (44.2% caries-free, DMFT = 1.7).

Similar disparities by fluoridation status were seen for Pacific children. In 2008, among Pacific five-year-olds, children in non-fluoridated areas had worse oral health (28.0% caries-free, dmft = 4.1) than children in fluoridated areas (33.6% caries-free, dmft = 3.2). A similar pattern of inequality was seen among Pacific Year 8 students: 37.5% were caries-free (DMFT = 2.3) in non-fluoridated areas compared with 50.4% caries-free (DMFT = 1.4) in fluoridated areas.

Overall, these findings identify that Māori and Pacific children living in non-fluoridated areas have a much higher burden of dental decay experience than other children. Differential access to fluoridated community water supplies has meant that Māori have not benefited equally from fluoridation; for example, a higher proportion of Māori live outside the main centres than other populations (Te Puni Kōkiri 1999) and are less likely to live in areas with a community water supply (Robson and Harris 2007; Te Puni Kōkiri 1999).

A recent systematic review of maternal and child oral health in New Zealand found that the role of fluoride in maternal and child oral health remains important, and that oral health promotion strategies that involve fluoride have consistently been shown to provide benefit and are supported by high-quality evidence (Kilpatrick et al 2008).

Fluorosis among New Zealand children

Dental fluorosis is a condition of altered enamel formation caused by excessive intake of fluoride only during tooth formation (Burt and Eklund 2005), with a wide range of severity. Fluorosis is only one of a wide range of developmental defects that can occur in tooth enamel. Clinically, dental fluorosis is characterised in its milder forms by opaque white areas in the enamel, while more severe fluorosis can be characterised by brown stains or pitting.

Many studies on fluorosis confirm that, in optimally fluoridated areas, increased dental fluorosis occurs, but usually only in the mild or very mild form. A nutrition risk assessment report undertaken by Food Standards Australia and New Zealand (FSANZ) observed that the prevalence of very mild and mild fluorosis was 10% to 25% in Australian and New Zealand children (FSANZ 2009). This was associated with exposure from several sources, both individually and collectively, including fluoridated water, toothpaste, other dental products and supplement use. The prevalence is usually higher in fluoridated than non-fluoridated areas. The FSANZ did not report any evidence of the more severe forms of fluorosis (FSANZ 2009; New Zealand Guidelines Group 2009).

The Public Health Commission reported in 1994 that:

It is possible that there is some level of cosmetic concern associated with dental fluorosis in New Zealand, however, fluorosis at a level that caused cosmetic concerns is more likely to be attributable to other forms of fluoride use (fluoride supplements and toothpaste ingestion by young children during tooth development) than to water fluoridation (Public Health Commission 1994).

Actual concentrations of fluoride in reticulated water in New Zealand average around 0.8–0.9 ppm (0.8–0.9 mg/L) in fluoridated areas and around 0.15 ppm in non-fluoridated areas.

A study in 2002 of children living in fluoridated and non-fluoridated areas in Southland found that children in non-fluoridated areas had a greater prevalence of diffuse enamel opacities (indicative of fluorosis) (Mackay and Thomson 2005). A study in Auckland found that 28% of 9-year-olds had diffuse opacities, although there were significant regional differences in diffuse opacity rates (from 29% to 15%) by fluoridation status (Schluter et al 2008).

Recent reviews of enamel defects in New Zealand show that those living in fluoridated areas have more diffuse enamel opacities and fewer dental caries than those living in non-fluoridated areas, but the prevalence of diffuse opacities has not increased compared to earlier studies and is largely unchanged from estimates reported within New Zealand over the last 25 years (Mackay and Thomson 2005; New Zealand Guidelines Group 2009; Schluter et al 2008). A recent literature review concluded that mild fluorosis was not a concern for people, and that mild fluorosis was sometimes found to be associated with improved oral health-related quality of life. Severe fluorosis was consistently reported to have negative effects on oral health-related quality of life (Chankanka et al 2010).

Summary

As shown in this chapter, gaps exist in our knowledge of the oral health status and needs of many population groups in New Zealand. The only national oral health data systematically collected in New Zealand is for five-year-olds and Year 8 (age 12–13 years) students. This is clinical data only, and so there is no background information (such as self-reported data) to give the overall picture of oral health in these groups. Overall, this summary of the evidence on oral health in New Zealand shows a trend of better oral health over time, but suggests that there are possible disparities in oral health status.

The 2009 NZOHS is a key source of information on oral health, and provides up-to-date information on the oral health status, behaviours and service utilisation of New Zealanders of all ages. Results from the survey will be used to inform the strategic vision for oral health, as well as oral health policies and programmes in New Zealand, and to monitor the investment in the reorientation of children and adolescent oral health services in New Zealand. They will also provide a third point in the time series from the previous national oral health surveys.

In particular, this report provides valuable information on the oral health status of certain groups for which the strategic vision identified that there was little evidence. These population groups include preschool children, children (other than 5- and 12–13-year-olds), adolescents, adults, older adults, people experiencing inequalities in oral health (such as Māori, Pacific people and people of low socioeconomic status), as well as other minority groups, such as Asian people. This report not only includes clinical data but also self-reported information in order to provide a complete view of the oral health status and quality of life experienced by these population groups.

Chapter 3: Methods

Introduction

This chapter provides an overview of the survey methods and analysis. Key points for interpreting the results and a guide on how to interpret tables and graphs in this report are provided at the end of this chapter. A glossary of the key dental and statistical terms used is available at the end of the report.

This chapter also answers the following questions:

- Why do a survey?
- How were survey participants selected?
- Who agreed to take part?
- How were the face-to-face interviews carried out?
- What questions were asked in the interview?
- How were the dental examinations carried out?
- What information was collected in the dental examination?
- What has been analysed and reported?
- What is the quality of these findings?
- How can readers access more survey findings?

More detailed information on the survey methods and analysis can be found in the methodology reports for the 2009 New Zealand Oral Health Survey (NZOHS) (Ministry of Health 2010c) and the 2006/07 New Zealand Health Survey (NZHS) (Ministry of Health 2008b).

Overview of the survey

The 2009 NZOHS was carried out from February to December 2009, and collected information on oral health for 4906 New Zealanders (including adults and children), as well as conducting dental examinations for 3196 New Zealanders. It was made up of two components: a computer-assisted face-to-face interview and a dental examination. The questionnaire measured self-reported oral health status, risk and protective factors for oral health outcomes and the use of oral health care services, among the usually resident New Zealand population living in private dwellings. Information on oral disease (particularly dental decay and periodontal disease) was recorded during clinical examinations of the teeth and gums conducted by survey dentists.

The 2009 NZOHS was a follow-up to the 2006/07 New Zealand Health Survey (NZHS). The sampling frame for the 2009 NZOHS included the NZHS households that had provided permission to be re-contacted for future health-related surveys. All results have been weighted in order to be representative of New Zealand's estimated resident population living in permanent private dwellings.

Why do a survey?

There had been two previous national oral health surveys in New Zealand, carried out in 1976 and 1988. In 2000, an Oral Health Forum recommended that a third national oral health survey (or a series of focused surveys) was needed in order to provide up-to-date information on oral health in New Zealand (Brown and Eden 2000). This information was considered important for monitoring, planning, evaluating interventions, and providing visibility for oral health issues (Thomson 2000).

The Ministry of Health commissioned the 2009 NZOHS to gather up-to-date information about the oral health status of New Zealand adults and children and the oral health services they use. The 2009 NZOHS is valuable because it collected information on New Zealander's oral health that is not available through other means, such as analysis of health system records. For most of the topics in this report, the 2009 NZOHS is the best source of information on the oral health status of the New Zealand population. In particular, it is the first nationwide survey of oral health to collect comprehensive objective and subjective information on the oral health of New Zealand children aged two years and over.

Objectives of the 2009 New Zealand Oral Health Survey

The objectives of the 2009 NZOHS were to collect information to:

1. describe the oral health of New Zealand children and adults, and the prevalence and severity of selected oral conditions, including dental injury
2. estimate the prevalence of risk and protective factors associated with these oral health conditions
3. examine the relationship between general health and oral health
4. examine the relationship between adult oral health and child oral health within households
5. describe the use of oral health services, including the nature of barriers to accessing oral health services and the extent of any unmet need
6. examine inequalities between population subgroups (as defined by age, sex, ethnicity, rurality and socioeconomic position)
7. examine changes that have occurred in the oral health of New Zealanders, since previous national surveys
8. provide policy makers with information that can be used to improve oral health and the oral health care system and services.

The findings presented in this report cover the majority of the above objectives. Further research could investigate objectives 3 and 4, as well as other objectives in more detail.

The Ministry of Health developed the objectives and content of the 2009 NZOHS in consultation with stakeholders and an external technical advisory group. The data collection was carried out by a specialist survey company, CBG Health Research Ltd, which undertook the interviewing and prepared the data sets. Qualified and registered dentists specially trained for the survey carried out the dental examinations.

The New Zealand Health and Disability Multi-Region Ethics Committee granted approval for the 2009 NZOHS and approved the wording of all public materials for the survey (MEC/07/11/149).

How were survey participants selected?

2006/07 New Zealand Health Survey

The 2009 NZOHS was a follow-up to the 2006/07 NZHS. The 2006/07 NZHS used a multi-stage, stratified, probability-proportional-to-size (PPS) sample design, with greater sampling of some ethnic groups, primarily through a 'screened' sample.

Small geographic areas (meshblocks) were randomly chosen throughout New Zealand, with larger areas having an increased chance of selection into the 2006/07 NZHS. Areas with greater proportions of Māori, Pacific or Asian people were also given a slightly higher chance of selection.

Interviewers began at a random point in each area and systematically selected every k th house⁷ as the 'core' sample households. In core households, one adult aged 15 years and over, and one child aged from birth to 14 years old, if any, were randomly selected for the survey. Interviewers then selected every j th house⁷ in each area as the 'screened' sample households, to boost Māori, Pacific and Asian sample sizes. In screened households, adults and children were only eligible if the participants identified with a Māori, Pacific or Asian ethnicity (determined using the Census ethnicity question and Statistics New Zealand ethnicity classification). There was no substitution of households or participants if the selected household or participant refused, was not contactable or was unavailable.

This sample design ensured that robust national estimates for key health behaviours and outcomes could be produced. Furthermore, all population groups of interest, in particular Māori, Pacific and Asian populations, were included in sufficient numbers to enable estimates that are accurate for all groups. Interviewer travel costs were also reduced, because the sample was geographically clustered or 'clumped'.

A total of 12,874 households from throughout New Zealand participated in the 2006/07 NZHS, resulting in interviews with 12,488 adults (aged 15 years and over) and the parent or caregiver of 4921 children (aged from birth to 14 years).

Over four out of five households (84%) who took part in the NZHS agreed to be re-contacted for future health surveys, and formed the re-contact database from which the sample for the 2009 NZOHS was selected.

⁷ The exact number was calculated for each small area; for example, by dividing the number of houses in the area by the (predetermined) number of houses to be selected from that area.

2009 New Zealand Oral Health Survey

In the 2006/07 NZHS re-contact database, all Pacific, Asian and Māori respondents were selected for the 2009 NZOHS, to ensure that the sample sizes for these key population groups were maximised. Four out of ten European/Other respondents in the 2006/07 NZHS re-contact database were selected for the 2009 NZOHS. Where an adult 2006/07 NZHS respondent was selected for the 2009 NZOHS and a child in that household had also been interviewed for the 2006/07 NZHS, the child was also selected for the 2009 NZOHS (regardless of their age at the time of the NZOHS).

There was a 16-month period between the end of data collection for the 2006/07 NZHS and the start of the 2009 NZOHS. All participants were interviewed using the questionnaire/exam protocol appropriate for their age at the time of the 2009 NZOHS interview and exam (ie, the adult questionnaire for people aged 15 years and over, and the child questionnaire for children aged 2–14 years).

A total of 6318 households were selected to participate in the 2009 NZOHS, representing 8938 people.

Who agreed to take part?

Sample size

A total of 4906 New Zealanders completed the face-to-face interview for the 2009 NZOHS, including 3475 adults aged 18 years and over and 1431 children and adolescents aged 2–17 years. The sample included 1267 Māori, 353 Pacific, 518 Asian and 2125 European/Other adults (aged 18 years and over), and included 694 Māori, 269 Pacific, 237 Asian and 817 European/Other children and adolescents (aged 2–17 years). The parent or caregiver completed the interview for the 1210 children participants aged 2–14 years.

A total of 3196 New Zealanders were dentally examined, including 2209 adults aged 18 years and over and 987 children and adolescents aged 2–17 years. Among adults, 781 Māori, 219 Pacific, 380 Asian and 1353 European/Other adults were dentally examined. Among children and adolescents aged 2–17 years, there were 461 Māori, 184 Pacific, 171 Asian and 817 European/Other children and adolescents dentally examined.

Overall, 2048 adult respondents aged 18 years and over were periodontally examined.

Table 1 presents the sample size numbers for the face-to-face interview, dental examination and periodontal examination, by age group, for the 2009 NZOHS. Further details of sample sizes by population group are provided in Appendix C.

Table 1: Sample size numbers for the 2009 New Zealand Oral Health Survey, by age group

Age group	Number interviewed	Number dentally examined	Number periodontally examined
2–4 years	280	195	–
5–11 years	642	438	–
12–17 years	509	354	–
18–24 years	268	168	163
25–34 years	549	364	352
35–44 years	783	578	560
45–54 years	687	464	433
55–64 years	510	303	269
65–74 years	375	202	176
75 years and over	303	130	95
Total	4906	3196	2048

Note: While respondents aged 15 years and over were periodontally examined, this report presents periodontal findings only for adults aged 18 years and over, due to the structure of the report.

Response rate

Among people selected to participate in the 2009 NZOHS, the weighted response rate to the interview was 70% for adults (aged 18 years and over) and 69% for children. Among people who completed the interview, the weighted response rate to the dental examination was 84% for adults and 80% for children.

However, the overall response rate also needs to account for the 2009 NZOHS being a follow-up survey to the 2006/07 NZHS, which itself had a response rate of 68% for adults and 71% for children. When combined for adults and children, the overall response rate to the 2009 NZOHS was 49% for the face-to-face interview and 41% for the dental examination. The response rates at each stage of the survey were quite reasonable, but the combined effect of each stage of drop-out means that the response rate is lower than the standard aimed at for other New Zealand health surveys (70%). However, these lower rates are fairly typical of response rates for surveys of this type internationally.

It is also important to note that, as this survey was a follow-up to the 2006/07 NZHS, it was possible to examine potential non-response bias quite thoroughly, and much more so than in other large national surveys. The 2006/07 NZHS contained several questions related to oral health, which made it possible to examine whether respondents with better oral health outcomes and/or more frequent use of oral health services were more or less likely to participate in the 2009 NZOHS survey and dental examination. The results of this analysis show that non-response was not related to the oral health variables collected in the 2006/07 NZHS (see the online methodology report for more information).

Tables presenting response rates and sample sizes by population group are provided in Appendix C.

How were the face-to-face interviews carried out?

Interviews were conducted from February to mid-December 2009. The interview team consisted of 39 CBG Health Research Ltd (CBG) interviewers.

Participation in the 2009 NZOHS was voluntary, relying on the good will of participants, and informed consent was obtained without coercion or inducement. Interviews were conducted in participants' homes, at a time to suit participants. The survey was carried out using a face-to-face computer-assisted personal interview (CAPI). Interviewers typed responses directly into a laptop computer, and show cards with predetermined response categories were used to assist the participant where appropriate.

Adult interviews were an average of 31 minutes long, and the child interviews (with the primary caregiver) were an average of 14 minutes long.

What questions were asked in the interview?

The 2009 NZOHS collected information on the topics of self-reported oral health and perceptions, risk and protective factors, use of oral health services, history of orofacial trauma, and attitudes to and opinions about oral health.

Where possible, questions were sourced from previous New Zealand and international oral health surveys. New questions were also developed to investigate oral health topics of interest in New Zealand. The questionnaires were field tested in a pilot survey carried out in March 2008 and adapted where necessary. The 2009 NZOHS adult (15 years and over) and child (2 to 14 years) questionnaires are available online (www.moh.govt.nz/dataandstatistics).

Policies and practices were used in the survey to help the participation of different ethnic groups. Language assistance was provided to 2009 NZOHS participants by family members or a specialised interpreter service where participants required help to understand the survey, answer the questions, or attend the dental examination. Information brochures for the survey were available in eight languages.

Further information about the content of the 2009 NZOHS is available online in the methodology report and the questionnaire.

Adult questionnaire

The adult questionnaire for the 2009 NZOHS was answered by survey participants aged 15 years and over at the time of the NZOHS. The adult questionnaire contained 129 questions specific to oral health, organised into the following broad topic areas: self-reported oral health status; risk and protective behaviours; use of oral health services, nature of barriers to accessing service and extent of unmet need; orofacial trauma; opinions, knowledge and attitudes about oral health; and a sociodemographic update of information previously collected for each participant in the 2006/07 NZHS.

Child questionnaire

The child questionnaire for the 2009 NZOHS contained 74 questions about the oral health of the child, organised into the following topic areas: proxy-reported oral health; risk and protective behaviours; use of oral health care services; and a child response module (including questions about toothbrushing). Questions to update the sociodemographic information collected about the child in the 2006/07 NZHS were also included.

The primary caregiver of each selected child participant (ie, the person with the day-to-day responsibility for the care of the child) was invited to answer the child questionnaire on the child participant's behalf. Children aged 9–14 years were able to answer a child response module if they were willing and their primary caregiver gave permission.

In households where the primary caregiver of the child was not the adult respondent in the 2006/07 NZHS and 2009 NZOHS, further information about the oral health of the primary caregiver was collected to enable further research into oral health within households.

How were the dental examinations carried out?

At the end of the face-to-face interview, adult respondents who reported having at least one of their own teeth and child respondents (through their primary caregiver) were invited to take part in the dental examination. Those who agreed were given an information sheet that explained in more detail about the adult or child dental examination.

After reading the information sheet, participants still willing to participate in the dental examination were given a selection of appointment times at a private dental practice, a DHB, School Dental Service clinic or iwi-provider clinic close to their home or work. Where a participant could not physically travel to a clinic-based appointment, an in-home examination was offered. About 84% of clinic-based dental examinations were completed within six weeks of the interview. Dental examinations were never completed on the same day as the interview.

Informed consent for the dental examination was obtained by the survey dental examiner from adult respondents, and from the parent or caregiver of child respondents. Children aged 6–14 years could complete a voluntary written consent form for themselves, and children were examined only if both they and their caregiver consented. Adults and children were advised that they could stop the examination at any time. Adult survey participants, or the caregiver accompanying child survey participants, completed a medical history form. The adult and child medical history forms asked questions about general medical conditions in case of medical emergency. The adult form also asked about conditions which, if present, would preclude a gum (periodontal) examination. These included always needing to take antibiotics before a dental visit, having a heart problem (eg, heart valve problems or congenital heart disease), having had rheumatic fever, having had a hip or knee replacement in the last six months, or being immuno-suppressed or on immuno-suppressant therapy.

At the end of the examination, survey participants were given a written report completed by the survey dentist describing the main clinical findings and providing general advice about the importance of regular dental check-ups and dental treatment. If the dental examiner had discovered a suspected malignancy, the respondent was referred for further investigation to the DHB.

Adult participants who completed the dental examination were sent a thank-you letter from the Ministry of Health and a \$50 travel voucher to cover travel expenses incurred in attending a dental examining facility. Children who completed the dental examination were given a toothbrush and toothpaste.

Dental examiners

The 2009 NZOHS clinical team comprised a lead examiner (Associate Professor Kaye Roberts-Thomson) and 22 dental examiners, including a gold standard examiner (Dr Robyn Haisman). All dental examiners (including the lead examiner and gold standard examiner) were fully qualified and registered, and held current Annual Practising Certificates. In addition, CBG interviewers were trained as dental recorders for the 2009 NZOHS, to record information provided by the dental examiners during the dental examinations.

Consistency between dental examiners

Whenever there are multiple examiners there is the potential for variation between examiners in their diagnostic criteria and recording of oral health indices. To minimise this variation, the following strategies were adopted.

- All examiners were given an 83-page manual describing the examination protocols, with simple and clear codes for each component of the examination.
- All examiners attended a two-and-a-half-day training and calibration course run by the lead examiner.
- When there was a delay between training and starting in the field, the gold standard examiner worked with and recalibrated the dentist on their first day of dental examinations.

To measure the consistency among dental examiners, the gold standard examiner conducted replicate examinations for about six survey participants per examiner. The reliability of each examiner, relative to the gold standard examiner, was measured by calculating the intra-class correlation coefficient (ICC). There was almost perfect agreement for all indicators measured (ICC of 0.78 or greater) (for more details, see the 2009 NZOHS methodology report).

What information was collected in the dental examination?

Examining dentists followed a standardised protocol to record information about the clinical oral status of the survey participant. Information was collected on:

- tooth loss
- dental decay experience
- dental trauma
- periodontal disease (for adult participants with no medical contraindications to periodontal probing)
- dental fluorosis
- oral mucosal lesions
- oral debris (not presented in this report)
- use of dentures worn to the examination (not presented in this report).

Clinical photographs of upper anterior permanent teeth were taken using the technique described by Wong et al (2005).

The examination protocols followed those used in the Australian National Survey of Adult Oral Health 2004–2006. Full details of the examination protocol are provided online (www.moh.govt.nz/dataandstatistics).

What has been analysed and reported?

This report presents the key descriptive results from the 2009 NZOHS.

Use of survey weights

To ensure estimates of population prevalences and means were representative of the total usually resident population of New Zealand (excluding institutionalised groups and the homeless), survey ‘weights’ were used in all of the results presented in this report. Survey weights can be thought of as the number of population members represented by each survey participant. Using weights in analyses ensures that no population group is under- or over-represented in estimates from the survey. The weighting process took into account selection probabilities and calibration to a set of population benchmarks, and is described in more detail in the 2009 NZOHS methodology report. All results have been weighted in order to be representative of New Zealand’s estimated resident population living in permanent private dwellings at 30 June 2007 (the reference date for the 2006/07 NZHS).

Denominator populations

In this report some results are presented for the adult *dentate population*. This represents all adults with at least one natural tooth, and represents 90.6% (89.7–91.5) of the total adult population. Some results are reported for *periodontally examined dentate adults* (ie, people who had their gums examined). This excluded adults who had certain medical conditions (see page 39).

Population groups for analyses

The results in this report are presented by sex, age group, ethnic group, neighbourhood socioeconomic deprivation, and usual reason for visiting a dental professional (for a check-up or dental problem). These results should be interpreted within the context of the broader determinants of health, which include the social and physical environment, socioeconomic status, inequalities in the distribution of and access to material resources such as oral health care, and other determinants of health (such as education and employment).

Age group

For adults, results have generally been presented by 10-year age group (18–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75+ years). For children and adolescents, results have generally been presented by the following age groups: 2–4, 5–11, 12–17 years.

Ethnic group

Results in this report have been presented by *total response ethnic group*. Ethnicity is self-defined, and respondents were able to report affiliation with up to nine different groups, using the Statistics New Zealand standard ethnicity question.

For this report, respondents' ethnicity was aggregated to the following ethnic groups: European/Other, Māori, Pacific and Asian. For this report, the 'Other' ethnic group (comprising mainly Middle-Eastern, Latin-American and African ethnicities) was combined with 'European' to avoid small number problems.

Because respondents could be reported in more than one ethnic group, the sum of the individual ethnic group population totals will exceed the overall New Zealand population total. Furthermore, overlapping ethnic groups means that ethnic groups should not be compared with each other using the analyses in this report.

Neighbourhood deprivation

Analyses in this report have been presented by neighbourhood socioeconomic deprivation, as measured by the New Zealand Index of Deprivation 2006 (NZDep2006) quintiles. NZDep2006 is an area-based index of deprivation, which measures the level of socioeconomic deprivation for each neighbourhood (meshblock) according to a combination of the following 2006 Census variables: income, benefit receipt, transport (access to car), household crowding, home ownership, employment status, qualifications, support (sole-parent families), and access to a telephone (Salmond et al 2007). The predecessors of NZDep2006 (NZDep91, NZDep96 and NZDep2001) have been validated, meaning that the index accurately describes levels of deprivation in small areas and is highly correlated with key health outcomes and behaviours, such as mortality and smoking (Crampton et al 2004).

Other groups for analysis

This report also compares people who reported usually visiting a dental professional for a dental check-up with those people who usually visited a dental professional for a dental problem (ie, not a dental check-up). For three indicators, people who lived in areas with a fluoridated reticulated water supply at the time of the survey are also compared with people who did not.

Unadjusted analyses

Unadjusted prevalences have been presented in this report for estimates of the prevalence in the total population, and by age group, sex, ethnic group and neighbourhood deprivation (NZDep2006 quintiles). These unadjusted prevalences give an indication of the burden of oral health outcomes in these population groups. An example of a table with unadjusted prevalences is given on page 51.

Comparative measures and adjustment

To help answer comparative questions such as, *Do men have a higher prevalence of untreated decay than women?*, two types of measures are presented in this report: rate ratios and rate differences (and the equivalent measures for means; ie, ratios of means and differences of means). Rate ratios give a measure of relative difference in burden for the group of interest, while rate differences give a measure of the absolute difference in burden. These measures were adjusted for possible confounding factors.

Rate ratios and rate differences complement each other and give different perspectives on the difference between the two groups with respect to the outcome measure. For example, a 20% rate difference (eg, men = 40%, women = 20%, difference = 40% – 20% = 20%) can be interpreted as placing a much higher burden on men, than a 1% rate difference (eg, men = 2%, women = 1%, difference = 1%), even though in both examples men have twice the risk as women (ie, the same rate ratio of 2). Rate ratios and rate differences are explained in more detail below, and an example is given on page 53.

Rate ratios and ratios of means

A rate ratio is a ratio of the prevalence estimates for two population groups. Similarly, the ratio of means is the ratio of the means for two population groups.

Rate ratio	=	$\frac{\text{prevalence in group of interest}}{\text{prevalence in reference group}}$
Ratio of means	=	$\frac{\text{mean in group of interest}}{\text{mean in reference group}}$

Rate ratios (and ratios of means) can be interpreted in the following ways:

- a value of 1 shows that there is no difference between the group of interest (eg, men) and the reference group (eg, women)
- a value higher than 1 means that the result is higher for the group of interest than for the reference group
- a value lower than 1 means that the result is lower for the group of interest than for the reference group
- values that have an asterisk (*) in this report are statistically significant.

All the comparisons in this report refer to a 'group of interest' compared with a 'reference group'. For example, men are compared with women, and Māori are compared with non-Māori. Conversely, to obtain the rate ratio for the reference group compared to the group of interest (eg, women compared with men), divide 1 by the rate ratio.

Rate differences and differences in means

The rate difference is a measure of the difference in prevalence estimates between the group of interest and the reference group. Similarly, the difference in means is a measure of the difference in estimates of the means, for two groups.

Rate difference	=	(prevalence in group of interest) – (prevalence in reference group)
Difference in means	=	(mean in group of interest) – (mean in reference group)

It should be noted that in a few cases the rate difference is statistically significant (noted with an asterisk, *) while the rate ratio is not (or vice versa), for a particular comparison. This may occur when both the rate difference and rate ratio are close to the cut-off of statistical significance (ie, close to a p-value of 0.05).

Adjustment

In this report, rate ratios and rate differences (and ratios of means and differences in means) were adjusted for possible confounding factors, to make comparisons more accurate and meaningful. Confounding factors include age and sex, which are important and fundamental determinants of health. For example, since people often experience poorer health as they get older, populations with different age structures (such as men and women, due to women having a longer life expectancy) may have differences in rates simply because of their age differences. Similarly, the Māori population is generally younger than the total New Zealand population, and therefore it is important to adjust for age when comparing Māori and non-Māori.

The following approach was taken to select adjustment factors used in this report.

- Results are generally adjusted for age and sex, because these are fundamental determinants related to most health outcomes.
- Ethnicity comparisons are adjusted for sex and age, but do not adjust for socioeconomic deprivation, because deprivation is a mediator, not a confounder, of the association between ethnicity and oral health. That is, deprivation is on the causal pathway linking ethnicity to oral health, and is one of the key mechanisms whereby ethnicity exerts its influence on oral health.
- Socioeconomic deprivation comparisons are not only adjusted for sex and age, but also for ethnicity, since ethnicity confounds the relationship between deprivation and oral health outcomes. That is, ethnicity is associated with deprivation (different NZDep2006 quintiles have differing ethnic compositions), and is independently and causally linked to oral health outcomes, but does not lie on the causal pathway between deprivation and oral health outcomes. Adjusting deprivation analyses for ethnicity ensures the effects reflect the independent effect of deprivation rather than being a mix of deprivation and ethnic effects.
- For other comparison results, such as reason for usually visiting a dental professional (for a dental problem or check-up), or residence in areas with or without a fluoridated reticulated water supply, it was appropriate to adjust for both ethnicity and deprivation (as well as age and sex), as both of these variables may be confounders (but not mediators) in this situation.

The adjustment factors used for each comparative analysis are noted in the report. For all comparative analyses, regression models were used to incorporate the adjustment factors. When adjusting for age, a categorical variable (ie, age group) was used in the model. When ethnicity was included, a single 'ethnic group' variable based on a prioritised approach was used (in the prioritised order: Māori, Pacific, Asian, European/Other). Although ethnic groups based on total response were used as the basis for reporting ethnicity in the report, a prioritised ethnic group variable was used as an adjustment variable in models because it was simpler to include in the regression model, and is a very good approximation to using a full set of total response ethnic group indicators as adjustment factors in a regression model.

Ethnic comparisons

For ethnicity, a series of separate two-way comparisons are presented in this report. Each ethnic group is compared with a non-overlapping (mutually exclusive) comparator group (ie, Māori vs non-Māori, Pacific vs non-Pacific and Asian vs non-Asian). In these analyses, if an individual identified with both Māori and Pacific ethnic groups, they would be in the Māori group (rather than the non-Māori group) for the Māori comparison, and in the Pacific group (rather than the non-Pacific group) for the Pacific comparison.

This method of presenting comparisons for total response ethnic groups ensures that multiple ethnicity information is reflected in the results in a more complete way, and that fundamental questions that readers may have about ethnic groups are the main focus of the analysis (eg, do Māori differ from other New Zealanders with respect to the oral health behaviours and outcomes reported on in this survey?).

There has been much recent debate and discussion about how ethnicity has been, and should be, collected and analysed (Callister and Didham 2009), and ethnicity is clearly a concept that will continue to evolve over time. This document reports ethnicity in terms of total response ethnicity, rather than prioritised ethnicity, according to Statistics New Zealand recommendations (Statistics New Zealand 2006). Although this report uses a series of two-way comparisons as the basis for the ethnic group analyses, it is recognised that other approaches to analysing ethnicity data are also valid and could be used in future analyses of the data set.

It is important to note that the 'non' ethnic groups (ie, the comparator groups, such as non-Māori) should not be treated as valid ethnic groups in their own right, because they do not meet Statistics New Zealand's definition of an ethnic group. Therefore, they should not be the focus of analysis, but rather used as a statistical reference group (Statistics New Zealand 2005).

Neighbourhood deprivation comparisons

For neighbourhood deprivation, the comparisons presented in this report were calculated slightly differently than for other comparisons. For deprivation, rate ratios and rate differences in fact refer to the relative index of inequality (RII) and the slope of inequality (SII) respectively, which are two frequently used summary measures of socioeconomic inequality in health. These results can be interpreted in the same way as rate ratios and rate differences.

For NZDep2006 comparisons, instead of simply comparing the most deprived quintile (NZDep2006 quintile 5) with the least deprived quintile (quintile 1), data from all quintiles (1–5) were used to calculate a line of best fit (regression line), adjusted for age group, sex and ethnic group. This method provided adjusted estimates for the extremes of these values; that is, the minimum deprived (slightly 'less deprived' than quintile 1) and the maximum deprived (slightly 'more deprived' than quintile 5). These estimates were then used to calculate the relative index of inequality (RII) in a similar way as a standardised rate ratio (Hayes and Berry 2002). Similarly, the difference between the estimated rate for minimum deprived and maximum deprived was used to calculate the 'slope index of inequality' (SII) in a similar way as a rate difference. The same techniques were used to calculate the ratios in means and differences in means.

Time trend analyses

Where possible, key findings from the 2009 NZOHS have been compared with data from the previous two New Zealand national surveys of oral health:

- 1976 Survey of Adult Oral Health (SAOH)
- 1988 Survey of Oral Health Outcomes (SOHO).

Although the 1976 survey included adults aged 15 years and over, the 1988 survey only covered four specific age groups. In order to make comparisons between 1988 and 2009, time trend comparisons were limited to the following age groups: 12–13 years for children, and 20–24, 35–44 and 65–74 years for adults. The 1976 survey did not include children, and therefore comparisons over time for children aged 12–13 years were only possible for 1988 and 2009.

For adults, results are presented for each specific age group (20–24, 35–44 and 65–74 years) for 1976, 1988 and 2009. In addition, to assess whether any of the oral health outcome measures had changed significantly across age groups, an overall age-standardised rate ratio (SRR) was constructed, which combined the population in these three age groups to compare 2009 with 1976 and 1988.

There are a number of differences between the 1976, 1988 and 2009 surveys, which limit the comparisons between the surveys.

- The questionnaires for the three surveys were very different, and as a result only a few direct comparisons can be made for self-reported oral health.
- The long-term and widespread use of the DMFT index to report experience of dental decay has enabled the time trends to be reported in this report. However, the criteria used to determine dental caries have changed to become more sensitive over time, resulting in a greater chance of decay being recorded in the 2009 dental examination than in previous surveys, which may have affected comparisons. It should also be noted that probing was not used in the 2009 NZOHS to detect dental caries, as it was in previous surveys.
- To enable comparisons in DMFT with previous surveys, coronal and root surface data from 2009 were combined to a whole-tooth measure (ie, including both the crown and root of the tooth), and surface-level data were aggregated to tooth-level data. Therefore, results presented in the time trends chapter are not directly comparable to results presented earlier in the report.

International comparisons

Comparisons between New Zealand and Australia were possible to include in this report because the measures were very similar for the 2009 NZOHS and the Australian National Survey of Adult Oral Health 2004–2006. The 2009 NZOHS dental examination closely followed the protocol for the Australian oral health survey. The only slight difference in protocols was in the periodontal examination. The Australian protocol used mesial, mid-buccal and distal sites (all buccal sites), whereas New Zealand used mesial, mid-buccal and disto-lingual sites. A question in the Australian survey about the use of oral health services in the past year was relatively similar to that included in the New Zealand survey.

The results for comparisons with Australia are presented in this report for the adult population aged 15 years and over. Unadjusted rates are presented by age group, and overall age-standardised rate ratios (SRRs) are presented to show direct comparisons between New Zealand and Australia. The age standardisation used the WHO standard population (Ahmad et al 2000) for both the New Zealand and the Australian data.

What is the quality of these findings?

As a signatory to the Protocols of Official Statistics (Statistics New Zealand 2007), the Ministry of Health has used best-practice survey techniques throughout the 2009 NZOHS. Many steps have been taken to ensure the data collected are as high quality and robust as possible, including the establishment of an advisory group to direct questionnaire and dental examination content. External peer review of the sample design of the survey and this report has contributed to maintaining the high quality of the survey and results.

However, readers should be aware that errors can arise due to sampling (selection of only some people in a population) and for other reasons (referred to as non-sampling errors). Methods used to quantify sampling errors and prevent non-sampling errors are discussed below.

Sampling error

Sampling error results from selecting a sample to represent the entire population, and is influenced by the complex design of the survey (resulting in some people having a higher chance of selection than others). That is, the estimates in this survey may differ from the results that would have been produced if all the information had been obtained for all people in the population. The most common measure of sampling error is the standard error. Standard errors for survey estimates from this survey were calculated using a replicate method, called the delete-a-group jack-knife method (Kott 1998).

Statistical significance and 95% confidence intervals

In this report, information about statistical significance is given as either 95% confidence intervals, or as asterisks (*) noting statistical significance at the 5% level of significance (p-value < 0.05).

If multiple survey samples were obtained, even at the same time, they would provide results that differed. The 95% confidence interval is the interval that would be expected to contain the true population value 95% of the time if many samples were taken. The confidence interval is influenced by the sample size of the group: when the sample size is small, the confidence interval becomes wider.

The difference between two estimates is said to be statistically significant at the 0.05 level if the difference is of a magnitude that would be unlikely to occur by chance (5% probability or less). When the confidence intervals of two groups do not overlap, the difference in rates between the groups is statistically significant. For any differences between two variables noted in the text as being statistically significant but having overlapping confidence intervals, the difference was tested using a t-test.

It should be noted that in this report the term 'significant' (or 'significance') refers to statistical significance.

Non-sampling errors

Non-sampling errors may occur in any enumeration, regardless of whether it is a sample or a full enumeration. Possible non-sampling errors include coverage errors, response bias and measurement errors. Although these elements cannot be measured, it is useful to be aware of them when interpreting the results of the survey. Substantial effort is made to reduce non-sampling error by carefully designing and testing the survey, questionnaire and processes, and ensuring quality control of procedures and data.

Response bias may have occurred if there was differential non-response; that is, if the survey was less likely to be answered by certain people, such as a certain population group (eg, young males), or people who were not often home. The use of weighting tends to reduce the effect of response bias. The interview introduction was an important part of trying to ensure that people take part in the survey.

Measurement error might also have occurred in this survey. Some of the analyses in this report used self-reported information, which may be inaccurate. Measurement errors include recall error (eg, mistakes made when respondents recall how often they have done something over the last 12 months), under- and over-reporting (which may be influenced by the respondent's perception of what is socially desirable), and item non-response (if the respondent does not answer certain questions). As discussed previously, the inter-examiner reliability in the 2009 NZOHS was shown to be sufficient, and therefore there is unlikely to be a large amount of measurement bias in the clinical analyses.

How can readers access more survey findings?

The Ministry of Health hopes this report stimulates interest in the oral health of New Zealanders and generates more research, both through additional use of 2009 NZOHS data and by informing future research direction and priorities.

There are several ways to access further data from the 2009 NZOHS:

- online data tables
- confidentialised unit record files (CURFs)
- contacting Health and Disability Intelligence at the Ministry of Health.

Online data tables, which contain data for all analyses presented in this report and extra descriptive results, are available online in Excel format (www.moh.govt.nz/dataandstatistics).

The analyses presented in this report are only a small proportion of those that could be undertaken, and in many ways pose more questions than they answer. Health and Disability Intelligence in the Ministry of Health encourages researchers to use NZOHS data sets to explore topics of interest. Confidentialised unit record files are potentially available for statistical purposes to bona fide public good researchers working within academic institutions, government agencies and the wider health sector, subject to certain conditions. The 2009 NZOHS adult and child CURFs, with accompanying documentation and user guides, will be available in 2011. For more information on

accessing CURFs, and to download an application form, please go to [www.moh.govt.nz /dataandstatistics](http://www.moh.govt.nz/dataandstatistics).

Health and Disability Intelligence can be contacted:

by mail: Health and Disability Intelligence
Ministry of Health
PO Box 5013
Wellington 6145

by phone: +64 4 816 2000

by email: hdi@moh.govt.nz, or to contact staff directly,
firstname_lastname@moh.govt.nz

Key points for interpreting findings

There are a number of points the reader should be aware of when interpreting the results in this report.

- The 2009 NZOHS is a sample survey at one point in time and can be used to examine associations between oral health and sociodemographic characteristics. However, readers of this report need to be aware that associations do not necessarily imply causality. For example, if the survey finds that a particular behaviour is more common in people living in more socioeconomically deprived areas, an association has been identified. This does not mean the behaviour is caused by living in a deprived area.
- The survey only included the usually resident population living in private dwellings (ie, about 94% of the population). People living in institutions (hospitals, IHC and rest homes, prisons, boarding schools), the homeless, short-term visitors and tourists were not included.
- Many of the survey results are based on the assumption that participants can accurately recall previous events and that they are providing correct information. A range of steps were taken to try to minimise recall and other reporting errors, including testing, and using questions that had been validated elsewhere.
- Dental examination results were only reported for adults who had at least one natural tooth (ie, dentate adults). Adults who reported in the interview that they had no natural teeth were not asked to have a dental examination.
- Periodontal results were estimated only for adults who were periodontally examined. Therefore, they do not represent people with certain existing health conditions, such as people who must always take antibiotics before they visit a dentist, people who had ever been told they had a heart problem (excluding heart attack), people who had ever had rheumatic fever, people who had had a hip or knee replacement in the previous six months, and people who were immuno-suppressed or who were on immuno-suppressant therapy.
- Comparisons between the results presented in this report and other data sources (such as the Census, health system administrative and survey data) should be approached with caution, as there are many issues relating to comparability.

How to interpret tables and graphs in this report

Unadjusted table

The following diagram shows how to interpret the tables of unadjusted results presented in this report.

Table 2: Prevalence of complete tooth loss, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	9.4 (8.5–10.3)
Sex	Women	9.9 (8.5–11.3)
	Men	8.8 (7.4–10.3)
Ethnic group	Māori	10.4 (8.4–12.4)
	Pacific	4.0 (2.4–6.3)
	Asian	1.3 (0.6–2.6)
	European/Other	10.2 (9.2–11.2)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	6.1 (4.1–8.7)
	2	8.1 (5.3–10.8)
	3	10.5 (7.7–13.3)
	4	8.7 (6.3–11.1)
	5 (most deprived)	13.9 (10.9–16.9)

Source: 2009 New Zealand Oral Health Survey
 Note: Total response standard output for ethnic groups has been used.

The caption provides information about what the table is about, the population of interest, and whether the data are unadjusted prevalences or unadjusted means.

This number is the value for the prevalence (%) or mean for each population group.

This is the population group the results relate to.

These refer to total response ethnic groups. If a respondent reported being of both Māori and Pacific ethnicity, they have been included in both ethnic groups.

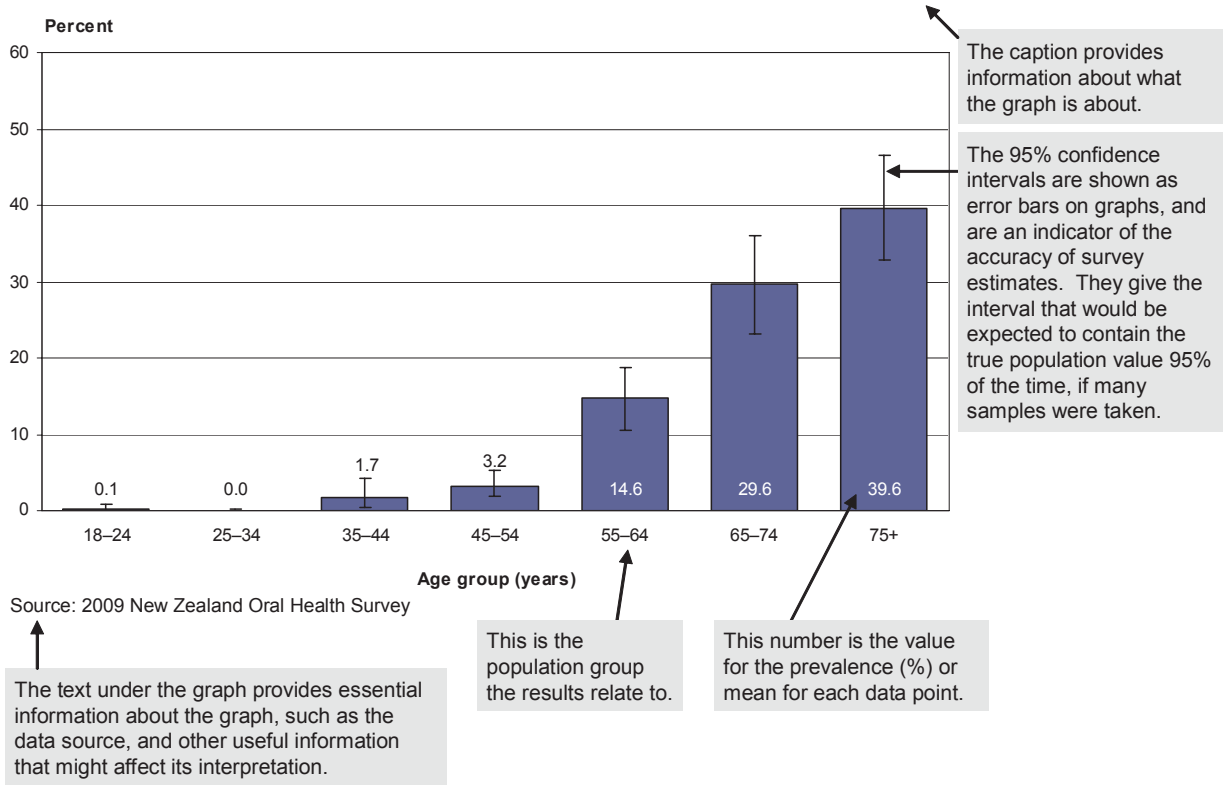
The notes provide essential information about the table, such as the data source, and other information that might affect interpretation.

The 95% confidence interval (in brackets) is an indicator of the accuracy of a survey estimate. It gives the interval that would be expected to contain the true population value 95% of the time, if many samples were taken.

Age group graph

The following diagram shows how to interpret the graphs presented in this report.

Figure 4: Prevalence of complete tooth loss, among adults aged 18 years and over, by age group (unadjusted prevalence)



Comparisons table

The following diagram shows how to interpret the tables of comparisons presented in this report. Further information on how to interpret rate ratios and rate differences (as well as ratios of means and differences in means) is available on pages 43–44.

Table 3: Complete tooth loss, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

The caption provides information about what the table is about and the population of interest.

This column tells us the population group of interest.

This column tells us the reference group for the comparison.

This column tells us what variables the results are adjusted for (such as age group).

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.9	-1.0
Māori	Non-Māori	Age group, sex	1.9*	8.3*
Pacific	Non-Pacific	Age group, sex	0.8	-1.9
Asian	Non-Asian	Age group, sex	0.4*	-5.9*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.8*	9.5*

Source: 2009 New Zealand Oral Health Survey
 Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

¹ For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

In the ethnic comparisons, each ethnic group is compared with people who did **not** identify with that ethnic group.

For example, Pacific people are compared with non-Pacific people. The non-Pacific group includes all people who did not identify with Pacific ethnicity. While the majority of non-Pacific people are likely to be European, this group also includes people from other ethnic groups who did not identify as being Pacific (such as Māori and Asian people).

These numbers are the values for the rate difference (ie, the difference in prevalence estimates between the group of interest and the reference group). A negative sign (-) indicates that the estimate for the group of interest is lower than that of the reference group.

These numbers are the ratio of two prevalences (ie, the rate ratios), rounded to one decimal place. A value greater than 1 indicates that the outcome is more likely in the group of interest than in the reference group. A value less than 1 indicates that the outcome is less likely in the group of interest than in reference group.

The notes provide essential information about the table, such as the data source, and other information that might affect its interpretation.

An asterisk (*) shows that the result is statistically significant (eg, significantly greater than 1) (p-value < 0.05).

Chapter 4: Oral Health Conditions in Adults

Key findings

- One in eleven (9.4%) adults aged 18 years and over had lost all of their natural teeth (ie, they were edentulous). Therefore, 90.6% of the population were dentate (ie, had one or more natural teeth).
- Among dentate adults, 88.6% had a functional dentition. This was defined as having 21 or more natural teeth, which is generally considered enough teeth to meet the functional, aesthetic and dietary needs of most people, without the need for dentures.
- Overall, dentate adults had a mean DMFT score of 13.9 (ie, a mean of 13.9 decayed, missing or filled teeth per person), comprising 0.8 decayed teeth, 4.6 missing teeth (due to dental decay or periodontal disease) and 8.5 filled teeth.
- One in three (35.3%) dentate adults had untreated coronal decay on one or more teeth.
- One in eleven (9.5%) dentate adults had untreated root decay on one or more teeth.
- One in three (33.5%) dentate adults had any periodontal pocketing of 4 mm or more at one or more sites, one in ten (10.5%) had moderate periodontal pocketing (of 5 mm or more) and 5.1% had deep periodontal pocketing (of 6 mm or more).
- One in two (49.9%) dentate adults had any loss of attachment (of 4 mm or more at one or more sites), one in four (27.5%) had moderate loss of attachment (of 5 mm or more), and one in eight (13.4%) had severe loss of attachment (of 6 mm or more).
- One in four (23.4%) dentate adults had experienced trauma to one or more of their upper six front teeth.
- A very low proportion of dentate adults (0.3%) had a suspected malignant tumour, while a further 5.2% had ulcerated lesions and 11.8% had any other mucosal conditions.

Introduction

Oral health conditions include dental caries, periodontal disease, tooth loss, cancers and lesions of the lips and mucosa lining the mouth and throat, oral manifestations of systemic conditions, and trauma associated with the mouth and teeth.

Oral health conditions are unique, in that most are chronic, progressive and irreversible, yet situated where they can be easily examined. The accessibility of the mouth means that trained examiners can readily measure the existing experience of dental diseases to that point in a person's life, and objective clinical data can therefore be collected and quantified for populations quite easily.

Objective clinical indices have been developed for measuring and describing the prevalence and severity of these diseases within populations. Some have been used for many decades, including the DMF index for dental caries (which measures the overall number of decayed (D), missing (M) and filled (F) teeth or tooth surfaces for a person) (Klein et al 1938). Criteria for measuring and recording oral health conditions

in population-based oral health surveys are relatively standard throughout the world, mostly due to the work of the World Health Organization (WHO) and its *Survey Methods* publications (WHO 1967, 1997).

This chapter reports the prevalence and severity of selected oral conditions for New Zealand adults aged 18 years and over (ie, the age group who generally have to pay for their oral health care). The oral conditions reported in this chapter were clinically measured for adults who had at least one natural tooth (the 'dentate' population) during the 2009 NZOHS dental examinations (with the exception of complete tooth loss, which was self-reported by adults in the survey interview).

The chapter is presented in four parts:

- Part 1: The retention of natural teeth
- Part 2: Condition of the natural teeth
- Part 3: Condition of supporting structures
- Part 4: Oral mucosal conditions.

Part 1: The retention of natural teeth

The retention of natural teeth is more complex than just preventing disease conditions. Although tooth loss is an end product of oral disease, it is also a reflection of patient and dentist attitudes, the dentist–patient relationship, the availability and accessibility of care, and the prevailing philosophies of care (Burt and Eklund 2005). Tooth loss occurs primarily because of a treatment decision to extract teeth rather than to use other treatment options. Most teeth are extracted because of extensive decay, but periodontal disease, and, less commonly, trauma or poor alignment, may also result in tooth loss.

The retention of natural teeth is a desirable goal, because tooth loss affects quality of life, is related to poorer general health, and has been shown to have psychosocial and functional consequences, particularly among older people (Locker 1997; Walls et al 2000). Furthermore, 21 or more natural teeth is considered to comprise a 'functional dentition', through which the functional, dietary and aesthetic needs of most people can be met with natural teeth alone (Steele et al 1998).

The retention of some natural teeth into older age is now a common occurrence and is evident from oral health surveys such as in Australia (Slade et al 2007), the United Kingdom (Kelly et al 2000) and Canada (Health Canada 2010). However, overall progress towards the goal of older people retaining natural teeth will be influenced by the existing burden of disease experience (both treated and untreated) among older adults.

This section presents the following indicators for describing tooth loss and the retention of natural teeth:

- loss of all natural teeth (edentulism)
- one or more teeth missing due to pathology (ie, dental decay or periodontal disease)
- mean number of teeth missing due to pathology
- mean number of natural teeth
- having a functional dentition (21 or more natural teeth).

Prevalence of complete tooth loss (edentulism)

A simple but important indicator of the oral health status of the population is the proportion of people who have no natural teeth (the 'edentulous'). Complete tooth loss (edentulism) is a fundamental indicator of dental impairment in the population, and reflects past experience of dental disease, including a surgical approach to its treatment.

Evidence suggests that the loss of all natural teeth can have an impact on diet, nutrition and general wellbeing, and that the impact may extend well beyond the mouth (Steele et al 1998; Walls et al 2000). For example, even though most edentulous people wear dentures, they report poorer subjective health, on average, than people who have natural teeth (Slade and Spencer 1994).

How was this measured?

International evidence shows that self-reported tooth loss is as reliable as clinically measured tooth loss (Axelsson and Helgadóttir 1995). In the 2009 NZOHS, all adults were asked, *Do you have any of your own natural teeth?* (Yes; no). Adults who answered 'No' were classified as edentulous.

One in eleven (9.4%) adults aged 18 years and over had lost all of their natural teeth (ie, they were edentulous). Table 4 presents the prevalence of complete tooth loss, by population group.

Table 4: Prevalence of complete tooth loss (edentulism), among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	9.4 (8.5–10.3)
Sex	Women	9.9 (8.5–11.3)
	Men	8.8 (7.4–10.3)
Ethnic group	Māori	10.4 (8.4–12.4)
	Pacific	4.0 (2.4–6.3)
	Asian	1.3 (0.6–2.6)
	European/Other	10.2 (9.2–11.2)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	6.1 (4.1–8.7)
	2	8.1 (5.3–10.8)
	3	10.5 (7.7–13.3)
	4	8.7 (6.3–11.1)
	5 (most deprived)	13.9 (10.9–16.9)

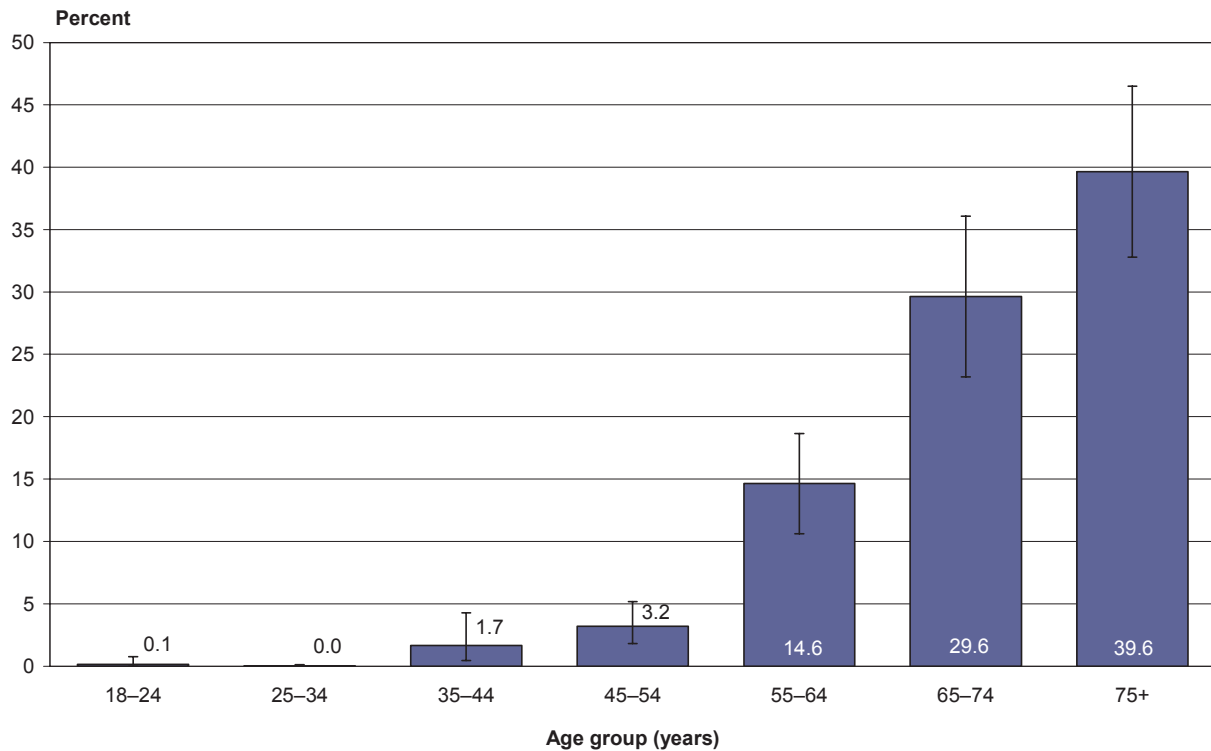
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 5 shows that the prevalence of edentulism was higher in older age groups. Although edentulism was virtually non-existent among adults younger than 35 years of age, the prevalence was over four times higher among 55–64-year-olds (14.6%) than among 45–54-year-olds (3.2%). About two in five (39.6%) adults aged 75 years and over had lost of all their natural teeth.

Figure 5: Prevalence of complete tooth loss (edentulism), among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 5 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 5: Complete tooth loss (edentulism), among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.9	-1.0
Māori	Non-Māori	Age group, sex	1.9*	8.3*
Pacific	Non-Pacific	Age group, sex	0.8	-1.9
Asian	Non-Asian	Age group, sex	0.4*	-5.9*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.8*	9.5*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Māori were almost twice as likely to have lost all their teeth as non-Māori, after adjustment. By contrast, Asian adults were less than half as likely as non-Asian adults to have completely lost all their teeth.

People living in the most deprived neighbourhoods were 2.8 times as likely to have lost all of their teeth as people in the least deprived neighbourhoods, when adjusted for age, sex and ethnic group. This represents a 9.5 percentage point difference in the prevalence of complete tooth loss between the most deprived and least deprived areas.

There were no significant differences by sex.

Prevalence of missing one or more teeth due to pathology

The previous results indicate that 90.6% (89.7–91.5) of adults were dentate (ie, had one or more natural teeth). Results in the rest of this chapter generally refer to the dentate population.

The following indicator presents the prevalence of having one or more teeth missing due to pathology (ie, extracted or lost due to dental decay or periodontal disease), among dentate adults.

How was this measured?

To estimate the prevalence of tooth loss due to pathology, dental examiners in the 2009 NZOHS made an assessment of the reason for the absence of a tooth in dentate adults (adults with one or more natural teeth) younger than 45 years of age at the time of examination. This meant that teeth missing for reasons other than decay or periodontal disease could be excluded from the analysis.

In dentate adults aged 45 years and over, the assumption was made that missing teeth had been extracted for dental disease. For this reason, it should be noted that results for people aged 45 years and over may be slightly overestimated.

Three in five (61.8%) dentate adults aged 18 years and over had lost one or more teeth due to pathology. Table 6 presents the prevalence of having one or more teeth missing due to pathology, by population group.

Table 6: Prevalence of missing one or more teeth due to pathology, among dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	61.8 (59.4–64.3)
Sex	Women	61.7 (58.4–65.0)
	Men	61.9 (58.2–65.7)
Ethnic group	Māori	55.1 (50.5–59.7)
	Pacific	66.1 (57.8–74.4)
	Asian	41.2 (32.9–49.4)
	European/Other	63.6 (60.3–66.9)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	64.3 (56.1–72.4)
	2	63.4 (55.8–71.0)
	3	59.3 (52.7–65.9)
	4	59.1 (52.3–65.9)
	5 (most deprived)	62.9 (54.9–70.8)

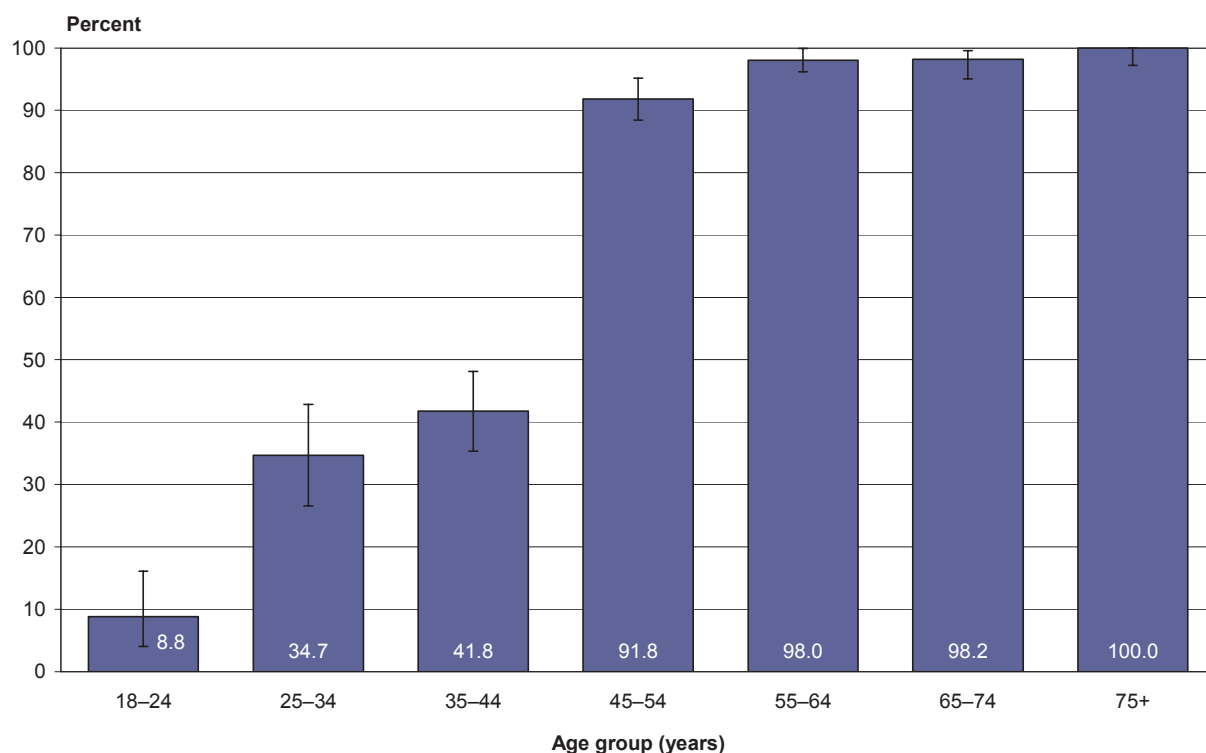
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

The prevalence of having lost one or more teeth due to pathology was significantly higher among adults aged 45 years and over than among those aged 18–44 years (Figure 6). In particular, people aged 45–54 years had twice the prevalence of this than people aged 35–44 years. Although 8.8% of people aged 18–24 years had lost at least one tooth due to pathology, one in three (34.7%) aged 25–34 years had done so.

Figure 6: Prevalence of missing one or more teeth due to pathology, among dentate adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 7 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 7: Missing one or more teeth due to pathology, among dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.0	-1.2
Māori	Non-Māori	Age group, sex	1.1*	4.7*
Pacific	Non-Pacific	Age group, sex	1.2*	10.9*
Asian	Non-Asian	Age group, sex	0.9*	-7.3*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.2*	8.8*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.1*	6.4*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, Māori were 1.1 times as likely as non-Māori to have one or more teeth missing due to pathology, after adjustment. Similarly, Pacific adults were 1.2 times as likely to have lost one or more teeth due to pathology as non-Pacific adults. Asian adults were significantly less likely to have lost one or more teeth due to pathology than non-Asian adults.

People living in more deprived neighbourhoods were 1.2 times as likely to have lost one or more teeth due to pathology as people living in the least deprived neighbourhoods.

People who usually visit a dental professional for a dental problem were 1.1 times as likely to have lost one or more teeth due to pathology as people who usually visit a dental professional for a check-up.

Mean number of teeth missing due to pathology

The severity of tooth loss due to pathology is presented as the mean number of teeth missing due to pathology (ie, dental decay or periodontal disease) per dentate adult.

How was this measured?

To estimate the prevalence of tooth loss due to pathology, dental examiners in the 2009 NZOHS made an assessment of the reason for the absence of a tooth in dentate adults (adults with one or more natural teeth) younger than 45 years of age at the time of examination. In dentate adults aged 45 years and over, the assumption was made that missing teeth had been extracted for dental disease. This means that results for people aged 45 years and over may be slightly overestimated.

The mean number of teeth missing due to pathology in dentate adults aged 18 years and over was 4.6. Table 8 presents the mean number of missing teeth due to pathology per person, by population group.

Table 8: Mean number of teeth per person missing due to pathology, among dentate adults aged 18 years and over, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	4.6 (4.3–4.9)
Sex	Women	4.6 (4.3–5.0)
	Men	4.6 (4.1–5.0)
Ethnic group	Māori	4.4 (3.8–5.0)
	Pacific	4.4 (3.5–5.2)
	Asian	2.1 (1.6–2.6)
	European/Other	4.8 (4.4–5.2)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	4.3 (3.4–5.1)
	2	4.8 (4.0–5.6)
	3	5.1 (4.1–6.1)
	4	4.1 (3.4–4.8)
	5 (most deprived)	4.8 (4.0–5.5)

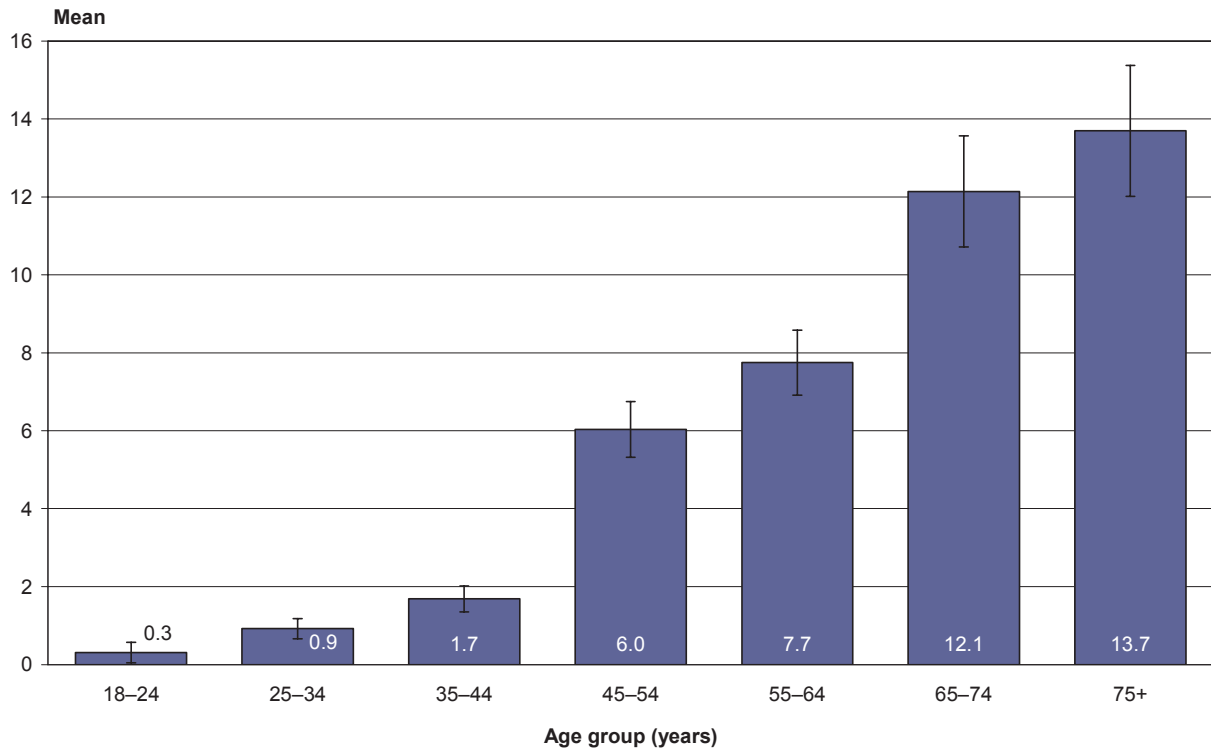
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 7 shows that the mean number of teeth missing due to pathology per person was higher in older age groups. People aged 45–54 years had, on average, over three times as many teeth missing due to pathology as people aged 35–44 years. Dentate adults aged 75 years and over were missing 13.7 teeth on average.

Figure 7: Mean number of teeth per person missing due to pathology, among dentate adults aged 18 years and over, by age group (unadjusted mean)



Source: 2009 New Zealand Oral Health Survey

Table 9 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 9: Number of teeth per person missing due to pathology, among dentate adults aged 18 years and over, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Men	Women	Age group	1.0	-0.2
Māori	Non-Māori	Age group, sex	1.6*	2.6*
Pacific	Non-Pacific	Age group, sex	1.3*	1.4*
Asian	Non-Asian	Age group, sex	0.8*	-1.1*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.4*	1.6*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.4*	1.5*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

After adjustment, the mean number of teeth missing per person due to pathology was 1.6 times higher among Māori than non-Māori, and 1.3 times higher among Pacific than non-Pacific people. Asian adults had significantly fewer teeth missing due to pathology on average than non-Asian adults.

Among people living in the most deprived neighbourhoods, the mean number of missing teeth due to pathology per person was 1.4 times higher than among people living in the least deprived neighbourhoods, after adjusting for age, sex and ethnic group.

The mean number of teeth missing was 1.4 times higher among people who usually visit a dental professional for a dental problem than people who usually visit a dental professional for a check-up, after adjustment.

Mean number of natural teeth present

As dental health has improved and more teeth are retained, measures that describe the number of teeth present are increasingly used. The measure 'mean number of natural teeth' describes how many natural teeth, on average, each person has, irrespective of the condition of the teeth. Adults can have a maximum of 32 natural teeth.

This measure provides a useful starting point for interpreting the burden of disease affecting those teeth that are present. For example, if older adults had, on average, 18 teeth and four of those teeth were decayed, they would have a much greater burden of untreated decay than younger adults who had 28 teeth, four of which were decayed. This measure can also be used to give an indication of the adequacy of oral function.

How was this measured?

In the 2009 NZOHS, data for the mean number of natural teeth per dentate adult were derived from data collected in the clinical dental examination.

Dentate adults aged 18 years and over had an average of 25.9 natural teeth per person. Table 10 presents the mean number of natural teeth per person, by population group.

Table 10: Mean number of natural teeth per person, among dentate adults aged 18 years and over, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	25.9 (25.7–26.2)
Sex	Women	25.8 (25.5–26.2)
	Men	26.1 (25.6–26.5)
Ethnic group	Māori	25.9 (25.4–26.5)
	Pacific	26.8 (26.0–27.6)
	Asian	28.0 (27.5–28.5)
	European/Other	25.7 (25.3–26.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	26.2 (25.5–26.9)
	2	25.8 (25.1–26.5)
	3	25.5 (24.5–26.4)
	4	26.5 (25.9–27.0)
	5 (most deprived)	25.7 (25.1–26.4)

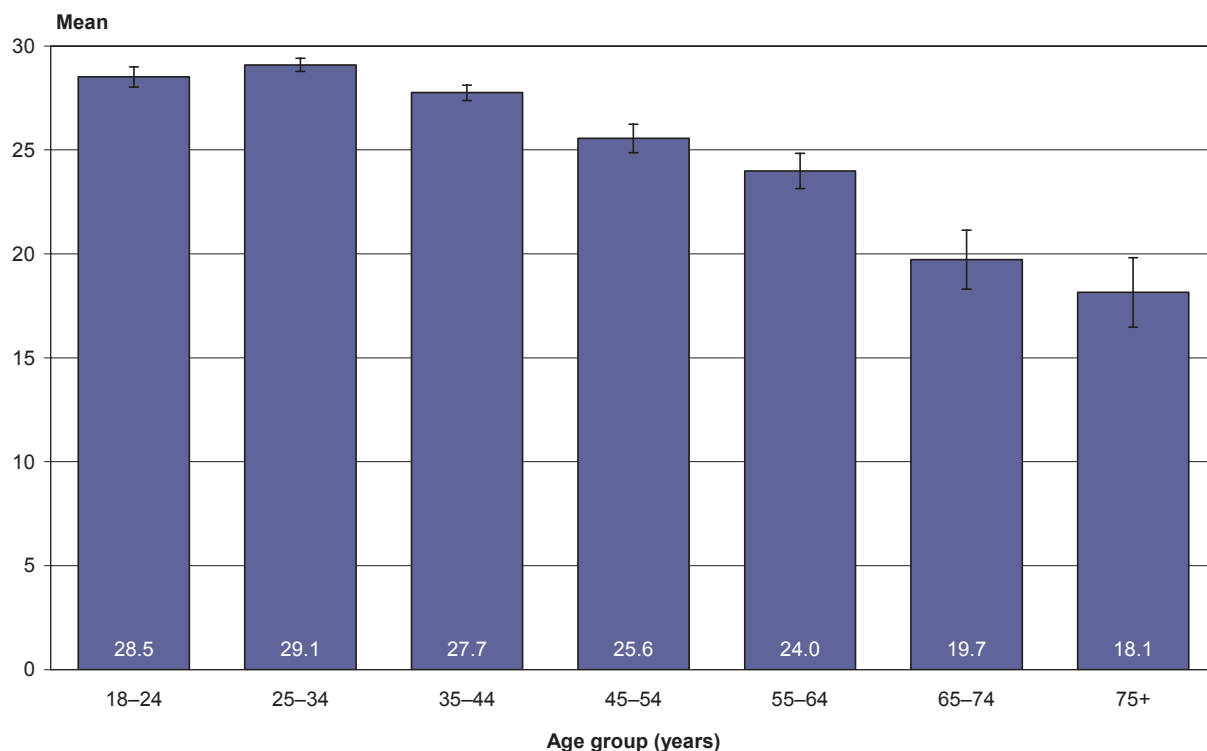
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

The average number of natural teeth per person was higher in the younger age groups (Figure 8). However, people aged 18–24 years had a slightly lower number of natural teeth on average than people aged 25–34 years, most likely because the wisdom teeth (third molars) would not yet have come through (erupted) in some people in the younger age group. Older adults aged 65 years and over had retained, on average, more than half the maximum number of natural teeth.

Figure 8: Mean number of natural teeth per person, among dentate adults aged 18 years and over, by age group (unadjusted mean)



Source: 2009 New Zealand Oral Health Survey

Table 11 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 11: Number of natural teeth per person, among dentate adults aged 18 years and over, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Men	Women	Age group	1.0	0.3
Māori	Non-Māori	Age group, sex	0.9*	-1.3*
Pacific	Non-Pacific	Age group, sex	1.0	0.0
Asian	Non-Asian	Age group, sex	1.0*	0.8*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.0*	-1.0*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	0.9*	-1.5*

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. Although presented as 1.0*, the value of the ratio of means (to two decimal places) was 1.03 for Asian adults and 0.96 for people living in the most deprived areas.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, Māori had a significantly lower mean number of natural teeth per person than non-Māori, after adjustment. Asian adults had a significantly higher mean number of natural teeth than non-Asian adults (ratio of means = 1.03).

People living in the more deprived neighbourhoods had a significantly lower number of natural teeth per person than people living in least deprived neighbourhoods, when adjusted for age, sex and ethnic group (ratio of means = 0.96).

People who usually visit a dental professional for a dental problem had a significantly lower number of natural teeth than people who usually visit a dental professional for a check-up, after adjustment.

Having a functional dentition (21 or more teeth)

The retention of 21 or more natural teeth is generally used to define a minimum functional dentition. Where there are 21 or more natural teeth, the functional, dietary and aesthetic needs of most people are generally met with natural teeth alone, without the need for removable partial dentures (Steele et al 1998).

How was this measured?

In the 2009 NZOHS, data for the mean number of natural teeth per dentate adult were derived from data collected in the clinical dental examination.

Nine in ten (88.6%) dentate adults aged 18 years and over had a functional dentition. Table 12 presents the prevalence of having a functional dentition among dentate adults, by population group.

Table 12: Prevalence of having a functional dentition, among dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	88.6 (86.9–90.3)
Sex	Women	89.5 (87.7–91.2)
	Men	87.6 (84.9–90.2)
Ethnic group	Māori	87.0 (83.7–90.4)
	Pacific	87.6 (82.7–92.5)
	Asian	95.0 (92.9–97.1)
	European/Other	88.4 (86.3–90.5)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	90.6 (86.4–94.8)
	2	89.3 (85.8–92.8)
	3	84.7 (79.8–89.7)
	4	90.3 (86.8–93.9)
	5 (most deprived)	87.3 (83.8–90.8)

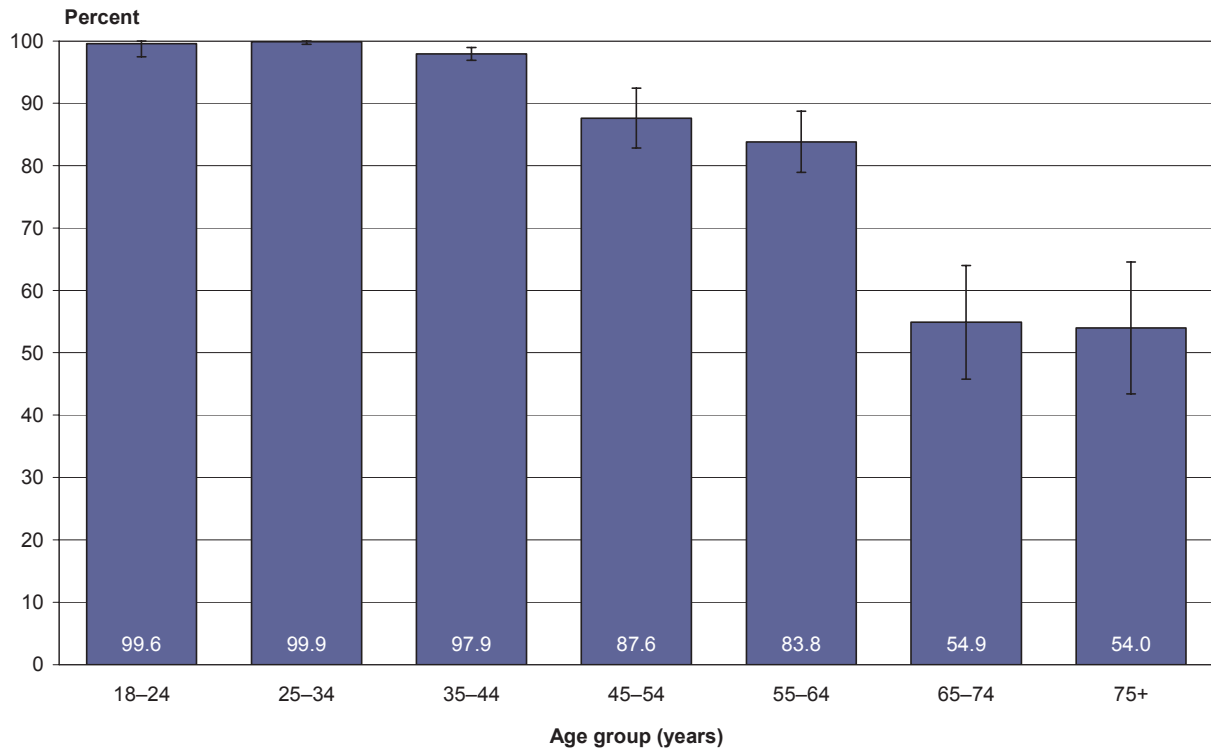
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 9 shows that, among dentate adults, the prevalence of having a functional dentition was higher in the younger age groups. Almost all dentate adults aged 18–44 years had a functional dentition, while about one in two dentate adults aged 65 years and over had a functional dentition.

Figure 9: Prevalence of having a functional dentition, among dentate adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 13 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 13: Having a functional dentition, among dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.0	-1.6
Māori	Non-Māori	Age group, sex	0.9*	-11.6*
Pacific	Non-Pacific	Age group, sex	0.9*	-7.1*
Asian	Non-Asian	Age group, sex	1.0	1.5
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.9	-5.9
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	0.9*	-8.5*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, Māori and Pacific adults were significantly less likely to have a functional dentition than non-Māori and non-Pacific adults, respectively, after adjustment.

People who usually visited a dental professional for a dental problem were significantly less likely to have a functional dentition, compared with people who usually visited a dental professional for a check-up.

There were no significant differences by sex or neighbourhood deprivation in the prevalence of having a functional dentition, after adjustment.

Part 2: Condition of the natural teeth

The structure of natural teeth can be affected by several conditions, including dental caries, dental erosion and abrasion, and dental trauma. The main threat to the condition of natural teeth is dental caries.

Dental caries is a chronic condition of the teeth, which can occur on any tooth surface. In the early stages, dental caries can be prevented and even reversed, through altering the dental environment by reducing plaque, reducing sugar exposure, and through the use of protective modifiers such as fluoride, and treatment options such as fluoride varnishes, fissure seals and preventive restorations. These measures can reduce the need for fillings or restorations.

If dental caries progresses unchecked and the enamel surface breaks down to form a cavity, the damage to the tooth becomes irreversible and a cavity on the crown of the tooth or a softening of the root surface occurs. (The crown is the part of the tooth that, on a natural sound tooth, is covered in dental enamel, while the root is that part of the tooth not covered by enamel, which is usually below the level of the gum.) To retain the tooth once a cavity has formed, a filling or other restoration is needed to remove the diseased tooth tissue and restore the form and function of the tooth. If caries is left untreated, pain and infection may occur, and the tooth may ultimately be lost.

The risk factors and indicators for dental caries include socioeconomic deprivation, suboptimal fluoride exposure, ethnicity, poor oral hygiene, prolonged infant bottle feeding, poor family dental health, enamel defects, eating disorders, irregular dental care, high sugar diet, high carbohydrate diet (in people with complex medical conditions), active orthodontic treatment, and low salivary flow (New Zealand Guidelines Group 2009).

Self-care, including twice-daily toothbrushing with fluoride toothpaste, can help to reduce the risk of caries.

In this section, the following indicators are presented for the crowns of teeth:

- sound teeth
- decayed teeth
- filled (restored) teeth
- severity of dental caries experience (DMFT).

The following indicators are also presented:

- decay on roots of teeth
- dental trauma (to the crowns of the upper six front teeth).

Results in this chapter are presented at tooth level. Surface-level data are reported in supplementary tables in Appendix B.

Mean number of sound teeth

In this indicator, *sound teeth* refer to teeth with no past or present evidence of coronal decay (ie, in the crown of the tooth), or any fillings placed to treat coronal decay.

How was this measured?

In the 2009 NZOHS, all teeth present were first divided into crowns and roots. The crown was 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, or for a filling placed to treat decay. The assessment was made for up to 160 coronal surfaces per person. Teeth assessed as having no past or present evidence of dental decay or any fillings placed to treat decay on any of the five coronal surfaces were classified as 'sound'.

Dentate adults aged 18 years and over had an average of 16.5 sound teeth per person. Table 14 presents the mean number of sound teeth per person, by population group.

Table 14: Mean number of sound teeth per person, among dentate adults aged 18 years and over, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	16.5 (16.2–16.8)
Sex	Women	16.2 (15.8–16.7)
	Men	16.8 (16.3–17.3)
Ethnic group	Māori	17.8 (17.1–18.5)
	Pacific	21.4 (20.3–22.5)
	Asian	23.2 (22.2–24.3)
	European/Other	15.4 (14.9–15.9)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	14.7 (13.5–16.0)
	2	15.7 (14.5–16.9)
	3	16.6 (15.3–17.9)
	4	17.9 (16.6–19.2)
	5 (most deprived)	17.9 (16.8–19.1)

Source: 2009 New Zealand Oral Health Survey

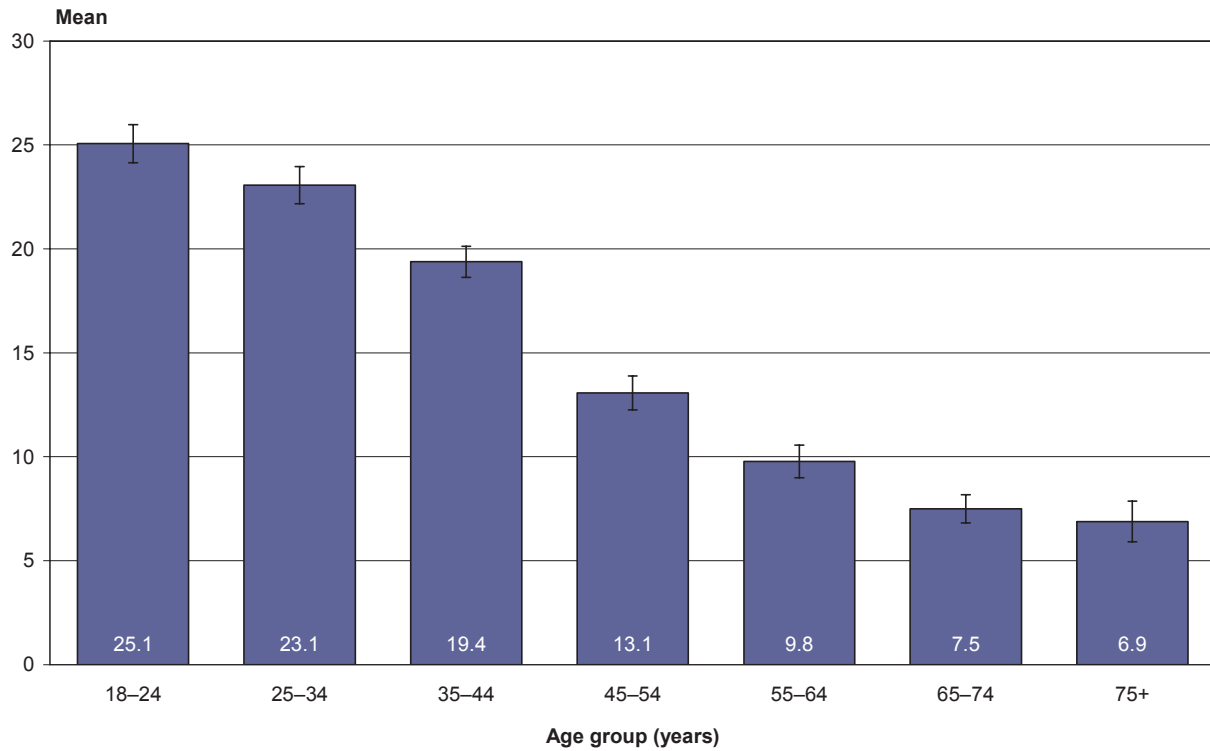
Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Among dentate adults, the mean number of sound teeth per person was highest among 18–24-year-olds, who had, on average, about 25 sound teeth (Figure 10). By contrast, adults aged 75 years and older had fewer than seven sound teeth on average per person.

It is useful to interpret these data in the context of the mean number of natural teeth present for each age group (page 67). The proportion of natural teeth present that were sound was about 88% among 18–24-year olds (25.1 sound teeth out of 28.5 natural teeth present) and 70% among 35–44-year-olds (19.4 out of 27.7); and it was 51% among adults aged 45–54 years (13.1 out of 25.6), and 38% in adults aged 75 years and over (6.9 out of 18.1).

Figure 10: Mean number of sound teeth per person, among dentate adults aged 18 years and over, by age group (unadjusted mean)



Source: 2009 New Zealand Oral Health Survey

Table 15 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 15: Number of sound teeth per person, among dentate adults aged 18 years and over, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Men	Women	Age group	1.1*	0.9*
Māori	Non-Māori	Age group, sex	0.9*	-1.2*
Pacific	Non-Pacific	Age group, sex	1.2*	3.1*
Asian	Non-Asian	Age group, sex	1.2*	3.6*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.0	0.8
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.0*	-0.8*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. Although presented as 1.0*, the value of the ratio of means for people who usually visit a dental professional for a dental problem was 0.95 (to two decimal places).

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, men had 1.1 times as many sound teeth per person on average than women, when adjusted for age.

After adjusting for age and sex, Māori dentate adults had significantly fewer sound teeth on average than non-Māori adults. However, Pacific and Asian dentate adults had 1.2 times as many sound teeth on average as non-Pacific and non-Asian adults, respectively.

People who usually visited a dental professional for a dental problem had significantly fewer sound teeth per person than those who usually visited a dental professional for a check-up, after adjustment (ratio of means = 0.95).

Prevalence of being caries-free, in adults aged 18–24 years

For children, the experience of dental decay is traditionally reported as the prevalence of being ‘caries-free’; that is, having no decayed, missing (due to pathology) or filled teeth. For this report, the measure also includes young adults aged 18–24 years. The indicator is not presented for older adult age groups, as it is assumed that the prevalence of being caries-free is low in older adults.

How was this measured?

Dentate adults aged 18–24 years 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; or in other words, they had ‘caries-free’ teeth.

One in four (22.7%) dentate adults aged 18–24 years were caries-free in their permanent teeth. Table 16 presents the proportion of adults aged 18–24 years who were caries-free, by population group.

Table 16: Caries-free prevalence, among dentate adults aged 18–24 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	22.7 (14.6–32.5)
Sex	Women	16.1 (7.3–29.3)
	Men	30.6 (17.0–47.1)
Ethnic group	Māori	21.2 (9.7–37.4)
	Pacific	10.1 (0.6–38.8)
	Asian	22.8 (5.0–53.4)
	European/Other	24.9 (15.0–37.2)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	22.1 (0.8–73.3)
	2	18.4 (4.3–43.6)
	3	37.9 (11.2–71.7)
	4	21.8 (5.0–50.7)
	5 (most deprived)	17.0 (5.5–36.1)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Table 17 present results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for relevant demographic factors to allow appropriate comparisons.

Table 17: Being caries-free, among dentate adults aged 18–24 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women		1.9	14.4
Māori	Non-Māori	Sex	0.9	-1.9
Pacific	Non-Pacific	Sex	0.5	-11.7
Asian	Non-Asian	Sex	0.8	-5.4
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Sex, ethnic group	0.8	-3.8
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Sex, ethnic group, NZDep2006	0.4	-18.3

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. There were no statistically significant results (where p-value < 0.05).

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

There were no significant differences by population group.

Prevalence of untreated coronal decay

The prevalence of dental decay is a fundamental measure of oral health and an indicator of the long-term prospects for a natural functional dentition. This section presents the percentage of dentate adults aged 18 years and over who had untreated decay on the crown of one or more teeth.

How was this measured?

In the 2009 NZOHS, all teeth present were first divided into crowns and roots. The crown is the part of the tooth which, on a natural sound tooth, is covered in dental enamel. The crown was 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. The assessment was made for up to 160 coronal surfaces per person. Results for root decay are presented on page 90.

One in three (35.3%) dentate adults aged 18 years and over had untreated coronal decay on one or more of their teeth. Table 18 presents the prevalence of untreated coronal decay, by population group.

Table 18: Prevalence of untreated coronal decay on one or more teeth, among dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	35.3 (32.5–38.2)
Sex	Women	29.7 (26.3–33.1)
	Men	41.5 (37.1–46.0)
Ethnic group	Māori	50.0 (44.2–55.7)
	Pacific	59.2 (49.9–68.5)
	Asian	34.4 (25.4–43.3)
	European/Other	32.9 (29.6–36.2)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	25.1 (18.9–31.4)
	2	33.2 (27.1–39.4)
	3	33.4 (26.3–40.5)
	4	44.2 (37.7–50.8)
	5 (most deprived)	42.2 (35.0–49.5)

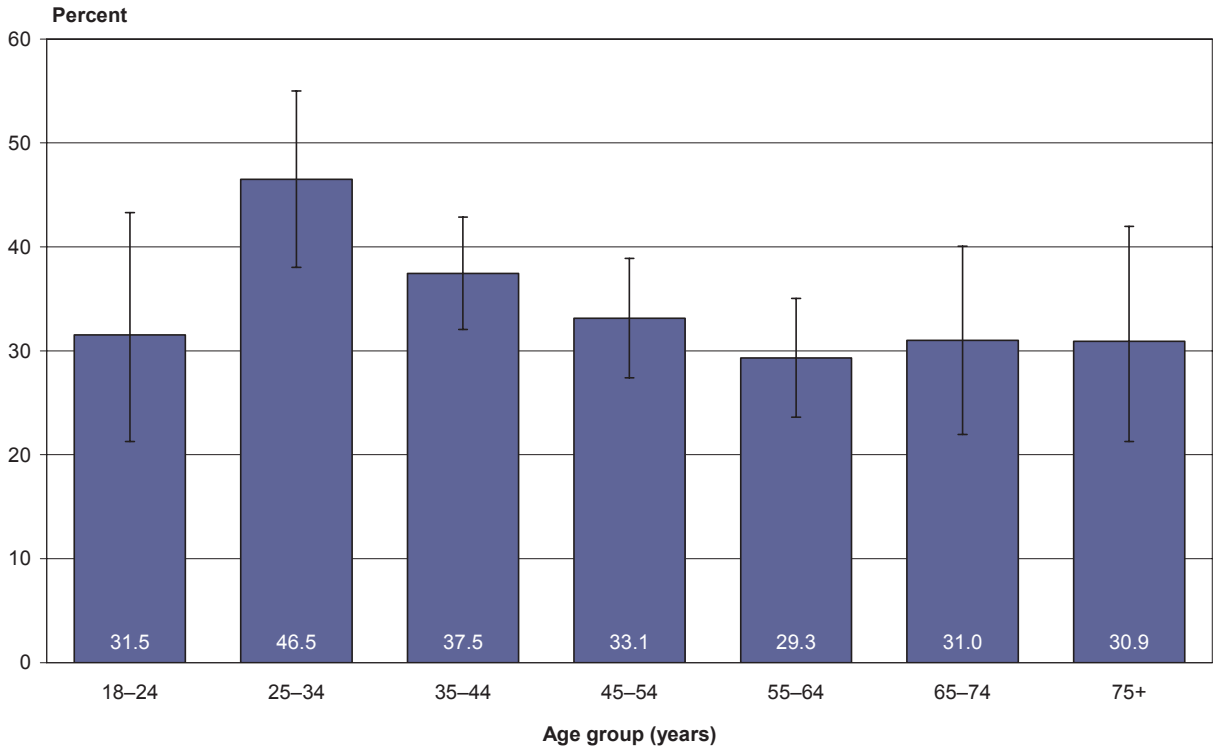
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

The prevalence of having untreated coronal decay on one or more teeth was highest in adults aged 25–34 years, where almost one in two (46.5%) were affected (Figure 11). The prevalence was similar for all adults aged 45 years and over, at about 30%.

Figure 11: Prevalence of having untreated coronal decay on one or more teeth, among dentate adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 19 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 19: Having untreated coronal decay on one or more teeth, among dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.4*	12.0*
Māori	Non-Māori	Age group, sex	1.5*	15.5*
Pacific	Non-Pacific	Age group, sex	1.7*	24.3*
Asian	Non-Asian	Age group, sex	0.9	-3.6
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.6*	16.4*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.9*	21.3*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, men were 1.4 times as likely as women to have untreated coronal decay on one or more teeth, after adjustment.

Māori were 1.5 times as likely to have untreated decay on one or more teeth, compared with non-Māori, after adjustment. Pacific adults were 1.7 times as likely to have untreated decay on at least one tooth as non-Pacific adults. This represents a 24.3 percentage point difference between Pacific and non-Pacific adults.

Adjusting for age, sex and ethnic group, people living in the most deprived areas were 1.6 times as likely to have untreated decay on at least one tooth compared with people living in the least deprived areas. This represents a 16.4 percentage point difference in the prevalence of untreated decay on one or more teeth.

People who usually visited a dental professional for a dental problem were almost twice as likely to have untreated decay on at least one tooth as people who usually visited a dental professional for a check-up; this represents a 21.3 percentage point difference in prevalences.

Mean number of teeth with untreated coronal decay

The average number of decayed teeth per person reflects the burden of untreated disease in adults with at least one natural tooth (dentate adults). In this section, severity of untreated dental decay is reported as the mean number of teeth with untreated coronal decay per person, among New Zealand dentate adults aged 18 years and over.

How was this measured?

In the 2009 NZOHS, all teeth present were first divided into crowns and roots. The crown is the part of the tooth which, on a natural sound tooth, is covered in dental enamel. The crown was 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. The assessment was made for up to 160 coronal surfaces per person. Surface-level data are reported in Appendix B.

Dentate adults aged 18 years and over had an average of 0.8 teeth with untreated decay. Table 20 presents the mean number of decayed teeth per person, by population group.

Table 20: Mean number of teeth with untreated coronal decay, among dentate adults aged 18 years and over, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	0.8 (0.7–0.9)
Sex	Women	0.7 (0.6–0.8)
	Men	1.0 (0.8–1.2)
Ethnic group	Māori	1.5 (1.2–1.7)
	Pacific	1.6 (1.2–2.0)
	Asian	0.7 (0.5–0.9)
	European/Other	0.8 (0.6–0.9)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	0.5 (0.3–0.6)
	2	0.7 (0.5–0.9)
	3	0.7 (0.5–0.9)
	4	1.0 (0.8–1.2)
	5 (most deprived)	1.4 (1.0–1.7)

Source: 2009 New Zealand Oral Health Survey

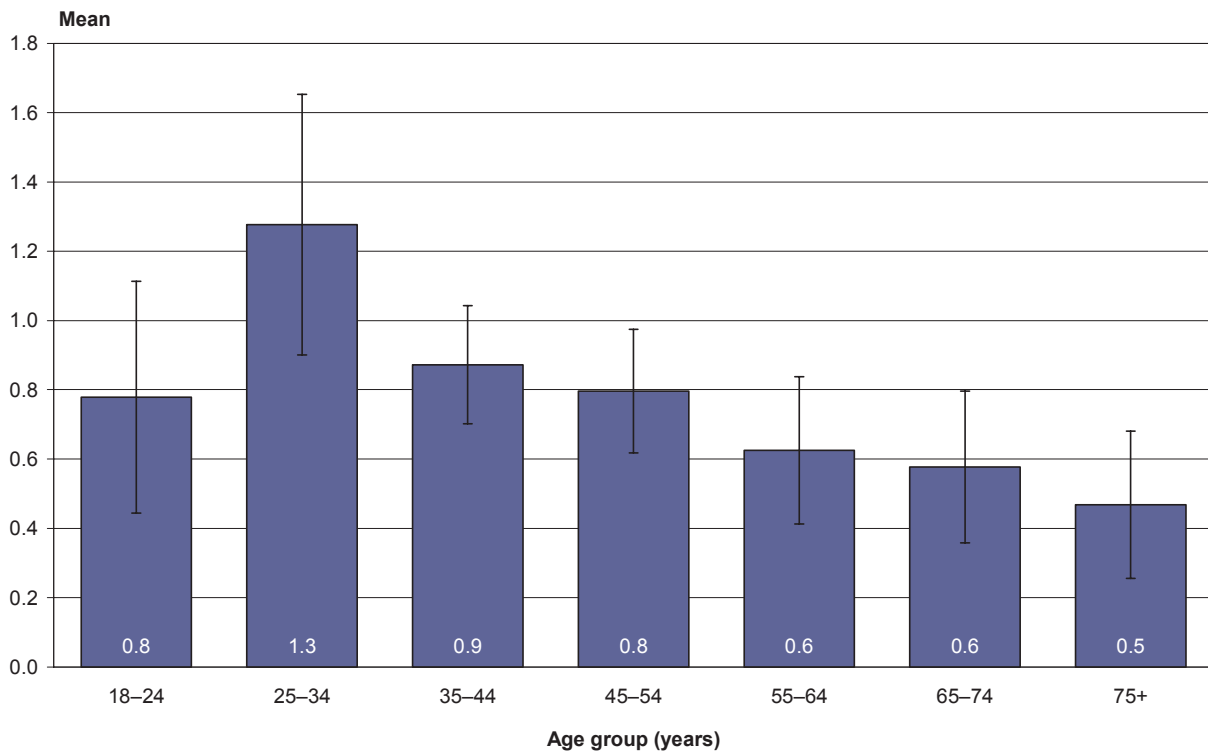
Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 12 shows that dentate adults aged 25–34 years had the highest mean number of teeth with untreated coronal decay per person of all age groups (1.3 decayed teeth on average). The mean number of decayed teeth per person was lower for older adults, with dentate adults aged 75 years and over having about 0.5 decayed teeth.

In interpreting these findings, the mean number of natural teeth present should be taken into account (page 67). The relative proportion of decayed teeth to natural teeth suggests that people aged 25–34 years had the greatest burden of untreated decay. The proportion of teeth with untreated coronal decay was about 2.8% among 18–24-year olds (0.8 decayed teeth out of 28.5 natural teeth present), 4.5% for 25–34-year-olds (1.3 out of 29.1), and 3.2% among 35–44-year-olds (0.9 out of 27.7). The proportion was around 3% in older age groups: 3.1% among adults aged 45–54 years (0.8 out of 25.6) and 2.8% in adults aged 75 years and over (0.5 out of 18.1).

Figure 12: Mean number of teeth with untreated coronal decay, among dentate adults aged 18 years and over, by age group (unadjusted mean)



Source: 2009 New Zealand Oral Health Survey

Table 21 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 21: Number of teeth with untreated coronal decay per person, among dentate adults aged 18 years and over, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Men	Women	Age group	1.5*	0.3*
Māori	Non-Māori	Age group, sex	1.9*	0.6*
Pacific	Non-Pacific	Age group, sex	1.9*	0.7*
Asian	Non-Asian	Age group, sex	0.7	-0.2*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.6*	0.8*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	2.3*	0.6*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, the mean number of teeth with untreated decay was 1.5 times higher among men than women, after adjusting for age.

After adjustment, the average number of teeth with untreated decay among dentate adults was 1.9 times higher for Māori than for non-Māori, and was also 1.9 times higher for Pacific adults than for non-Pacific adults. Asian adults had an average of 0.2 teeth fewer than non-Asian adults with untreated decay, which was statistically significant (although the ratio of means was not statistically significant).

The mean number of decayed teeth was 2.6 times higher among people living in deprived neighbourhoods than among people living in the least deprived neighbourhoods, after adjusting for age, sex and ethnic group.

After adjustment, the mean number of decayed teeth per person was 2.3 times higher among people who usually visited a dental professional for a dental problem than among people who usually visited a dental professional for a check-up.

Mean number of filled teeth

Once a cavity has formed in a tooth, a restoration is needed to restore the form, function and appearance of the tooth, if the tooth is to be retained and not extracted. The extent to which teeth have been restored represents the past experience of dental caries, as well as access to oral health care and patterns of dental treatment.

In this report, 'fillings' refers to restorations placed to treat decay, ranging from simple fillings to complex fillings and crowns (but not including fillings placed for cosmetic reasons).

How was this measured?

In the 2009 NZOHS, all five coronal surfaces of each tooth were assessed for the presence of a filling or other restoration placed to treat decay. Fillings placed for cosmetic reasons were not included in this measure. The assessment was made for up to 160 tooth surfaces per person. Surface-level data are reported in Appendix B.

Dentate adults aged 18 years and over had an average of 8.5 filled teeth. Table 22 presents the mean number of filled teeth in the dentate population, by population group.

Table 22: Mean number of filled teeth, among dentate adults aged 18 years and over, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	8.5 (8.1–8.8)
Sex	Women	8.9 (8.5–9.3)
	Men	8.0 (7.5–8.5)
Ethnic group	Māori	6.4 (5.9–6.9)
	Pacific	3.6 (3.0–4.3)
	Asian	4.0 (3.3–4.7)
	European/Other	9.4 (9.0–9.8)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	10.9 (9.8–11.9)
	2	9.3 (8.3–10.3)
	3	8.0 (7.1–8.9)
	4	7.4 (6.5–8.4)
	5 (most deprived)	6.2 (5.3–7.0)

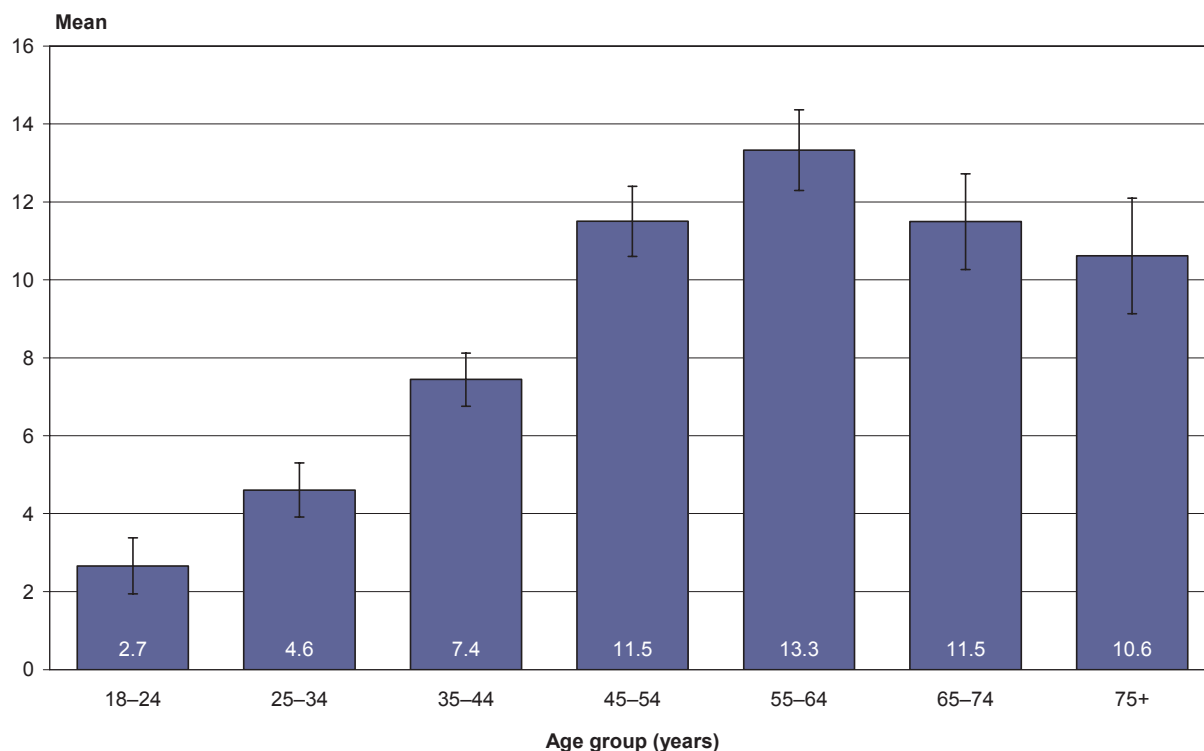
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Among dentate adults, the mean number of filled teeth per person was highest in the 55–64 years age group, at 13.3 filled teeth per person (Figure 13).

Figure 13: Mean number of filled teeth, among dentate adults aged 18 years and over, by age group (unadjusted mean)



Source: 2009 New Zealand Oral Health Survey

Table 23 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 23: Number of filled teeth per person, among dentate adults aged 18 years and over, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Men	Women	Age group	0.9*	-1.0*
Māori	Non-Māori	Age group, sex	0.9*	-1.0*
Pacific	Non-Pacific	Age group, sex	0.5*	-4.7*
Asian	Non-Asian	Age group, sex	0.6*	-3.6*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.7*	-2.7*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	0.9*	-1.3*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, men had significantly fewer filled teeth on average than women, after adjustment.

After adjustment, Pacific adults had about half the mean number of filled teeth as non-Pacific adults, and Asian adults had less than two-thirds the mean number of filled teeth as non-Asian adults. There were also significantly lower mean numbers of filled teeth among Māori compared with non-Māori.

People living in the most deprived neighbourhoods had significantly fewer filled teeth, on average, than people living in the least deprived neighbourhoods, when adjusted for age, sex and ethnic group.

People who usually visited a dental professional for a dental problem had significantly fewer filled teeth, on average, than people who usually visited a dental professional for a check-up.

Severity of dental decay experience (DMFT)

If dental decay progresses unchecked and the enamel surface breaks down to form a cavity, the damage to the tooth becomes irreversible. The treatment of irreversible dental decay leaves a permanent mark on the dentition, either through the presence of a filling or the loss of the affected tooth by extraction.

The number of decayed, missing or filled teeth or surfaces of teeth reflects a person's lifetime experience of dental decay. By convention, dental decay experience is quantified as the sum of three components: decayed (D), missing due to pathology (M) and filled (F) teeth (T), and is a measure that is widely referred to as the DMFT index (Klein et al 1938). The index is cumulative, so an individual's DMFT score cannot decrease over time.

How was this measured?

For this section the DMFT index was calculated using data from previous sections: mean number of teeth with untreated coronal decay, mean number of teeth missing due to pathology, and mean number of filled teeth. Tables in Appendix B report the components of the index and the overall DMF score at the tooth level (DMFT) and surface level (DMFS).

It should be noted that for people younger than 45 years, teeth missing due to reasons other than pathology were excluded from analysis, while for people aged 45 years and over, it was assumed that all missing teeth were missing due to pathology. This means that results for people aged 45 years and over may be slightly overestimated.

Overall, dentate adults aged 18 years and over had a mean of 13.9 decayed, missing, or filled teeth (ie, a DMFT score of 13.9). Table 24 presents the mean DMFT among dentate adults, by population group.

Table 24: Mean number of decayed, missing or filled teeth (DMFT score), among dentate adults aged 18 years and over, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	13.9 (13.5–14.2)
Sex	Women	14.1 (13.7–14.6)
	Men	13.6 (13.1–14.1)
Ethnic group	Māori	12.3 (11.5–13.1)
	Pacific	9.6 (8.4–10.8)
	Asian	6.8 (5.8–7.8)
	European/Other	15.0 (14.4–15.5)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	15.6 (14.2–17.1)
	2	14.8 (13.4–16.1)
	3	13.8 (12.4–15.3)
	4	12.5 (11.2–13.9)
	5 (most deprived)	12.3 (11.1–13.5)

Source: 2009 New Zealand Oral Health Survey

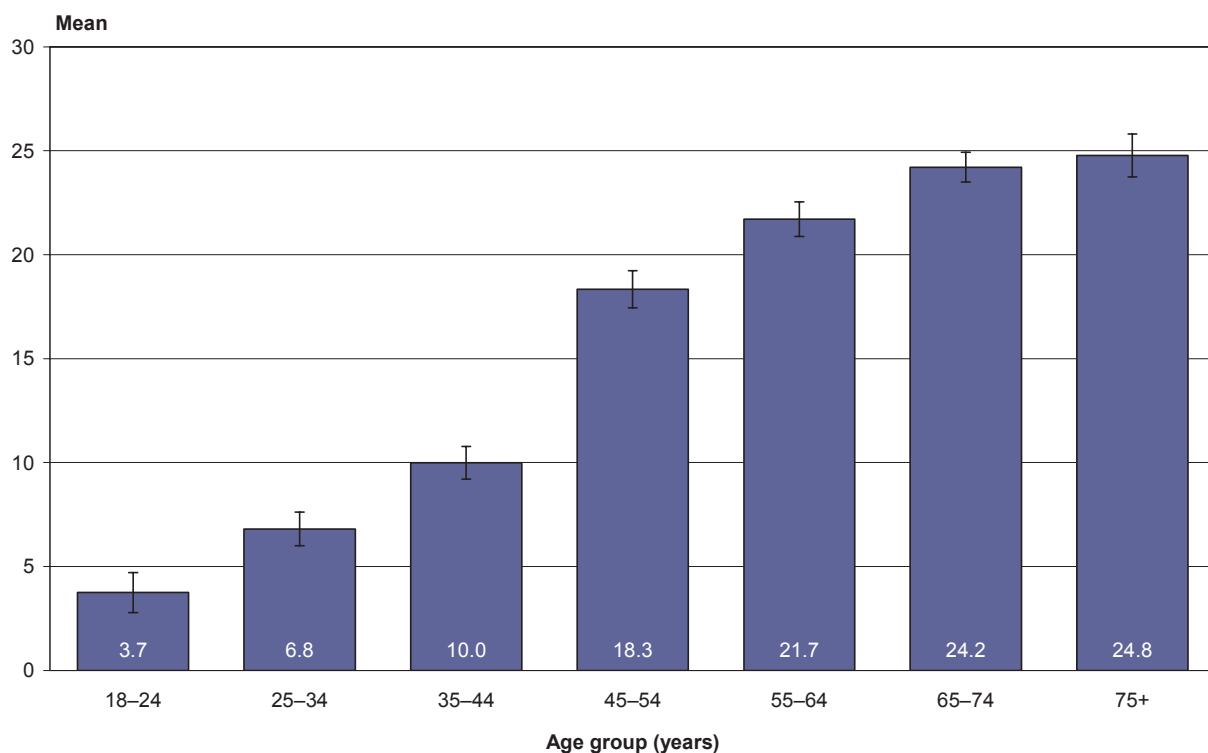
Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

The mean DMFT score was higher among older dentate adults (Figure 14). People aged 18–24 years had a mean DMFT of 3.7 teeth, while people aged 75 years and over had a mean DMFT of almost 25.

The largest difference in mean DMFT in adjacent age groups was for adults aged 35–44 years and 45–54 years, where the mean DMFT was almost twice as high. (It should be noted that there were different assessment criteria for missing teeth for people aged 45 years and over, as all missing teeth were assumed to be due to pathology in this age group).

Figure 14: Mean number of decayed, missing or filled teeth (DMFT) per person, among dentate adults aged 18 years and over, by age group (unadjusted mean)

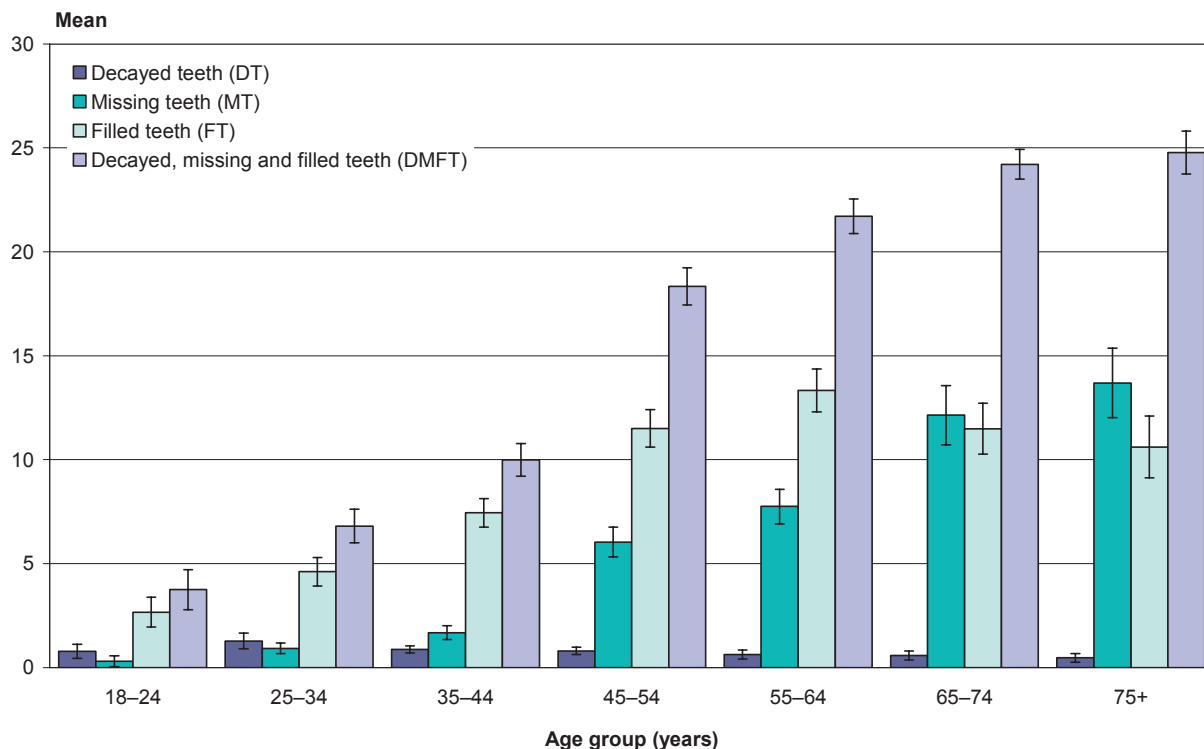


Source: 2009 New Zealand Oral Health Survey

The overall DMFT score for dentate adults aged 18 years and over (13.9) was made up of 0.8 decayed teeth, 4.6 missing teeth and 8.5 filled teeth. Figure 15 shows the relative contribution of each of the components of the DMFT index and the overall DMFT score for each population age group.

Among adults aged 18–64 years, filled teeth made the greatest contribution to the DMFT score. Decayed teeth comprised the smallest component of the DMFT score across most age groups, except in younger adults, where decayed teeth proportionally made a greater contribution to the DMFT score than in other age groups. Missing teeth made a larger contribution to the DMFT score in the older age groups than in younger age groups.

Figure 15: Mean number of decayed teeth (DT), missing teeth due to pathology (MT), filled teeth (FT), and overall DMFT score per person, among New Zealand dentate adults aged 18 years and over, by age group (unadjusted mean)



Source: 2009 New Zealand Oral Health Survey

Table 25 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 25: Number of decayed, missing or filled teeth (DMFT score) per person, among dentate adults aged 18 years and over, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Men	Women	Age group	0.9*	-0.9*
Māori	Non-Māori	Age group, sex	1.1*	1.9*
Pacific	Non-Pacific	Age group, sex	0.8*	-2.9*
Asian	Non-Asian	Age group, sex	0.6*	-5.0*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.0	-0.4
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.1*	0.7*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, men had significantly fewer decayed, missing and filled teeth (a lower DMFT score) on average than women, after adjustment.

For dentate adults, Māori adults had a significantly higher mean DMFT score than non-Māori adults, after adjustment. Pacific and Asian adults had significantly lower mean DMFT scores than non-Pacific and non-Asian adults, respectively.

Among dentate adults, people who usually visited a dental professional for a dental problem had a significantly higher DMFT score than people who usually visited a dental professional for a check-up.

There was no significant pattern in the mean DMFT by neighbourhood deprivation among dentate adults, after adjustment.

Prevalence of untreated root decay

The root is that part of the tooth not covered by enamel and which is usually below the level of the gum. As people age, gum recession and pocketing of gum tissues can expose the root surface of the tooth. When the root surface becomes exposed to the oral environment, and potentially to factors that cause dental decay, the roots can become vulnerable to decay. As recession is usually associated with increasing age, decay of root surfaces of teeth is more common in older people. As adults retain their teeth for longer, decay on root surfaces is likely to become more common in the future.

How was this measured?

In the 2009 NZOHS, teeth were divided into crowns and roots. For adults, the roots of all teeth present were subdivided into four surfaces, and each surface was assessed for untreated decay, defined as a lesion on the root surface that was soft to exploration using a periodontal probe. Results for coronal decay are presented on page 77.

One in eleven (9.5%) dentate adults aged 18 years and over had one or more decayed root surfaces. Table 26 presents the prevalence of having one or more decayed root surfaces, by population group.

Table 26: Prevalence of one or more decayed root surfaces, among dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	9.5 (8.1–11.0)
Sex	Women	7.0 (5.3–8.8)
	Men	12.2 (9.5–15.0)
Ethnic group	Māori	11.1 (8.0–14.3)
	Pacific	10.1 (6.1–15.5)
	Asian	5.5 (3.4–8.3)
	European/Other	9.7 (7.9–11.5)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	7.3 (4.0–12.2)
	2	10.4 (7.0–14.8)
	3	6.2 (3.4–10.3)
	4	11.5 (7.5–16.6)
	5 (most deprived)	12.5 (8.6–16.4)

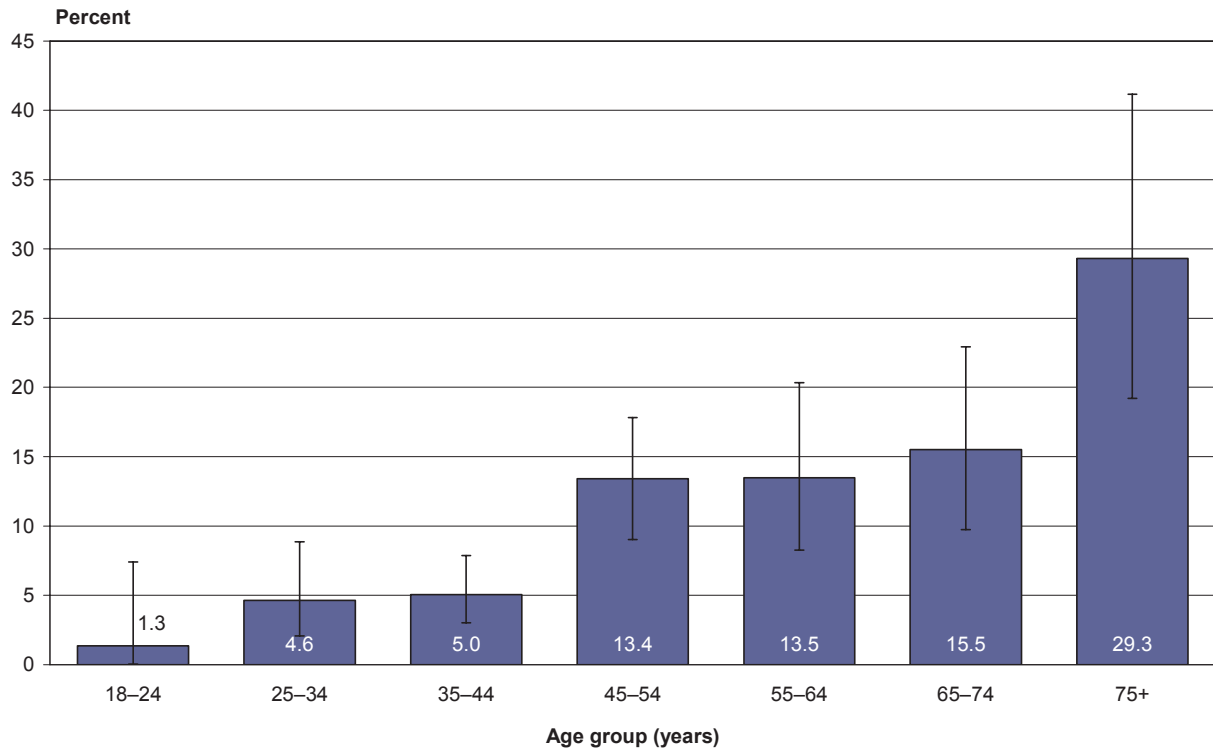
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 16 shows that the prevalence of having one or more decayed root surfaces was highest among dentate adults aged 75 years and over, where about one in three (29.3%) were affected. In addition, 45–54-year-olds had a significantly higher prevalence (13.4%) than 35–44-year-olds (5.0%).

Figure 16: Prevalence of one or more decayed root surfaces, among dentate adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 27 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 27: Having one or more decayed root surfaces, among dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.7*	5.0*
Māori	Non-Māori	Age group, sex	1.7*	6.2*
Pacific	Non-Pacific	Age group, sex	1.3	3.0
Asian	Non-Asian	Age group, sex	0.8	-2.3
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.3*	7.9*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.5*	3.7*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, men were 1.7 times as likely as women to have one or more decayed root surfaces, when adjusted for age.

After adjustment, Māori were 1.7 times as likely to have one or more decayed root surfaces as non-Māori.

Dentate adults in the most deprived areas were 2.3 times as likely to have one or more decayed root surfaces as those in the least deprived areas, after adjustment.

People who usually visited a dental professional for a dental problem were 1.5 times as likely to have one or more decayed root surfaces as people who usually visited a dental professional for a dental check-up, after adjustment.

Prevalence of dental trauma

Traumatic dental injuries are a public health problem and in many countries are considered a greater threat to the front teeth than dental caries. Injuries to teeth vary greatly in severity, from minor cracks in the enamel to tooth fracture, the tooth being moved from its natural position, or the tooth being knocked completely out of the tooth socket (avulsed). The main risk factors for dental injuries are protrusion of the front teeth, traffic and bicycle accidents, contact sports, violence, falls, piercing of tongue and lips and physical abuse (Beaglehole et al 2009). Few population-based studies of traumatic dental injury in adults have been undertaken.

For this report, the prevalence of dental trauma is reported as the percentage of dentate adults aged 18 years and over who had one or more traumatised upper six front permanent teeth (which are the teeth most likely to be affected by dental trauma), irrespective of the degree of damage to the teeth. Teeth lost due to trauma were also included in this measure.

How was this measured?

In the 2009 NZOHS, the upper six front (anterior) permanent teeth were assessed for signs of trauma. Teeth that had a positive history of trauma, as reported by the participant, were classified by the dental examiner, according to the level of trauma sustained and any treatment provided to repair or replace these teeth.

One in four (23.4%) dentate adults aged 18 years and over had experienced trauma to one or more upper six front teeth. Table 28 presents the prevalence of having had any dental trauma in the upper six front teeth, by population group.

Table 28: Prevalence of one or more traumatised upper six front teeth, among dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	23.4 (20.9–25.9)
Sex	Women	19.8 (16.7–22.9)
	Men	27.3 (23.3–31.3)
Ethnic group	Māori	27.2 (22.5–31.8)
	Pacific	29.6 (21.3–37.8)
	Asian	22.7 (14.8–32.4)
	European/Other	23.4 (20.5–26.3)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	24.9 (18.7–31.0)
	2	21.5 (15.7–27.4)
	3	23.6 (17.0–30.3)
	4	21.0 (15.6–26.5)
	5 (most deprived)	26.3 (20.9–31.8)

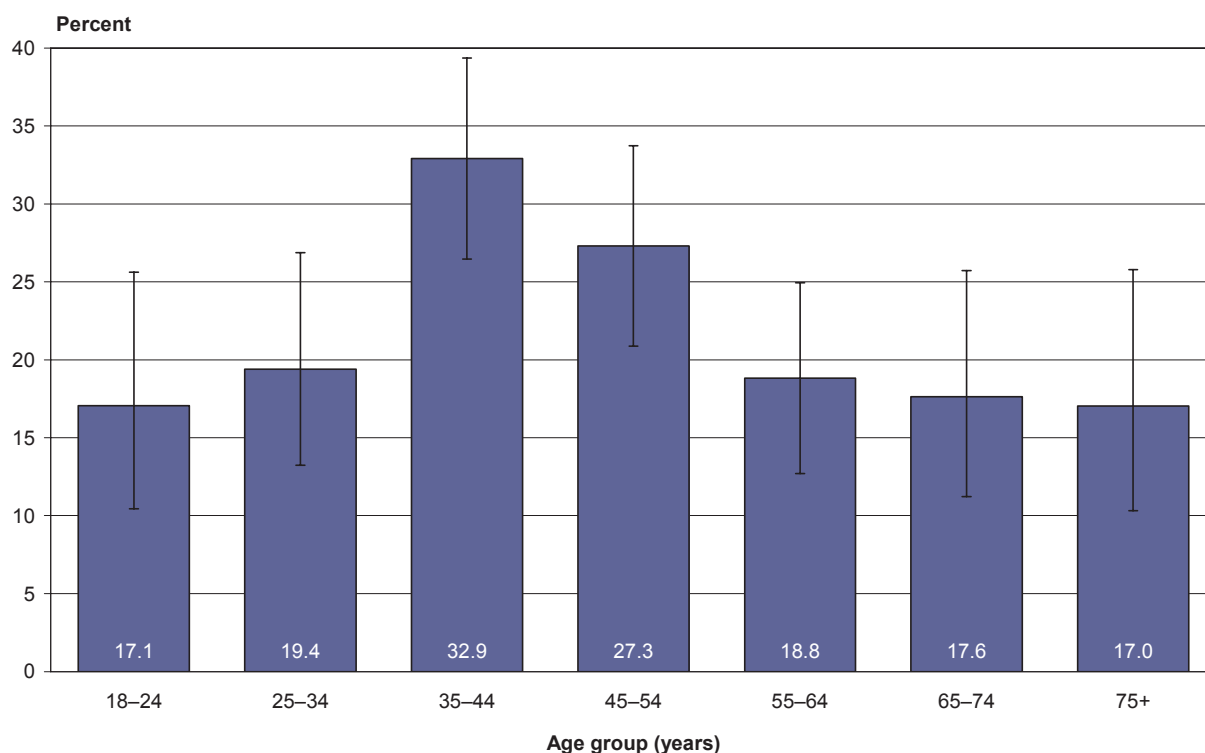
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 17 shows that across all population age groups at least 17% of dentate adults had sustained some trauma to the upper six front teeth. The highest prevalence of having one or more traumatised upper front teeth was among people aged 35–44 years (32.9%) and 45–54 years (27.3%). Adults aged 35–44 years were significantly more likely to have one or more traumatised upper front teeth than adults aged 18–34 years and 55 years and over.

Figure 17: Prevalence of one or more traumatised upper six front teeth, among dentate adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 29 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 29: Having one or more traumatised upper six front teeth, among dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.4*	7.7*
Māori	Non-Māori	Age group, sex	1.2	4.3
Pacific	Non-Pacific	Age group, sex	1.2	5.7
Asian	Non-Asian	Age group, sex	1.1	1.3
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.0	0.8
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.0	-0.3

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

After age adjustment, men were 1.4 times as likely to have experienced trauma to one or more of their upper six front teeth as women.

There were no other significant differences in the prevalence of having one or more traumatised upper front teeth, by ethnic group, neighbourhood deprivation or usual reason for visiting a dental professional.

Part 3: Condition of supporting structures

The teeth sit in bony sockets within each jaw and are connected to the jaw bone by a periodontal ligament, which, in turn, is protected by the gums (gingiva). Two common types of periodontal disease occur: gingivitis and chronic periodontitis. The underlying cause of both gingivitis and chronic periodontitis is bacteria in dental plaque (the sticky film that accumulates on teeth). The more plaque accumulates (typically due to infrequent or ineffective oral hygiene), the greater the risk of both conditions. However, aspects of general health (eg, smoking and diabetes) also increase the risk and severity of chronic periodontitis.

Gingivitis (inflammation of the gums) occurs in response to the bacteria in the dental plaque that accumulates around the necks of the teeth, near the gum line. It is a painless condition, characterised by redness, swelling or bleeding of the gums, and was not assessed in the 2009 NZOHS.

Chronic periodontitis is also caused by a bacterial infection and occurs when inflammation of the gums extends, leading to progressive loss of the ligament and bone that support the teeth (in its severe forms, the teeth may become loose and even be lost). The loss of supporting structures can result in the formation of 'pockets' between the gum and the tooth. The depth of a pocket is an indication of the severity of the destructive process.

In the 2009 NZOHS, adults examined in the survey were assessed for periodontal diseases provided they had no medical conditions that precluded measurements being made (see the list on page 39). Gum recession and pocket depth were measured at three sites on each tooth. Gum recession occurs in response to disease or trauma to the gums when the overlying gum tissue is thin, meaning that it is an indicator of past disease and/or trauma. Periodontal loss of attachment is the loss of supporting periodontal structure around the tooth, through either gum recession, or periodontal pocketing, or a combination of both. Loss of attachment was derived from the measurements for periodontal pocketing and gum recession.

This report presents the progressive loss of supporting structures of the teeth, as quantified by two measures:

- prevalence of periodontal pocketing (any, moderate, deep)
- prevalence of periodontal loss of attachment (any, moderate, severe).

Prevalence of periodontal pocketing

When chronic periodontitis becomes established, the loss of supporting structures can result in the formation of 'pockets' between the gum and the tooth. The depth of a pocket, measured in millimetres using a periodontal probe, is an indication of the severity of the destructive process. Periodontal pocketing is presented in this report as any pocketing (of 4 mm or more), moderate pocketing (of 5 mm or more) and deep pocketing (of 6 mm or more). The prevalence of 'any pocketing' includes any, moderate and deep pocketing. Similarly, the prevalence of 'moderate pocketing' includes deep pocketing. Results are reported for dentate adults aged 18 years and over who were periodontally examined.

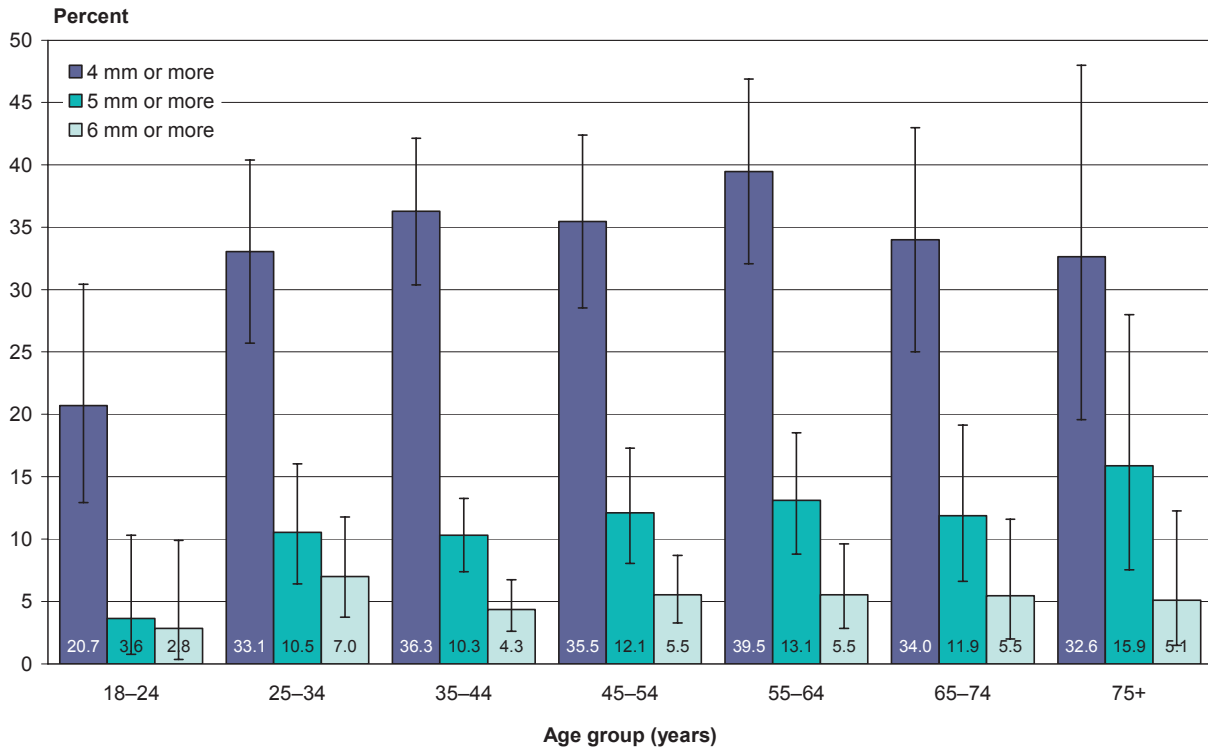
How was this measured?

In the 2009 NZOHS dentate adults were assessed for periodontal diseases provided they had no medical conditions that precluded measurements being made of the gums. For adults who were assessed clinically for periodontal disease, gum recession (the amount of exposed dental root) and pocket depth were measured at three sites on each tooth. Up to 168 periodontal measurements were made for each periodontally examined dentate adult (based on three sites per tooth and two measurements per site, for 28 teeth).

One in three (33.5%) dentate adults aged 18 years and over had periodontal pocketing (of 4 mm or more) at one or more sites. One in ten (10.5%) had moderate periodontal pocketing (of 5 mm or more), and 5.1% had deep periodontal pocketing (of 6 mm or more).

Figure 18 shows that there were similar prevalences of periodontal pocketing across age groups for all three measures, although people aged 18–24 years appeared to have a slightly lower prevalence of any periodontal pocketing than other age groups.

Figure 18: Prevalence of periodontal pocketing (4 mm or more, 5 mm or more and 6 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Detailed results for each of the three measures of periodontal pocketing are presented below.

Prevalence of any periodontal pocketing (4 mm or more)

One in three (33.5%) dentate adults aged 18 years and over had any periodontal pocketing of 4 mm or more, at one or more sites. Table 30 presents the prevalence of having any periodontal pocketing of 4 mm or more, by population group.

Table 30: Prevalence of any periodontal pocketing (4 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	33.5 (30.7–36.3)
Sex	Women	28.5 (25.1–31.9)
	Men	38.9 (34.2–43.6)
Ethnic group	Māori	46.2 (41.1–51.2)
	Pacific	46.0 (36.7–55.2)
	Asian	44.2 (32.5–56.0)
	European/Other	30.5 (27.0–34.0)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	30.2 (23.3–37.2)
	2	36.0 (28.1–43.8)
	3	25.2 (19.2–31.2)
	4	39.7 (33.2–46.3)
	5 (most deprived)	36.7 (29.9–43.5)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 31 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 31: Having any periodontal pocketing (4 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.4*	10.2*
Māori	Non-Māori	Age group, sex	1.5*	16.5*
Pacific	Non-Pacific	Age group, sex	1.4*	14.2*
Asian	Non-Asian	Age group, sex	1.5*	15.5*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.1	4.5
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.1	4.4

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, men were 1.4 times as likely as women to have any periodontal pocketing of 4 mm or more at one or more sites, after adjustment.

Māori and Asian adults were 1.5 times as likely to have any periodontal pocketing of 4 mm or more as non-Māori and non-Asian adults, respectively, after adjustment. Pacific adults were 1.4 times as likely to have any periodontal pocketing as non-Pacific adults.

After adjustment, there were no significant differences in the prevalence of any periodontal pocketing by neighbourhood deprivation or usual reason for visiting a dental professional.

Prevalence of moderate periodontal pocketing (5 mm or more)

One in ten (10.5%) dentate adults aged 18 years and over had moderate periodontal pocketing of 5 mm or more, at one or more sites. Table 32 presents the prevalence of having periodontal pocketing of 5 mm or more, by population group.

Table 32: Prevalence of moderate periodontal pocketing (5 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	10.5 (8.8–12.3)
Sex	Women	7.9 (5.9–10.0)
	Men	13.3 (10.3–16.4)
Ethnic group	Māori	16.4 (12.9–19.9)
	Pacific	20.9 (13.8–29.5)
	Asian	19.5 (12.2–28.6)
	European/Other	8.4 (6.4–10.4)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	8.8 (5.0–14.2)
	2	7.7 (4.9–11.4)
	3	8.3 (5.5–12.0)
	4	16.2 (11.3–21.0)
	5 (most deprived)	12.2 (8.4–16.0)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 33 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 33: Having moderate periodontal pocketing (5 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.7*	5.2*
Māori	Non-Māori	Age group, sex	1.9*	8.6*
Pacific	Non-Pacific	Age group, sex	2.2*	11.7*
Asian	Non-Asian	Age group, sex	2.4*	13.2*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.6	5.0
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.0	-0.3

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

After adjustment, men were 1.7 times as likely to have moderate periodontal pocketing of 5 mm or more at one or more sites as women.

Māori were 1.9 times as likely to have moderate periodontal pocketing of 5 mm or more, compared with non-Māori, after adjustment. Pacific adults were 2.2 times as likely, and Asian adults were 2.4 times as likely, to have moderate periodontal pocketing as non-Pacific and non-Asian adults, respectively.

There were no significant differences by neighbourhood deprivation or usual reason for visiting a dental professional, after adjustment.

Prevalence of deep periodontal pocketing (6 mm or more)

About 5.1% of dentate adults aged 18 years and over had deep periodontal pocketing of 6 mm or more at one or more sites. Table 34 presents the prevalence of deep periodontal pocketing, by population group.

Table 34: Prevalence of deep periodontal pocketing (6 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	5.1 (3.9–6.4)
Sex	Women	4.1 (2.7–5.8)
	Men	6.2 (4.1–8.4)
Ethnic group	Māori	7.3 (5.5–9.2)
	Pacific	10.7 (6.4–16.6)
	Asian	12.9 (7.2–20.6)
	European/Other	3.6 (2.4–5.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	2.6 (1.0–5.3)
	2	4.4 (2.4–7.3)
	3	4.0 (2.1–7.0)
	4	8.2 (4.8–12.7)
	5 (most deprived)	6.9 (4.0–11.0)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 35 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 35: Having deep periodontal pocketing (6 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.5	2.2
Māori	Non-Māori	Age group, sex	1.6*	2.7*
Pacific	Non-Pacific	Age group, sex	2.3*	6.1*
Asian	Non-Asian	Age group, sex	3.0*	8.6*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.4	4.5
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.1	0.7

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, Asian adults were about three times as likely to have deep periodontal pocketing as non-Asian adults, while Pacific adults were over twice as likely as non-Pacific adults to have deep pocketing. Māori were also significantly more likely than non-Māori to have deep pocketing.

There were no significant differences by sex, neighbourhood deprivation or usual reason for visiting a dental professional, after adjustment.

Prevalence of loss of attachment

Loss of attachment is the loss of supporting periodontal structure around the tooth through either gum recession or periodontal pocketing, or a combination of both. It can be quantified by measuring the distance from where the enamel of the tooth meets the root to the bottom of the pocket between the gum tissue and the root. Once the attachment loss is 6 mm or more, the tooth may be at greater risk of being lost (Health Canada 2010). Loss of attachment can be mostly prevented through good oral hygiene habits (including brushing and flossing), professional dental care (to remove hardened plaque, also known as calculus) and avoiding smoking.

Loss of attachment is a useful indicator to supplement information on periodontal pocketing, particularly for older dentate adults, because it shows the effect of past disease or trauma. When interpreting findings on the loss of attachment, it is important to consider the person's age.

The data on periodontal loss of attachment are presented in this report as the prevalence of any loss of attachment (of 4 mm or more), moderate loss of attachment (of 5 mm or more) and severe loss of attachment (of 6 mm or more) at one or more sites. Results are reported for dentate adults aged 18 years and over who were periodontally examined.

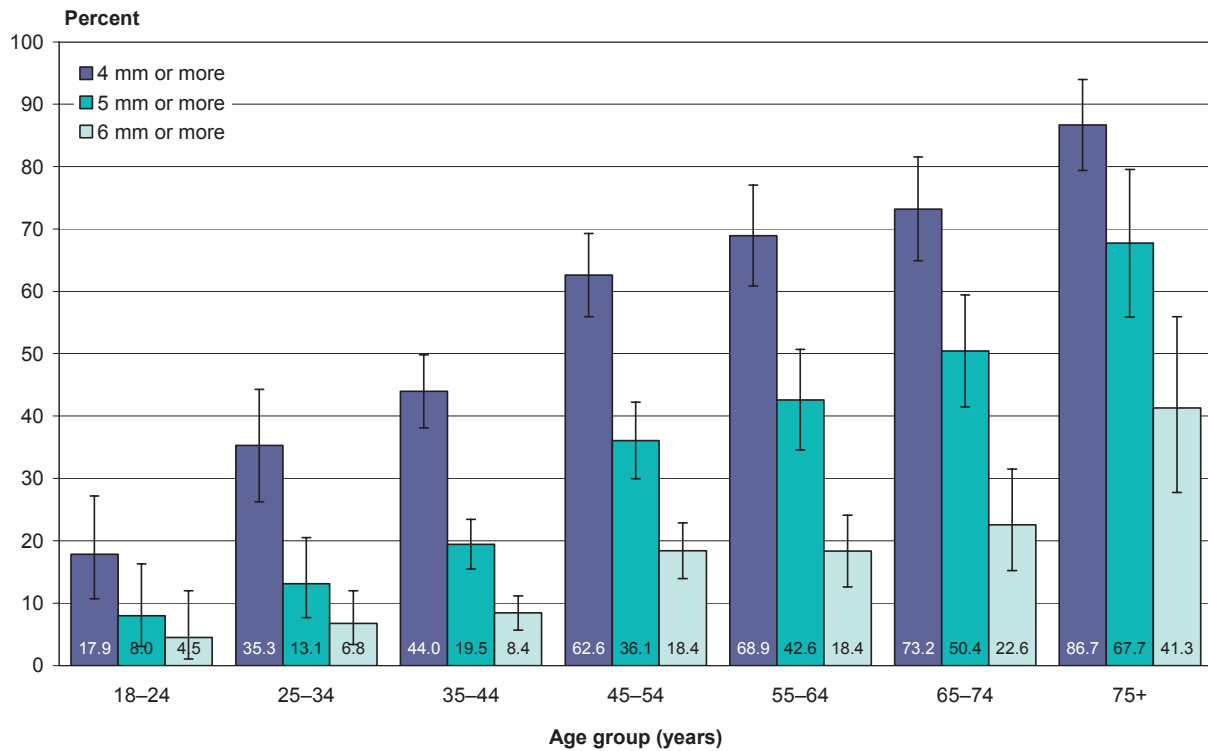
How was this measured?

In the 2009 NZOHS, clinical attachment loss was measured using a combination of gum recession and periodontal probing depth on three sites per tooth, and was calculated during analysis of the survey data set. In cases where the gum line sits above the neck of the tooth, a negative measurement was made for recession to allow 'false pocketing' to be excluded from individual loss of attachment data. The same three threshold measurements have been used for loss of attachment as were used for pocketing; that is, 4 mm or more for 'any' loss of attachment, 5 mm or more for 'moderate' loss of attachment, and 6 mm or more for 'severe' loss of attachment.

Overall, one in two (49.9%) dentate adults aged 18 years and over had any loss of attachment. One in four (27.5%) had moderate loss of attachment, and one in eight (13.4%) had severe loss of attachment.

The prevalence of loss of attachment was higher among older dentate adults, for all three measures (Figure 19). Adults aged 45–54 years had significantly higher prevalences of all three measures than adults aged 35–44 years. In addition, the prevalence of any loss of attachment was significantly higher among 25–34-year-olds than among 18–24-year-olds.

Figure 19: Prevalence of periodontal loss of attachment of 4 mm or more, 5 mm or more and 6 mm or more, at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Detailed results for each of the three measures of loss of attachment are presented below.

Prevalence of any loss of attachment (4 mm or more)

One in two (49.9%) dentate adults aged 18 years and over had any loss of attachment of 4 mm or more, at one or more sites. Table 36 presents the prevalence of having any loss of attachment of 4 mm or more, by population group.

Table 36: Prevalence of any loss of attachment (4 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	49.9 (47.0–52.7)
Sex	Women	45.1 (41.0–49.1)
	Men	55.2 (50.2–60.1)
Ethnic group	Māori	53.9 (48.9–59.0)
	Pacific	51.9 (42.9–61.0)
	Asian	46.6 (33.9–59.6)
	European/Other	49.1 (45.5–52.7)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	49.3 (40.8–57.9)
	2	50.5 (43.9–57.2)
	3	44.5 (36.9–52.1)
	4	50.7 (43.8–57.6)
	5 (most deprived)	55.0 (47.1–62.9)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 37 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 37: Having any loss of attachment (4 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.2*	9.2*
Māori	Non-Māori	Age group, sex	1.3*	12.8*
Pacific	Non-Pacific	Age group, sex	1.1	6.5
Asian	Non-Asian	Age group, sex	1.1	6.8
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.3*	12.4*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.0	1.7

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, men were 1.2 times as likely to have any loss of attachment of 4 mm or more at one or more sites as women, after adjustment.

After adjustment, Māori were 1.3 times as likely to have any loss of attachment as non-Māori adults.

People living in the most deprived areas were 1.3 times as likely to have any loss of attachment as people living in the least deprived areas, after adjustment.

There were no significant differences by usual reason for visiting a dental professional, after adjustment.

Prevalence of moderate loss of attachment (5 mm or more)

One in four (27.5%) dentate adults aged 18 years and over had moderate loss of attachment of 5 mm or more at one or more sites. Table 38 presents the prevalence of having moderate loss of attachment of 5 mm or more, by population group.

Table 38: Prevalence of moderate loss of attachment (5 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	27.5 (25.1–29.9)
Sex	Women	22.9 (19.8–26.0)
	Men	32.6 (28.4–36.7)
Ethnic group	Māori	28.9 (25.2–32.7)
	Pacific	33.2 (23.8–42.7)
	Asian	30.2 (21.3–39.1)
	European/Other	26.1 (23.2–29.0)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	25.1 (18.4–31.8)
	2	26.3 (19.8–32.8)
	3	25.2 (19.5–31.0)
	4	31.0 (25.1–37.0)
	5 (most deprived)	30.7 (24.5–36.9)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 39 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 39: Having moderate loss of attachment (5 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.4*	8.9*
Māori	Non-Māori	Age group, sex	1.4*	9.7*
Pacific	Non-Pacific	Age group, sex	1.4*	11.4*
Asian	Non-Asian	Age group, sex	1.5*	12.0*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.6*	12.4*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.0	0.7

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, men were 1.4 times as likely to have moderate loss of attachment of 5 mm or more, at one or more sites, as women, after adjusting for age.

After adjustment, Māori and Pacific adults were 1.4 times as likely to have moderate loss of attachment of 5 mm or more as non-Māori and non-Pacific adults, respectively. Asian adults were 1.5 times as likely to have moderate loss of attachment as non-Asian adults.

People living in the most deprived areas were 1.6 times as likely to have moderate loss of attachment as people living in the least deprived areas, after adjustment.

There were no significant differences by usual reason for visiting a dental professional, after adjustment.

Prevalence of severe loss of attachment (6 mm or more)

About one in eight (13.4%) dentate adults aged 18 years and over had severe loss of attachment of 6 mm or more, at one or more sites. Table 40 presents the prevalence of having severe loss of attachment at one or more sites, by population group.

Table 40: Prevalence of severe loss of attachment (6 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	13.4 (11.5–15.2)
Sex	Women	10.8 (8.4–13.1)
	Men	16.2 (13.3–19.2)
Ethnic group	Māori	18.3 (14.3–22.4)
	Pacific	19.8 (13.4–27.7)
	Asian	18.4 (12.5–25.5)
	European/Other	11.7 (9.5–13.9)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	9.6 (6.0–14.2)
	2	13.3 (9.1–17.5)
	3	11.8 (8.0–16.6)
	4	17.9 (12.6–23.1)
	5 (most deprived)	14.8 (10.4–19.2)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 41 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 41: Having severe loss of attachment (6 mm or more) at one or more sites, among periodontally examined dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.5*	5.0*
Māori	Non-Māori	Age group, sex	1.9*	11.0*
Pacific	Non-Pacific	Age group, sex	1.8*	10.0*
Asian	Non-Asian	Age group, sex	1.9*	11.5*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.8*	8.1*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.1	1.5

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among dentate adults, men were 1.5 times as likely to have severe loss of attachment of 6 mm or more at one or more sites as women, after adjusting for age.

After adjustment, Māori and Asian adults were 1.9 times as likely to have severe loss of attachment of 6 mm or more as non-Māori and non-Asian adults, respectively. Pacific adults were 1.8 times as likely to have severe loss of attachment as non-Pacific adults.

People living in the most deprived areas were 1.8 times as likely to have severe loss of attachment as people living in the least deprived areas, after adjustment.

There were no significant differences by usual reason for visiting a dental professional, after adjustment.

Part 4: Oral mucosal conditions

The soft tissues of the lips and mouth can be affected by a variety of lesions, ranging from the most innocent tissue aberrations to malignant tumours (oral cancer). In addition, a number of oral mucosal conditions can be the first sign of particular systemic diseases.

In recent years the health professions and public have been made more aware of the importance of oral mucosal pathologies, in large part due to the visibility given to the health effects of smoking, smokeless (or chewing) tobacco use, herpes simplex virus infections (cold sores), and human immunodeficiency virus (HIV/AIDS) infections, together with the health status of special populations such as older people (Kleinman et al 1991).

Two decades ago, a New Zealand study of an institutionalised older population showed that one-third had mucosal lesions, many of which were associated with denture wearing. The most common lesions observed were angular cheilitis (18%), traumatic ulcers (14%), atrophic glossitis (12%) and leukoplakia (8%). No malignant lesions were found (Thomson et al 1992).

'Oral cancer' is a term used to describe cancers of the lip, tongue, salivary glands, mouth and all parts of the pharynx. Overall, oral cancer was the 12th most common cancer in New Zealand in 2007 (Ministry of Health 2010a). New Zealand statistics showed that in 2007, 222 men and 135 women were diagnosed with oral cancer, and 81 men and 42 women died from it (Ministry of Health 2010a).

Tobacco use, particularly when combined with alcohol consumption, is the major risk factor for developing oral cancer, together with other factors including poor diet and vitamin deficiency, viral infections and genetic disposition (Beaglehole et al 2009). Smoking is associated with about 75% of oral cancer cases, and worldwide the combination of tobacco use, heavy alcohol use and poor diet is responsible for 90% of all oral cancers (Beaglehole et al 2009; Burt and Eklund 2005). The risk for oral cancer is 15 times higher when the two main risk factors of tobacco use and alcohol are combined (Beaglehole et al 2009).

This section presents the prevalence of mucosal conditions in dentate adults.

Prevalence of mucosal conditions

How was this measured?

In the 2009 NZOHS, dental examiners examined the lips and intra-oral mucosa of each respondent for any of the following: suspected malignant tumours (oral cancer), ulcerated lesions (aphthous, herpetic, traumatic), any other oral mucosal lesions (including tongue piercings and lip piercings), or none of the above (ie, healthy oral mucosa). If the dental examiner discovered a suspected malignancy, the respondent was referred for further investigation to the DHB.

Overall, a small proportion of dentate adults aged 18 years and over (0.3%) had suspected malignant tumours (Table 42). A further 5.2% had ulcerated lesions and 11.8% had any other mucosal conditions.

Table 42: Prevalence of oral mucosal conditions, among dentate adults aged 18 years and over (unadjusted prevalence)

Oral mucosal condition	Prevalence (95% CI)
Suspected malignant tumour (suspected oral cancer)	0.3 (0.0–0.7)
Ulcerated lesions	5.2 (3.6–6.7)
Any other mucosal conditions	11.8 (9.8–13.9)
Healthy mucosa (ie, none of the above conditions)	82.7 (80.2–85.2)

Source: 2009 New Zealand Oral Health Survey

Table 43 presents the prevalence of adults who had any oral mucosal condition (ie, suspected malignant tumour, ulcerated lesions or any other mucosal conditions), by population group. Overall, one in six (17.3%) adults aged 18 years and over had any mucosal condition.

Table 43: Prevalence of any oral mucosal condition, among dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	17.3 (14.8–19.8)
Sex	Women	17.5 (13.8–21.2)
	Men	17.1 (13.6–20.5)
Ethnic group	Māori	12.8 (10.0–15.5)
	Pacific	22.3 (14.5–32.0)
	Asian	19.6 (11.5–30.1)
	European/Other	16.9 (14.2–19.7)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	17.7 (11.9–23.5)
	2	17.2 (12.1–22.4)
	3	16.5 (10.8–23.6)
	4	14.9 (10.5–19.3)
	5 (most deprived)	20.6 (14.6–26.5)

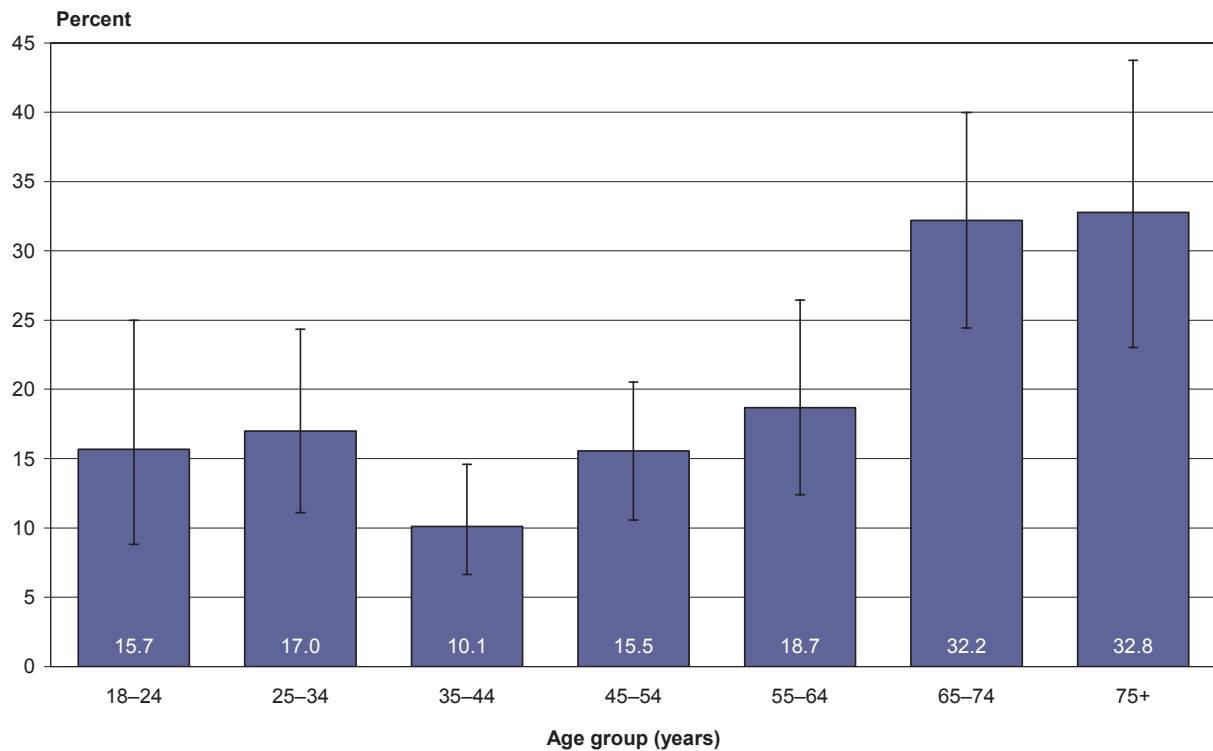
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 20 shows that dentate adults aged 65 years and over were significantly more likely to have any oral mucosal condition than dentate adults aged 18–64 years (p -values < 0.05).

Figure 20: Prevalence of any oral mucosal condition, among dentate adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 44 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 44: Having any oral mucosal condition, among dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.0	-0.6
Māori	Non-Māori	Age group, sex	0.8	-3.3
Pacific	Non-Pacific	Age group, sex	1.4	7.5
Asian	Non-Asian	Age group, sex	1.3	4.9
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.1	1.3
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	0.8	-3.8

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. There were no statistically significant results (where p-value < 0.05).

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

There were no significant differences by population group in the adjusted prevalence of having any mucosal condition.

Chapter 5: Oral Health Conditions in Children and Adolescents

Key findings

Among children aged 2–11 years:

- 59.1% were caries-free in their primary teeth
- 16.6% had untreated coronal decay in one or more primary teeth
- the mean number of decayed, missing or filled primary teeth was 1.6 (ie, they had a mean dmft score of 1.6).

Among children and adolescents aged 5–17 years:

- 61.3% were caries-free in their permanent teeth
- 7.6% had untreated coronal decay on one or more permanent teeth
- the mean number of decayed, missing or filled permanent teeth was 1.2 (ie, they had a mean DMFT score of 1.2).

Among all children and adolescents aged 2–17 years:

- 49.3% were caries-free in all of their teeth (combined primary and permanent teeth)
- 15.9% had untreated coronal decay on one or more primary or permanent teeth.

Among children and adolescents aged 7–17 years, 16.0% had experienced trauma to one or more of their upper six front permanent teeth.

Introduction

In New Zealand, children are eligible to receive publicly-funded (free) oral health services from birth until they turn 18 years of age (ie, 0–17 years). This chapter reports the oral health status of New Zealand children and adolescents aged 2–17 years, as clinically measured in the 2009 NZOHS dental examinations.

In this section, teeth are referred to as *primary* and *permanent* teeth. Teeth become at risk of dental decay as soon as they erupt into the mouth. Primary teeth (also known as deciduous or baby teeth) start to erupt into the mouth at about 6 months of age. The maximum number of teeth in the primary dentition (set of teeth) is 20. Between the ages of about 6 and 11 years, children lose their primary teeth and gain their permanent teeth. By the age of 12 most children have lost all of their primary teeth and gained all their permanent teeth (with the exception of wisdom teeth, which may erupt several years or even decades later). The maximum number of teeth in the adult permanent dentition is 32.

The changing patterns of primary and permanent teeth with age should be remembered when interpreting the patterns of decay experience presented in this section. Many children aged 6–12 years have both primary and permanent teeth in their mouth (ie, a mixed dentition). However, from the age of about 9 years, children generally have more permanent teeth than primary teeth.

In the 2009 NZOHS, children aged 2–14 years were examined by survey dental examiners using the child dental examination assessment criteria, while adolescents aged 15–17 years were examined using the adult dental examination assessment criteria. Identical criteria were used in the adult and child examinations for the assessment of dental decay, fillings and missing teeth, which has allowed results on dental conditions to be combined for adults and children. This chapter presents results for children and adolescents aged 2–17 years (ie, the age group eligible for publicly-funded oral health care).

The results in this chapter are split into three parts:

- Part 1 – Primary teeth (for children aged 2–11 years)
- Part 2 – Permanent teeth (for children aged 5–17 years)
- Part 3 – All teeth (combined primary and permanent teeth, for children and adolescents aged 2–17 years).

Part 1: Primary teeth

Part 1 reports on the following selected oral conditions in primary teeth in children aged 2–11 years:

- number of primary teeth
- sound primary teeth and caries-free in primary teeth
- decayed primary teeth
- filled primary teeth
- primary teeth missing due to decay
- severity of dental decay experience (dmft) in primary teeth.

Mean number of primary teeth

This measure reports the number of primary teeth per child, on average, irrespective of the condition of the teeth. This is useful contextual information for other indicators in this section.

How was this measured?

The number of primary teeth per child was derived from data collected in the 2009 NZOHS dental examinations.

Children aged 2–11 years had an average of 13.1 primary teeth. Table 45 presents the mean number of primary teeth, by population group. The mean number of primary teeth for 2–4-year-olds was 19.5 teeth, and for 5–11-year-olds was 10.6 teeth.

Table 45: Mean number of primary teeth, among children aged 2–11 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	13.1 (12.6–13.6)
Sex	Girls	12.6 (12.0–13.3)
	Boys	13.6 (12.9–14.3)
Age group (years)	2–4	19.5 (19.3–19.8)
	5–11	10.6 (9.9–11.4)
Ethnic group	Māori	12.7 (12.2–13.3)
	Pacific	13.0 (12.2–13.9)
	Asian	14.4 (12.6–16.3)
	European/Other	13.1 (12.5–13.8)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	13.3 (11.8–14.8)
	2	14.0 (12.2–15.8)
	3	11.9 (9.7–14.1)
	4	14.1 (12.7–15.5)
	5 (most deprived)	12.4 (11.2–13.7)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 46 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 46: Number of primary teeth per child, among children aged 2–11 years, by population group (ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	1.1*	1.6*
Māori	Non-Māori	Age group, sex	1.0	-0.5
Pacific	Non-Pacific	Age group, sex	1.0	-0.6
Asian	Non-Asian	Age group, sex	1.1	0.8
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.9	-1.8

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

The mean number of primary teeth was 1.1 times higher for boys than for girls, after adjusting for age.

There were no significant differences by ethnic group or neighbourhood deprivation in the mean number of primary teeth.

Mean number of sound primary teeth

Sound teeth are those teeth that have no past or present experience of dental decay or fillings placed to treat decay. This indicator presents the mean number of sound primary teeth in children aged 2–11 years.

How was this measured?

In the 2009 NZOHS, the crowns of primary 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, or for a filling that had been placed to treat decay. Teeth assessed as having no evidence of decay or fillings placed to treat decay on any of the five coronal surfaces were classified as sound.

Overall, children aged 2–11 years had, on average, 11.6 sound primary teeth.

Table 47 presents the mean number of sound primary teeth per child, by population group. On average, children aged 2–4 years had 18.8 sound primary teeth and children aged 5–11 years had 8.8. Taking into account the average number of primary teeth present for these age groups, 96% of primary teeth present in the mouths of 2–4-year-olds were sound (18.8 out of 19.5), compared with 83% for 5–11-year-olds (8.8 out of 10.6).

Table 47: Mean number of sound primary teeth, among children aged 2–11 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	11.6 (11.0–12.2)
Sex	Girls	11.2 (10.4–12.0)
	Boys	12.0 (11.2–12.9)
Age group (years)	2–4	18.8 (18.3–19.4)
	5–11	8.8 (8.0–9.6)
Ethnic group	Māori	10.7 (10.1–11.4)
	Pacific	11.2 (10.0–12.4)
	Asian	13.2 (11.4–15.1)
	European/Other	11.8 (11.0–12.6)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	12.2 (10.5–13.9)
	2	12.7 (10.5–14.9)
	3	10.3 (8.0–12.5)
	4	12.7 (10.9–14.4)
	5 (most deprived)	10.6 (9.3–11.9)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 48 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 48: Number of sound primary teeth per child, among children aged 2–11 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	1.1*	1.5*
Māori	Non-Māori	Age group, sex	0.9*	-1.1*
Pacific	Non-Pacific	Age group, sex	0.9	-1.0
Asian	Non-Asian	Age group, sex	1.1	1.0
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.8*	-2.4*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Boys had a significantly higher mean number of sound primary teeth than girls, adjusting for age. However, as previously shown, boys also had a higher mean number of primary teeth overall than girls.

After adjustment, Māori children had a significantly lower mean number of sound primary teeth than non-Māori children.

Children living in more deprived areas had significantly fewer sound primary teeth than children living in the least deprived areas, after adjustment.

Prevalence of caries-free primary teeth

The prevalence of dental decay has traditionally been reported in children as the proportion of children *without* the disease. This indicator presents the percentage of children who were caries-free in all of their primary teeth (ie, they had no primary teeth with untreated decay, missing due to dental decay, or filled due to decay).

How was this measured?

In the 2009 NZOHS, children aged 2–11 years whose survey examination revealed no untreated decay or fillings in any primary teeth, and no primary teeth missing due to pathology, were classified as having no experience of dental decay in primary teeth; in other words, they were ‘caries-free’ in their primary teeth.

Overall, three in five (59.1%) children aged 2–11 years were caries-free in their primary teeth.

Table 49 presents the prevalence of having caries-free primary teeth among children aged 2–11 years, by population group. Children aged 2–4 years were significantly more likely to be caries-free in their primary teeth (79.7%) than children aged 5–11 years (51.0%).

Table 49: Prevalence of caries-free primary teeth, among children aged 2–11 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	59.1 (52.6–65.6)
Sex	Girls	60.6 (51.5–69.8)
	Boys	57.6 (49.1–66.0)
Age group (years)	2–4	79.7 (71.7–87.7)
	5–11	51.0 (43.2–58.8)
Ethnic group	Māori	48.1 (40.7–55.4)
	Pacific	47.0 (35.3–58.7)
	Asian	66.3 (56.4–76.3)
	European/Other	62.6 (54.3–70.9)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	69.5 (53.3–85.7)
	2	63.0 (45.6–80.4)
	3	53.8 (38.1–69.4)
	4	59.4 (48.6–70.1)
	5 (most deprived)	51.4 (42.3–60.5)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 50 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 50: Caries-free in the primary teeth, among children aged 2–11 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.0	-1.1
Māori	Non-Māori	Age group, sex	0.8*	-14.1*
Pacific	Non-Pacific	Age group, sex	0.7*	-15.5*
Asian	Non-Asian	Age group, sex	1.1	6.5
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.8	-13.4

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

The prevalence of caries-free primary teeth was significantly lower for Māori and Pacific children than for non-Māori and non-Pacific children, respectively, after adjustment.

There were no significant differences in the prevalence of having caries-free primary teeth by sex or neighbourhood deprivation.

Prevalence of having one or more primary teeth with untreated coronal decay

Teeth become at risk of dental decay as soon as they erupt into the mouth, usually from six months of age onwards.

How was this measured?

In the 2009 NZOHS, all primary teeth present were subdivided into five coronal surfaces, and each was assessed for untreated decay. Untreated decay was defined as a cavity that had broken the enamel or visibly undermined it (ie, coronal decay).

One in six (16.6%) children aged 2–11 years had one or more primary teeth with untreated decay.

Table 51 presents the prevalence of having one or more decayed primary teeth among children aged 2–11 years, by population group. There was no significant difference in prevalence of having one or more decayed primary teeth between children aged 2–4 years (14.9%) and those aged 5–11 years (17.3%).

Table 51: Prevalence of untreated coronal decay on one or more primary teeth, among children aged 2–11 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	16.6 (12.7–20.5)
Sex	Girls	15.3 (9.1–21.4)
	Boys	18.0 (12.0–23.9)
Age group (years)	2–4	14.9 (10.2–20.7)
	5–11	17.3 (12.2–22.4)
Ethnic group	Māori	26.6 (19.9–33.4)
	Pacific	25.6 (18.0–34.5)
	Asian	18.1 (11.6–26.2)
	European/Other	12.5 (7.4–17.5)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	12.2 (5.6–22.4)
	2	8.4 (3.6–16.3)
	3	20.2 (13.0–29.1)
	4	12.4 (7.6–18.7)
	5 (most deprived)	27.2 (19.0–35.5)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 52 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 52: Having untreated coronal decay on one or more primary teeth, among children aged 2–11 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.2	2.5
Māori	Non-Māori	Age group, sex	2.0*	13.1*
Pacific	Non-Pacific	Age group, sex	1.7*	10.3
Asian	Non-Asian	Age group, sex	1.1	1.5
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.7	8.5

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Māori children were twice as likely as non-Māori children to have one or more decayed primary teeth, after adjusting for age and sex. Pacific children were about 1.7 times as likely to have one or more decayed primary teeth as non-Pacific children, which was statistically significant (although the rate difference was not).

There were no significant differences in the prevalence of having one or more decayed primary teeth by sex or neighbourhood deprivation, after adjustment.

Mean number of primary teeth with untreated coronal decay

The severity of untreated decay in primary teeth is reported as the mean number of decayed primary teeth among New Zealand children aged 2–11 years.

How was this measured?

In the 2009 NZOHS, all primary 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. Surface-level data are reported in Appendix B.

Children aged 2–11 years had an average of 0.3 decayed primary teeth per child.

Table 53 presents the mean number of decayed primary teeth per child, among children aged 2–11 years, by population group. There was no significant difference in the mean number of primary teeth with untreated decay per child between 2–4-year-olds (0.4) and 5–11-year-olds (0.3).

Table 53: Mean number of primary teeth with untreated coronal decay, among children aged 2–11 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	0.3 (0.3–0.4)
Sex	Girls	0.3 (0.2–0.4)
	Boys	0.4 (0.2–0.5)
Age group (years)	2–4	0.4 (0.2–0.5)
	5–11	0.3 (0.2–0.4)
Ethnic group	Māori	0.6 (0.4–0.8)
	Pacific	0.6 (0.2–1.0)
	Asian	0.4 (0.2–0.6)
	European/Other	0.2 (0.1–0.3)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	0.2 (0.0–0.4)
	2	0.2 (0.0–0.3)
	3	0.3 (0.0–0.5)
	4	0.3 (0.1–0.5)
	5 (most deprived)	0.7 (0.4–1.0)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 54 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 54: Number of primary teeth with untreated coronal decay per child, among children aged 2–11 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	1.3	0.1
Māori	Non-Māori	Age group, sex	2.3*	0.3*
Pacific	Non-Pacific	Age group, sex	2.1	0.3
Asian	Non-Asian	Age group, sex	1.3	0.1
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.8	0.3

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

The mean number of primary teeth with untreated decay was 2.3 times higher for Māori children than for non-Māori children, after adjustment.

There were no significant differences in the mean number of decayed primary teeth by sex or neighbourhood deprivation.

Mean number of filled primary teeth

Once a cavity has formed in a tooth, a filling (restoration) is needed to restore the form, function and appearance of the tooth, if the tooth is to be retained and not extracted. The extent to which teeth have been restored gives an indication of the past history of treatment of dental caries, as well as access to oral health care and patterns of dental treatment.

In this report, 'fillings' refers to restorations placed to treat decay, ranging from simple fillings to complex fillings and crowns (but not including fillings placed for cosmetic reasons).

How was this measured?

In the 2009 NZOHS, all five coronal surfaces of each primary tooth present were assessed for the presence of a filling placed to treat decay. Surface-level data for filled primary teeth are available in Appendix B.

Overall, the mean number of filled primary teeth per child in children aged 2–11 years was 1.1.

Table 55 presents the mean number of filled primary teeth per child among children aged 2–11 years, by population group. The mean number of filled primary teeth per child was significantly higher for children aged 5–11 years (1.5) than for children aged 2–4 years (0.3).

Table 55: Mean number of filled primary teeth, among children aged 2–11 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	1.1 (0.9–1.4)
Sex	Girls	1.1 (0.7–1.5)
	Boys	1.2 (0.8–1.5)
Age group (years)	2–4	0.3 (0.1–1.8)
	5–11	1.5 (1.1–1.8)
Ethnic group	Māori	1.4 (1.0–1.7)
	Pacific	1.2 (0.7–1.7)
	Asian	0.8 (0.4–1.1)
	European/Other	1.1 (0.8–1.5)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	0.9 (0.1–1.8)
	2	1.2 (0.5–1.9)
	3	1.4 (0.7–2.1)
	4	1.1 (0.6–1.6)
	5 (most deprived)	1.1 (0.8–1.5)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 56 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 56: Number of filled primary teeth per child, among children aged 2–11 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	1.0	-0.1
Māori	Non-Māori	Age group, sex	1.3	0.3
Pacific	Non-Pacific	Age group, sex	1.1	0.1
Asian	Non-Asian	Age group, sex	0.7	-0.4
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.3	0.3

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. There were no statistically significant results (where p-value < 0.05).

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

Using adjusted results for comparisons, there were no significant differences in the mean number of filled primary teeth by sex, ethnic group or neighbourhood deprivation.

Prevalence of missing one or more primary teeth due to dental decay

How was this measured?

In the 2009 NZOHS the examining dentist made an assessment as to the reason for the absence of teeth in children and adolescents. Teeth missing for reasons other than dental decay (eg, trauma, unerupted teeth) were excluded from this analysis. Teeth missing due to decay were not specifically noted as primary or permanent teeth in the dental examination. In this analysis, missing teeth due to decay in children and adolescents were classified as missing primary teeth, missing permanent teeth or unerupted teeth, using assumptions based on the specific tooth, the average age of the eruption of the permanent tooth, and the age of the child or adolescent. See the 2009 NZOHS methodology report for more details (Ministry of Health 2010c).

About 3.9% of children aged 2–11 years had one or more primary teeth missing due to dental decay.

Table 57 presents the prevalence of missing one or more primary teeth due to dental decay among children aged 2–11 years, by population group. The prevalence of missing one or more primary teeth due to decay was significantly lower for children aged 2–4 years (1.4%) than for children aged 5–11 years (4.9%) (p -value < 0.05).

Table 57: Prevalence of missing one or more primary teeth due to dental decay, among children aged 2–11 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	3.9 (2.6–5.7)
Sex	Girls	4.2 (2.2–7.0)
	Boys	3.7 (1.9–6.4)
Age group (years)	2–4	1.4 (0.3–4.2)
	5–11	4.9 (3.1–7.4)
Ethnic group	Māori	5.7 (3.4–8.9)
	Pacific	6.1 (2.5–12.1)
	Asian	5.3 (2.1–11.0)
	European/Other	3.6 (1.9–6.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	0.0 (0.0–5.2)
	2	1.7 (0.1–7.1)
	3	7.6 (3.3–14.4)
	4	4.4 (1.7–9.0)
	5 (most deprived)	5.7 (3.0–9.6)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 58 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 58: Missing one or more primary teeth due to dental decay, among children aged 2–11 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	0.8	-0.7
Māori	Non-Māori	Age group, sex	1.7	2.3
Pacific	Non-Pacific	Age group, sex	1.8	2.8
Asian	Non-Asian	Age group, sex	1.5	1.8
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	5.8*	6.5

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Children living in the most deprived neighbourhoods were almost six times as likely to be missing one or more primary teeth due to decay as children in the least deprived neighbourhoods, after adjustment.

There were no other significant differences in the prevalence of having one or more decayed primary teeth, by sex or ethnic group.

Mean number of primary teeth missing due to decay

How was this measured?

In the 2009 NZOHS the examining dentist made an assessment as to the reason for the absence of teeth in children and adolescents. Teeth missing for reasons other than dental decay (eg, trauma, unerupted teeth) were excluded from this analysis. Teeth missing due to decay were not specifically noted as primary or permanent teeth in the dental examination. In this analysis, missing teeth due to decay in children and adolescents were classified as missing primary teeth, missing permanent teeth or unerupted teeth, using assumptions based on the specific tooth, the average age of the eruption of the permanent tooth, and the age of the child or adolescent. See the methodology report for more details (Ministry of Health 2010c).

The mean number of primary teeth missing due to dental decay per child among children aged 2–11 years was 0.1.

Table 59 presents the mean number of primary teeth missing due to decay, by population group. There was no significant difference in the mean number of primary teeth missing due to decay between children aged 5–11 years (0.1) and those aged 2–4 years (0.04, rounded to 0.0).

Table 59: Mean number of primary teeth missing due to decay, among children aged 2–11 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	0.1 (0.0–0.1)
Sex	Girls	0.1 (0.0–0.1)
	Boys	0.1 (0.0–0.1)
Age group (years)	2–4	0.0 (0.0–0.2)
	5–11	0.1 (0.0–0.2)
Ethnic group	Māori	0.1 (0.0–0.2)
	Pacific	0.1 (0.0–0.1)
	Asian	0.1 (0.0–0.3)
	European/Other	0.1 (0.0–0.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	0.0 (0.0–0.0)
	2	0.0 (0.0–0.1)
	3	0.1 (0.0–0.8)
	4	0.1 (0.0–1.3)
	5 (most deprived)	0.1 (0.0–0.2)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 60 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 60: Number of primary teeth missing due to decay per child, among children aged 2–11 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	0.9	0.0
Māori	Non-Māori	Age group, sex	1.9	0.1
Pacific	Non-Pacific	Age group, sex	1.0	0.0
Asian	Non-Asian	Age group, sex	1.6	0.0
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	14.5*	0.2

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Children living in the most deprived areas had significantly more primary teeth missing due to decay, on average, as children in the least deprived areas, after adjustment. This represented a difference in means of 0.2 teeth.

There were no other significant differences in the mean number of primary teeth missing due to decay, by sex or ethnic group.

Severity of dental decay experience in primary teeth (dmft)

The overall severity of dental decay experience in primary teeth is presented using the dmft index. By convention, this is quantified for primary teeth as the sum of three components: decayed (d), missing (m) and filled (f) primary teeth (t). Patterns in severity of dental decay experience in primary teeth must be interpreted in light of the loss (shedding) of primary teeth with age.

How was this measured?

For this section the dmft index was calculated using data from previous sections: mean number of primary teeth with untreated coronal decay, mean number of primary teeth missing due to pathology, and mean number of filled primary teeth. Tables in Appendix B report the components of the index and the overall dmft score at the tooth level (dmft) and surface level (dmfs).

The mean number of decayed, missing or filled primary teeth (ie, the dmft score) among children aged 2–11 years was 1.6.

Table 61 presents the mean number of decayed, missing or filled primary teeth (dmft score) per child, by population group. Children aged 2–4 years had a significantly lower mean dmft (0.8) than children aged 5–11 years (1.9).

Table 61: Mean number of decayed, missing or filled primary teeth (dmft) per child, among children aged 2–11 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	1.6 (1.2–1.9)
Sex	Girls	1.5 (1.1–1.9)
	Boys	1.6 (1.2–2.1)
Age group (years)	2–4	0.8 (0.3–1.2)
	5–11	1.9 (1.5–2.3)
Ethnic group	Māori	2.1 (1.7–2.5)
	Pacific	1.9 (1.3–2.5)
	Asian	1.3 (0.8–1.8)
	European/Other	1.4 (1.0–1.8)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	1.1 (0.2–2.0)
	2	1.3 (0.6–2.1)
	3	1.8 (1.0–2.6)
	4	1.5 (0.8–2.3)
	5 (most deprived)	2.0 (1.5–2.4)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 62 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 62: Number of decayed, missing or filled primary teeth (dmft) per child, among children aged 2–11 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	1.0	0.0
Māori	Non-Māori	Age group, sex	1.5*	0.7*
Pacific	Non-Pacific	Age group, sex	1.3	0.5
Asian	Non-Asian	Age group, sex	0.9	-0.2
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.6	0.7

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

The mean dmft score for primary teeth was 1.5 times higher among Māori children than among non-Māori children, after adjustment.

There were no significant differences in the mean number of decayed, missing or filled primary teeth by sex or neighbourhood deprivation.

Part 2: Permanent teeth

Children start to gain their permanent teeth from age six onwards, and have normally gained most or all of their permanent teeth by the time they are 12 years old (except their wisdom teeth, which may take several years to erupt). The maximum number of teeth in the adult permanent dentition is 32.

Part 2 reports the following selected oral conditions in permanent teeth for children and adolescents aged 5–17 years:

- number of permanent teeth
- sound permanent teeth and caries-free in permanent teeth
- decayed permanent teeth
- filled permanent teeth
- permanent teeth missing due to decay
- severity of dental decay experience (DMFT)
- dental trauma to the six upper permanent teeth.

Mean number of permanent teeth

This indicator presents the mean number of permanent teeth per child and adolescent aged 5–17 years, irrespective of the condition of the teeth. This is useful contextual information for other indicators in this section.

How was this measured?

The number of permanent teeth per child was derived from data collected in the 2009 NZOHS dental examinations.

Children and adolescents aged 5–17 years had an average of 19.8 permanent teeth per person.

Table 63 presents the mean number of permanent teeth, among children and adolescents aged 5–17 years, by population group. Children aged 5–11 years had an average of 12.8 permanent teeth, and those aged 12–17 years had an average of 27.0.

Table 63: Mean number of permanent teeth, among children and adolescents aged 5–17 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	19.8 (19.0–20.6)
Sex	Girls	20.5 (19.4–21.5)
	Boys	19.3 (18.1–20.5)
Age group (years)	5–11	12.8 (11.8–13.8)
	12–17	27.0 (26.5–27.6)
Ethnic group	Māori	19.5 (18.6–20.4)
	Pacific	20.5 (19.1–22.0)
	Asian	19.2 (15.0–23.3)
	European/Other	19.9 (19.0–20.8)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	19.3 (17.1–21.6)
	2	20.6 (18.3–23.0)
	3	20.8 (18.6–23.0)
	4	17.9 (15.4–20.4)
	5 (most deprived)	19.8 (18.3–21.3)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 64 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 64: Number of permanent teeth per person, among children and adolescents aged 5–17 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	0.9*	-1.4*
Māori	Non-Māori	Age group, sex	1.0	0.3
Pacific	Non-Pacific	Age group, sex	1.0	0.8
Asian	Non-Asian	Age group, sex	1.0	-0.6
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.1	1.2

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

The mean number of permanent teeth for boys was significantly lower than for girls, when adjusted for age.

There were no significant differences in the mean numbers of permanent teeth by ethnic group or neighbourhood deprivation.

Mean number of sound permanent teeth

Sound permanent teeth are those with no past or present evidence of coronal decay (ie, in the crown of the tooth), or any fillings placed to treat coronal decay. This section presents the mean number of sound permanent teeth for children and adolescents aged 5–17 years.

How was this measured?

In the 2009 NZOHS, permanent teeth assessed as having no evidence of decay or fillings placed to treat decay on any of the five coronal surfaces were classified as sound.

Children and adolescents aged 5–17 years had an average of 18.6 sound permanent teeth.

Table 65 presents the mean number of sound permanent teeth per person among children and adolescents aged 5–17 years, by population group. Children aged 5–11 years had 12.4 sound permanent teeth on average, and adolescents aged 12–17 years had 25.1. When the mean numbers of teeth for these respective age groups were taken into account, on average 97% of permanent teeth in 5–11-year-olds (12.4 out of 12.8) and 93% in 12–17-year-olds (25.1 out of 27.0) were sound.

Table 65: Mean number of sound permanent teeth, among children and adolescents aged 5–17 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	18.6 (17.9–19.4)
Sex	Girls	19.2 (18.1–20.2)
	Boys	18.2 (17.1–19.3)
Age group (years)	5–11	12.4 (11.4–13.4)
	12–17	25.1 (24.5–25.7)
Ethnic group	Māori	17.8 (16.9–18.7)
	Pacific	19.2 (17.7–20.6)
	Asian	18.2 (14.1–22.3)
	European/Other	18.8 (17.9–19.7)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	18.4 (16.3–20.5)
	2	19.5 (17.2–21.8)
	3	19.5 (17.6–21.4)
	4	16.8 (14.5–19.1)
	5 (most deprived)	18.5 (17.0–20.0)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 66 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 66: Number of sound permanent teeth per person, among children and adolescents aged 5–17 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	0.9*	-1.2*
Māori	Non-Māori	Age group, sex	1.0	-0.4
Pacific	Non-Pacific	Age group, sex	1.0	0.6
Asian	Non-Asian	Age group, sex	1.0	-0.4
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.1	1.0

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Boys had a significantly lower mean number of sound permanent teeth than girls, adjusted for age. However, boys also had a significantly lower mean number of permanent teeth than girls on average.

There were no significant differences in the mean number of sound permanent teeth by ethnic group or neighbourhood deprivation.

Prevalence of caries-free permanent teeth

The prevalence of dental decay has traditionally been reported for children as the proportion *without* the disease. This indicator presents the percentage of children who were caries-free in all of their permanent teeth (ie, they had no permanent teeth affected by decay, missing due to dental decay, or filled).

How was this measured?

In the 2009 NZOHS, children and adolescents aged 5–17 years whose survey examination revealed no untreated decay, no fillings in permanent teeth and no permanent teeth missing due to pathology, were classified as having no experience of dental decay in their permanent teeth; in other words, they were ‘caries-free’ in their permanent teeth. In this section, caries-free is reported for permanent teeth in children and adolescents aged 5–17 years.

Overall, 61.3% of children and adolescents aged 5–17 years were caries-free in their permanent teeth.

Table 67 presents the prevalence of being caries-free in their permanent teeth, by population group. Children aged 5–11 years were significantly more likely to be caries-free in their permanent teeth (77.5%) than adolescents aged 12–17 years (44.7%).

Table 67: Prevalence of caries-free permanent teeth, among children and adolescents aged 5–17 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	61.3 (56.4–66.3)
Sex	Girls	60.3 (52.8–67.8)
	Boys	62.2 (55.0–69.4)
Age group (years)	5–11	77.5 (71.4–83.5)
	12–17	44.7 (37.2–52.3)
Ethnic group	Māori	56.7 (50.2–63.2)
	Pacific	51.8 (42.6–60.9)
	Asian	70.9 (54.2–87.6)
	European/Other	62.8 (56.6–68.9)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	65.7 (52.7–78.8)
	2	53.8 (41.7–65.9)
	3	63.0 (48.6–77.3)
	4	65.3 (53.1–77.4)
	5 (most deprived)	60.2 (51.5–68.9)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 68 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 68: Caries-free in the permanent teeth, among children and adolescents aged 5–17 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.0	2.5
Māori	Non-Māori	Age group, sex	0.9	-7.9
Pacific	Non-Pacific	Age group, sex	0.8	-10.7*
Asian	Non-Asian	Age group, sex	1.2	10.1
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.1	3.8

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

There was a statistically significant difference in rates of being caries-free between Pacific and non-Pacific children and adolescents of 10.7 percentage points (although the rate ratio was not statistically significant).

There were no significant differences in the prevalence of being caries-free in the permanent teeth by sex or neighbourhood deprivation.

Prevalence of untreated coronal decay in one or more permanent teeth

This section presents the prevalence of having untreated decay in the crowns of permanent teeth, among children and adolescents aged 5–17 years.

How was this measured?

In the 2009 NZOHS, all permanent 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 (ie, coronal decay).

Overall, 7.6% of children and adolescents aged 5–17 years had one or more permanent teeth with untreated coronal decay.

Table 69 presents the prevalence of having one or more permanent teeth with untreated decay, by population group. Adolescents aged 12–17 years were significantly more likely to have one or more permanent teeth with untreated decay (12.7%) than children aged 5–11 years (2.7%).

Table 69: Prevalence of untreated coronal decay on one or more permanent teeth, among children and adolescents aged 5–17 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	7.6 (5.1–10.2)
Sex	Girls	7.0 (4.6–10.1)
	Boys	8.2 (3.7–12.6)
Age group (years)	5–11	2.7 (1.4–4.7)
	12–17	12.7 (8.0–17.4)
Ethnic group	Māori	10.5 (6.4–14.6)
	Pacific	13.1 (8.2–19.6)
	Asian	5.8 (2.4–11.5)
	European/Other	6.8 (3.6–9.9)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	6.1 (2.3–12.8)
	2	6.1 (2.7–11.5)
	3	8.0 (4.3–13.4)
	4	7.4 (3.9–12.4)
	5 (most deprived)	10.5 (6.8–15.2)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 70 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 70: Having untreated coronal decay on one or more permanent teeth, among children and adolescents aged 5–17 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.1	1.0
Māori	Non-Māori	Age group, sex	1.7	4.5
Pacific	Non-Pacific	Age group, sex	1.9	6.2
Asian	Non-Asian	Age group, sex	0.7	-2.0
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.5	3.1

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. There were no statistically significant results (where p-value < 0.05).

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

There were no significant differences in the prevalence of having one or more permanent teeth with untreated decay by sex, ethnic group or neighbourhood deprivation.

Mean number of permanent teeth with untreated coronal decay

In this section, the severity of untreated decay is reported as the mean number of permanent teeth with untreated coronal decay for children and adolescents aged 5–17 years. Surface-level data are reported in Appendix B.

How was this measured?

In the 2009 NZOHS, all permanent 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 (ie, coronal decay).

Overall, the mean number of permanent teeth with untreated decay in children and adolescents aged 5–17 years was 0.1 teeth.

Table 71 presents the mean number of permanent teeth with untreated decay per person, by population group. Adolescents aged 12–17 years had a significantly higher mean number of permanent teeth with untreated decay (0.2) than 5–11-year-olds (0.03, rounded to 0.0).

Table 71: Mean number of permanent teeth with untreated coronal decay per person, among children and adolescents aged 5–17 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	0.1 (0.1–0.2)
Sex	Girls	0.1 (0.1–0.2)
	Boys	0.1 (0.0–0.2)
Age group (years)	5–11	0.0 (0.0–0.1)
	12–17	0.2 (0.1–0.3)
Ethnic group	Māori	0.2 (0.1–0.3)
	Pacific	0.2 (0.0–0.3)
	Asian	0.1 (0.0–0.1)
	European/Other	0.1 (0.0–0.2)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	0.1 (0.0–2.4)
	2	0.1 (0.0–0.2)
	3	0.1 (0.0–0.2)
	4	0.1 (0.0–0.2)
	5 (most deprived)	0.2 (0.1–0.3)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 72 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 72: Number of permanent teeth with untreated coronal decay per person, among children and adolescents aged 5–17 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	1.0	0.0
Māori	Non-Māori	Age group, sex	2.4*	0.1*
Pacific	Non-Pacific	Age group, sex	1.3	0.0
Asian	Non-Asian	Age group, sex	0.6	0.0
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.4	0.0

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among children and adolescents aged 5–17 years, the mean number of permanent teeth was 2.4 times higher among Māori than among non-Māori, after adjustment.

There were no significant differences by sex or neighbourhood deprivation in the mean number of permanent teeth with untreated decay, after adjustment.

Mean number of filled permanent teeth

Once a cavity has formed in a tooth, a filling (restoration) is needed to restore the form, function and appearance of the tooth, if the tooth is to be retained and not extracted. The extent to which teeth have been restored gives an indication of the past history of treatment of dental caries, as well as access to oral health care and patterns of dental treatment.

This section reports on the mean number of filled permanent teeth for children and adolescents aged 5–17 years.

How was this measured?

In the 2009 NZOHS, all five coronal surfaces of each permanent tooth were assessed for the presence of a filling placed to treat decay.

Children and adolescents aged 5–17 years had, on average, 1.1 filled permanent teeth.

Table 73 presents the mean number of filled permanent teeth per person, by population group. Children aged 5–11 years had significantly fewer filled permanent teeth on average (0.4) than adolescents aged 12–17 years (1.7).

Table 73: Mean number of filled permanent teeth per person, among children and adolescents aged 5–17 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	1.1 (0.9–1.3)
Sex	Girls	1.2 (0.9–1.4)
	Boys	1.0 (0.6–1.3)
Age group (years)	5–11	0.4 (0.3–0.6)
	12–17	1.7 (1.3–2.1)
Ethnic group	Māori	1.5 (1.1–1.9)
	Pacific	1.2 (0.9–1.5)
	Asian	0.9 (0.3–1.5)
	European/Other	1.0 (0.7–1.2)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	0.8 (0.5–1.2)
	2	1.1 (0.7–1.5)
	3	1.2 (0.5–2.0)
	4	0.9 (0.6–1.3)
	5 (most deprived)	1.2 (0.8–1.6)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 74 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 74: Number of filled permanent teeth per person, among children and adolescents aged 5–17 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	0.8	-0.3
Māori	Non-Māori	Age group, sex	1.7*	0.6*
Pacific	Non-Pacific	Age group, sex	1.2	0.2
Asian	Non-Asian	Age group, sex	0.9	-0.1
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.2	0.2

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

The mean number of filled permanent teeth was 1.7 times higher among Māori children than among non-Māori children, after adjusting for age and sex.

There were no other significant differences by sex, ethnic group or neighbourhood deprivation in the mean number of filled permanent teeth among children and adolescents aged 5–17 years.

Mean number of permanent teeth missing due to decay

This section reports the mean number of permanent teeth missing due to decay among adolescents aged 12–17 years.

How was this measured?

In the 2009 NZOHS the examining dentist made an assessment as to the reason for the absence of teeth in children and adolescents. Teeth missing for reasons other than dental decay (eg, trauma, unerupted teeth) were excluded from this analysis. Teeth missing due to decay were not specifically noted as primary or permanent teeth in the dental examination. In this analysis, missing teeth due to decay in children and adolescents were classified as missing primary teeth, missing permanent teeth or unerupted teeth, using assumptions based on the specific tooth, the average age of the eruption of the permanent tooth, and the age of the child or adolescent. See the methodology report for more details (Ministry of Health 2010c).

Among adolescents aged 12–17 years, the mean number of permanent teeth per person missing due to dental decay was very low (0.00 teeth, 95% confidence interval: 0.00–0.01). A very low proportion of adolescents aged 12–17 years (0.2%, 0.0–1.5) were missing one or more permanent teeth due to decay.

Due to the low prevalence and number of missing teeth due to decay in this age group, no further analyses on these indicators are presented.

Severity of dental decay experience in permanent teeth (DMFT)

The number of decayed, missing or filled teeth reflects a person's experience of dental decay in their lifetime. By convention, dental decay experience is quantified for permanent teeth, as decayed (D) + missing (M) + filled (F) teeth (T), and is expressed as DMFT. Patterns in severity of dental decay experience in permanent teeth must be interpreted in light of the gaining of permanent teeth with age.

How was this measured?

For this section the DMFT index was calculated using data from previous sections: mean number of permanent teeth with untreated coronal decay, mean number of permanent teeth missing due to pathology, and mean number of filled permanent teeth. Tables in Appendix B report the components of the index and the overall DMF score at the tooth level (DMFT) and surface level (DMFS).

Overall, children and adolescents aged 5–17 years had, on average, 1.2 decayed, missing or filled permanent teeth (ie, a DMFT score of 1.2).

Table 75 presents the mean number of decayed, missing or filled permanent teeth per person, by population group. Children aged 5–11 years had a mean DMFT of 0.5, which was significantly lower than the mean DMFT of 1.9 for adolescents aged 12–17 years.

Table 75: Mean number of decayed, missing or filled permanent teeth (DMFT) per person, among children and adolescents aged 5–17 years, by population group (unadjusted mean)

Population group		Mean (95% CI)
All	Total	1.2 (1.0–1.4)
Sex	Girls	1.3 (1.0–1.6)
	Boys	1.1 (0.7–1.4)
Age group (years)	5–11	0.5 (0.3–0.6)
	12–17	1.9 (1.5–2.4)
Ethnic group	Māori	1.7 (1.3–2.2)
	Pacific	1.4 (1.0–1.7)
	Asian	1.0 (0.3–1.6)
	European/Other	1.1 (0.8–1.4)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	1.0 (0.5–1.5)
	2	1.2 (0.8–1.6)
	3	1.3 (0.5–2.1)
	4	1.1 (0.6–1.5)
	5 (most deprived)	1.3 (0.9–1.8)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 76 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 76: Number of decayed, missing or filled permanent teeth (DMFT) per person, among children and adolescents aged 5–17 years, by population group (adjusted ratio of means and difference in means)

Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Boys	Girls	Age group	0.8	-0.2
Māori	Non-Māori	Age group, sex	1.8*	0.8*
Pacific	Non-Pacific	Age group, sex	1.2	0.2
Asian	Non-Asian	Age group, sex	0.8	-0.2
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.2	0.2

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the ratio of means and difference in means refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among children and adolescents aged 5–17 years, the mean DMFT score was 1.8 times higher for Māori than for non-Māori, after adjustment.

There were no significant differences in the mean DMFT scores by sex or neighbourhood deprivation.

Prevalence of any dental trauma to the six upper permanent teeth

Traumatic dental injuries present a public health problem and in most countries are considered a greater threat to the front (anterior) teeth than dental caries. Injuries to teeth vary greatly in severity, from minor cracks in the enamel to tooth fracture, the tooth being moved from its natural position, or the tooth being knocked out of the socket.

This indicator presents the percentage of children and adolescents aged 7–17 years who had experienced trauma to one or more of their six upper permanent front teeth, irrespective of the degree of damage to the teeth or the loss of teeth following trauma. Children aged 2–6 years were not included in this analysis, as they were not assessed for trauma in their permanent teeth (because they were less likely to have any of their upper front permanent teeth well erupted into the mouth).

How was this measured?

In the 2009 NZOHS, the upper six front permanent teeth were assessed for signs of trauma in children and adolescents aged 7–17 years. Teeth that had a positive history of trauma, as reported by the participant or by the child's parent, were classified according to the level of trauma sustained and any treatment provided to repair or replace the traumatised teeth.

One in six (16.0%) children and adolescents aged 7–17 years had one or more traumatised upper six front permanent teeth.

Table 77 presents the prevalence of having at least one traumatised upper front permanent tooth, by population group. Adolescents aged 12–17 years were significantly more likely to have experienced trauma to one or more of their upper front permanent teeth (23.4%) than children aged 7–11 years (6.2%).

Table 77: Prevalence of having one or more traumatised upper six front permanent teeth, among children and adolescents aged 7–17 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	16.0 (11.2–20.8)
Sex	Girls	17.9 (11.0–24.7)
	Boys	14.3 (8.2–20.5)
Age group (years)	7–11	6.2 (3.7–9.5)
	12–17	23.4 (15.9–30.9)
Ethnic group	Māori	18.4 (12.4–24.4)
	Pacific	16.2 (10.3–23.6)
	Asian	7.9 (3.4–15.1)
	European/Other	17.4 (11.6–23.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	17.6 (10.3–27.1)
	2	14.7 (8.9–22.3)
	3	21.1 (14.4–29.1)
	4	9.1 (4.8–15.5)
	5 (most deprived)	14.9 (10.1–20.9)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 78 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 78: Having one or more traumatised upper six front permanent teeth, among children and adolescents aged 7–17 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	0.8	-4.4
Māori	Non-Māori	Age group, sex	1.2	3.6
Pacific	Non-Pacific	Age group, sex	1.0	0.2
Asian	Non-Asian	Age group, sex	0.5	-8.9
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.8	-3.6

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. There were no statistically significant results (where p-value < 0.05).

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

There were no significant differences in the prevalence of having one or more traumatised upper front permanent teeth by sex, ethnic group or neighbourhood deprivation, after adjusting for other variables.

Part 3: All teeth (primary and permanent teeth combined)

This section provides an overall picture of oral health status for children and adolescents by looking at the condition of their combined primary and permanent teeth. This is a useful analysis, as many children (particularly those between the ages of 6 and 12 years) have a mixed dentition; that is, they have both primary and permanent teeth in their mouth at the same time. Overall dental decay experience in both the primary and permanent teeth provides an indication of the total burden of disease among children and adolescents.

Part 3 reports the following selected oral conditions in combined primary and permanent teeth for children aged 2–17 years:

- prevalence of being caries-free in all teeth (combined primary and permanent)
- prevalence of having one or more primary and/or permanent teeth with untreated coronal decay.

Prevalence of being caries-free in all teeth (combined primary and permanent teeth)

This section presents the proportion of children and adolescents aged 2–17 years who were caries-free in all of their teeth (ie, combined primary and permanent teeth). This means they had no primary or permanent teeth that were affected by decay, missing due to dental decay, or filled. This measure includes all children and adolescents aged 2–17 years, including those with primary teeth only, those with permanent teeth only, and those who have primary and permanent teeth (ie, a mixed dentition).

How was this measured?

Caries-free in the primary and permanent teeth (combined dentitions) represents the proportion of children and adolescents aged 2–17 years who had no experience of dental decay in any of their primary and permanent teeth (in other words, dmft + DMFT = 0).

Overall, one in two (49.3%) children and adolescents aged 2–17 years were caries-free in the combined primary and permanent teeth (ie, all of their teeth).

Table 79 presents the prevalence of being caries-free for children and adolescents aged 2–17 years, by population group. The prevalence of being caries-free was significantly higher among 2–4-year-olds (79.7%) than among 5–11-year-olds (42.5%) or 12–17-year-olds (44.0%).

Table 79: Prevalence of being caries-free in all teeth (primary and permanent teeth), among children and adolescents aged 2–17 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	49.3 (44.4–54.1)
Sex	Girls	50.5 (43.8–57.2)
	Boys	48.1 (41.7–54.6)
Age group (years)	2–4	79.7 (71.7–87.7)
	5–11	42.5 (34.4–50.7)
	12–17	44.0 (36.3–51.6)
Ethnic group	Māori	38.4 (32.6–44.1)
	Pacific	35.6 (27.2–43.9)
	Asian	58.2 (44.4–72.1)
	European/Other	52.1 (45.8–58.3)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	55.0 (40.6–69.4)
	2	49.9 (38.1–61.7)
	3	48.1 (36.0–60.1)
	4	51.6 (41.5–61.6)
	5 (most deprived)	42.7 (34.9–50.6)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 80 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 80: Caries-free in all teeth (primary and permanent teeth), among children and adolescents aged 2–17 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.0	-0.5
Māori	Non-Māori	Age group, sex	0.7*	-14.3*
Pacific	Non-Pacific	Age group, sex	0.7*	-17.0*
Asian	Non-Asian	Age group, sex	1.2	8.5
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.9	-3.5

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among children and adolescents aged 2–17 years, the prevalence of being caries-free was significantly lower among Māori and Pacific than among non-Māori and non-Pacific children and adolescents, respectively, after adjustment.

There were no significant differences in the prevalence of being caries-free in the combined dentition by sex or neighbourhood deprivation.

Prevalence of untreated coronal decay in one or more primary or permanent teeth

This indicator presents the percentage of children and adolescents aged 2–17 years who had one or more primary or permanent teeth with untreated decay in the crowns of their teeth (ie, coronal decay).

How was this measured?

In the 2009 NZOHS, all primary and permanent teeth present were subdivided into five coronal surfaces, and each was assessed for untreated decay. Untreated coronal decay was defined as a cavity that had broken the enamel or visibly undermined it.

One in six (15.9%) children and adolescents aged 2–17 years had untreated decay in one or more primary or permanent teeth.

Table 81 presents the prevalence of untreated decay in the combined primary and permanent teeth, by population group. One in seven (14.9%) children aged 2–4 years had untreated decay in at least one primary or permanent tooth, as did 19.3% of children aged 5–11 years, and 12.7% of adolescents aged 12–17 years. The prevalence of untreated decay among 5–11-year-olds was mostly attributable to decay affecting primary teeth.

Table 81: Prevalence of having one or more primary or permanent teeth with untreated coronal decay, among children and adolescents aged 2–17 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	15.9 (13.0–18.8)
Sex	Girls	14.9 (10.6–19.1)
	Boys	16.8 (12.2–21.3)
Age group (years)	2–4	14.9 (10.2–20.7)
	5–11	19.3 (14.2–24.4)
	12–17	12.7 (8.0–17.4)
Ethnic group	Māori	25.1 (19.9–30.4)
	Pacific	24.0 (13.0–34.9)
	Asian	15.6 (10.5–21.9)
	European/Other	12.5 (8.9–16.2)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	12.6 (7.2–19.9)
	2	9.4 (5.4–14.9)
	3	17.2 (8.4–26.0)
	4	14.1 (8.5–19.7)
	5 (most deprived)	25.5 (17.6–33.5)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 82 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 82: Having one or more primary or permanent teeth with untreated coronal decay, among children and adolescents aged 2–17 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.1	2.0
Māori	Non-Māori	Age group, sex	1.9*	11.6*
Pacific	Non-Pacific	Age group, sex	1.6	9.3
Asian	Non-Asian	Age group, sex	1.0	-0.4
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.6	7.6

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among children and adolescents aged 2–17 years, Māori were almost twice as likely to have untreated decay in the combined primary and permanent teeth as non-Māori, after adjustment.

There were no significant differences by sex or neighbourhood deprivation in the prevalence of having untreated decay on one or more primary or permanent teeth.

Chapter 6: Protective Factors

Key findings

Among children and adolescents aged 2–17 years:

- 63.5% brushed their teeth at least twice a day
- 43.0% brushed their teeth at least twice a day with fluoride toothpaste of 1000 ppm or greater.

Among adults aged 18 years and over:

- 65.3% brushed their teeth at least twice a day with fluoride toothpaste of 1000 ppm or greater.

When comparing people who lived in non-fluoridated areas with those living in fluoridated areas at the time of the survey:

- among people aged 2 years and over, those living in non-fluoridated areas had a significantly more severe dental decay experience (a higher mean dmft/DMFT score) than people living in fluoridated areas, after adjustment for age, sex, ethnic group and neighbourhood deprivation
- 44.5% of 8–30-year-olds had some dental fluorosis, with the majority of fluorosis being questionable or very mild; moderate dental fluorosis was rare (2.0%), as was severe fluorosis (0.0%)
- there were no significant differences in the prevalence of dental fluorosis in people aged 8–30 years between those living in areas with water fluoridation and those in areas with no water fluoridation, after adjustment.

Introduction

This chapter examines two factors that have been repeatedly shown to protect populations from dental caries and periodontal diseases: toothbrushing and water fluoridation. International research shows that both the use of fluoridated toothpaste and water fluoridation have reduced levels of dental decay in the developed world (Beaglehole et al 2009; Burt and Pai 2001). Other protective factors, such as the use of oral health care services, are presented in the next chapter.

Toothbrushing removes dental plaque, which is the sticky soft layer (a bacterial biofilm) that forms on teeth every day. If left to build up, plaque can cause tooth decay and periodontal disease. Bacteria in plaque react with (metabolise) sugar consumed in the daily diet to produce an acid that dissolves the minerals in teeth, and over time this can cause cavities (holes). Bacteria in plaque also produce substances that cause inflammation in the periodontal tissues surrounding the teeth.

The Ministry of Health recommends that adults and children brush their teeth twice a day with fluoride toothpaste of 1000 ppm or greater, and spit out toothpaste rather than rinsing after brushing (New Zealand Guidelines Group 2009). By not rinsing toothpaste from the mouth after brushing, fluoride remains in contact with the teeth for longer and can more effectively prevent dental caries. A smaller amount of toothpaste (a smear of toothpaste on a small brush) should be used for younger children. It is also recommended that children be supervised when using toothpaste, to ensure they do not swallow or eat it (New Zealand Guidelines Group 2009).

Most fluoridated toothpastes on sale in New Zealand contain 1000 ppm of fluoride, although a 400 ppm fluoride toothpaste is also available for use by children under six years. However, it is recommended that 1000 ppm fluoride toothpaste be used for both adults and children (New Zealand Guidelines Group 2009), based on the consensus of many years of research on the effectiveness of different strength toothpastes.

Fluoride acts both systemically and topically to prevent dental caries in three ways:

- the presence of fluoride within saliva enhances the repair of early enamel caries (through remineralising enamel)
- fluoride becomes incorporated into the structure of enamel and renders it more resistant to acid attack
- fluoride interferes with the metabolic pathways of caries-causing bacteria, thus reducing acid production (and therefore reducing the potential for enamel demineralisation) (Daly et al 2002).

At a population level, water fluoridation has been identified as the single most effective public health measure to prevent tooth decay and improve oral health (US Department of Health and Human Services 2001). A recent systematic review carried out by the Australian National Health and Medical Research Council found that evidence strongly suggests that water fluoridation helps to reduce dental caries (NHMRC 2007). Several studies on the benefits of fluoridation to the primary and permanent teeth of children have demonstrated significant reductions in decay rates (ranging from 20% to 80%) (Newbrun 1989). Most studies show that water fluoridation provides benefits over and above those from other forms of fluoride (eg, toothpastes and tablets). Recent information has shown that water fluoridation is effective throughout the lifespan, preventing root caries in adults and older adults, so that fluoride can be seen to be of benefit to anyone with natural teeth, not just children (Newbrun 1989; Public Health Commission 1995). The World Health Organization (WHO) has confirmed that universal access to fluoride for dental health is part of the basic human right to health (Petersen and Lennon 2004).

In addition, a New Zealand report has shown water fluoridation to be a highly cost-effective way of improving oral health. The lifetime benefit of exposure to water fluoridation is estimated to be the prevention of a total of 2.4 to 12.0 decayed, missing or filled teeth for the average individual. At the population level, it has been estimated that water fluoridation prevents between 58,000 and 267,000 decayed, missing or filled teeth in New Zealand per year (Public Health Commission 1994). A 1995 report estimated that, based on levels of 50% of the population receiving fluoridated water at the time, annual savings on dental treatment for decay were up to \$14.3 million (Public

Health Commission 1995). Furthermore, water fluoridation was estimated to prevent around 74,200 cases of dental decay over 30 years for a town of 50,000 people, which equates to the cost of treating each case of decay being 30 times more expensive than the cost of water fluoridation to prevent each case of decay (ESR 1999; Public Health Commission 1994, 1995). Several recent New Zealand studies have shown that children living in non-fluoridated areas have higher caries experience than those in fluoridated areas (Kanagaratnam et al 2009; Lee and Dennison 2004; Mackay and Thomson 2005; Schluter et al 2008).

The Ministry of Health recommends the fluoridation of reticulated water supplies as a way to promote the oral health of both children and adults at a population level, in addition to daily oral health care practices. This recommendation is supported by the New Zealand Dental Association (2002) and Te Ao Marama (The Māori Dental Association) (Broughton 2008).

Toothbrushing

The Ministry of Health recommends that children and adolescents brush their teeth twice a day, and that they use fluoride toothpaste of 1000 ppm or greater (New Zealand Guidelines Group 2009).

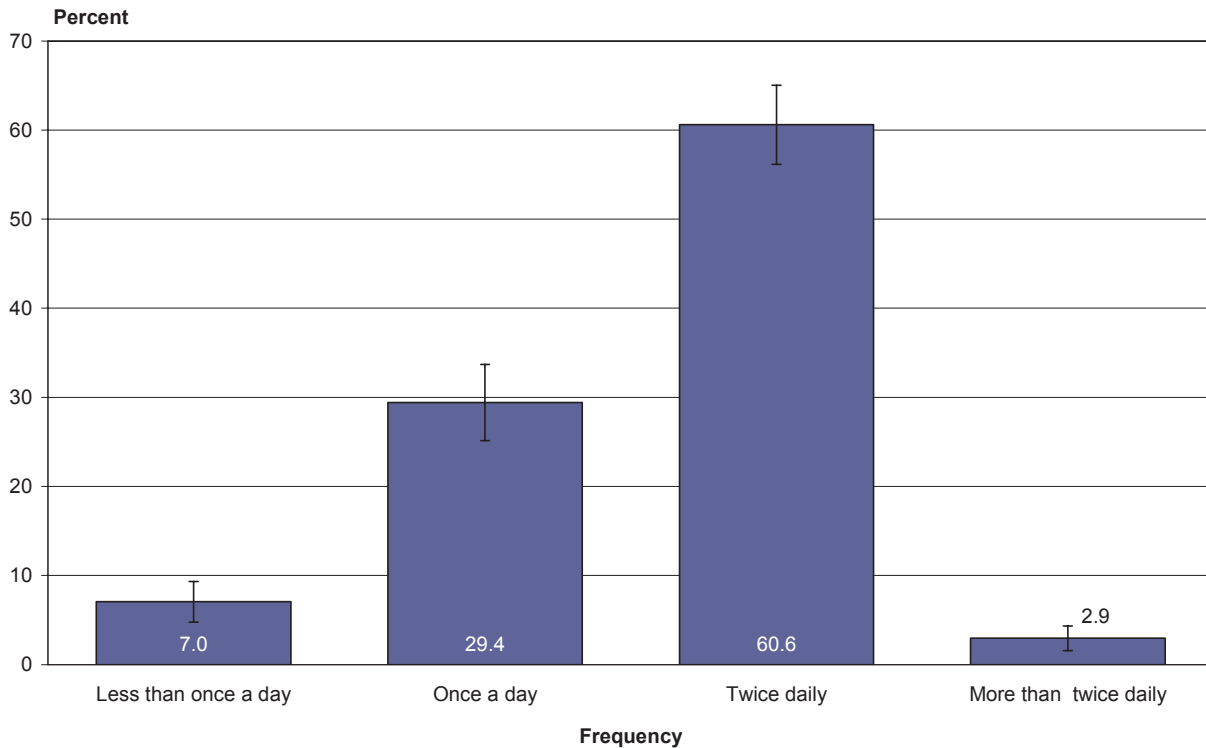
Frequency of toothbrushing, among children and adolescents

What were the survey questions?

In the 2009 NZOHS, the parents of child participants aged 2–14 years were asked how often their child's teeth were brushed per day and what kind of toothpaste they used, if any. Adolescents aged 15–17 years were asked how often they brushed their teeth per day and whether they used toothpaste when brushing their teeth. They were also asked what kind of toothpaste they used (*standard fluoride toothpaste, infant or children's toothpaste, non-fluoridated toothpaste, or don't use toothpaste / no toothpaste available in house*).

The majority of children and adolescents aged 2–17 years brushed their teeth twice a day (60.6%), and a small proportion brushed their teeth more than twice a day (2.9%) (Figure 21). A further 29.4% brushed once a day, while 7.0% brushed less than once a day.

Figure 21: Frequency of brushing teeth, among children and adolescents aged 2–17 years, by population group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Overall, three in five (63.5%) children and adolescents aged 2–17 years brushed their teeth at least twice a day.

Toothbrushing at least twice daily, and at least twice daily with fluoride toothpaste, among children and adolescents

In the following analyses, ‘fluoride toothpaste’ refers to toothpaste with fluoride of 1000 ppm or greater.

Table 83 presents the prevalence of brushing teeth at least twice daily (with or without fluoride toothpaste of 1000 ppm or greater), and at least twice daily with fluoride toothpaste, by population group. Two in five (43.0%) children and adolescents aged 2–17 years brushed their teeth with fluoride toothpaste at least twice a day.

The prevalence of brushing at least twice daily was somewhat lower among 12–17-year-olds (59.0%) than among 2–4-year-olds (65.6%) and 5–11-year-olds (66.9%). Children aged 2–4 years were significantly less likely to brush their teeth at least twice daily with fluoride toothpaste (15.3%) than those aged 5–11 years (40.4%) and 12–17 years (57.1%).

Table 83: Brushed teeth at least twice daily, and brushed teeth at least twice daily with fluoride toothpaste, among children and adolescents aged 2–17 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)	
		Brushing teeth at least twice daily	Brushing teeth at least twice daily with fluoride toothpaste
All	Total	63.5 (59.1–68.0)	43.0 (38.2–47.9)
Sex	Girls	68.7 (63.2–74.2)	45.9 (40.1–51.8)
	Boys	58.7 (53.0–64.4)	40.4 (33.8–46.9)
Age group (years)	2–4	65.6 (56.3–74.9)	15.3 (8.0–22.6)
	5–11	66.9 (61.0–72.7)	40.4 (33.3–47.5)
	12–17	59.0 (50.7–67.2)	57.1 (48.9–65.3)
Ethnic group	Māori	51.9 (47.2–56.6)	35.4 (30.8–40.0)
	Pacific	64.3 (57.2–71.3)	41.0 (33.3–48.6)
	Asian	71.8 (61.0–82.7)	48.2 (35.7–60.7)
	European/Other	64.5 (58.7–70.2)	43.7 (37.5–49.9)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	78.1 (69.9–86.3)	51.4 (39.8–63.0)
	2	70.4 (60.2–80.7)	50.2 (38.7–61.8)
	3	56.1 (44.6–67.6)	38.0 (27.6–48.4)
	4	57.8 (48.1–67.5)	39.8 (29.8–49.8)
	5 (most deprived)	54.8 (48.1–61.5)	35.7 (29.3–42.0)

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for ethnic groups has been used. 'Fluoride toothpaste' refers to toothpaste with 1000 ppm fluoride or greater.

Comparisons by population group, for brushing at least twice daily

Table 84 presents results for brushing at least twice daily (with or without fluoride toothpaste) by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 84: Brushed teeth at least twice a day, among children and adolescents aged 2–17 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	0.9*	-9.9*
Māori	Non-Māori	Age group, sex	0.8*	-15.4*
Pacific	Non-Pacific	Age group, sex	1.0	0.6
Asian	Non-Asian	Age group, sex	1.1	9.4
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.6*	-31.0*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Boys were significantly less likely to brush their teeth at least twice a day than girls, adjusted for age.

Among children and adolescents, Māori were significantly less likely than non-Māori to brush their teeth at least twice a day, adjusted for age and sex.

Children and adolescents living in the most deprived neighbourhoods were only about two-thirds as likely as those living in the least deprived neighbourhoods to brush their teeth at least twice a day, adjusted for age, sex and ethnicity.

Comparisons by population group, for brushing at least twice daily with fluoride toothpaste

Table 85 presents results for brushing at least twice daily with fluoride toothpaste of 1000 ppm or greater, by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 85: Brushed teeth at least twice a day with fluoride toothpaste, among children and adolescents aged 2–17 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	0.8	-7.1
Māori	Non-Māori	Age group, sex	0.8*	-9.0*
Pacific	Non-Pacific	Age group, sex	1.0	-0.4
Asian	Non-Asian	Age group, sex	1.1	6.4
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.7	-16.6

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for ethnic groups has been used. 'Fluoride toothpaste' refers to toothpaste with 1000 ppm fluoride or greater.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among children and adolescents aged 2–17 years, Māori were significantly less likely than non-Māori to brush at least twice daily with fluoride toothpaste, after adjustment.

Toothbrushing at least twice daily with fluoride toothpaste, among adults

The Ministry of Health recommends that adults brush their teeth twice a day, and that they use fluoride toothpaste of 1000 ppm or greater (New Zealand Guidelines Group 2009).

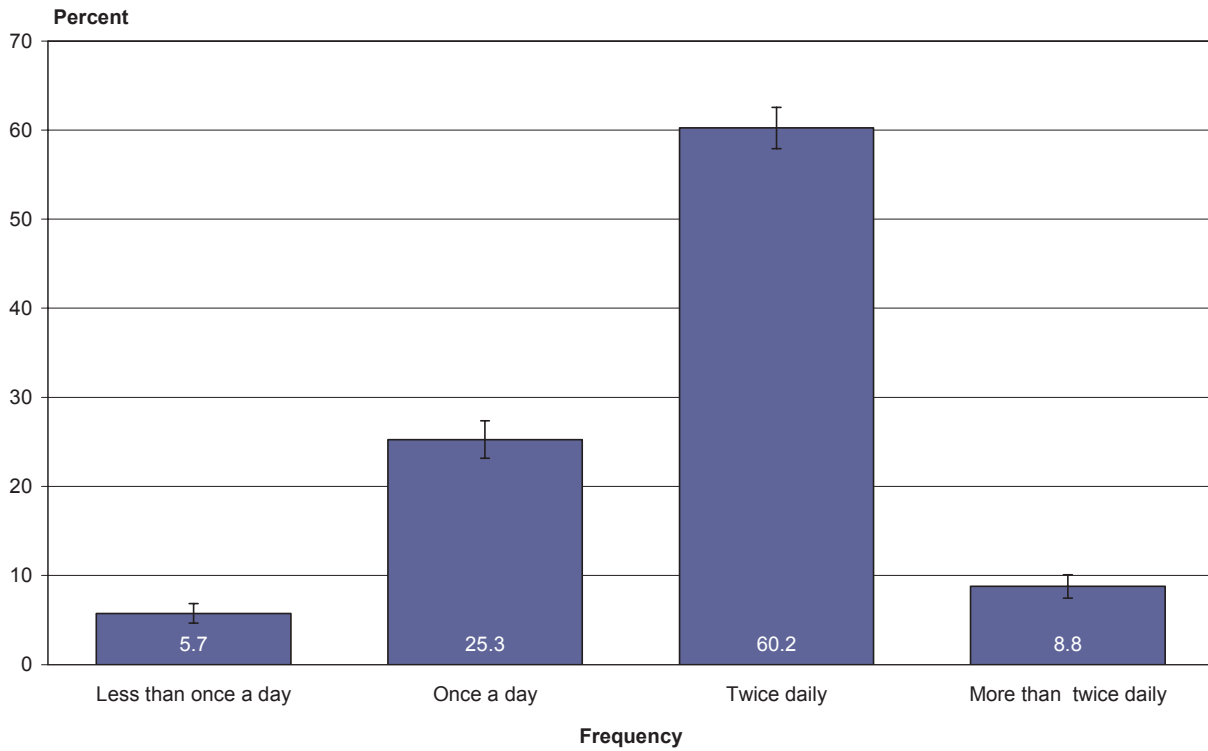
What were the survey questions?

In the 2009 NZOHS, adults aged 15 years and over who had one or more natural teeth were asked how often they brushed their teeth. Adults were also asked how often they used toothpaste when brushing their teeth, and which type of toothpaste they usually used: 1000 ppm fluoride toothpaste; 400–500 ppm fluoride toothpaste; or non-fluoridated toothpaste.

The prevalence of toothbrushing at least twice a day (either with or without fluoride toothpaste) is not presented here, as it was very similar to the prevalence of brushing twice daily with fluoride toothpaste (ie, nearly all adults who brushed twice a day used fluoride toothpaste with 1000 ppm or greater).

Overall, fewer than two in three dentate adults brushed twice daily (60.2%), with an additional 8.8% brushing more than twice daily, with or without fluoride toothpaste (Figure 22). One in four (25.3%) dentate adults brushed once a day, and one in twenty (5.7%) brushed less than once a day.

Figure 22: Frequency of brushing teeth, among dentate adults aged 18 years and over (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Overall, two in three (65.3%) dentate adults aged 18 years and over brushed their teeth with fluoride toothpaste at least twice daily. Table 86 presents the prevalence of brushing at least twice daily with fluoride toothpaste, by population group.

Table 86: Brushed teeth at least twice a day with fluoride toothpaste, among dentate adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	65.3 (62.9–67.7)
Sex	Women	72.8 (69.8–75.9)
	Men	57.0 (53.3–60.7)
Ethnic group	Māori	49.6 (45.6–53.7)
	Pacific	62.0 (54.4–69.6)
	Asian	75.2 (68.3–82.2)
	European/Other	65.7 (62.9–68.4)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	70.6 (65.7–75.6)
	2	65.4 (59.5–71.3)
	3	64.0 (58.0–69.9)
	4	66.0 (60.2–71.7)
	5 (most deprived)	59.4 (54.2–64.6)

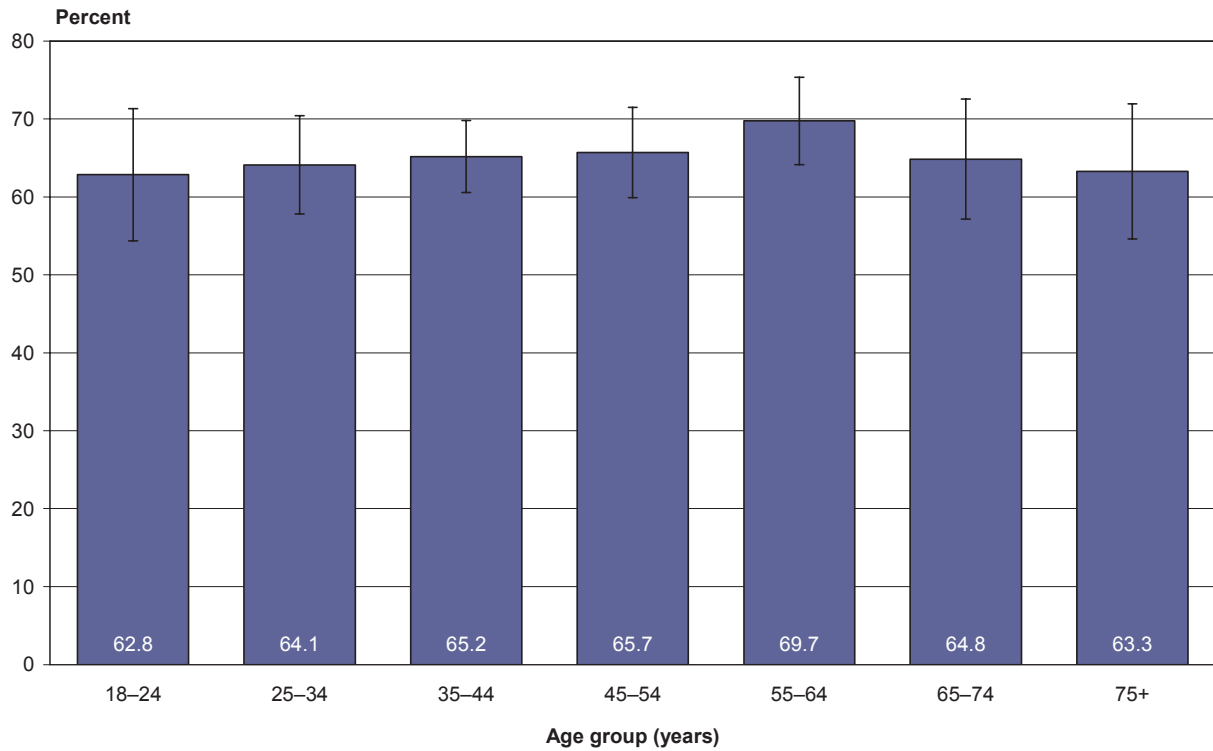
Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for ethnic groups has been used. 'Fluoride toothpaste' refers to toothpaste with 1000 ppm fluoride or greater.

Comparisons by population group

Figure 23 shows that brushing teeth at least twice a day with fluoride toothpaste did not vary significantly by age group.

Figure 23: Brushed teeth at least twice a day with fluoride toothpaste, among dentate adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Note: 'Fluoride toothpaste' refers to toothpaste with 1000 ppm fluoride or greater.

Table 87 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 87: Brushed teeth at least twice a day with fluoride toothpaste, among dentate adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.8*	-16.0*
Māori	Non-Māori	Age group, sex	0.7*	-17.8*
Pacific	Non-Pacific	Age group, sex	0.9	-3.5
Asian	Non-Asian	Age group, sex	1.2*	13.6*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.9	-8.4
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	0.9*	-8.7*

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. 'Fluoride toothpaste' refers to toothpaste with 1000 ppm fluoride or greater.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Overall, men were significantly less likely to brush their teeth at least twice daily with fluoride toothpaste than women, after adjusting for age.

Among dentate adults, Māori were significantly less likely than non-Māori to brush their teeth at least twice a day with fluoride toothpaste, adjusted for age and sex. Asian adults were 1.2 times as likely to brush their teeth twice a day with fluoride toothpaste as non-Asian adults.

Dentate adults who usually visited a dental professional for a dental problem were significantly less likely to brush their teeth at least twice a day with fluoride toothpaste, compared with those who usually visited a dental professional for a check-up.

Oral health status by fluoridation status

This section presents three measures of oral health status (mean dmft/DMFT score, mean dmfs/DMFS score and prevalence of dental fluorosis) by water fluoridation status.

It is important to note that it was not one of the objectives of the 2009 NZOHS to compare the oral health status of people by fluoridation status, and therefore the survey cannot be considered a fluoridation study as such. The following results are for a snapshot in time, and constitute an ecological analysis based on current place of residence. As such, they do not take into consideration lifetime exposure to fluoridated and non-fluoridated water supplies. Individuals who currently live in fluoridated areas may have spent time in non-fluoridated areas, and the reverse is also true. Furthermore, there may be other confounding factors that have not been taken into

account in this analysis, such as the usual reason for visiting a dental professional, and other sources of fluoride such as fluoride toothpaste.

How was fluoridation status measured?

Information on fluoridated and non-fluoridated areas was based on 2008 data obtained from Environmental Science and Research (ESR). Survey respondents were categorised into living in fluoridated or non-fluoridated areas, based on where they were living at the time of the survey.

Severity of dental decay experience (DMFT), by fluoridation status

The DMFT index reports the severity of dental decay experience over a lifetime (ie, the number of decayed, missing or filled teeth). The index is cumulative, so an individual's DMFT cannot decrease over time. This section compares the overall mean DMFT (including dmft for primary teeth in children) for people who, at the time of the interview, were living in areas receiving fluoridated or non-fluoridated water.

How was this measured?

For this section the DMFT index was calculated using data from the mean number of teeth with untreated coronal decay, mean number of teeth missing due to pathology, and mean number of filled teeth. In dentate adults aged 45 years and over, the assumption was made that missing teeth had been extracted due to pathology. For children, the scores for primary teeth (dmft) and permanent teeth (DMFT) were combined to give an overall measure of dental decay experience in the combined dentitions.

Table 88 presents the mean dmft/DMFT for children and adults, for those living in fluoridated areas and those living in non-fluoridated areas.

Table 88: Mean number of decayed, missing or filled teeth (dmft/DMFT), among dentate adults and children, by fluoridation status (unadjusted mean)

Population group		Mean (95% CI)
Children (aged 2–17 years)	Living in non-fluoridated areas	2.4 (2.0–2.8)
	Living in fluoridated areas	1.5 (1.1–1.9)
Adults (aged 18 years and over)	Living in non-fluoridated areas	15.7 (15.0–16.4)
	Living in fluoridated areas	12.2 (11.6–12.8)
All (aged 2 years and over)	Living in non-fluoridated areas	12.1 (11.5–12.7)
	Living in fluoridated areas	9.6 (9.1–10.1)

Source: 2009 New Zealand Oral Health Survey

Note: For children, this measure presents the overall mean number of decayed, missing or filled primary and permanent teeth combined (ie, dmft + DMFT).

Table 89 presents the results for mean dmft/DMFT score, by age group, for people living in non-fluoridated areas, which are adjusted for age, sex, ethnic group and neighbourhood deprivation to allow appropriate comparisons with people living in fluoridated areas.

Table 89: Number of decayed, missing or filled teeth (dmft and DMFT) per person, among dentate adults and children, by fluoridation status (adjusted ratio of means and difference in means)

Age group	Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Children (aged 2–17 years)	Living in non-fluoridated areas	Living in fluoridated areas	Age, sex, ethnic group, NZDep2006	1.7*	1.0*
Adults (aged 18 years and over)	Living in non-fluoridated areas	Living in fluoridated areas	Age, sex, ethnic group, NZDep2006	1.1*	0.7*
All (aged 2 years and over)	Living in non-fluoridated areas	Living in fluoridated areas	Age, sex, ethnic group, NZDep2006	1.1*	0.8*

Source: 2009 New Zealand Oral Health Survey

* Indicates a statistically significant result (p-value < 0.05).

Overall, the mean dmft/DMFT score was 1.7 times as high among children and adolescents aged 2–17 years living in non-fluoridated areas as those living in fluoridated areas, adjusted for age, sex, ethnic group and neighbourhood deprivation. This equates to a difference in mean DMFT scores of one whole tooth (1.0), between those living in fluoridated and non-fluoridated areas.

Among adults aged 18 years and over, the mean DMFT score was 1.1 times as high for people living in non-fluoridated areas, compared with those living in fluoridated areas, after adjustment. This equates to a difference in mean DMFT scores of 0.7 teeth between people living in fluoridated and non-fluoridated areas. Similar results were found when examining the total population aged 2 years and over.

Although this analysis is only a snapshot, these findings indicate overall that adults and children who lived in fluoridated areas had lower experience of dental caries than adults and children without a fluoridated water supply. This difference is found despite the fact that the majority of people brush their teeth with fluoridated toothpaste. This, together with migration of people into and out of areas with fluoridated reticulated water supplies, means that the true protective effect of water fluoridation may have been underestimated in this study.

Severity of dental decay experience (DMFS), by fluoridation status

The DMFS index is similar to the DMFT index but measures tooth surfaces instead of teeth. This section compares the overall mean DMFS (including dmfs for primary teeth in children) for people who, at the time of the interview, were living in areas receiving fluoridated water and those in areas with non-fluoridated water.

How was this measured?

For this section the DMFS index was calculated using data from the mean number of tooth surfaces with untreated coronal decay, mean number of teeth missing due to pathology, and mean number of filled tooth surfaces. In the permanent dentition, there is a maximum of 160 coronal surfaces, while in the primary dentition, there is a maximum of 100 coronal surfaces. In dentate adults aged 45 years and over, the assumption was made that missing teeth had been extracted due to pathology. For children, the DMFS scores for surfaces on primary teeth (dmfs) and surfaces on permanent teeth (DMFS) were combined to give an overall measure of dental decay experience in the combined dentitions.

Table 90 presents the mean dmfs/DMFS for children and adults living in fluoridated areas and those living in non-fluoridated areas.

Table 90: Mean number of decayed, missing or filled teeth surfaces (dmfs and DMFS), among dentate adults and children, by fluoridation status (unadjusted mean)

Population group		Mean (95% CI)
Children (aged 2–17 years)	Living in non-fluoridated areas	3.9 (3.1–4.7)
	Living in fluoridated areas	2.5 (1.7–3.2)
Adults (aged 18 years and over)	Living in non-fluoridated areas	42.8 (40.4–45.1)
	Living in fluoridated areas	32.3 (30.3–34.2)
All (aged 2 years and over)	Living in non-fluoridated areas	32.3 (30.3–34.2)
	Living in fluoridated areas	25.0 (23.4–26.7)

Source: 2009 New Zealand Oral Health Survey

Table 91 presents the results for mean dmfs/DMFS score, by age group, for people living in non-fluoridated areas, which are adjusted for age, sex, ethnic group and neighbourhood deprivation to allow appropriate comparisons with people living in fluoridated areas.

Table 91: Number of decayed, missing or filled teeth surfaces (dmfs and DMFS) per person, among dentate adults and children, by fluoridation status (adjusted ratio of means and difference in means)

Age group	Group of interest	Reference group	Adjustment variables	Ratio of means	Difference in means
Children (aged 2–17 years)	Living in non-fluoridated areas	Living in fluoridated areas	Age, sex, ethnic group, NZDep2006	1.7*	1.6*
Adults (aged 18 years and over)	Living in non-fluoridated areas	Living in fluoridated areas	Age, sex, ethnic group, NZDep2006	1.1	1.7
All (aged 2 years and over)	Living in non-fluoridated areas	Living in fluoridated areas	Age, sex, ethnic group, NZDep2006	1.1*	1.6*

Source: 2009 New Zealand Oral Health Survey

* Indicates a statistically significant result (p-value < 0.05).

After adjustment, children and adolescents aged 2–17 years living in non-fluoridated areas had a mean dmfs/DMFS score 1.7 times as high as children and adolescents living in fluoridated areas. This equated to 1.6 teeth surfaces. In addition, people aged 2 years and over living in non-fluoridated areas had a significantly higher dmfs/DMFS score than those living in fluoridated areas. There was no statistically significant difference for adults aged 18 years and over.

It should be noted that dmfs/DMFS is a more variable measure than dmft/DMFT (as there are more teeth surfaces than teeth). This makes it more difficult to detect small differences in the dmfs/DMFS analysis.

Prevalence of dental fluorosis, by fluoridation status

Dental fluorosis is a condition of altered enamel formation caused by excessive intake of fluoride during tooth formation (Burt and Eklund 2005), with a wide range of severity. Fluorosis is only one of a wide range of developmental defects that can occur in tooth enamel. Clinically, dental fluorosis is characterised by opaque white areas in the enamel in its milder forms, while more severe fluorosis can be characterised by brown stains or pitting.

Many studies on fluorosis confirm that, in optimally fluoridated areas, dental fluorosis is usually only mild or very mild. A recent review concluded that mild fluorosis was not a concern for people, and that mild fluorosis was sometimes found to be associated with improved oral health-related quality of life. Severe fluorosis was consistently reported to have negative effects on oral health-related quality of life (Chankanka et al 2010).

This section presents the prevalence of fluorosis among dentate children and adults aged 8–30 years living in fluoridated areas and those living in non-fluoridated areas. Unadjusted results are presented, because the numbers of respondents with moderate or severe fluorosis were too low to adjust for other variables.

How was this measured?

The appearance of the upper front permanent teeth has the greatest impact on aesthetics for individuals over their lifetime. The eight upper front permanent teeth of children and adults aged 8–30 years were assessed for fluorosis in this survey. For teeth to be assessed for fluorosis, the teeth must be fully erupted into the mouth. By age 8 years, the upper central incisor teeth will be fully erupted in most children and therefore able to be assessed for fluorosis. The teeth of adults older than 30 years were excluded from the fluorosis assessment, as it becomes more difficult to assess fluorosis because the tooth enamel matures, people have dental procedures undertaken or some teeth become restored with dental fillings or crowns.

In the 2009 NZOHS, for survey participants aged 8–30 years, the buccal surfaces of eight upper anterior teeth (upper right first premolar to upper left first premolar), if present, were assessed by the dental examiners for dental fluorosis using the following six categories of Dean's Index of Fluorosis: normal, questionable, very mild, mild, moderate, severe. This indicator presents the prevalence of fluorosis. The tooth with the highest fluorosis score per person was selected for the analysis.

Table 92 presents the prevalence of fluorosis (by the six categories of Dean's Index of Fluorosis), among dentate children and adults aged 8–30 years, overall and by fluoridated and non-fluoridated areas. Overall, the prevalence of moderate and severe fluorosis was very low in the population, with 2.0% of people aged 8–30 years with moderate fluorosis and virtually no people with severe fluorosis (0.0%).

These results suggest there was no significant difference in the prevalence of fluorosis between people living in fluoridated and non-fluoridated areas.

Table 92: Prevalence of dental fluorosis, among dentate adults and children aged 8–30 years, by level of fluorosis (unadjusted prevalence)

Level of fluorosis	Prevalence (95% CI) among 8–30-year-olds		
	All	Living in fluoridated areas	Living in non-fluoridated areas
None (level 0)	55.5 (49.0–62.0)	54.5 (45.9–63.0)	56.9 (48.3–65.6)
Questionable (level 1)	27.2 (22.2–32.2)	30.6 (23.3–37.9)	22.7 (16.3–29.0)
Very mild (level 2)	10.2 (6.6–15.0)	10.2 (5.5–16.9)	10.3 (5.7–16.8)
Mild (level 3)	5.1 (2.9–8.1)	3.0 (0.8–7.6)	7.8 (4.3–12.7)
Moderate (level 4)	2.0 (0.7–4.4)	1.7 (0.3–5.5)	2.3 (0.5–6.8)
Severe (level 5)	0.0 (0.0–0.8)	0.0 (0.0–1.5)	0.0 (0.0–1.8)

Source: 2009 New Zealand Oral Health Survey

Chapter 7: Use of Oral Health Services

Key findings

- Four in five (81.2%) children and adolescents aged 2–17 years had visited a dental professional in the last year.
- By comparison, one in two (47.1%) adults aged 18 years and over had visited a dental professional in the last year.
- Two in five (38.9%) adults reported usually visiting a dental professional for a check-up rather than a dental problem.
- Two in three (67.0%) adults usually visited the same dental professional for dental care or advice.
- Four in five (84.2%) adults reported that their dental professional always listened carefully to what they had to say.
- One in two (55.3%) adults felt they did not see a dental professional often enough.
- One in two (45.9%) adults felt they currently needed dental treatment.
- Two in five (44.1%) adults reported that they had avoided dental care in the past year due to cost.
- One in four (25.3%) adults reported that they went without recommended routine dental treatment due to cost in the past year.
- Among people who had not visited a dental professional in the past year, 47.5% reported that they had not visited because they had no dental problems, and 46.8% had not visited due to cost.

Introduction

The Ministry of Health has a vision for high-quality oral health services which promote, improve, maintain and restore good oral health, and which are proactive in addressing the needs of those at greatest risk of poor oral health (Ministry of Health 2006b).

In New Zealand, oral health services are a mix of publicly- and privately-funded care, depending on age group and socioeconomic status. While oral health care for most adults is performed by private dental professionals on a user-pays basis, free or partially publicly-funded basic oral health care is available for the following groups:

- children and adolescents from birth to their 18th birthday
- low-income adults
- special needs and medically compromised patients who cannot access care in a community setting.

This chapter presents information on:

- visits to a dental professional in the last 12 months
- the reason for the last visit
- continuity and patterns of oral health care (including the usual reason for visiting a dental professional)
- experiences of dental care
- unmet need, cost and barriers to accessing oral health care services.

This chapter presents results for the total adult population, not just adults with natural teeth (dentate adults). This is because quality of care and unmet need are still issues that can affect edentulous people.

Visited a dental professional in the last 12 months

The Ministry of Health and the New Zealand Dental Association recommend regular dental visits as one of the ways to keep teeth and gums healthy. Regular visits to a dental professional enable the early detection of oral health problems, and the provision of preventive advice and procedures to maintain and improve oral health.

In New Zealand, the recommended recall for children and adolescents is determined specifically for each patient and based on the assessment of disease levels and risk of or from dental disease. Typically, the majority of children enrolled in child and adolescent oral health services are seen by an oral health professional every year. However, if a child has greater dental needs, the child may be seen every six months. The National Institute for Health and Clinical Excellence in the United Kingdom recommends that the interval between oral health reviews for patients under 18 years should be no longer than 12 months, and for adults over 18 years should be no longer than 24 months (NICE 2004).

In this report, visiting a dental professional in the last 12 months was used as an indicator of a recent dental visit, for children, adolescents and adults.

Visited a dental professional in the last 12 months, among children and adolescents

Children and adolescents are eligible to receive free, publicly-funded oral health care from birth until the day before they turn 18 years of age.

What were the survey questions?

In the 2009 New Zealand Oral Health Survey, the parents of child participants aged 2–14 years were asked how long ago their child last saw a dental professional, for any reason. Adolescents aged 15–17 years were asked if they had been to a dental professional in the last 12 months.

Overall, four in five (81.2%) children and adolescents aged 2–17 years had visited a dental professional in the past 12 months.

Table 93 presents the prevalence of having visited a dental professional in the past year, by population group. Children aged 5–11 years were significantly more likely to have visited a dental professional in the last 12 months (90.3%) than adolescents aged 12–17 years (79.9%) or children aged 2–4 years (59.7%).

Table 93: Prevalence of having visited a dental professional in the last 12 months, among children and adolescents aged 2–17 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	81.2 (77.9–84.4)
Sex	Girls	80.7 (75.8–85.5)
	Boys	81.6 (77.5–85.7)
Age group (years)	2–4	59.7 (51.1–68.3)
	5–11	90.3 (86.6–94.1)
	12–17	79.9 (74.3–85.5)
Ethnic group	Māori	76.6 (72.8–80.4)
	Pacific	70.7 (62.3–79.1)
	Asian	80.3 (72.2–88.3)
	European/Other	83.2 (79.2–87.2)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	79.2 (70.3–88.2)
	2	80.4 (72.8–88.1)
	3	90.5 (86.2–94.9)
	4	83.4 (77.3–89.4)
	5 (most deprived)	71.9 (64.8–79.1)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 94 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 94: Visited a dental professional in the last 12 months, among children and adolescents aged 2–17 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.0	-0.3
Māori	Non-Māori	Age group, sex	0.9*	-5.8*
Pacific	Non-Pacific	Age group, sex	0.9*	-10.3*
Asian	Non-Asian	Age group, sex	1.0	0.3
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.0	2.9

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among children and adolescents aged 2–17 years, Māori and Pacific children and adolescents were significantly less likely to have visited a dental professional in the last 12 months than non-Māori and non-Pacific children and adolescents, respectively.

There were no significant differences by sex or neighbourhood deprivation.

Visited a dental professional in the last 12 months, among adults

What were the survey questions?

In the 2009 NZOHS, all adult participants were asked if they had been to a dental professional in the last 12 months.

Overall, one in two (47.1%) adults aged 18 years and over had visited a dental professional in the past 12 months. Table 95 presents the prevalence of having visited a dental professional in the past year, by population group.

Table 95: Prevalence of having visited a dental professional in the last 12 months, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	47.1 (44.5–49.7)
Sex	Women	49.8 (46.6–53.1)
	Men	44.1 (40.2–48.0)
Ethnic group	Māori	35.6 (31.9–39.2)
	Pacific	32.8 (26.3–39.4)
	Asian	41.7 (33.9–49.5)
	European/Other	49.4 (46.4–52.5)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	63.3 (57.3–69.2)
	2	46.8 (40.8–52.9)
	3	48.0 (41.8–54.2)
	4	42.6 (36.8–48.3)
	5 (most deprived)	33.9 (29.1–38.6)

Source: 2009 New Zealand Oral Health Survey

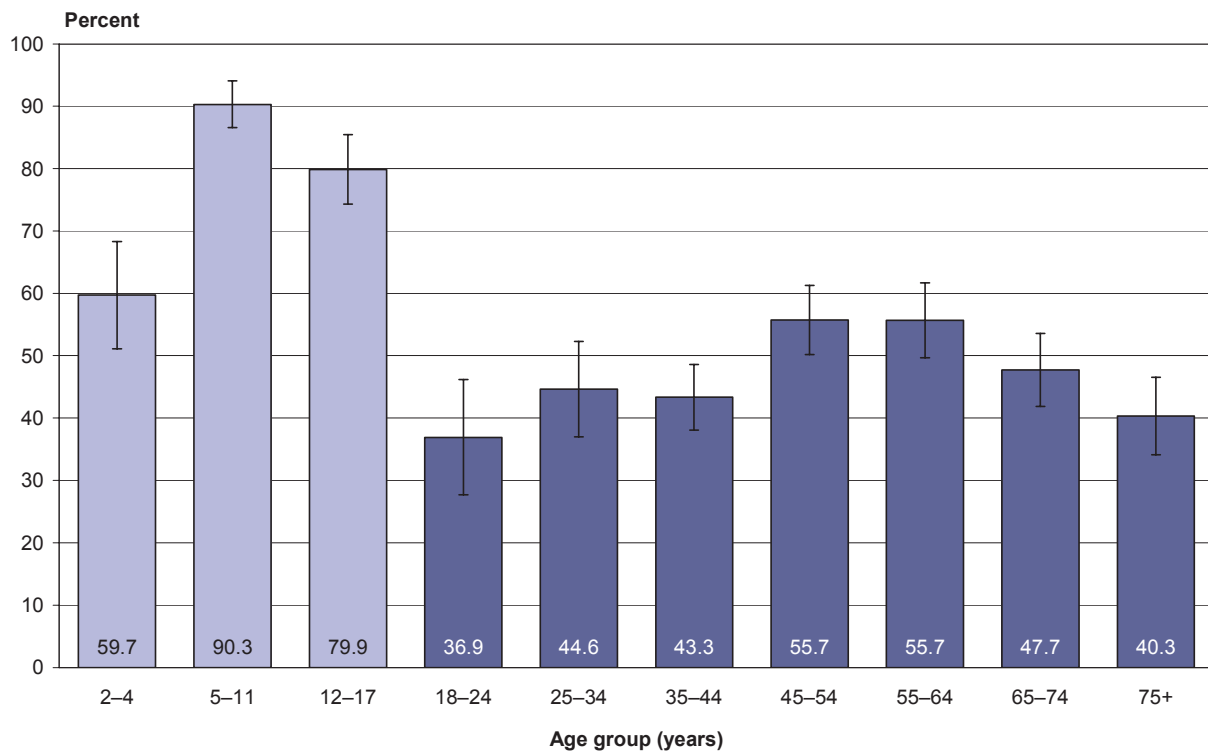
Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 24 presents the prevalence of having visited a dental professional in the last 12 months, by age group. Results for children and adolescents aged 2–17 years are presented in the graph for comparison purposes.

Overall, children and adolescents aged 5–17 years had a much higher prevalence of having visited a dental professional in the previous year than adults aged 18 years and over. Among adults, people aged 45–64 years had the highest prevalence of having visited a dental professional in the past year (at about 56%). The prevalence was lower among people aged 18–24 years (36.9%) and 75 years and over (40.3%).

Figure 24: Prevalence of having visited a dental professional in the last 12 months, among children and adolescents aged 2–17 years, and adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 96 presents results for adults aged 18 years and over, by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 96: Visited a dental professional in the last 12 months, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.9*	-6.0*
Māori	Non-Māori	Age group, sex	0.8*	-12.1*
Pacific	Non-Pacific	Age group, sex	0.7*	-14.4*
Asian	Non-Asian	Age group, sex	1.0	-1.9
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.6*	-26.0*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	0.5*	-32.7*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

There were clear differences in having visited a dental professional in the last 12 months by population group. Men were significantly less likely than women to have visited a dental professional in the past year, adjusted for age.

The prevalence of having visited a dental professional in the past 12 months was significantly lower among Māori and Pacific adults, compared with non-Māori and non-Pacific adults, respectively, after adjustment.

People living in the most deprived areas were only about two-thirds as likely to have visited a dental professional in the past year as people living in the least deprived areas, after adjustment. This equates to a 26.0 percentage point difference between the most deprived and least deprived areas.

People who usually visited a dental professional for a dental problem were only about half as likely to have visited a dental professional in the past year as people who usually visited a dental professional for a dental check-up. This equates to a 32.7 percentage point difference between those who usually visited a dental professional for a problem compared with those who usually visited for a check-up.

Reason for last visit to a dental professional

A defining characteristic of people's dental care is the reason they visit a dental professional – whether it is for a check-up or for a dental problem. Visiting a dental professional for check-ups is important (even in the absence of symptoms), because it increases the chances of dental professionals detecting signs of oral disease (eg, decay, periodontal disease or oral cancer) early, which allows for timely treatment and/or preventive measures.

Prevalence of last visit to a dental professional being for a check-up

What were the survey questions?

In the 2009 NZOHS, all adult participants were asked the main reason for their last visit to a dental professional. The response options offered were: *went in on own for check-up, examination or cleaning; was called in by the dental professional for check-up, examination or cleaning; went for treatment of a condition that dental professional discovered at earlier check-up or examination; something was wrong, bothering or hurting; to get treatment for teeth damaged in an accident.* The first three options were assumed to be for a check-up.

Overall, one in two (47.9%) adults aged 18 years and over had last visited a dental professional for a check-up (rather than for any other reason). Table 97 presents the prevalence of having last visited a dental professional for a check-up, by population group.

Table 97: Prevalence of last visit to a dental professional being for a check-up, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	47.9 (45.9–50.0)
Sex	Women	49.7 (46.7–52.6)
	Men	46.0 (42.3–49.7)
Ethnic group	Māori	40.8 (37.0–44.6)
	Pacific	38.2 (31.3–45.1)
	Asian	57.1 (49.7–64.5)
	European/Other	48.4 (45.9–51.0)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	58.3 (52.2–64.5)
	2	47.0 (41.3–52.7)
	3	46.2 (40.5–52.0)
	4	46.9 (41.3–52.4)
	5 (most deprived)	40.4 (35.0–45.7)

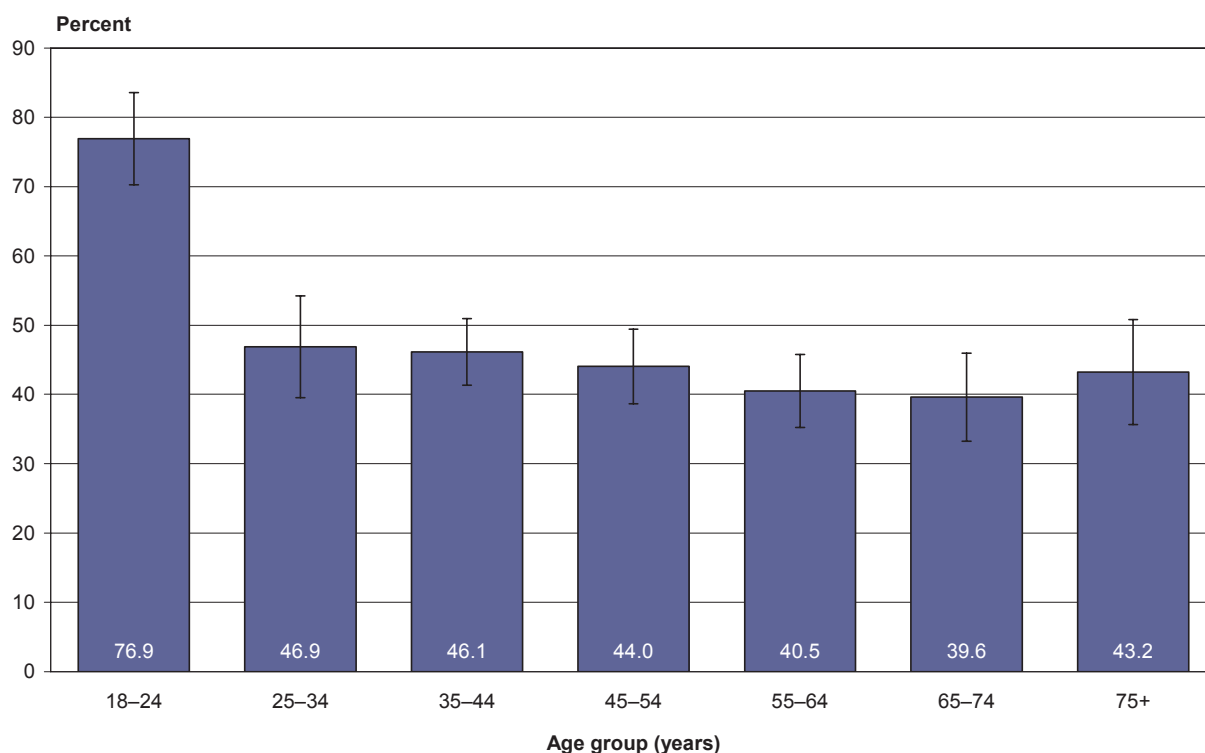
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 25 shows that people aged 18–24 years had the highest prevalence of having last visited a dental professional for a check-up (about 77%). This higher prevalence among 18–24-year-olds may be the true indication of dental visiting for this age group, but may possibly relate to visits made while people in this age group received publicly-funded oral health care (when they were younger than 18 years of age). The prevalence of having last visited a dental professional for a check-up was relatively stable among all other age groups, at about 40–47%.

Figure 25: Prevalence of last visit to a dental professional being for a check-up, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 98 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 98: Last visit to a dental professional was for a check-up, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.9	-3.4
Māori	Non-Māori	Age group, sex	0.8*	-12.2*
Pacific	Non-Pacific	Age group, sex	0.7*	-14.3*
Asian	Non-Asian	Age group, sex	1.1	2.6
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.7*	-19.9*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

The prevalence of having last visited a dental professional for a check-up was significantly lower for Māori and Pacific adults than for non-Māori and non-Pacific adults, respectively, after adjustment.

People living in the most deprived areas were significantly less likely than people in the least deprived areas to have last visited a dental professional for a check-up, after adjustment.

Patterns and continuity of oral health care

There are many things that can influence people's attitudes towards going to a dental professional, including their previous experiences. These factors may influence how often they visit a dental professional, and in some instances may lead them to avoid going to a dental professional altogether.

Prevalence of usually visiting a dental professional for a check-up

Usually visiting a dental professional for check-ups is important for the early detection of signs of oral disease, because it allows for timely treatment and/or preventive measures.

What were the survey questions?

In the 2009 NZOHS, all adults were asked whether their usual reason for visiting a dental professional was for check-ups or when they have a dental problem.

Overall, two in five adults reported that they usually visit a dental professional for a check-up rather than a dental problem (38.9%). Table 99 presents the prevalence of usually visiting a dental professional for a check-up rather than a dental problem, by population group.

Table 99: Prevalence of usually visiting a dental professional for a check-up rather than a dental problem, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	38.9 (36.5–41.3)
Sex	Women	41.2 (38.4–44.0)
	Men	36.4 (32.4–40.3)
Ethnic group	Māori	26.8 (23.2–30.4)
	Pacific	22.0 (16.0–28.1)
	Asian	39.5 (31.6–47.4)
	European/Other	40.9 (38.3–43.5)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	54.5 (48.5–60.5)
	2	38.8 (33.1–44.5)
	3	38.6 (32.1–45.0)
	4	35.8 (30.3–41.4)
	5 (most deprived)	25.3 (20.3–30.3)

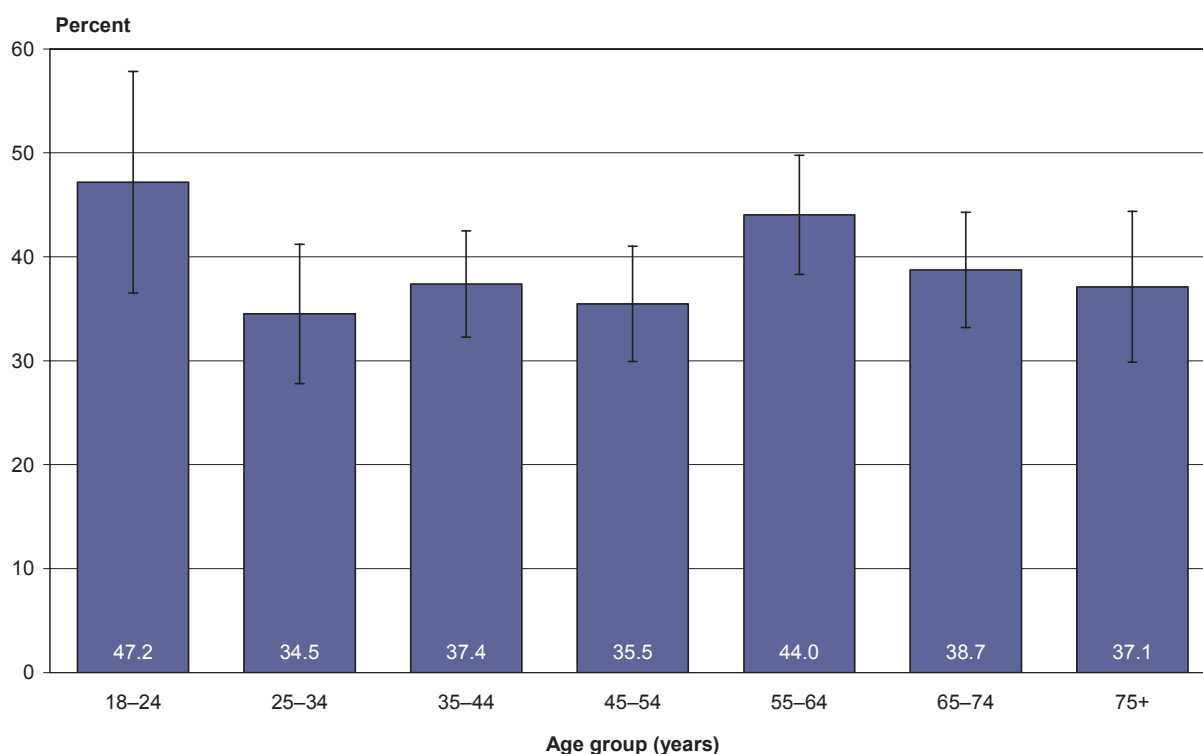
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 26 shows that people aged 18–24 and 55–64 years had somewhat higher prevalences of usually visiting a dental professional for a check-up rather than a dental problem. The higher prevalence among 18–24-year-olds may be related to their last experiences of publicly-funded oral health services (when they were younger than 18 years of age).

Figure 26: Prevalence of usually visiting a dental professional for a check-up rather than a dental problem, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 100 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 100: Usually visiting a dental professional for a check-up rather than a dental problem, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.9*	-4.9*
Māori	Non-Māori	Age group, sex	0.6*	-14.4*
Pacific	Non-Pacific	Age group, sex	0.5*	-18.1*
Asian	Non-Asian	Age group, sex	1.0	0.7
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.5*	-27.8*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Men were significantly less likely than women to usually visit a dental professional for a check-up rather than a dental problem, after adjusting for age.

After adjustment, Māori were less than two-thirds as likely to usually visit a dental professional for a check-up rather than a dental problem as non-Māori. Pacific adults were half as likely to usually visit a dental professional for a check-up as non-Pacific adults.

People living in the most deprived neighbourhoods were only half as likely to usually visit a dental professional for a check-up as people in the least deprived neighbourhoods, when adjusted for age, sex and ethnic group. This equates to a 27.8 percentage point difference between the most deprived and least deprived neighbourhoods.

Prevalence of usually visiting the same dental professional for dental care or dental advice

Usually visiting the same dental professional implies an ongoing relationship with a particular dental professional, and continuity in dental care.

What were the survey questions?

In the 2009 NZOHS, all adults were asked if there was a particular dental professional who they usually go to if they need dental care or dental advice.

Overall, two in three adults reported usually visiting the same dental professional for dental care or dental advice (67.0%). Table 101 presents the prevalence of usually visiting the same dental professional for dental care or dental advice, by population group.

Table 101: Prevalence of usually visiting the same dental professional for dental care or dental advice, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	67.0 (64.8–69.2)
Sex	Women	71.5 (68.7–74.3)
	Men	62.1 (58.8–65.4)
Ethnic group	Māori	52.9 (48.9–56.8)
	Pacific	34.6 (27.9–41.2)
	Asian	46.7 (39.0–54.4)
	European/Other	72.1 (69.7–74.5)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	83.1 (78.8–87.5)
	2	71.9 (66.2–77.6)
	3	62.6 (56.2–69.0)
	4	62.7 (58.2–67.2)
	5 (most deprived)	53.2 (48.4–58.0)

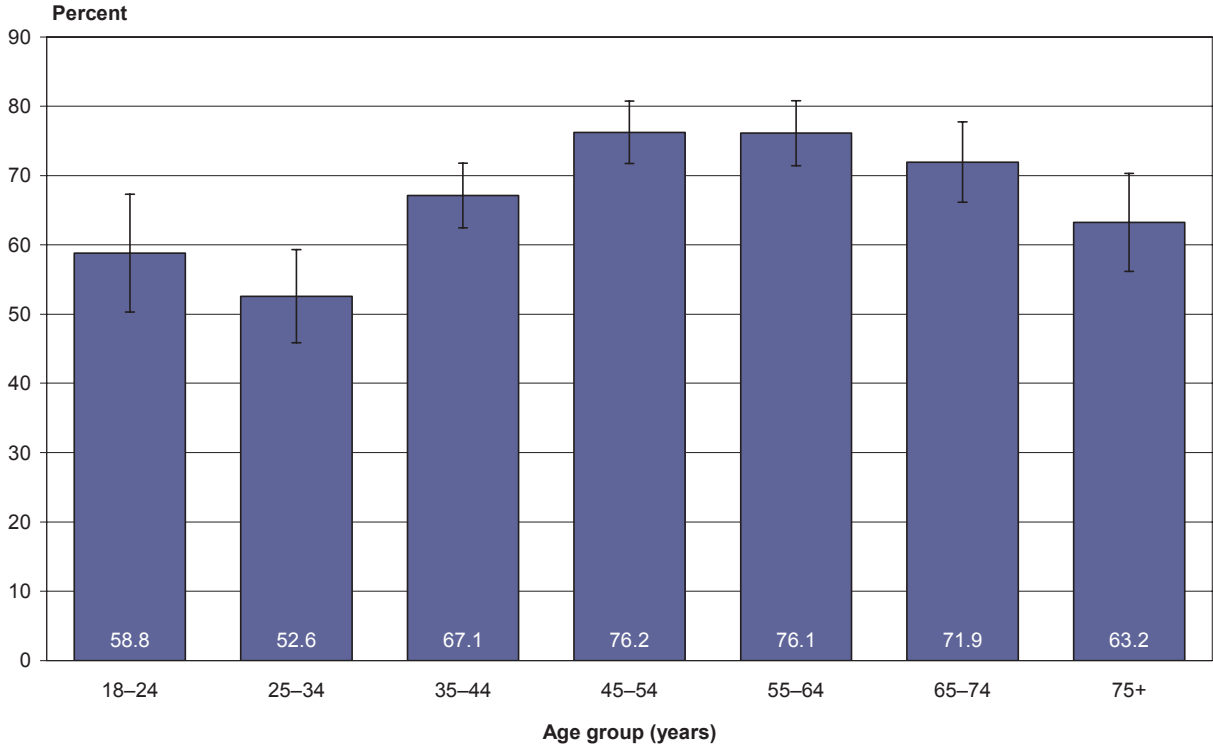
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 27 shows that the prevalence of usually visiting the same dental professional for dental care or dental advice was highest in the 45–64 years age groups (at about 76%). People aged 25–34 years had the lowest prevalence of usually visiting the same dental professional (52.6%).

Figure 27: Prevalence of usually visiting the same dental professional for dental care or dental advice, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 102 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 102: Usually visited the same dental professional for dental care or dental advice, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.9*	-9.6*
Māori	Non-Māori	Age group, sex	0.8*	-13.8*
Pacific	Non-Pacific	Age group, sex	0.5*	-32.4*
Asian	Non-Asian	Age group, sex	0.8*	-16.7*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.7*	-24.1*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	0.7*	-25.1*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Adjusted for age, men were significantly less likely than women to usually visit the same dental professional for dental care or advice.

The prevalence of usually visiting the same dental professional for dental care or advice was significantly lower for Māori and Asian adults than for non-Māori and non-Asian adults, respectively, after adjustment. Pacific adults were about half as likely as non-Pacific adults to usually visit the same dental professional.

There was a significant gradient associated with neighbourhood deprivation, with people in more deprived areas having a lower prevalence of usually visiting the same dental professional for care than people in less deprived areas. This equates to a 24.1 percentage point difference between the most deprived and least deprived areas in the prevalence of usually visiting the same dental professional.

People who usually visit a dental professional for a problem were significantly less likely to usually visit the same dental professional than people who usually visit for a check-up.

Experiences of dental care

An individual’s overall experience of care is an important aspect of quality of care, and helps to assess the extent to which care is people-focused.

Prevalence of being listened to carefully by a dental professional

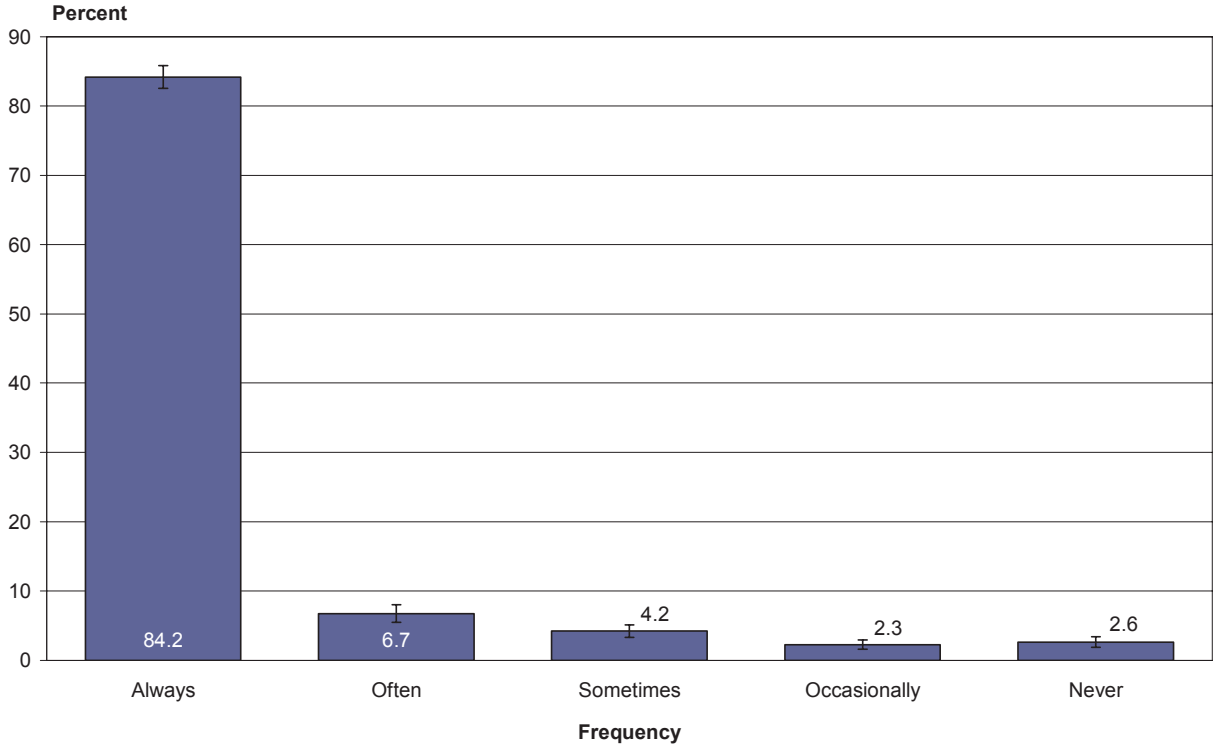
One measure of experience of dental care is whether individuals feel they are listened to carefully by their dental professional.

What were the survey questions?

In the 2009 NZOHS, all adults were asked to select whether, on their recent visits to the dental professional, the professional listened carefully to what they had to say: *always, often, sometimes, occasionally, never.*

Overall, the large majority (84.2%) of adults reported that their dental professional ‘always’ listened carefully to what they had to say (Figure 28). A further 6.7% reported that their dental professional listened carefully ‘often’. A small proportion of adults (2.6%) reported that their dental professional ‘never’ listened carefully to what they had to say.

Figure 28: Frequency of their dental professional listening carefully to what they had to say in their recent dental visits, among adults aged 18 years and over (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 103 presents the prevalence of adults reporting that their dental professional ‘always’ listened carefully to what they had to say, by population group.

Table 103: Adults whose dental professional ‘always’ listened carefully to what they had to say in their recent dental visits, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	84.2 (82.5–85.8)
Sex	Women	84.2 (82.1–86.3)
	Men	84.2 (81.5–86.8)
Ethnic group	Māori	78.2 (75.2–81.3)
	Pacific	67.5 (58.7–76.3)
	Asian	89.1 (84.7–93.5)
	European/Other	85.2 (83.3–87.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	84.9 (80.6–89.1)
	2	86.7 (82.2–91.2)
	3	82.5 (77.7–87.3)
	4	86.7 (83.7–89.8)
	5 (most deprived)	79.7 (75.6–83.8)

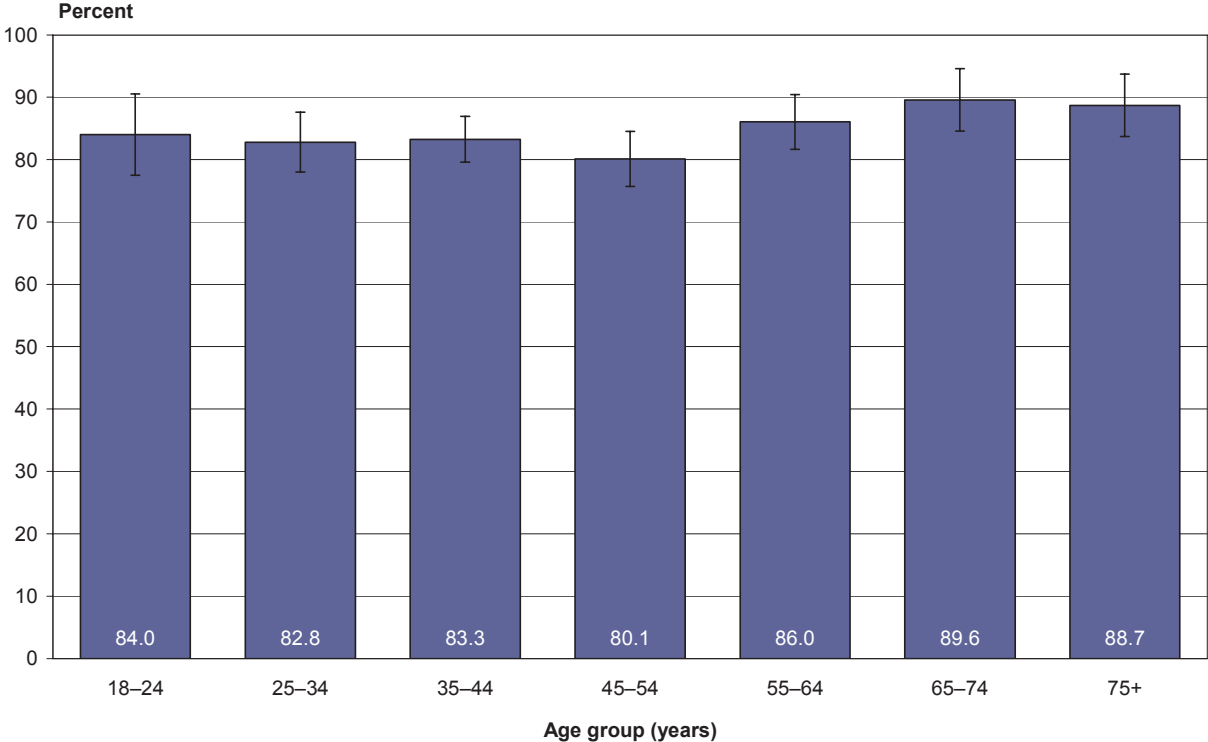
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 29 shows that there was relatively little difference by age group in the proportion of people whose dental professional ‘always’ listened carefully to what they had to say in their recent dental visits.

Figure 29: Adults whose dental professional ‘always’ listened carefully to what they had to say in their recent dental visits, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 104 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 104: Adults whose dental professional ‘always’ listened carefully to what they had to say in their recent dental visits, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.0	0.0
Māori	Non-Māori	Age group, sex	0.9*	-6.2*
Pacific	Non-Pacific	Age group, sex	0.8*	-16.7*
Asian	Non-Asian	Age group, sex	1.1*	6.4*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.0	-1.5
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	0.9*	-8.1*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

There were no significant differences by sex or neighbourhood deprivation in the adjusted prevalence of always being listened to carefully by a dental professional.

After adjustment, Māori and Pacific adults were significantly less likely to report that they were always listened to carefully by a dental professional than non-Māori and non-Pacific adults, respectively. By contrast, the prevalence was significantly higher among Asian adults than among non-Asian adults.

People who usually went to a dental professional for a dental problem were significantly less likely to report they were always listened to carefully by their dental professional than people who usually visited for a dental check-up, after adjustment.

Unmet need, cost and barriers to accessing oral health care services

This section examines unmet need for oral health care services, including reasons for the unmet need and barriers to accessing care. In particular, cost may make people less likely to visit a dental professional, and may also affect the timeliness and comprehensiveness of the care that is sought and received.

Prevalence of feeling they did not see a dental professional often enough

What were the survey questions?

In the 2009 NZOHS, all adults were asked if they felt they see a dental professional often enough.

Overall, one in two (55.3%) adults felt they did not see a dental professional often enough. Table 105 presents the prevalence of adults who felt they did not see a dental professional often enough, by population group.

Table 105: Prevalence of feeling they did not see a dental professional often enough, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	55.3 (52.9–57.7)
Sex	Women	54.0 (50.8–57.1)
	Men	56.8 (53.3–60.3)
Ethnic group	Māori	74.9 (71.2–78.7)
	Pacific	74.5 (69.3–79.7)
	Asian	62.1 (54.7–69.5)
	European/Other	52.4 (49.6–55.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	36.8 (30.5–43.2)
	2	55.1 (49.4–60.8)
	3	54.7 (49.7–59.6)
	4	62.4 (57.8–66.9)
	5 (most deprived)	69.1 (63.9–74.3)

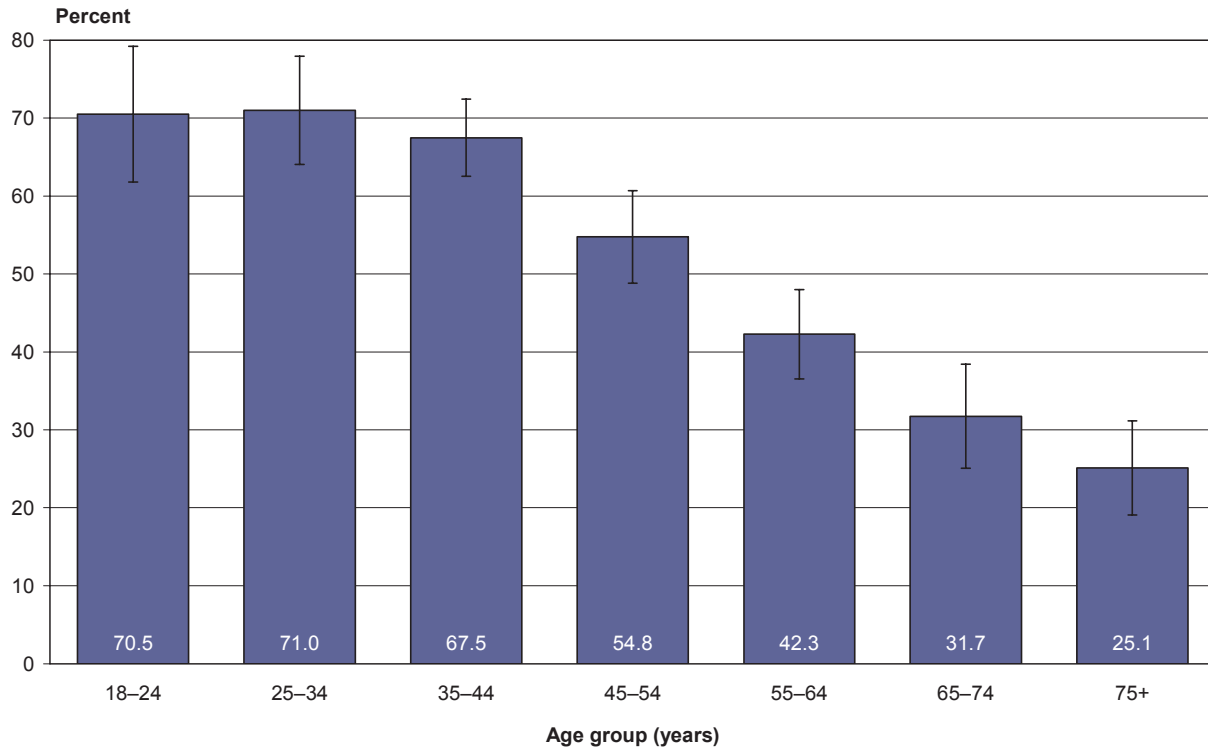
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 30 shows that the prevalence of feeling they did not see a dental professional often enough was highest among the younger age groups.

Figure 30: Prevalence of feeling they did not see a dental professional often enough, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 106 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 106: Feeling they did not see a dental professional often enough, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.1	2.9
Māori	Non-Māori	Age group, sex	1.3*	16.7*
Pacific	Non-Pacific	Age group, sex	1.3*	15.1*
Asian	Non-Asian	Age group, sex	1.0	-2.3
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.7*	28.8*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	2.2*	37.9*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII) respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

There was no significant difference between men and women in the prevalence of feeling they did not see a dental professional often enough, adjusting for age.

Māori and Pacific adults were 1.3 times as likely as non-Māori and non-Pacific adults, respectively, to feel they did not see a dental professional often enough, after adjustment.

People living in the most deprived areas were 1.7 times as likely to feel they did not see a dental professional often enough as people living in the least deprived areas, after adjustment. This equates to a 28.8 percentage point difference between the most deprived and least deprived areas.

People who usually visited a dental professional for a dental problem were over twice as likely to feel they did not see a dental professional often enough as people who usually visited for a dental check-up, after adjustment. This equates to a 37.9 percentage point difference between those who usually visit a dental professional for a problem and those who usually visit for a check-up.

Perceived need for dental treatment, among adults

People's perception of their own need for dental care can influence their likelihood of visiting a dental professional, and has been used in a number of models to predict the probability of dental visits (Slade et al 2007). When people experience symptoms of oral disease (such as pain, swelling and bad breath), they are more likely to perceive a need for dental care. In contrast, perceived need among people who have had dental visits should be reduced.

What was the survey question?

In the 2009 NZOHS, all adults were asked whether they feel they currently need dental treatment. If they answered yes, respondents were asked what type of dental care they thought they needed now. Respondents could select multiple responses from the following: *teeth filled or replaced (for example, fillings, crowns and/or bridges); teeth pulled/extracted; gum treatment; denture work; relief of pain; work to improve appearance (for example, braces or bonding); cleaning; other (please specify); nothing.*

Overall, almost one in two adults (45.9%) felt they currently needed dental treatment. Table 107 presents the prevalence of feeling they currently needed dental treatment, by population group.

Table 107: Perceived current need for dental treatment, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	45.9 (43.1–48.8)
Sex	Women	47.7 (44.4–51.0)
	Men	43.9 (40.0–47.8)
Ethnic group	Māori	58.1 (54.4–61.9)
	Pacific	63.3 (56.6–70.0)
	Asian	41.4 (33.5–49.3)
	European/Other	44.6 (41.4–47.8)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	37.7 (30.9–44.5)
	2	47.4 (41.2–53.6)
	3	45.8 (40.4–51.2)
	4	45.7 (40.1–51.2)
	5 (most deprived)	53.6 (47.8–59.3)

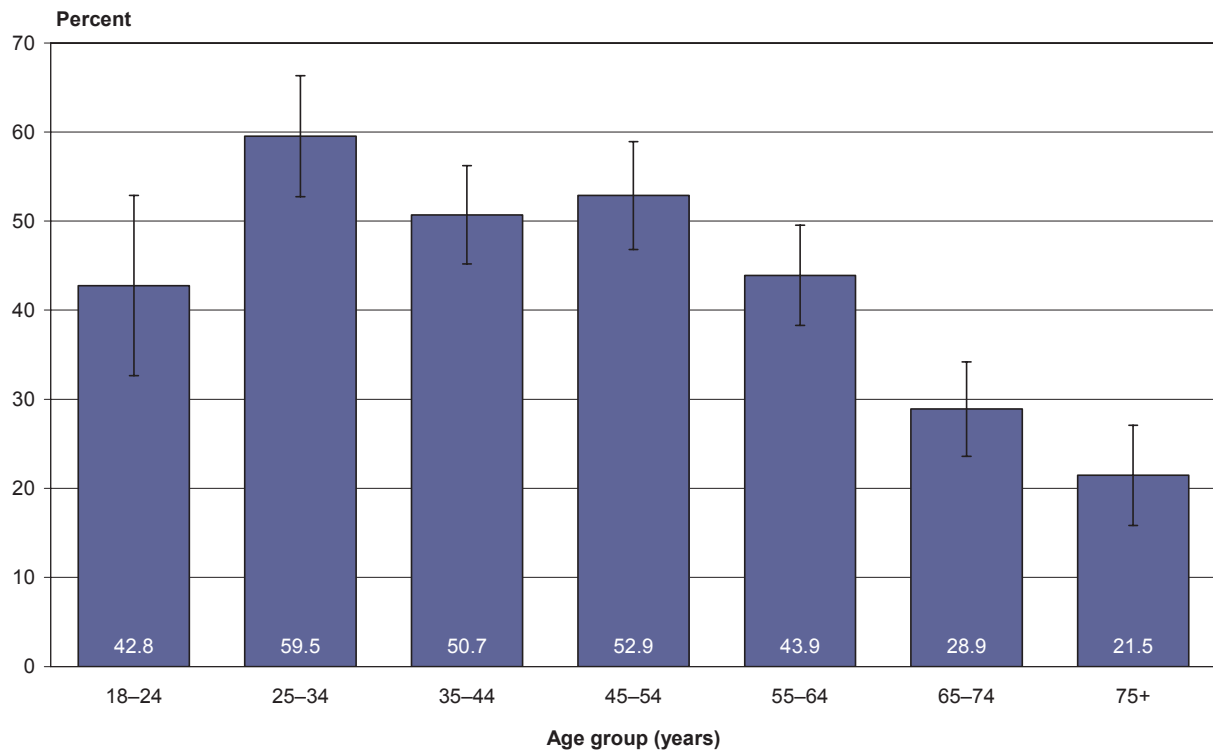
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 31 shows that the prevalence of perceived need for dental treatment was highest in the 25–34 years age group, and was lowest among adults aged 75 years and over.

Figure 31: Perceived current need for dental treatment, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 108 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 108: Perceived current need for dental treatment, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.9	-4.0
Māori	Non-Māori	Age group, sex	1.2*	10.8*
Pacific	Non-Pacific	Age group, sex	1.3*	15.3*
Asian	Non-Asian	Age group, sex	0.8*	-9.2*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.3*	11.3*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.3*	13.2*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among adults, Māori were 1.2 times as likely, and Pacific adults 1.3 times as likely, to feel they currently needed dental treatment as non-Māori and non-Pacific adults, respectively, adjusted for age and sex. Asian adults were significantly less likely to perceive a current need for dental treatment than non-Asian adults.

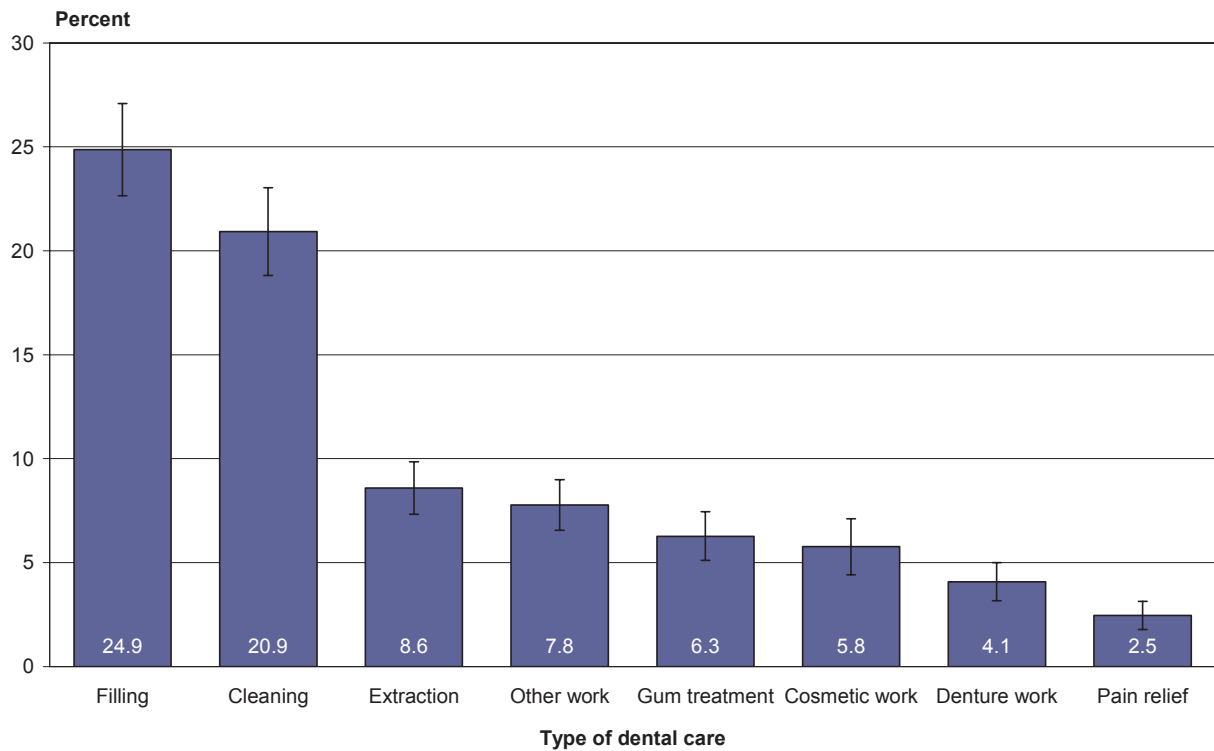
Adults living in the most deprived neighbourhoods were 1.3 times as likely to feel they currently needed dental treatment as adults living in the least deprived neighbourhoods, after adjustment.

Adults who usually visited a dental professional for a dental problem were 1.3 times as likely to perceive a current need for dental treatment as adults who usually visited for a check-up.

Types of dental treatment people felt they currently needed

Figure 32 presents the prevalence of perceiving a current need for individual types of dental care. Overall, one in four (24.9%) adults thought they needed a filling, while one in five (20.9%) thought they needed their teeth cleaned.

Figure 32: Types of dental treatment people felt they currently needed, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Prevalence of avoiding dental care due to cost

One of the key barriers to accessing oral health services in a timely way is cost.

What was the survey question?

In the 2009 NZOHS, all adults were asked whether they agree or disagree with the following statement: *In the last year I have avoided going to a dental professional because of the cost.*

Overall, 44.1% of adults reported they had avoided dental care in the last 12 months due to cost. Table 109 presents the prevalence of avoiding dental care in the past year due to cost, by population group.

Table 109: Prevalence of having avoided dental care in the last 12 months due to cost, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	44.1 (41.8–46.5)
Sex	Women	48.2 (45.2–51.2)
	Men	39.6 (36.0–43.3)
Ethnic group	Māori	61.5 (57.4–65.6)
	Pacific	66.3 (60.3–72.2)
	Asian	46.6 (40.0–53.3)
	European/Other	41.4 (38.7–44.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	29.0 (23.5–34.6)
	2	41.5 (35.8–47.2)
	3	41.4 (36.4–46.4)
	4	53.1 (47.5–58.6)
	5 (most deprived)	56.8 (51.7–62.0)

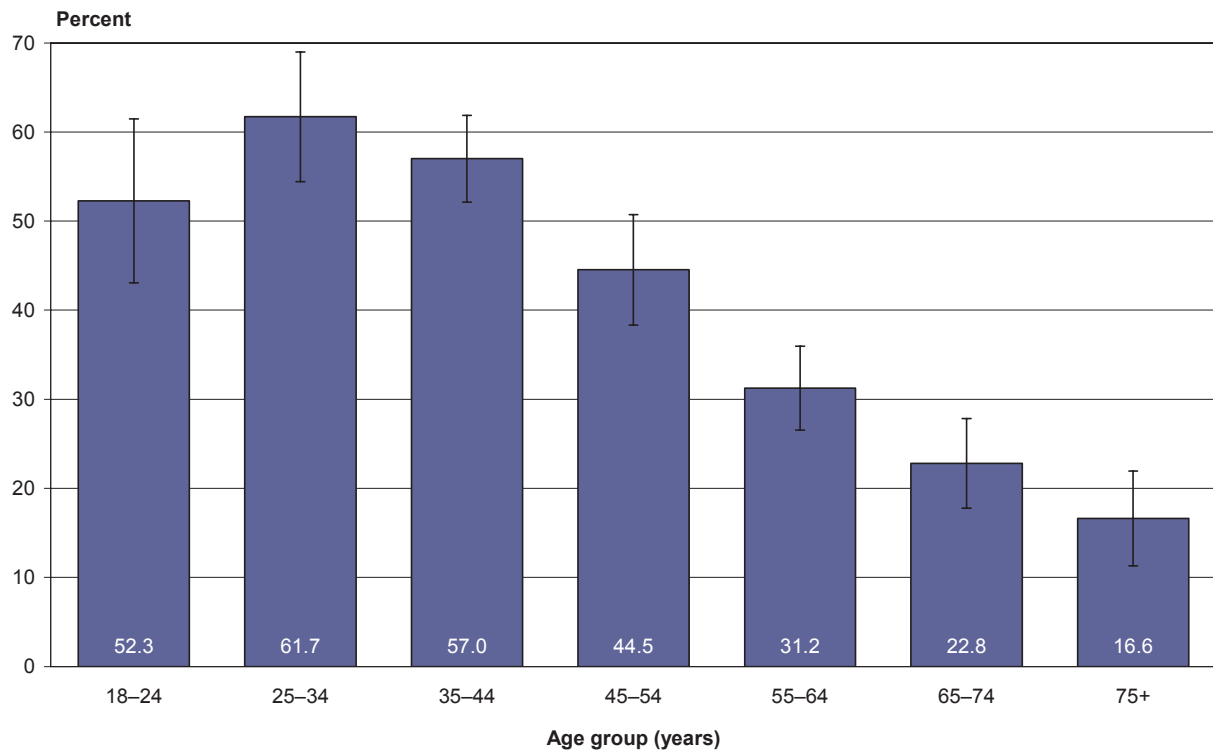
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 33 shows that the prevalence of avoiding dental care in the past year due to cost was higher among adults aged 18–44 years (at about 50–62%), and lowest among adults aged 75 years and over.

Figure 33: Prevalence of having avoided dental care in the last 12 months due to cost, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 110 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 110: Avoided dental care in the last 12 months due to cost, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.8*	-8.5*
Māori	Non-Māori	Age group, sex	1.3*	13.9*
Pacific	Non-Pacific	Age group, sex	1.4*	17.8*
Asian	Non-Asian	Age group, sex	0.9	-4.5
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.8*	26.4*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.9*	24.7*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Men were significantly less likely than women to have avoided dental care in the past year due to cost, after adjustment.

Māori were 1.3 times as likely as non-Māori to have avoided dental care in the previous year due to cost, after adjustment. Similarly, Pacific adults were 1.4 times as likely as non-Pacific adults to have avoided dental care due to cost in the past year.

After adjustment, people living in the most deprived areas were almost twice as likely to have avoided dental care in the past year because of the cost as people in the least deprived areas, representing a 26.4 percentage point difference.

People who usually visited a dental professional for a problem were also almost twice as likely to have avoided dental care in the past year due to cost as people who usually visit for a check-up, after adjustment. This equated to a 24.7 percentage point difference.

Prevalence of going without recommended routine dental treatment due to cost

Going without recommended routine dental treatment increases the chance of having ongoing dental damage caused by untreated disease. This indicator examines the prevalence of reporting going without recommended routine dental treatment due to cost in the past year, among all adults aged 18 years and over.

What were the survey questions?

In the 2009 NZOHS, all adults were asked whether the cost prevented them from having any routine dental treatment that was recommended during the last 12 months.

Overall, one in four (25.3%) adults reported that they went without recommended routine dental treatment due to cost in the last 12 months. Table 111 presents the prevalence of adults reporting that they went without recommended routine dental treatment in the past year due to cost, by population group.

Table 111: Prevalence of going without recommended routine dental treatment in the last 12 months due to cost, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	25.3 (23.2–27.3)
Sex	Women	27.7 (24.9–30.6)
	Men	22.5 (19.5–25.5)
Ethnic group	Māori	38.1 (34.7–41.5)
	Pacific	45.3 (38.0–52.6)
	Asian	28.5 (22.1–35.0)
	European/Other	22.7 (20.4–25.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	16.9 (12.7–21.2)
	2	20.3 (15.5–25.0)
	3	24.2 (20.0–28.4)
	4	27.4 (23.0–31.9)
	5 (most deprived)	38.4 (33.7–43.2)

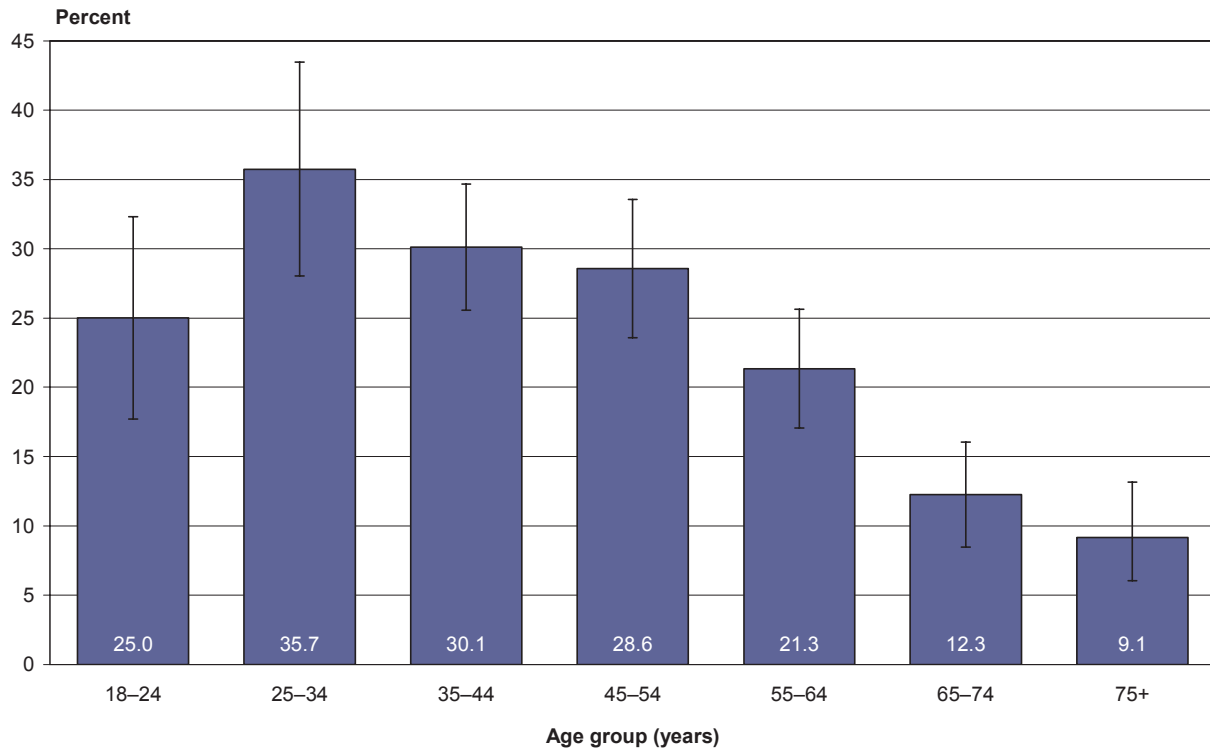
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 34 shows that adults aged 18–54 years were significantly more likely to have gone without recommended routine dental treatment due to cost in the past year than adults aged 65 years and over.

Figure 34: Prevalence of going without recommended routine dental treatment in the last 12 months due to cost, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 112 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 112: Went without recommended routine dental treatment in the last 12 months due to cost, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.8*	-5.4*
Māori	Non-Māori	Age group, sex	1.5*	11.6*
Pacific	Non-Pacific	Age group, sex	1.7*	17.9*
Asian	Non-Asian	Age group, sex	1.0	-0.1
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.2*	19.8*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.9*	14.2*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Men were significantly less likely than women to have gone without recommended routine dental treatment in the past 12 months due to cost, adjusted for age.

After adjustment, Māori were 1.5 times as likely as non-Māori to have gone without recommended routine dental treatment in the past year due to cost. Pacific adults were 1.7 times as likely to have gone without treatment due to cost as non-Pacific adults.

There was a significantly higher prevalence of going without recommended routine dental treatment due to cost in the past year in more deprived areas than in less deprived areas, after adjustment. People living in the most deprived neighbourhoods were 2.2 times as likely to have gone without recommended dental treatment in the past year due to cost as people living in the least deprived neighbourhoods. This equated to a 19.8 percentage point difference.

People who usually visit a dental professional for a dental problem were almost twice as likely to have gone without recommended dental treatment in the past year due to cost, compared with people who usually visit a dental professional for a check-up, after adjustment.

Reasons for having not visited a dental professional in the last year

The reason people give for not visiting a dental professional in the past year provides a valuable summary of the range of barriers to accessing services that people experience.

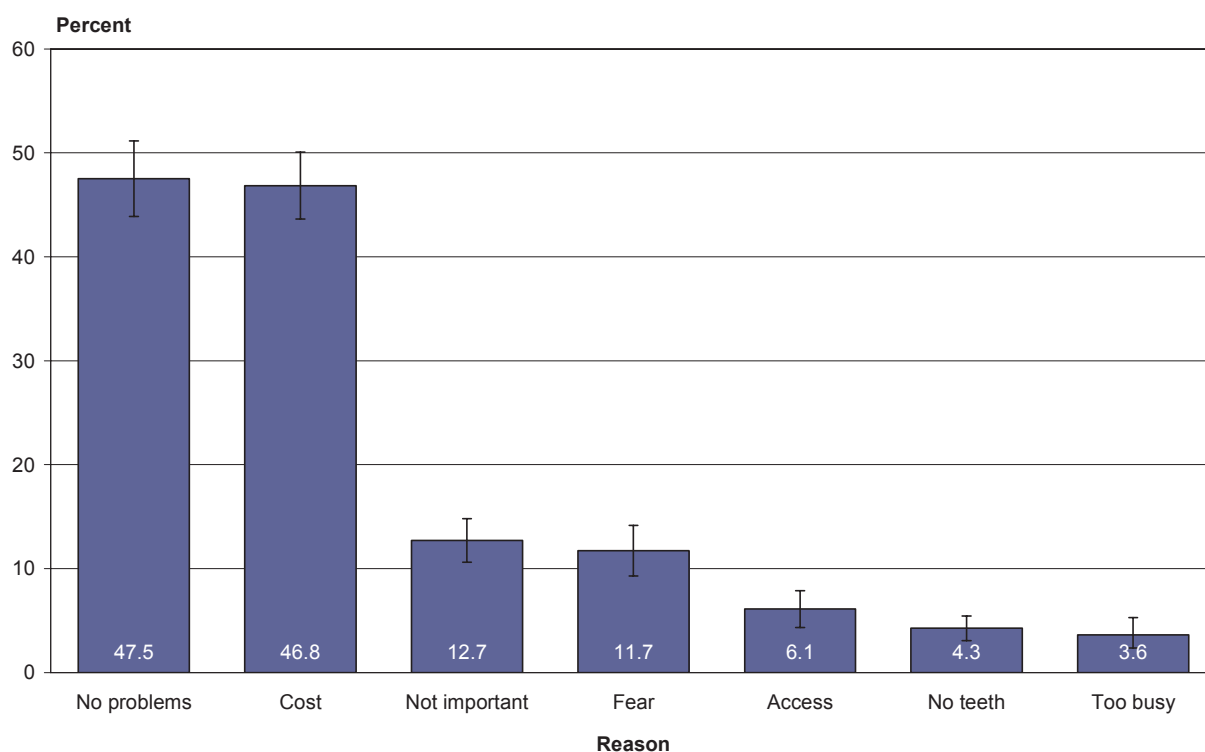
This indicator presents results for people who had not visited a dental professional in the past year, representing 52.9% (50.3–55.5) of adults aged 18 years and over.

What were the survey questions?

In the 2009 NZOHS, adult participants who had not been to a dental professional in the last 12 months were asked the reasons why they had not visited a dental professional in the last 12 months. The following options were available, and respondents could select all that applied: *afraid of dental professionals / don't like the thought of going to a dental professional; nervous; needles; cost; don't know dentist; dentist too far / difficult to make the journey; can't get there; no problems; no teeth; not important; didn't think of it; other*. For this analysis, 'fear' refers to the following: afraid of dental professional / don't like the thought of going to a dental professional; nervous; needles. 'Access' refers to the following: don't know dentist; dentist too far / difficult to make the journey; can't get there. 'Too busy' was formed from the large number of responses collected under 'other'.

Among adults who had not visited a dental professional in the last year, 47.5% reported that this was because they had no dental problems, and 46.8% reported that this was due to cost (Figure 35).

Figure 35: Reasons for having not visited a dental professional in the last year, among adults aged 18 years and over who had not visited a dental professional in the last 12 months (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Notes: 'Not important' refers to the reasons of 'not important', 'didn't think of it'. 'Fear' refers to 'afraid of dental professionals / don't like the thought of going to a dental professional', 'nervous', and 'needles'. 'Access' refers to 'don't know dentist', 'dentist too far / difficult to make the journey', 'can't get there'.

Chapter 8: Perceptions and Impact of Oral Health Status

Key findings

Among adults aged 18 years and over:

- one in four (26.6%) rated the health of their teeth or mouth as fair or poor
- one in six (15.6%) had experienced impacts on their life in the past year due to their oral health
- one in four (25.4%) had experienced orofacial pain in the last four weeks
- one in ten (10.2%) adults aged 18–64 years had taken time off work or school in the last 12 months due to dental problems; among these adults, the mean number of days taken off per person in the past year was 2.1 days.

Among children and adolescents aged 2–17 years:

- one in eight (12.6%) had parent-rated or self-rated fair or poor oral health
- one in eight (13.0%) had taken time away from school or normal activities because of problems with their teeth or mouth in the last year; among these children and adolescents, the mean number of days taken off per person in the past year was 2.5 days.

Among children and adolescents aged 2–14 years:

- the wellbeing of 6.1% was affected ‘a lot’ or ‘very much’ by the condition of their teeth, lips, jaws or mouth
- about 7.0% had experienced a toothache sometimes, often or always in the past year
- for one in nine (11.6%) children, their parent had taken time off work or normal activities in the past year because of problems with their child’s teeth or mouth; among these parents, the mean number of days taken off per person in the past year was 2.1 days.

Introduction

The clinical measures presented in earlier chapters are very important, but they reflect only the end-point of the disease process. Self-reported information can help to identify problems that people experience as a result of their teeth, and the impacts on people’s day-to-day functioning and wellbeing due to various dental conditions (including ill-fitting dentures or a dry mouth) (Shearer et al 2007). This chapter reports on people’s perceptions of how they are affected as a whole by dental disease, including toothache, quality of life, and lost work or school days due to dental problems.

In particular, this chapter includes two measures of oral-health-related quality of life. Measures of oral-health-related quality of life (OHRQoL) represent people's subjective assessment of the extent to which their oral health affects their wellbeing and enjoyment of life. They aim to capture the functional, psychological and social impacts of oral disease (Gift and Redford 1992).

There are two types of OHRQoL measures: *global* and *multi-item*. Global measures attempt to capture overall oral-health-related quality of life by asking a single question, with response options ranging from 'excellent' to 'poor'. They are widely used in research because they are simple to administer and provide an easily interpreted single summary of someone's experience of their oral health. The question taps into general health perceptions and therefore summarises people's perceptions of oral diseases and disorders and their impact on functioning and wellbeing (Locker 2001). The 2009 NZOHS included a global measure of oral-health-related quality of life.

Multi-item measures ask a number of conceptually related questions. The 2009 NZOHS adult questionnaire included the Oral Health Impact Profile (OHIP-14), which measures the impacts of a person's general oral condition (rather than the effects of specific disorders or the positive aspects of oral health). The OHIP-14 was developed in 1994 (Slade and Spencer 1994) and has been validated in a number of different cultures and age groups, including adolescents (Broder et al 2000) and young adults (Thomson, Lawrence et al 2006).

Perceptions and impacts of oral health, among adults

Self-rated oral health among adults

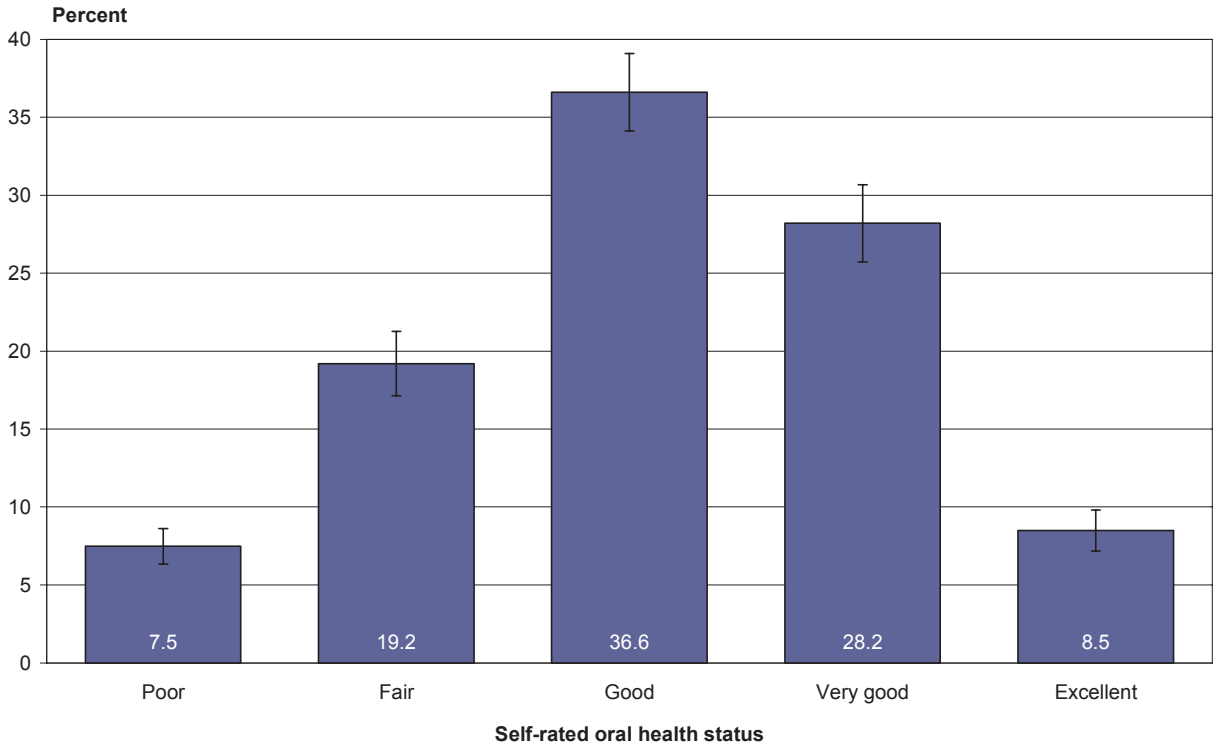
Self-rated oral health is an important predictor of future oral health status and future demands for oral health services (Locker 2001). This indicator presents the results of a global measure of oral-health-related quality of life.

What was the survey question?

In the 2009 NZOHS, all adult participants were asked, *How would you describe the health of your teeth or mouth? (Excellent, very good, good, fair, poor)*. Adults who answered 'fair' or 'poor' were classified as having fair or poor self-rated oral health.

Overall, fewer than one in ten (8.5%) adults aged 18 years and over rated their oral health as 'excellent', while about one in four (28.2%) rated it as 'very good' and one in three (36.6%) rated it as 'good' (Figure 36). At the other end of the scale, one in five (19.2%) rated their oral health as 'fair' and 7.5% described it as 'poor'.

Figure 36: Self-rated oral health status, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Self-rated fair or poor oral health among adults

Overall, one in four (26.6%) adults aged 18 years and over described the health of their teeth or mouth as fair or poor. Table 113 presents the prevalence of self-rated fair or poor oral health, by population group.

Table 113: Prevalence of self-rated fair or poor oral health, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	26.6 (24.5–28.8)
Sex	Women	23.1 (20.7–25.5)
	Men	30.6 (27.0–34.2)
Ethnic group	Māori	42.2 (38.2–46.2)
	Pacific	35.7 (29.9–41.6)
	Asian	31.2 (24.7–37.7)
	European/Other	24.4 (22.0–26.8)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	18.0 (13.6–22.5)
	2	26.4 (21.6–31.2)
	3	23.7 (19.0–28.4)
	4	28.7 (24.2–33.1)
	5 (most deprived)	37.2 (32.1–42.2)

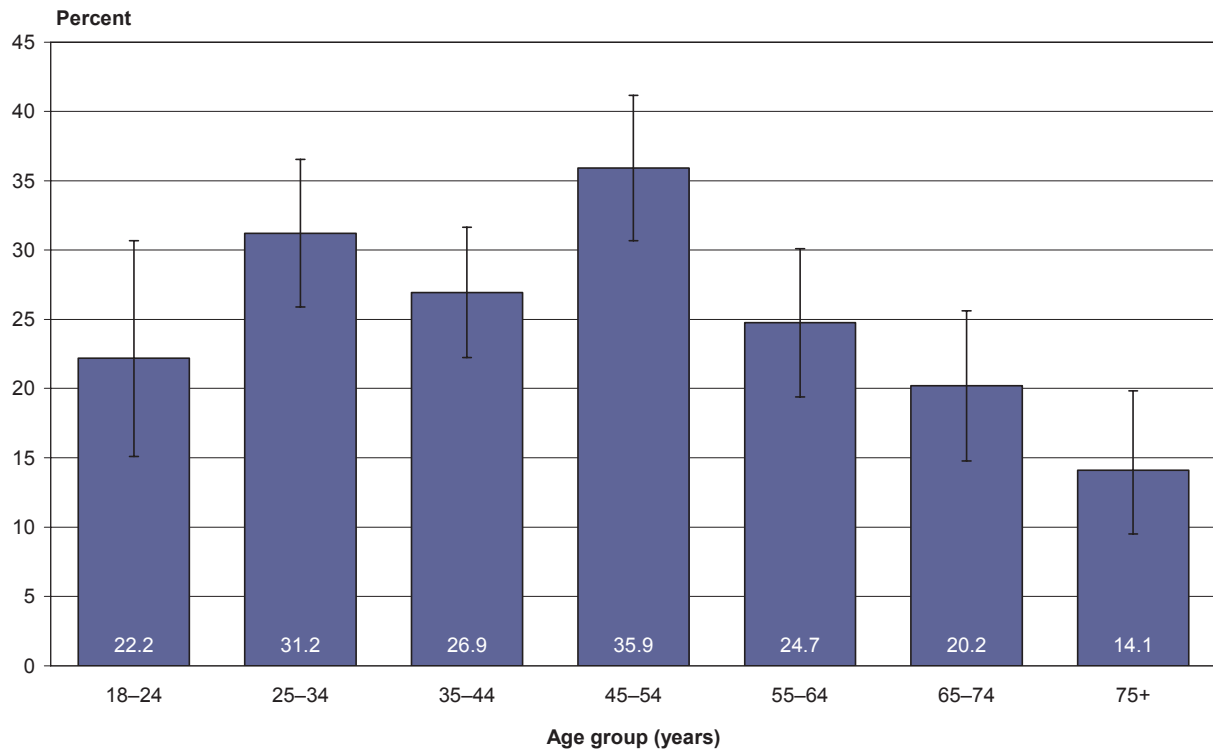
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 37 shows that the prevalence of self-rated fair or poor oral health was highest among adults aged 45–54 years, and lowest among adults aged 75 years and over.

Figure 37: Prevalence of self-rated fair or poor oral health, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 114 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 114: Self-rated fair or poor oral health, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.3*	7.4*
Māori	Non-Māori	Age group, sex	1.7*	17.2*
Pacific	Non-Pacific	Age group, sex	1.3*	8.7*
Asian	Non-Asian	Age group, sex	1.1	2.8
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.0*	17.9*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	2.0*	16.4*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Men were 1.3 times as likely as women to report fair or poor self-rated oral health, after adjusting for age.

Māori adults were 1.7 times as likely as non-Māori adults to describe their oral health as fair or poor. Pacific adults were 1.3 times as likely to report fair or poor self-rated oral health status as non-Pacific adults.

People living in the most deprived areas were twice as likely to report fair or poor self-rated oral health as people living in the least deprived areas, after adjustment.

People who usually visited a dental professional for a dental problem were twice as likely to describe their oral health as fair or poor as people who usually visited for a check-up.

Experiencing impacts due to oral health, often or very often (one or more OHIP-14 impacts)

The Oral Health Impact Profile (OHIP-14) is a multi-item oral-health-related quality of life measure, which measures the frequency and severity of oral problems in relation to functional and psychosocial wellbeing. It is intended to measure the impacts of a person's general oral condition rather than the effects of specific disorders, and is a measure of the burden of oral impairments (not the positive aspects of oral health).

The OHIP-14 consists of 14 statements that ask about experiences adults may have had in the last 12 months because of problems with their teeth, mouth or gums. There are seven domains within the OHIP-14, with each domain having two questions (Table 115).

Table 115: Oral Health Impact Profile (OHIP-14) domains and corresponding statements of experience

Domain	Statement of experience (OHIP-14 impacts)
Functional limitation	<ul style="list-style-type: none"> • Trouble pronouncing any words • Worsening of sense of taste
Pain	<ul style="list-style-type: none"> • Painful aching in the mouth • Uncomfortable to eat any foods
Psychological discomfort	<ul style="list-style-type: none"> • Been self-conscious • Felt tense
Physical disability	<ul style="list-style-type: none"> • Diet been unsatisfactory • Had to interrupt meals
Psychological disability	<ul style="list-style-type: none"> • Difficult to relax • Been a bit embarrassed
Social disability	<ul style="list-style-type: none"> • Been a bit irritable with other people • Difficulty doing your usual jobs
Handicap	<ul style="list-style-type: none"> • Felt in general that life was less satisfying • Been totally unable to function

Source: Slade (1997)

What were the survey questions?

In the 2009 NZOHS, all adult participants were asked to respond to the set of 14 statements comprising the OHIP-14. These statements ask about experiences adults may have had in the last 12 months because of problems with their teeth, mouth or gums (see Table 115 for topics). Adults who answered 'often' or 'very often' to one or more of the statements were classified as having 'one or more OHIP-14 impacts'.

Overall, one in six (15.6%) adults aged 18 years and over had experienced impacts due to their oral health (ie, reported experiencing one or more OHIP-14 impacts 'often' or 'very often') in the last 12 months. Table 116 presents the prevalence of adults who experienced one or more OHIP-14 impacts often or very often in the past year, by population group.

Table 116: Experiencing impacts due to oral health (one or more OHIP-14 impacts 'often' or 'very often') in the last 12 months, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	15.6 (13.8–17.4)
Sex	Women	18.5 (15.8–21.2)
	Men	12.4 (9.8–14.9)
Ethnic group	Māori	23.4 (20.2–26.5)
	Pacific	23.5 (18.4–28.7)
	Asian	13.8 (9.4–19.4)
	European/Other	14.6 (12.6–16.6)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	9.8 (6.5–13.1)
	2	13.5 (9.5–17.5)
	3	12.9 (9.6–16.2)
	4	18.0 (13.9–22.0)
	5 (most deprived)	24.1 (19.7–28.5)

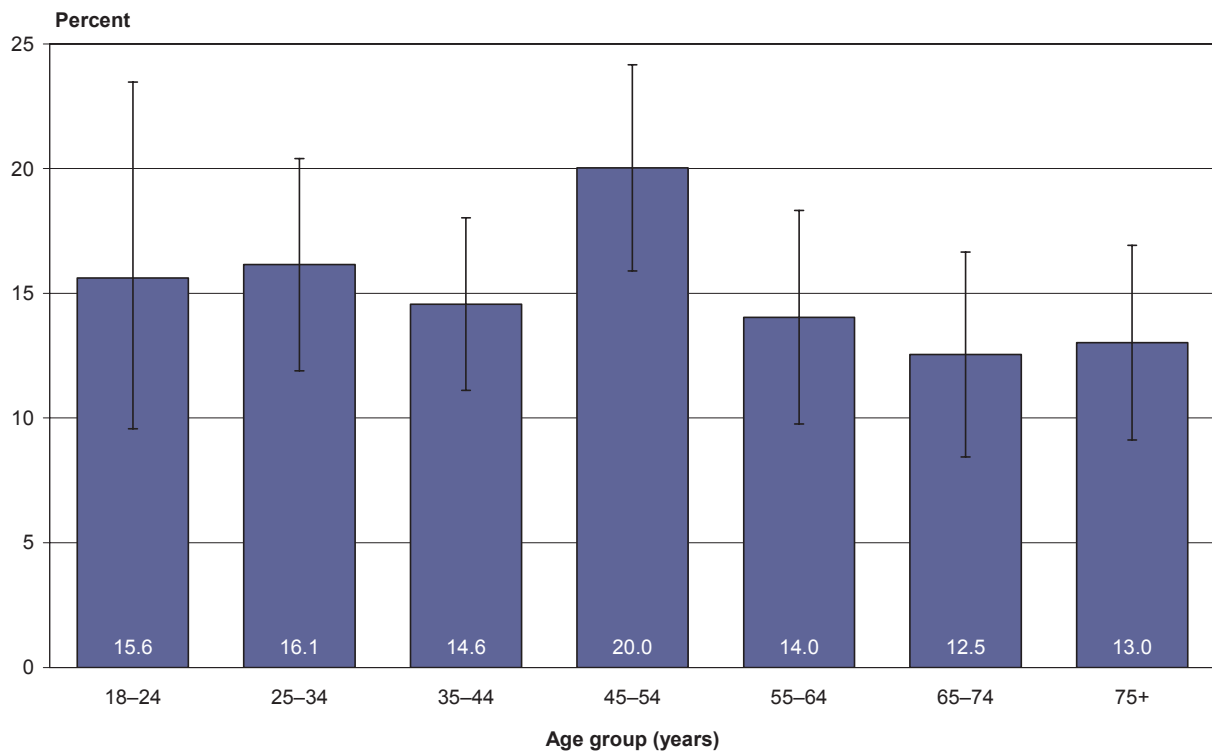
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 38 shows that the prevalence of having one or more OHIP-14 impacts often or very often was significantly higher among adults aged 45–54 years than among those aged 35–44 years, 55–64 years, 65–74 years and 75 years and over (p -values < 0.05).

Figure 38: Experiencing impacts due to oral health (one or more OHIP-14 impacts ‘often’ or ‘very often’) in the last 12 months, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 117 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 117: Experiencing impacts due to oral health (one or more OHIP-14 impacts ‘often or very often’) in the last 12 months, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.7*	-6.1*
Māori	Non-Māori	Age group, sex	1.6*	8.5*
Pacific	Non-Pacific	Age group, sex	1.5*	8.0*
Asian	Non-Asian	Age group, sex	0.8	-2.5
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.6*	14.9*
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	2.1*	10.1*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Men were significantly less likely than women to have experienced one or more OHIP-14 impacts often or very often in the last 12 months, after adjusting for age.

Māori were 1.6 times as likely as non-Māori to have experienced one or more OHIP-14 impacts often or very often, adjusted for age and sex. Pacific adults were 1.5 times as likely as non-Pacific adults to have experienced impacts due to their oral health in the past year.

Adults living in the most deprived areas were 2.6 times as likely to experience one or more OHIP-14 impacts often or very often as adults in the least deprived areas, adjusted for age, sex and ethnicity.

Adults who usually visited a dental professional for a dental problem were 2.1 times as likely to experience one or more OHIP-14 impacts often or very often as adults who usually visited for a check-up.

Experience of orofacial pain in the last 4 weeks, among adults

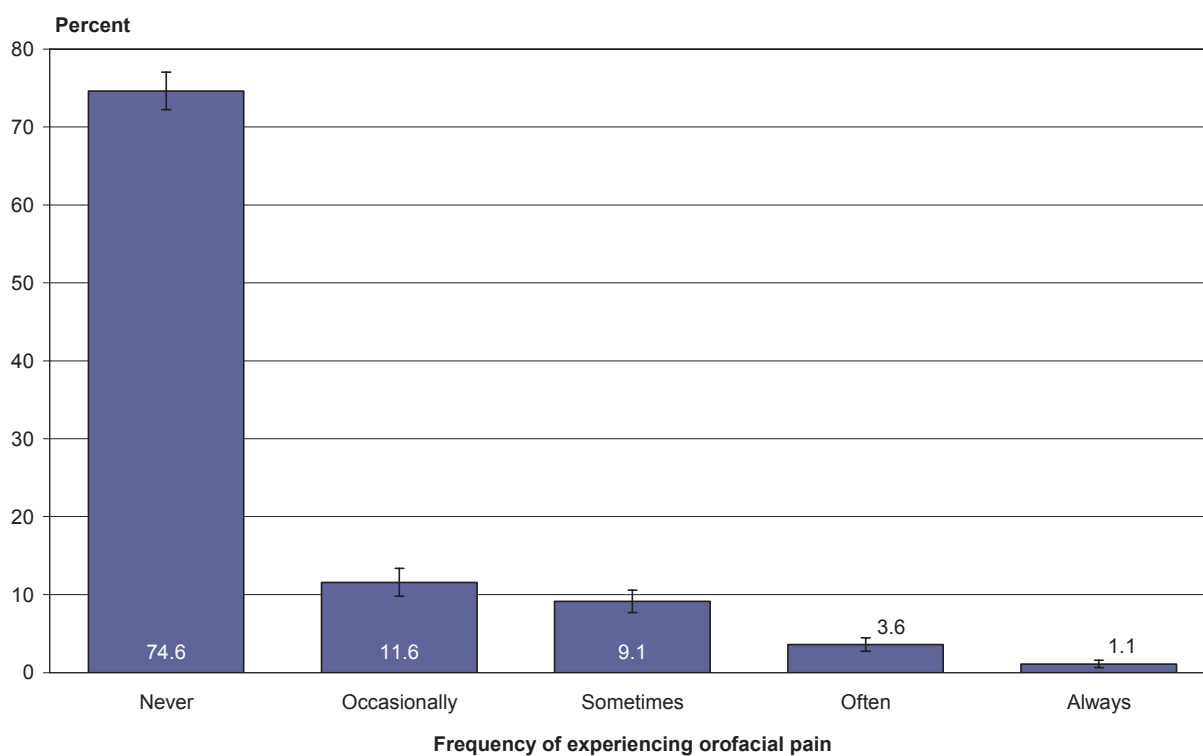
Orofacial pain (pain in the mouth, jaw or face) can have many causes, including sensitivity to hot or cold foods or drinks, pain from trauma or fractured teeth, decayed teeth, infections, periodontal diseases and chronic jaw pain.

What was the survey question?

In the 2009 NZOHS, adult participants were asked whether they had experienced pain or discomfort in their teeth or mouth within the last four weeks. Participants who answered 'always', 'often', 'sometimes', or 'occasionally' were said to have experienced orofacial pain in the last four weeks.

Overall, the majority of adults (74.6%) had not experienced any orofacial pain (pain in the mouth, jaw or face) in the last 4 weeks (Figure 39). However, 11.6% had experienced pain occasionally, and 9.1% had experienced pain sometimes. Small proportions had experienced pain often (3.6%) or always (1.1%).

Figure 39: Frequency of experiencing orofacial pain in the last 4 weeks, among adults aged 18 years and over (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Overall, 25.4% of adults aged 18 years and over had experienced any orofacial pain in the past 4 weeks (ie, occasionally, sometimes, often or always). Table 118 presents the prevalence of having experienced any orofacial pain in the past 4 weeks, by population group.

Table 118: Experienced orofacial pain in the last 4 weeks, among adults aged 18 years and over, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	25.4 (23.0–27.8)
Sex	Women	27.3 (24.3–30.3)
	Men	23.3 (19.9–26.7)
Ethnic group	Māori	29.0 (25.1–32.9)
	Pacific	29.7 (24.2–35.2)
	Asian	21.5 (15.4–27.6)
	European/Other	25.6 (22.8–28.4)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	24.9 (18.7–31.0)
	2	25.2 (20.2–30.1)
	3	24.3 (19.4–29.2)
	4	23.2 (18.2–28.3)
	5 (most deprived)	29.5 (24.8–34.2)

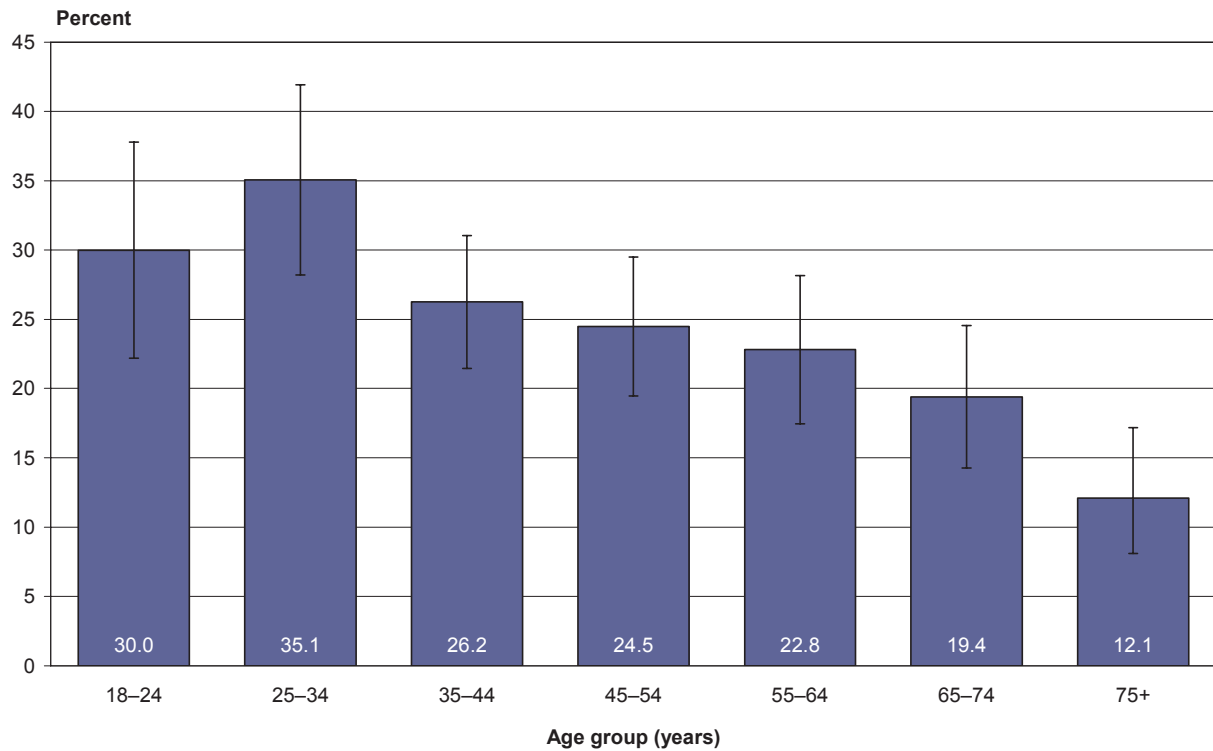
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 40 shows that the prevalence of having experienced orofacial pain in the past 4 weeks was highest among 25–34-year-olds and was lower in the older age groups.

Figure 40: Experienced orofacial pain in the last 4 weeks, among adults aged 18 years and over, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 119 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 119: Experienced orofacial pain in the last 4 weeks, among adults aged 18 years and over, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	0.9	-4.1
Māori	Non-Māori	Age group, sex	1.1	1.6
Pacific	Non-Pacific	Age group, sex	1.1	2.2
Asian	Non-Asian	Age group, sex	0.7*	-6.8*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.1	1.7
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.4*	7.4*

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Asian adults were significantly less likely than non-Asian adults to have experienced orofacial pain in the previous 4 weeks, adjusted for age and sex.

Adults who usually visited a dental professional for a problem were 1.4 times as likely to have experienced orofacial pain in the last 4 weeks as adults who usually visited for a check-up.

Taken time off work or school due to dental problems in the past year, among adults

The burden of illness can have an indirect cost to society, in the form of time lost by individuals who are ill and who take time off work or school to seek dental care.

What was the survey question?

In the 2009 NZOHS, adult participants were asked, *In the last 12 months, have you taken time off work or school because of problems with your teeth or mouth?* Adult participants who had taken time off were asked how much time they had taken off.

Overall, 10.2% of adults aged 18–64 years had taken time off work or school in the past 12 months due to dental problems. Among adults who had taken time off work or school due to problems with their teeth or mouth in the previous year, the mean number of days taken off was 2.1.

Table 120 presents the prevalence of having taken time off work or school due to dental problems in the past year, by population group.

Table 120: Taken time off work or school due to dental problems in the past 12 months, among adults aged 18–64 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	10.2 (8.2–12.2)
Sex	Women	8.7 (6.3–11.0)
	Men	11.8 (8.9–14.7)
Ethnic group	Māori	12.2 (9.5–14.8)
	Pacific	12.0 (8.5–15.5)
	Asian	6.9 (3.4–12.2)
	European/Other	10.4 (8.0–12.8)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	11.8 (7.3–17.7)
	2	7.6 (4.4–12.2)
	3	7.6 (4.3–12.1)
	4	12.6 (8.9–16.3)
	5 (most deprived)	11.1 (7.3–14.9)

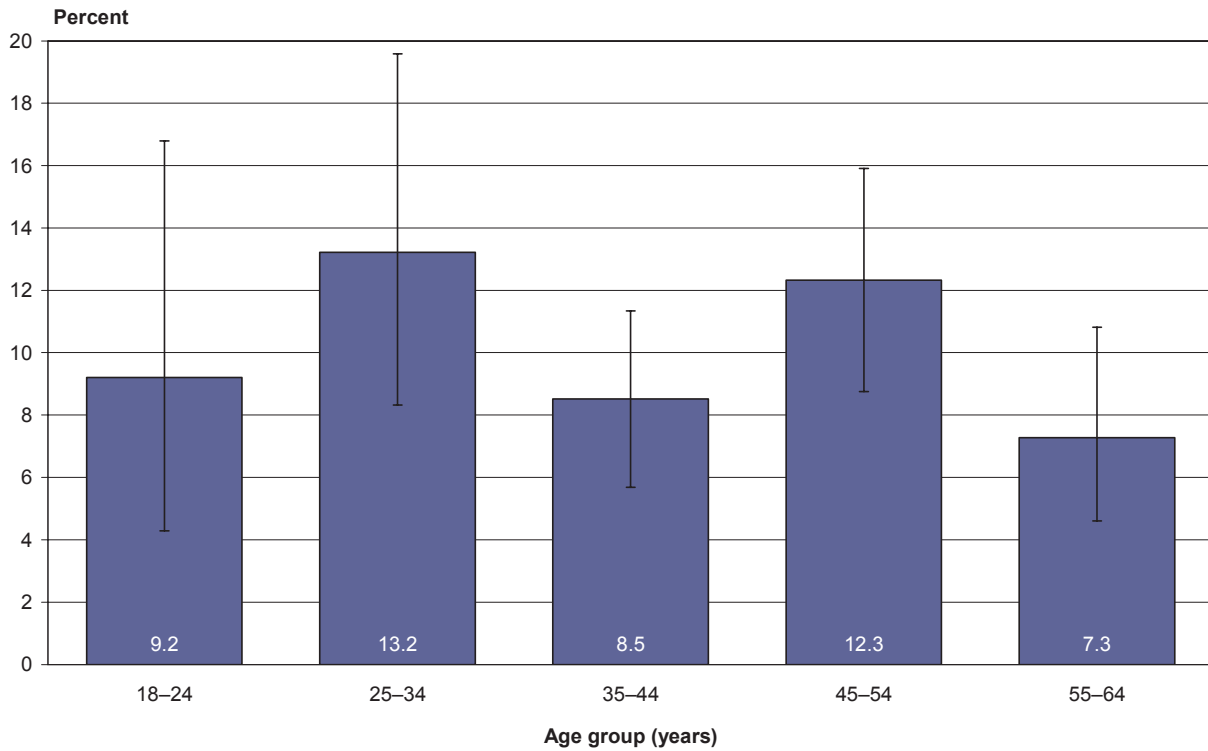
Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Figure 41 shows that the prevalence of having taken time off work or school due to dental problems in the past year was somewhat higher among people aged 25–34 years (13.2%) and 45–54 years (12.3%).

Figure 41: Taken time off work or school due to dental problems in the past 12 months, among adults aged 18–64 years, by age group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Table 121 presents results by sex, ethnic group, neighbourhood deprivation and the usual reason for visiting a dental professional, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 121: Taken time off work or school due to problems with their teeth or mouth, among adults aged 18–64 years, in the past 12 months, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Men	Women	Age group	1.4	3.2
Māori	Non-Māori	Age group, sex	1.2	2.3
Pacific	Non-Pacific	Age group, sex	1.2	1.8
Asian	Non-Asian	Age group, sex	0.6	-4.1
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.1	1.3
Usually visited a dental professional for a dental problem	Usually visited a dental professional for a dental check-up	Age group, sex, ethnic group, NZDep2006	1.1	0.7

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. There were no statistically significant results (where p-value < 0.05).

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

The prevalence of taking time off work or school due to oral health problems did not vary significantly by sex, ethnic group, deprivation or usual reason for visiting a dental professional.

Perceptions and impacts of oral health, among children and adolescents

This section of the report presents findings about perceptions and impacts of oral health for children and adolescents aged 2–17 years. Where the questions in the child questionnaire (for children aged 2–14 years) and adult questionnaires (for people aged 15 years and over) were comparable, the data have been combined to present results for the overall ‘child and adolescent group’ aged 2–17 years. Indicators available for this group include fair or poor oral health status and time taken away from school or normal activities.

Some questions in the child questionnaire were not comparable to those in the adult questionnaire and could not be combined into the ‘child and adolescent group’, and therefore only the results for children aged 2–14 years could be presented. Examples include wellbeing, experience of toothache, and time taken off by parents to tend their child.

It should be noted that self-rated and parent-rated oral health are subjective measures and may be influenced by other factors (including interpretation, awareness and cultural factors).

Parent-rated and self-rated fair or poor oral health, among children and adolescents aged 2–17 years

Parents of child participants aged 2–14 years were asked to rate the oral health of their child. Adolescents aged 15–17 years were asked to rate their own oral health using a comparable question. The results for fair or poor oral health have subsequently been produced for the two age groups combined. This measure is associated with functional impairment and discomfort, as well as clinical measures of oral health.

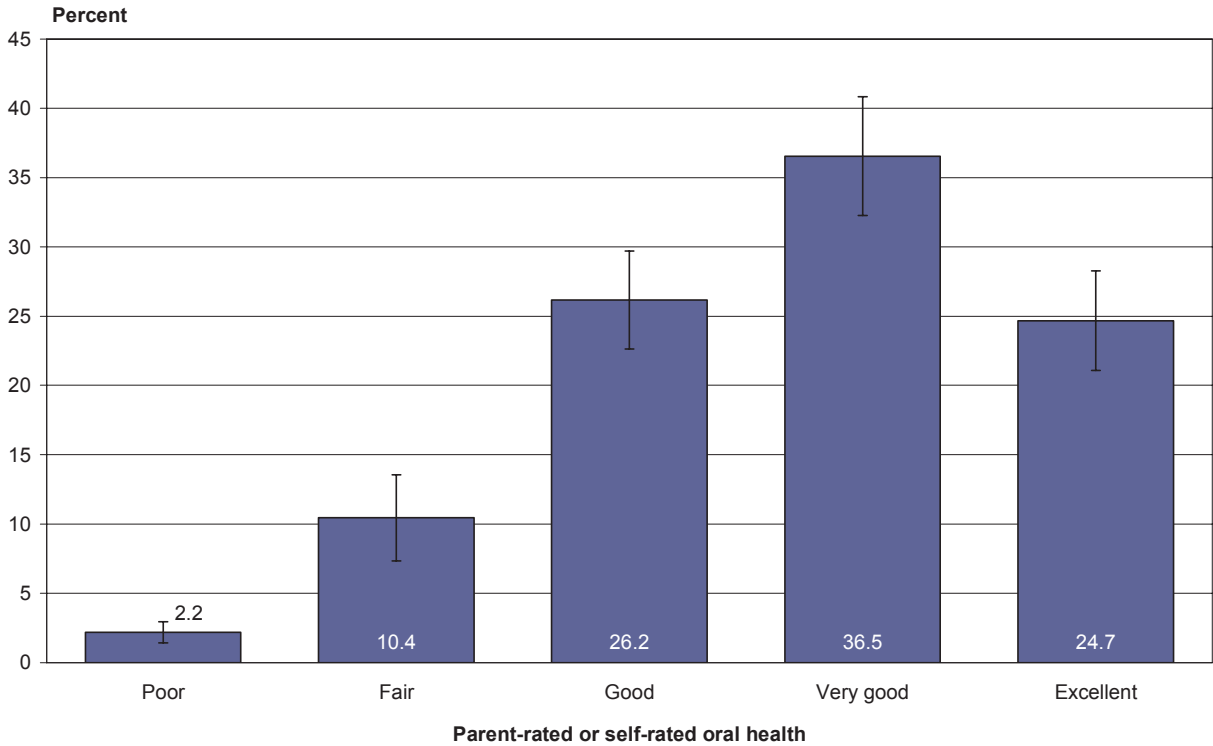
What were the survey questions?

In the 2009 NZOHS, the parents of child participants aged 2–14 years were asked, *How would you describe the health of your child's teeth or mouth? (Excellent, very good, good, fair, poor)*. The children of parents who answered 'fair' or 'poor' were classified as having fair or poor parent-rated oral health.

Participants aged 15–17 years were asked, *How would you describe the health of your teeth or mouth? (Excellent, very good, good, fair, poor)*. Participants who answered 'fair' or 'poor' were classified as having fair or poor self-rated oral health.

Overall, one in four children had excellent oral health (24.7%), and a further one in three (36.5%) had very good oral health, as rated by their parent (or themselves if they were 15–17 years old) (Figure 42).

Figure 42: Parent-rated or self-rated oral health status, among children and adolescents aged 2–17 years (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Overall, one in eight (12.6%) children and adolescents aged 2–17 years had parent-rated or self-rated fair or poor oral health. Table 122 presents the prevalence of fair or poor oral health among children and adolescents, by population group. Fair or poor oral health was significantly lower among 2–4-year-olds (4.9%) than among 5–11-year-olds (13.9%) and 12–17-year-olds (14.4%).

Table 122: Perceived fair or poor oral health, among children and adolescents aged 2–17 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	12.6 (9.4–15.9)
Sex	Girls	12.6 (8.3–16.9)
	Boys	12.6 (8.4–16.8)
Age group (years)	2–4	4.9 (2.7–8.1)
	5–11	13.9 (9.0–18.8)
	12–17	14.4 (9.2–19.6)
Ethnic group	Māori	16.2 (12.6–19.7)
	Pacific	17.1 (10.9–23.3)
	Asian	11.6 (7.8–16.4)
	European/Other	11.2 (7.6–14.8)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	10.5 (6.4–15.9)
	2	11.1 (7.3–16.0)
	3	13.9 (6.3–21.5)
	4	10.6 (4.1–17.1)
	5 (most deprived)	16.7 (11.6–21.8)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 123 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 123: Perceived fair or poor oral health, among children and adolescents aged 2–17 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.0	-0.4
Māori	Non-Māori	Age group, sex	1.4*	4.8*
Pacific	Non-Pacific	Age group, sex	1.5	5.8
Asian	Non-Asian	Age group, sex	0.9	-0.9
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	1.3	3.6

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

¹ For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Among children and adolescents aged 2–17 years, Māori were 1.4 times as likely to have fair or poor self-rated or parent-rated oral health as non-Māori, after adjustment.

Overall wellbeing affected ‘a lot’ or ‘very much’ by condition of teeth, lips, jaws and mouth, among children aged 2–14 years

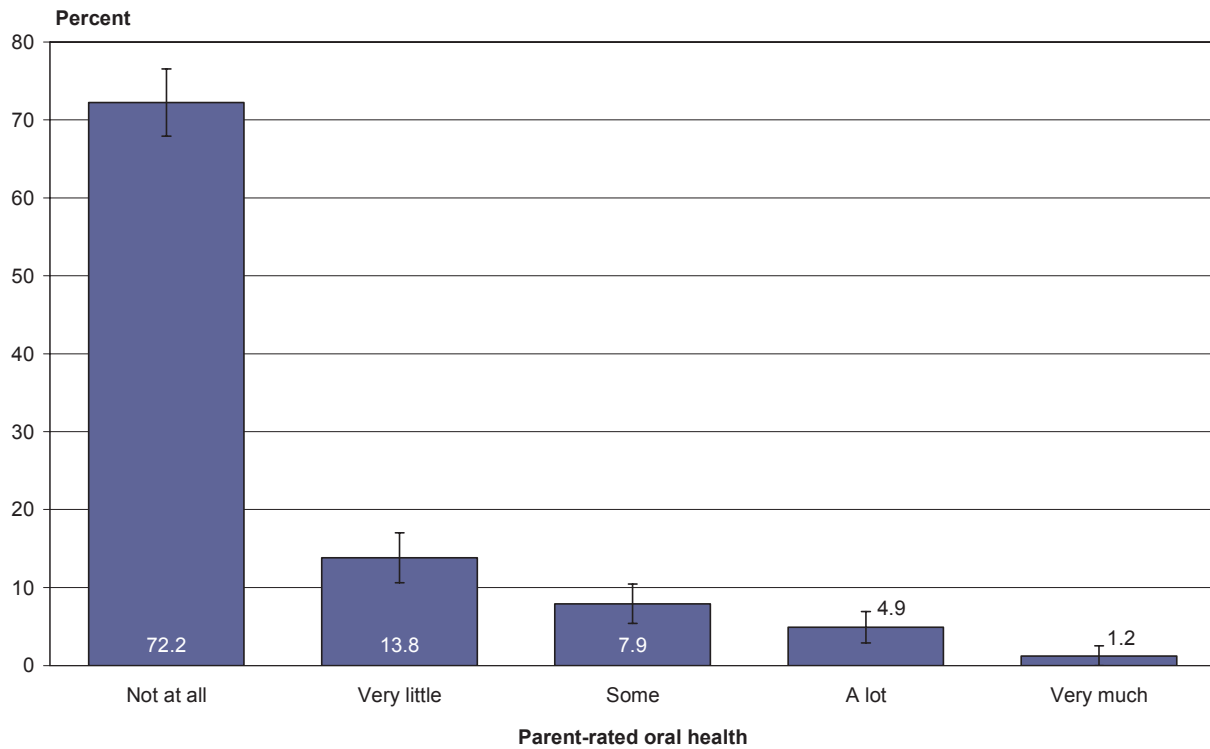
In addition to being asked about their child’s oral health status, parents were also asked how much their child’s overall wellbeing was affected by the condition of his/her teeth, lips, jaws or mouth. Both these measures are associated with functional impairment and discomfort, as well as clinical measures of oral health.

What were the survey questions?

In the 2009 NZOHS, the parents of child participants aged 2–14 years were asked how much their child’s overall wellbeing was affected by the condition of his/her teeth, lips, jaws or mouth, with options ranging from ‘not at all’ and ‘very little’ to ‘some’, ‘a lot’ and ‘very much’. Participants aged 15–17 years were not asked any questions about their wellbeing being affected by the condition of their teeth, lips, jaws or mouth, so have not been included in this analysis.

For seven in ten (72.2%) children aged 2–14 years, their wellbeing was ‘not at all’ affected by the condition of their teeth, lips, jaws and mouth (Figure 43).

Figure 43: Parent-rated reporting of how much children’s wellbeing was affected by the condition of their teeth, lips, jaws and mouth, among children aged 2–14 years, by population group (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Overall, the wellbeing of 6.1% of children aged 2–14 years was affected ‘a lot’ or ‘very much’ by the condition of their teeth, lips, jaws or mouth.

Table 124 presents the proportion of children whose wellbeing was reported as being affected ‘a lot’ or ‘very much’ by the condition of their teeth, lips, jaws or mouth in the past year, by population group. There were no significant differences in prevalence by age group.

Table 124: Wellbeing reported as being affected ‘a lot’ or ‘very much’ by condition of teeth, lips, jaws and mouth, among children aged 2–14 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	6.1 (3.7–8.5)
Sex	Girls	7.6 (4.0–11.2)
	Boys	4.7 (3.2–6.7)
Age group (years)	2–4	6.6 (4.0–10.2)
	5–11	6.4 (2.8–10.0)
	12–14	5.2 (2.9–8.5)
Ethnic group	Māori	4.8 (3.2–6.8)
	Pacific	2.3 (0.8–5.2)
	Asian	1.7 (0.4–4.5)
	European/Other	7.2 (4.2–10.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	10.5 (6.0–16.6)
	2	6.2 (3.1–10.8)
	3	3.9 (1.8–7.5)
	4	4.8 (2.6–8.0)
	5 (most deprived)	5.2 (3.2–7.8)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 125 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 125: Wellbeing reported as being affected ‘a lot’ or ‘very much’ by condition of teeth, lips, jaws and mouth, among children aged 2–14 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	0.6	-2.9
Māori	Non-Māori	Age group, sex	0.7	-1.7
Pacific	Non-Pacific	Age group, sex	0.4*	-4.3*
Asian	Non-Asian	Age group, sex	0.3*	-4.8*
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.5	-3.7

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

The overall wellbeing of Pacific and Asian children was significantly less likely to be reported as being affected ‘a lot’ or ‘very much’ by the condition of their teeth, lips, jaws and mouth than non-Pacific and non-Asian children, respectively, after adjusting for age and sex.

Experienced toothache in the past 12 months, among children aged 2–14 years

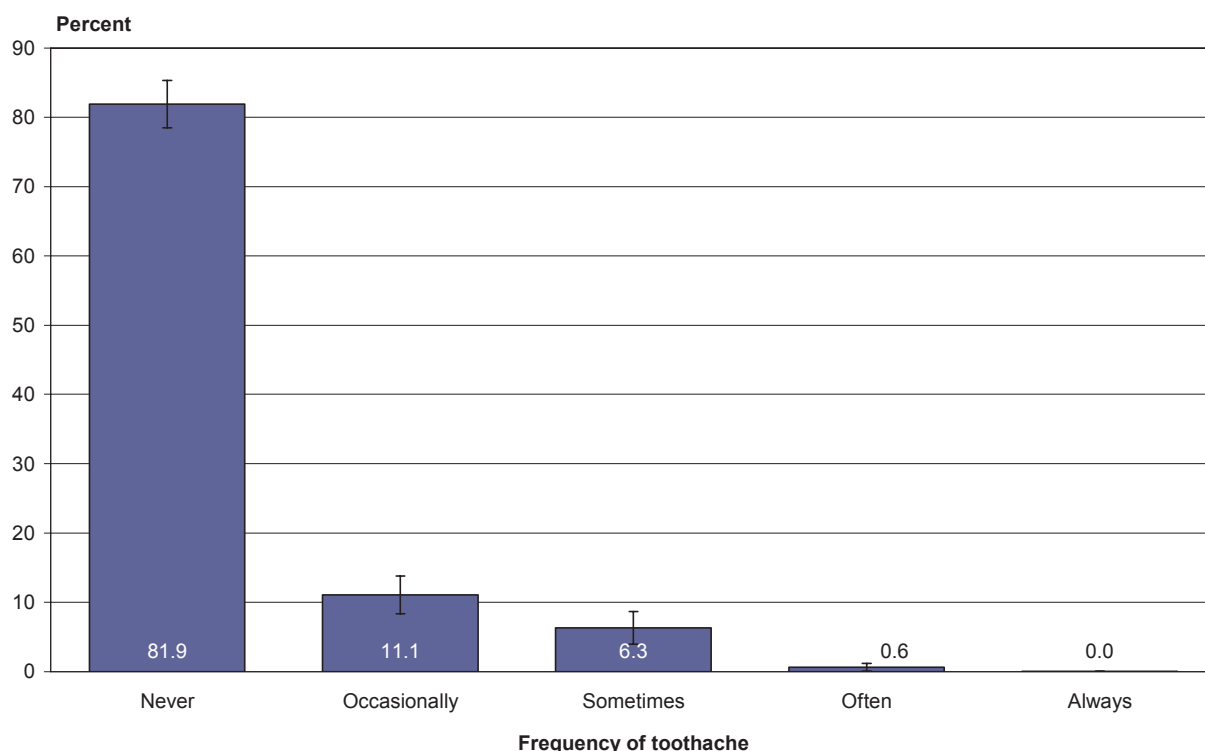
Toothache in children is mainly due to dental decay that causes pain directly or creates a painful infection. However, toothache can also be due to teething, trauma (where teeth can be fractured), or to severe sensitivity of the nerves inside the tooth to hot or cold foods or drinks. While some forms of toothache can be short-lived, if the toothache is due to decay, and is left untreated, the pain can persist and become disabling.

What were the survey questions?

In the 2009 NZOHS, parents of child participants aged 2–14 years were asked how often in the past 12 months their child had a toothache: ‘always’, ‘often’, ‘sometimes’, ‘occasionally’ or ‘never?’ Adolescents aged 15–17 years were not asked specifically about toothache in the survey, so have not been included in these results.

Overall, four in five (81.9%) children aged 2–14 years had never experienced a toothache in the last year, while one in nine (11.1%) had done so ‘occasionally’.

Figure 44: Frequency of experiencing a toothache in the last 12 months, among children aged 2–14 years (unadjusted prevalence)



Source: 2009 New Zealand Oral Health Survey

Overall, 7.0% of children aged 2–14 years had experienced a toothache sometimes, often or always in the last 12 months. These levels of experiencing a toothache (ie, sometimes, often and always) were considered to be indicative of dental decay, rather than just tooth sensitivity.

Table 126 presents the prevalence of children who experienced a toothache in the past year, by population group. Children aged 2–4 years were significantly less likely to have experienced a toothache in the last 12 months (1.4%) than those aged 5–11 years (7.8%) or 12–14 years (9.6%).

Table 126: Experienced toothache (sometimes, often or always) in the last 12 months, among children aged 2–14 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	7.0 (4.7–9.3)
Sex	Girls	6.7 (3.7–9.7)
	Boys	7.3 (4.0–10.6)
Age group (years)	2–4	1.4 (0.4–3.6)
	5–11	7.8 (5.1–10.6)
	12–14	9.6 (6.4–13.6)
Ethnic group	Māori	6.6 (4.3–8.9)
	Pacific	12.8 (8.8–17.8)
	Asian	8.5 (5.1–13.2)
	European/Other	6.3 (3.4–9.1)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	5.3 (2.3–10.2)
	2	2.2 (0.6–5.6)
	3	10.2 (6.5–15.0)
	4	8.1 (5.2–12.0)
	5 (most deprived)	8.7 (5.2–12.2)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 127 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 127: Experienced toothache (sometimes, often or always) in the last 12 months, among children aged 2–14 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.0	0.3
Māori	Non-Māori	Age group, sex	0.9	-0.4
Pacific	Non-Pacific	Age group, sex	2.2*	7.2*
Asian	Non-Asian	Age group, sex	1.3	2.4
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	2.1	5.1

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for Māori, Pacific and Asian ethnic groups has been used.

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

* Indicates a statistically significant result (p-value < 0.05).

Pacific children were over twice as likely to have experienced toothache sometimes, often or always, in the past year as non-Pacific children, after adjustment. There were no other significant differences by population group.

Taken time away from school or normal activities in the last 12 months because of problems with teeth or mouth, among children and adolescents aged 2–17 years

What were the survey questions?

In the 2009 NZOHS, parents of child participants aged 2–14 years were asked whether their child had taken time away from school (preschool, kohanga reo) or normal activities due to problems with their teeth or mouth in the last 12 months. The parents of those children who had taken time away from school or normal activities were asked how much time their child had taken off.

Adolescents aged 15–17 years were asked whether they had taken any time away from work or school due to problems with their teeth or mouth. Those adolescents who had taken time off were asked how much time they had taken off.

Overall, one in eight (13.0%) children and adolescents aged 2–17 years had taken time away from school or normal activities because of problems with their teeth or mouth in the last year. Among those who had, the mean number of days taken off was 2.5.

Table 128 presents the prevalence of having taken time away from school or normal activities because of problems with their teeth or mouth in the past year, by population group. The prevalence was significantly higher among 12–17-year-olds (17.0%) than among 2–4-year-olds (7.5%).

Table 128: Taken time away from school or normal activities in past 12 months, by children and adolescents aged 2–17 years, because of problems with their teeth or mouth, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	13.0 (10.4–15.6)
Sex	Girls	13.2 (9.2–17.2)
	Boys	12.8 (9.1–16.6)
Age group (years)	2–4	7.5 (4.7–11.2)
	5–11	11.3 (7.7–15.0)
	12–17	17.0 (11.9–22.2)
Ethnic group	Māori	13.3 (9.8–16.9)
	Pacific	12.3 (8.3–16.3)
	Asian	12.1 (8.2–16.9)
	European/Other	13.2 (10.0–16.4)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	17.5 (10.2–24.8)
	2	10.3 (6.7–15.1)
	3	12.2 (5.7–18.7)
	4	16.3 (8.1–24.5)
	5 (most deprived)	8.9 (5.7–12.1)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 129 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 129: Taken time away from school or normal activities in the past 12 months, by children and adolescents aged 2–17 years, because of problems with their teeth or mouth, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.0	-0.7
Māori	Non-Māori	Age group, sex	1.1	0.8
Pacific	Non-Pacific	Age group, sex	1.0	-0.3
Asian	Non-Asian	Age group, sex	0.9	-0.9
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.6	-5.8

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. There were no statistically significant results (where p-value < 0.05).

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

There were no significant differences by population group in the prevalence of taking time away from school or normal activities in the past 12 months due to problems with teeth or mouth.

Parent of child has taken time off work or normal activities in the past 12 months because of problems with child's teeth or mouth, for children aged 2–14 years

Problems with children's teeth also have the potential to have an impact on the ability of parents or caregivers to work or engage in normal activities.

What were the survey questions?

In the 2009 NZOHS, parents of child participants aged 2–14 years were asked how often in the past 12 months they, or another adult, had taken time away from work or normal activities because of problems with their child's teeth or mouth. Parents who had taken time away from work or normal activities were asked to quantify how much time.

Adolescents aged 15–17 years were not asked whether a caregiver had taken time off work or normal activities in the past year because of problems with the adolescent's teeth or mouth, and therefore have not been included in this analysis.

Overall, one in nine (11.6%) children's parents had taken time off work or normal activities in the past year because of problems with their child's teeth or mouth. Among those who had, the mean number of days taken off was 2.1.

Table 130 presents the prevalence of children whose parent took time off work or normal activities because of problems with their child's teeth or mouth in the past year, by population group.

Table 130: Time taken off work or normal activities by child's parent in the past 12 months because of problems with child's teeth or mouth, among children aged 2–14 years, by population group (unadjusted prevalence)

Population group		Prevalence (95% CI)
All	Total	11.6 (8.7–14.6)
Sex	Girls	10.5 (6.5–14.4)
	Boys	12.8 (8.3–17.3)
Age group (years)	2–4	5.8 (3.4–9.2)
	5–11	13.2 (8.4–17.9)
	12–14	13.0 (6.9–19.1)
Ethnic group	Māori	11.0 (7.4–14.7)
	Pacific	9.5 (6.1–14.0)
	Asian	14.6 (8.8–20.5)
	European/Other	12.1 (8.3–15.9)
Neighbourhood deprivation (NZDep2006 quintile)	1 (least deprived)	15.2 (9.8–22.0)
	2	6.3 (3.2–10.9)
	3	15.3 (6.8–23.8)
	4	13.0 (5.9–20.1)
	5 (most deprived)	8.2 (4.8–11.5)

Source: 2009 New Zealand Oral Health Survey

Note: Total response standard output for ethnic groups has been used.

Comparisons by population group

Table 131 presents results by sex, ethnic group and neighbourhood deprivation, which are adjusted for age (and other relevant demographic factors) to allow appropriate comparisons.

Table 131: Time taken off work or normal activities by parent of child in the past 12 months because of problems with child's teeth or mouth, among children aged 2–14 years, by population group (adjusted rate ratio and rate difference)

Group of interest	Reference group	Adjustment variables	Rate ratio	Rate difference (%)
Boys	Girls	Age group	1.2	1.9
Māori	Non-Māori	Age group, sex	0.9	-0.8
Pacific	Non-Pacific	Age group, sex	0.8	-2.2
Asian	Non-Asian	Age group, sex	1.3	3.7
Most deprived neighbourhoods (NZDep2006) ¹	Least deprived neighbourhoods	Age group, sex, ethnic group	0.7	-3.3

Source: 2009 New Zealand Oral Health Survey

Notes: Total response standard output for Māori, Pacific and Asian ethnic groups has been used. There were no statistically significant results (where p-value < 0.05).

1 For neighbourhood deprivation, the rate ratio and rate difference refer to the relative index of inequality (RII) and the slope of inequality (SII), respectively. See methods for more details.

There were no significant differences in time taken off work or normal activities by parents in the past 12 months due to problems with their child's teeth or mouth, by population group.

Chapter 9: Changes Over Time

Key findings

The 2009 NZOHS showed significant improvements in oral health status over time. The following results present age-standardised comparisons for adults in the age ranges 20–24, 35–44 and 65–74 years (combined), for 2009 compared with 1976 and 1988.

Compared with 1976 and 1988, adults had a lower prevalence of complete tooth loss (edentulism) in 2009.

Among dentate adults, compared with 1976 and 1988 there was:

- a higher prevalence of having a functional dentition (21 or more natural teeth)
- a higher mean number of natural teeth
- a lower prevalence of missing one or more teeth due to pathology
- a lower mean number of teeth missing due to pathology
- a lower mean number of filled teeth
- a lower mean DMFT.

Dentate adults had a higher prevalence of brushing teeth twice a day with fluoride toothpaste in 2009 than in 1988.

However, in 2009 adults were significantly less likely to have visited a dental professional in the previous 12 months than in 1988.

For adolescents aged 12–13 years there was a significant improvement from 1988 to 2009, with 12–13-year-olds in 2009 having:

- a higher prevalence of being caries-free in all teeth
- a lower mean number of filled teeth
- a lower lifetime dental decay experience (DMFT).

However, there was a significant decrease from 1988 to 2009 in the prevalence of having seen a dental professional in the previous year among 12–13-year-olds.

Introduction

The 2009 NZOHS is the third major descriptive dental epidemiological survey to take place in New Zealand, after two previous national oral health surveys in 1976 and 1988. The 1976 Survey of Adult Oral Health (SAOH) was commissioned by the Medical Research Council of New Zealand and collected information for New Zealanders aged 15 years and over (Cutress et al 1979). In late 1988 the New Zealand section of the WHO Study of Oral Health Outcomes (SOHO) was undertaken by the Department of Health (Hunter et al 1992). This study was limited to Form 2 children (aged 12–13 years) and three key adult age groups: 20–24 years, 35–44 years and 65–74 years.

The 2009 NZOHS provides the third consecutive 'snapshot' of oral health status, and thus contributes substantially to time series data available from the two previous national surveys on oral health. It also provides much-needed data on an increasingly dentate population.

This section presents time trend comparisons for a wide range of oral health indicators, comparing oral health status in 2009 with that in 1976 and 1988. These comparisons will help policy makers and the dental profession to:

- examine the prevalence and severity of oral conditions
- evaluate changes over time
- anticipate changes in dental disease patterns and associated workforce requirements, and take these into account when planning long-term health initiatives and programmes
- monitor progress towards health targets and objectives.

Presentation of results

This chapter compares the oral health status of New Zealanders in 2009 with that in 1976 and 1988, for tooth loss, decayed, missing and filled teeth, brushing teeth, and visiting a dental professional. Comparisons could only be made for selected age groups (12–13, 20–24, 35–44 and 65–74 years), due to the limited age groups for which data were collected in the 1988 SOHO. Sample sizes were too low to compare ethnic groups over time.

Overall comparisons between years have been presented as standardised rate ratios (SRRs) and standardised ratios of means (SRMs) among all adults in the specific age groups (20–24, 35–44 and 65–74 years), for 2009 compared with the previous survey. An SRR of less than 1 means that the prevalence (or mean) in 2009 was lower than in the comparison year (either 1976 or 1988). The comparisons were age standardised using the WHO world standard population to take the differing age structures of the populations into account.

Unadjusted prevalence estimates are also presented for each separate age group, for adults (20–24 years, 35–44 years and 65–74 years) and children (12–13 years). Unadjusted estimates were weighted for the population at the time.

Several points need to be considered when interpreting the data presented in this chapter.

- The 2009 data for coronal and root conditions were combined to produce data for the whole tooth in this chapter, to enable a consistent comparison with SAOH and SOHO data. Therefore, some of the 2009 results presented in this chapter are not strictly comparable with other results in this report.
- Results presented in this chapter were produced directly from the SAOH and SOHO survey data sets, and therefore may differ from previously published results. For example, in this report DMFT results are presented only for dentate adults, while in previously published reports DMFT results were presented for all adults (including edentulous adults).

- The assessment criteria used to determine dental caries have become more sensitive over time, and are therefore likely to have resulted in a higher mean number of decayed teeth identified in the 2009 survey.
- In making comparisons over time, there may be other factors influencing the results, including the change in the demographic structure of the population over time. For example, the change in the age structure of the dentate population may affect the overall results. As people keep their teeth for longer, the age distribution of the dentate population has changed, with a resulting increase in the proportion of older people represented. The following time trends should be interpreted in the context of these changes in the population demographic structure.

Retention of natural teeth

Complete loss of natural teeth (edentulism)

How was this measured?

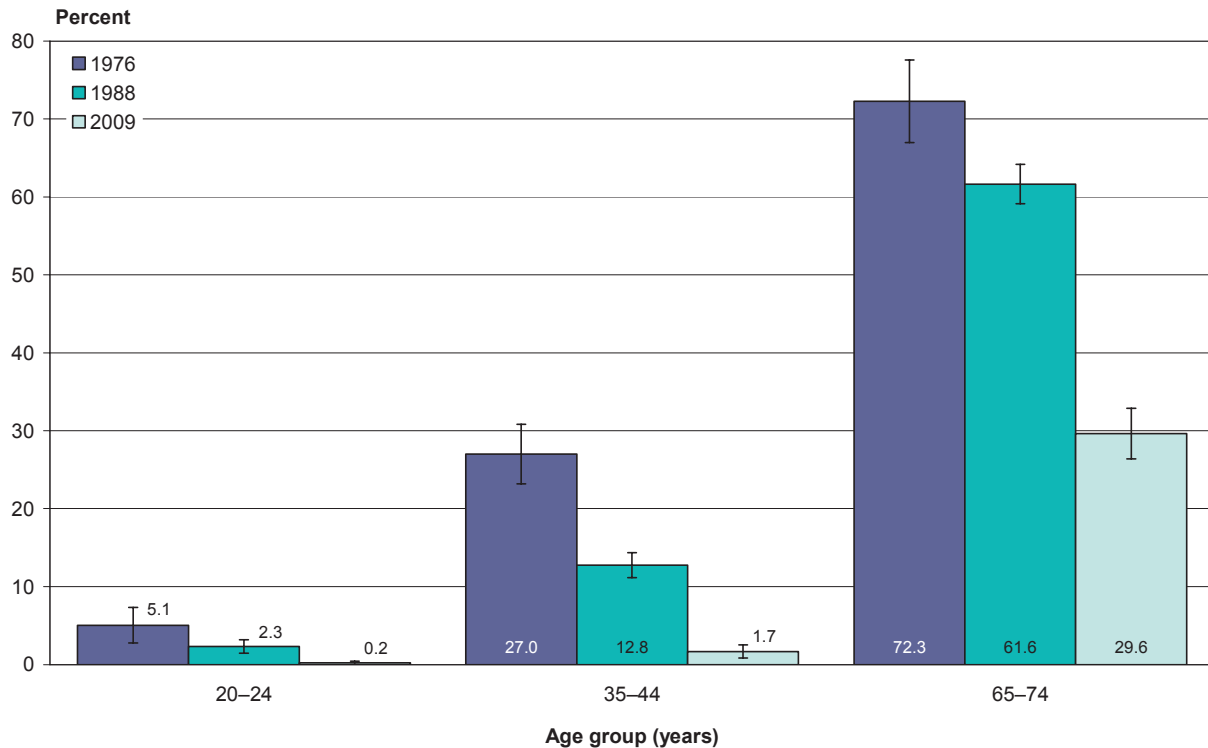
In the 2009 NZOHS, information on edentulism was self-reported in the interview, consistent with contemporary standard practice in national oral health surveys. Data from the 1976 and 1988 surveys were reanalysed for consistency reasons.

In the 1976 SAOH, information about complete tooth loss was obtained from the dental examination, which was completed by almost all (96%) interviewed respondents. For the 1988 SOHO study, this report has used available self-reported information rather than clinical data, as a smaller number of respondents completed the dental examination than the interview (particularly in the 20–24 years age group). Therefore, edentulism estimates are higher in this report than those previously published, for 20–24-year-olds (clinical 0.3%, self-reported 2%), 35–44-year-olds (clinical 11.7%, self-reported 13%) and 65–74-year-olds (clinical 58.6%, self-reported 62%).

In 2009 the prevalence of edentulism for all people aged 20–24, 35–44 and 65–74 years was less than half the rate in 1988 (SRR: 0.37, 0.29–0.46), and one-quarter of the rate in 1976 (SRR: 0.26, 0.19–0.32), after standardising for age.

Figure 45 shows that the prevalence of having lost all natural teeth has decreased dramatically in all three age groups since 1976, and particularly since 1988. The prevalence decreased markedly in young adults aged 20–24 years, from 5.1% in 1976 to 0.2% in 2009. In 2009 edentulism had been virtually eliminated in the 35–44 years age group, with the prevalence decreasing from 27.0% in 1976, to 1.7% in 2009. Similarly, there was a large reduction among older adults aged 65–74 years, with a decrease of over half between 1976 (72.3%) and 2009 (29.6%). Overall, these results show a marked rate of improvement in the retention of natural teeth in these age groups since 1976.

Figure 45: Prevalence of complete tooth loss among New Zealand adults in 1976, 1988 and 2009, by age group (unadjusted prevalence)



Sources: 1976 Survey of Adult Oral Health, 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Mean number of natural teeth

As dental health has improved and more people are retaining more teeth, measures focusing on the number of natural teeth present are increasingly used. The maximum number of natural teeth in adults is 32.

This section gives an indication of the average number of natural teeth people have retained over time, among dentate adults. Results for this indicator are not directly comparable with those presented earlier in the report due to a slightly different methodology used.

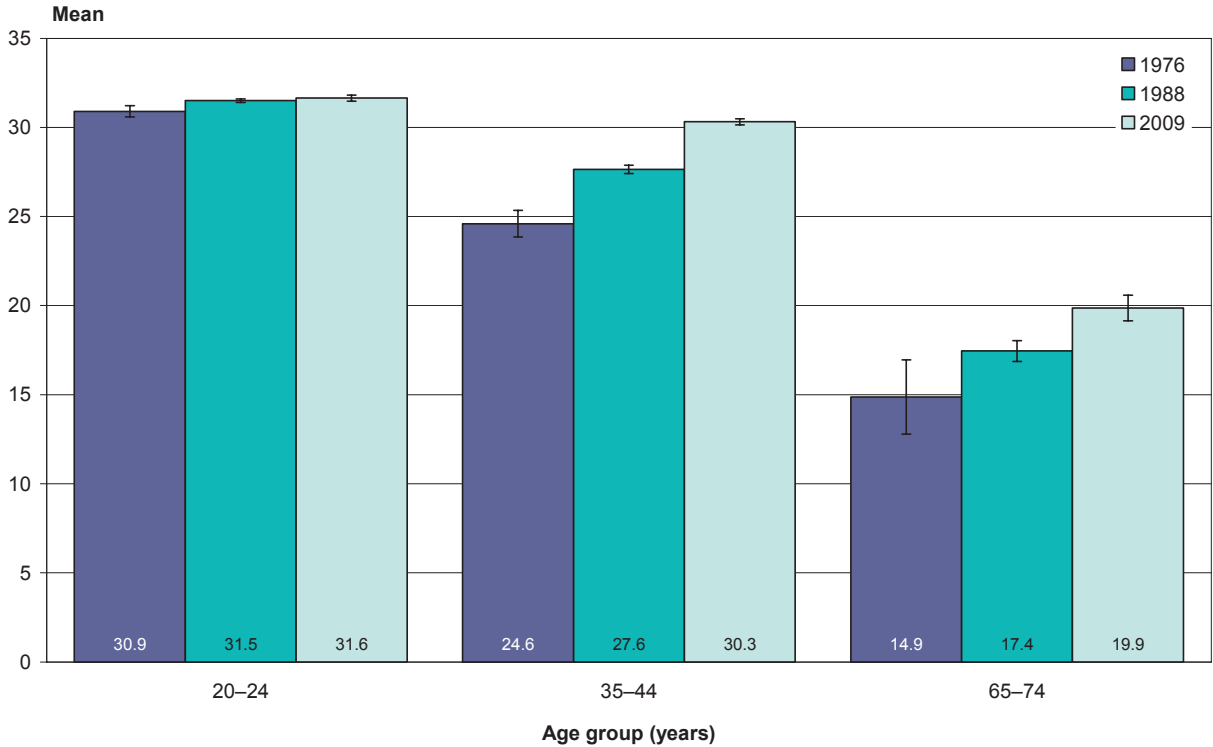
How was this measured?

In this section, an approximate method was used for all three survey data sets to calculate the mean number of natural teeth that dentate people have retained over time. The number of natural teeth retained was calculated by subtracting the number of teeth missing due to pathology from the nominal maximum of 32. This was because the only code available for missing teeth in the 1976 survey data set was for teeth missing due to pathology, and did not include teeth missing for other reasons.

In 2009, the mean number of natural teeth among dentate people aged 20–24, 35–44 and 65–74 years was significantly higher than in 1976 (SRM: 1.18, 1.14–1.23) and 1988 (SRM: 1.08, 1.06–1.10), after standardising for age.

Figure 46 shows that the average number of natural teeth per person significantly increased from 1976 to 2009 in all three age groups. The most marked increases in mean number of natural teeth occurred among dentate people aged 35–44 and 65–74 years, who had an average of five more natural teeth per person in 2009 than in 1976.

Figure 46: Mean number of natural teeth among New Zealand dentate adults in 1976, 1988 and 2009, by age group (unadjusted mean)



Sources: 1976 Survey of Adult Oral Health, 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Having a functional dentition (21 or more natural teeth)

This indicator examines the prevalence of having a functional dentition (ie, having 21 or more natural teeth) among dentate adults over time.

How was this measured?

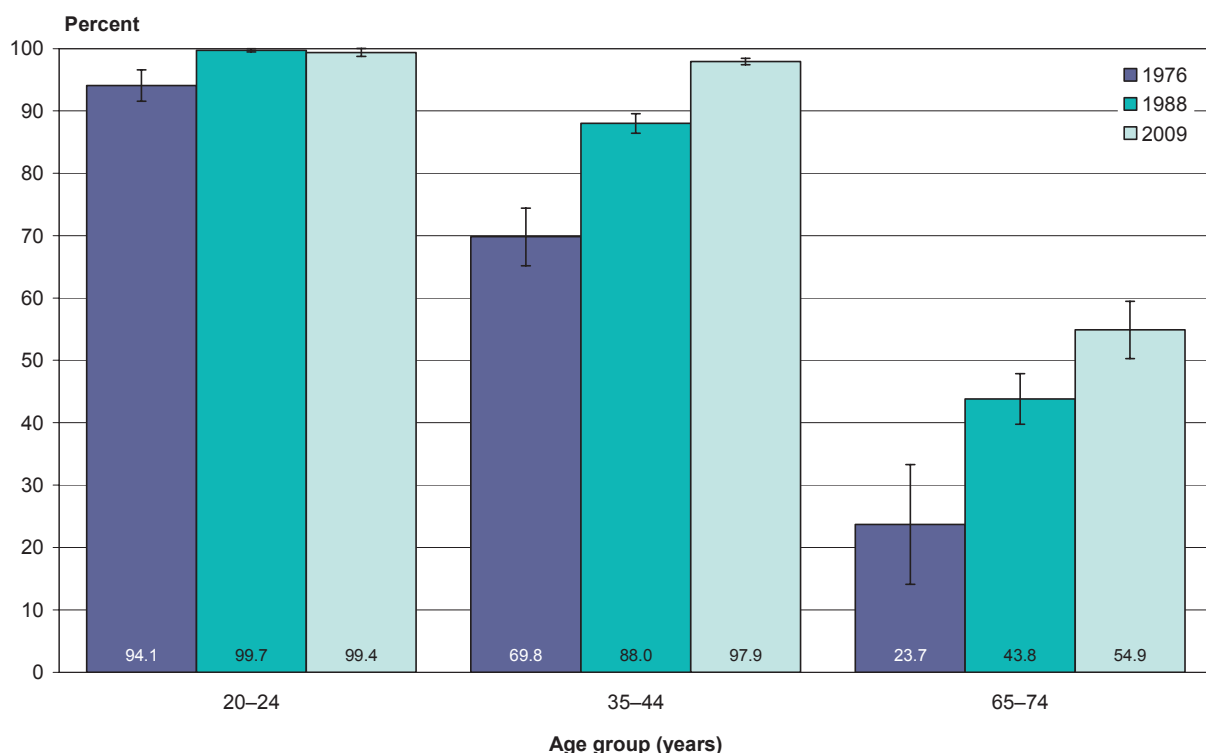
To accurately compare with 2009 data, 1976 and 1988 data were reanalysed to include only dentate people. Therefore the following results for 1976 and 1988 are not directly comparable with previously published reports (Cutress et al 1979; Hunter et al 1992), which presented results for the total population.

The prevalence of having a functional dentition has significantly increased in New Zealand since 1976. The prevalence of having a functional dentition was one-tenth higher in 2009 than in 1988 (SRR: 1.10, 1.06–1.14), and more than one-third higher than in 1976 (SRR: 1.36, 1.26–1.46), among dentate adults aged 20–24, 35–44 and 65–74 years, after standardising for age.

In each of the three age groups, the proportion of the dentate population with a functional dentition has increased since 1976 (Figure 47). Among dentate adults aged 20–24 years, the gain achieved between 1976 and 1988 (when nearly everyone had a functional dentition) was maintained in 2009. For dentate adults aged 35–44 years, nearly everyone (97.9%) had a functional dentition in 2009, a significant increase from 1976 and 1988.

Among dentate people aged 65–74 years, the greatest increase in the prevalence of having a functional dentition occurred between 1976 and 1988, when the prevalence nearly doubled to 43.8%. By 2009, more than one in two (54.9%) dentate adults in this age group had a functional dentition.

Figure 47: Prevalence of having a functional dentition (21 or more natural teeth), among New Zealand dentate adults in 1976, 1988 and 2009, by age group (unadjusted prevalence)



Sources: 1976 Survey of Adult Oral Health, 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Prevalence of having one or more teeth missing due to pathology

How was this measured?

To enable comparisons with 2009 data, 1976 SAOH and 1988 SOHO survey data were reanalysed for dentate adults only.

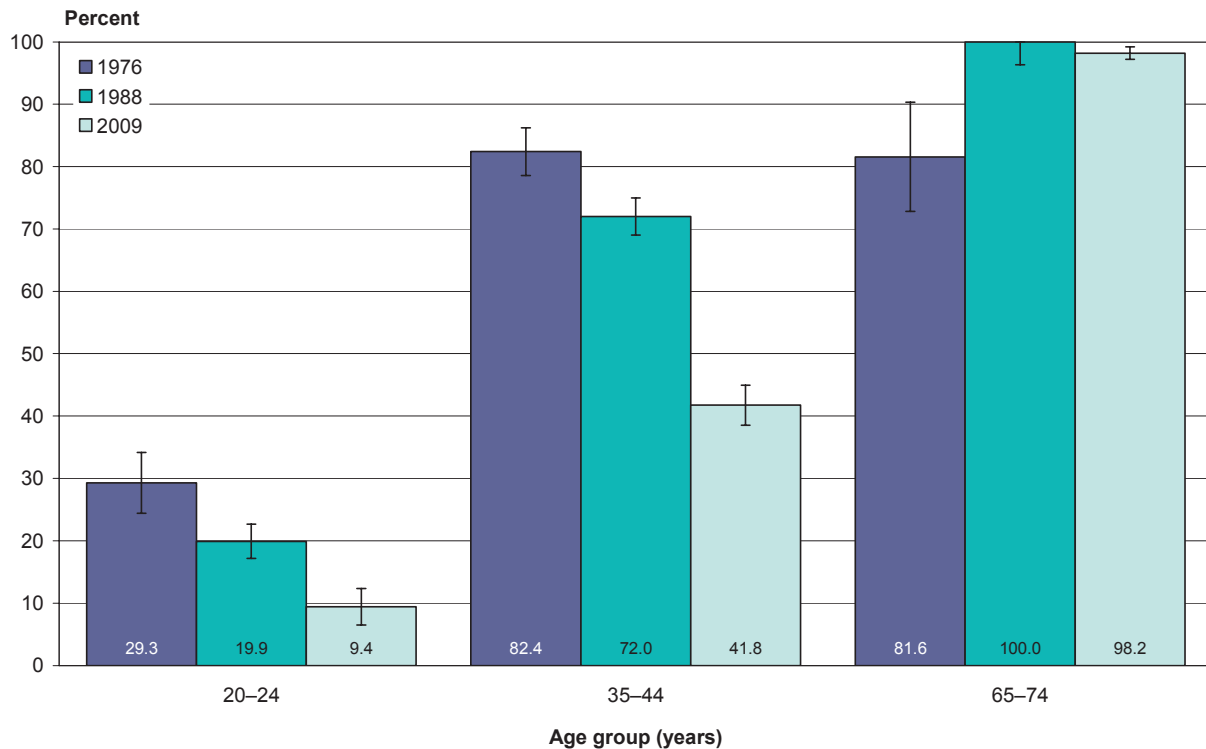
In 2009, dentate adults aged 20–24, 35–44 and 65–74 years were significantly less likely to have one or more teeth missing due to pathology (ie, dental decay or periodontal disease) than dentate adults of the same age in 1976 (SRR: 0.65, 0.58–0.72) and 1988 (SRR: 0.70, 0.63–0.76), after standardising for age.

Figure 48 shows that among dentate people aged 20–24 and 35–44 years, there have been marked reductions since 1976 in the prevalence of having one or more teeth missing due to pathology. Among adults aged 20–24 years, one in three dentate adults (29.3%) had one or more teeth missing due to pathology in 1976, decreasing to 19.9% in 1988 and 9.4% in 2009. This represented a three-fold reduction from 1976 to 2009.

Among adults aged 35–44 years, four in five (82.4%) adults had one or more teeth missing due to pathology in 1976. This significantly decreased to 72.0% in 1988, and to 41.8% in 2009. Overall, the prevalence of having one or more teeth missing due to pathology in this age group halved between 1976 and 2009, with the biggest drop from 1988 to 2009.

By contrast, the prevalence among older adults increased from 81.6% in 1976 to affect practically all dentate adults aged 65–74 years in 1988 and 2009. This trend can likely be attributed to increasing proportions of older adults retaining some natural teeth over time and becoming part of the dentate population since 1976.

Figure 48: Prevalence of having one or more teeth missing due to pathology, among New Zealand dentate adults in 1976, 1988 and 2009, by age group (unadjusted prevalence)



Sources: 1976 Survey of Adult Oral Health, 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Mean number of teeth missing due to pathology

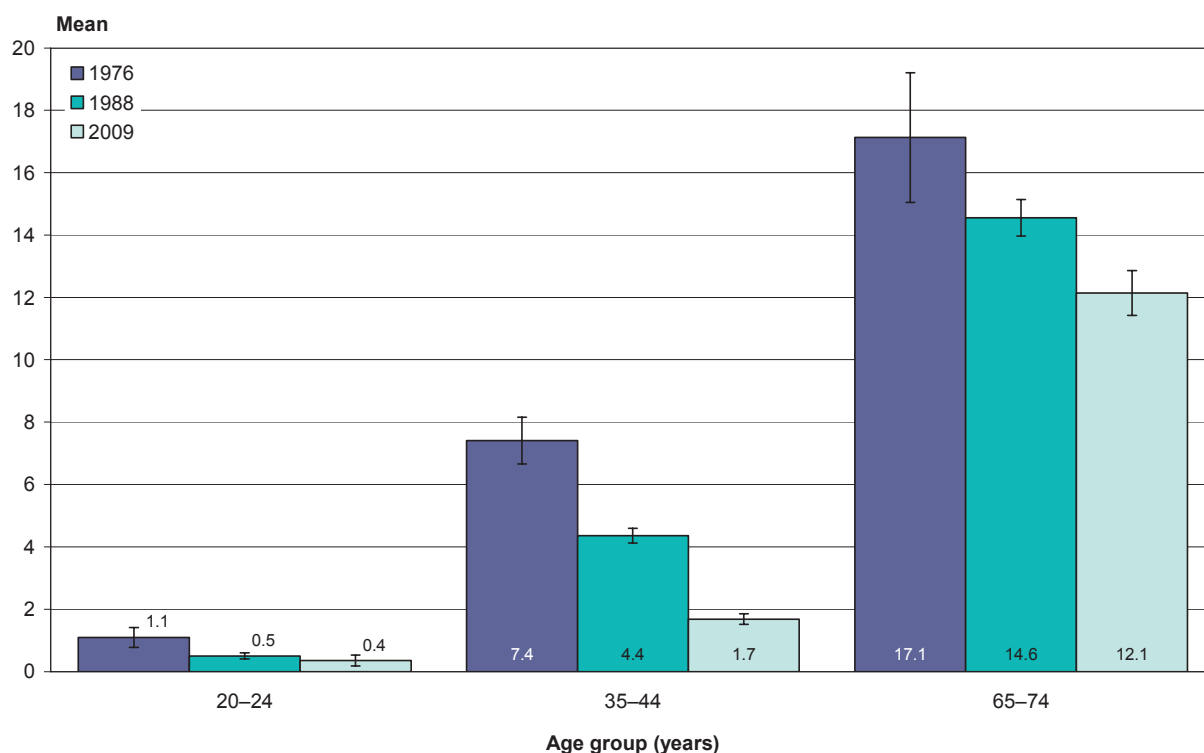
There has been an overall decrease in the mean number of teeth missing due to pathology (ie, dental decay or periodontal disease) among dentate adults.

In 2009, the mean number of teeth missing due to pathology among dentate adults aged 20–24, 35–44 and 65–74 years was less than half the 1976 value (SRR: 0.44, 0.37–0.50), and about two-thirds of the 1988 value (SRR: 0.63, 0.55–0.70), after standardising for age.

Figure 49 shows that there has been a significant decrease in the mean number of teeth missing due to pathology in all age groups since 1976. In the 20–24 years age group, the mean number of missing teeth fell from 1.1 in 1976 to 0.4 in 2009.

The decreases were more dramatic in the older age groups. Among 35–44-year-olds, the mean number of missing teeth decreased from 7.4 to 1.7 missing teeth from 1976 to 2009. In dentate adults aged 65–74 years, the mean number fell from 17.1 to 12.1 missing teeth per person on average from 1976 to 2009.

Figure 49: Mean number of teeth missing due to pathology, among New Zealand dentate adults in 1976, 1988 and 2009, by age group (unadjusted prevalence)



Sources: 1976 Survey of Adult Oral Health, 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Condition of natural teeth

Prevalence of having one or more teeth with untreated coronal or root decay

This indicator examines the prevalence of having one or more teeth with untreated decay (in the whole tooth; ie, having one or more teeth with coronal and/or root decay).

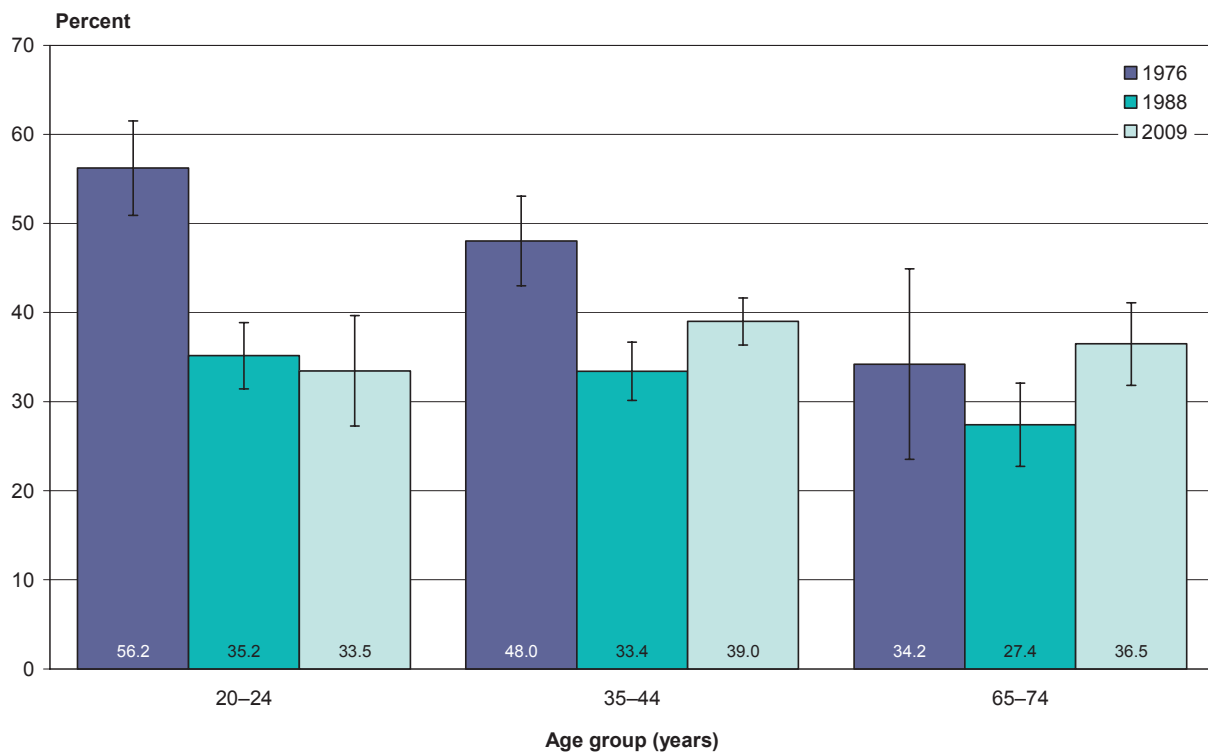
How was this measured?

For this report, data from the 1976 SAOH and 1988 SOHO surveys were reanalysed to calculate the prevalence of having one or more teeth with untreated decay (coronal and root) among dentate adults aged 20–24, 35–44 and 65–74 years. The results in this section are for the whole tooth (both the crown and root), and are therefore not comparable with results presented earlier in this report. It should be noted that the assessment criteria for decay were more sensitive in the 2009 survey than in the earlier surveys. In addition, probing for dental decay was carried out in earlier surveys but not in the 2009 survey.

After standardising for age, the prevalence of having one or more teeth with untreated decay was significantly lower in 2009 than in 1976 (SRR: 0.79, 0.66–0.92), and was not significantly different in 2009 than in 1988 (SRR: 1.14, 0.94–1.35), among dentate adults aged 20–24, 35–44 and 65–74 years.

Figure 50 shows that, for 20–24 and 35–44-year-olds, the prevalence of having one or more decayed teeth significantly decreased from 1976 to 1988. It then remained relatively stable for 20–24-year-olds, but significantly increased after 1988 among 35–44-year-olds. Among 65–74-year-old dentate adults, there has been no overall change in the prevalence of having one or more decayed teeth since 1976, but a significant increase since 1988 (p-value < 0.05). However, assessment criteria have become more sensitive over time, which means existing decay was more likely to be detected in the 2009 survey.

Figure 50: Prevalence of having one or more teeth (crowns or roots) with untreated decay, among New Zealand dentate adults in 1976, 1988 and 2009, by age group (unadjusted prevalence)



Sources: 1976 Survey of Adult Oral Health, 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Mean number of teeth with untreated coronal or root decay

How was this measured?

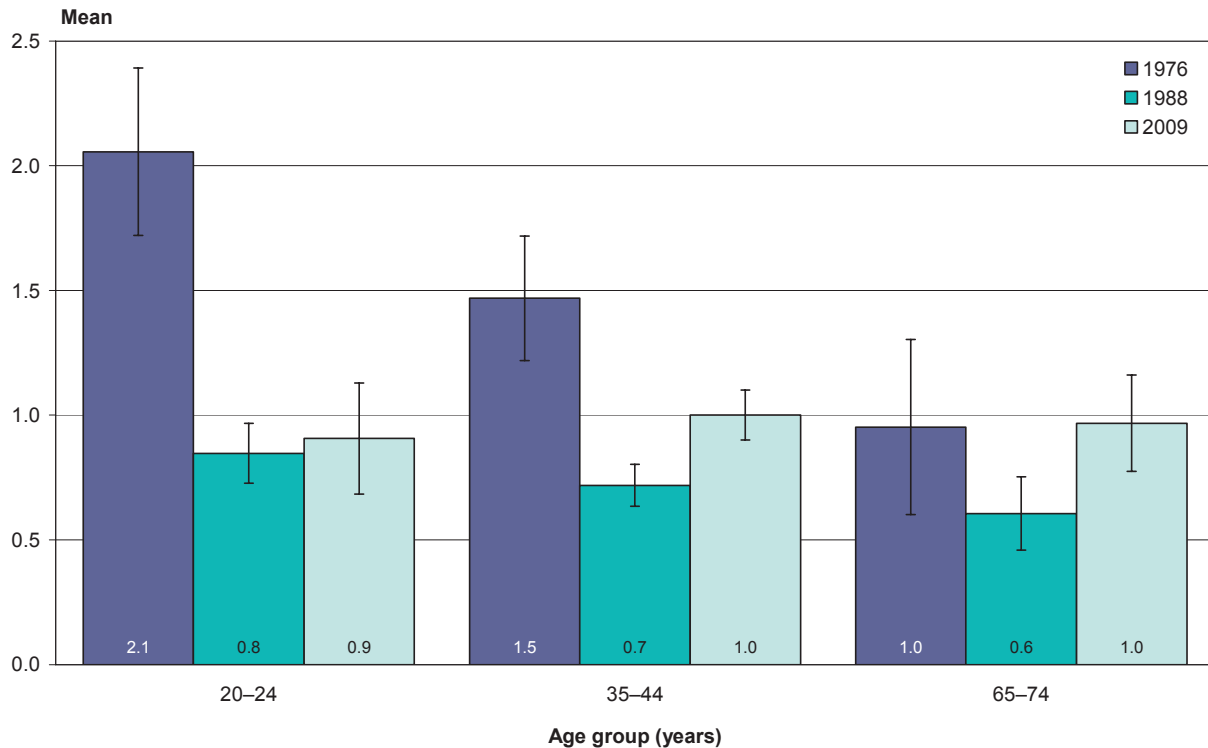
In the 1976 SAOH and 1988 SOHO survey reports, the estimates for mean number of decayed teeth were given for the total population. This estimate was based on 28 teeth, not 32 teeth, even though data were collected in 1976 for 32 teeth per person. To enable comparisons with 2009 data, data sets from the 1976 SAOH and 1988 SOHO surveys were reanalysed to calculate the mean number of decayed teeth for dentate adults aged 20–24, 35–44 and 65–74 years, based on 32 teeth.

The results in this section are for the whole tooth (both the crown and root), and are therefore not comparable with results presented earlier in this report. It should be noted that the assessment criteria for decay were more sensitive in the 2009 survey than in the earlier surveys. In addition, probing for dental decay was carried out in earlier surveys but not in the 2009 survey.

After standardising for age, the mean number of decayed teeth (among dentate adults aged 20–24, 35–44 and 65–74 years) was found to have significantly decreased since 1976 (SRR: 0.65, 0.49–0.81), but was about a third higher in 2009 than in 1988 (SRR: 1.34, 1.02–1.67).

Figure 51 shows that among people aged 20–24 years and 35–44 years, the mean number of decayed teeth per person significantly decreased between 1976 and 1988. While there were slight increases in the mean number of decayed teeth in some age groups from 1988 to 2009, this is likely to be due to increased sensitivity in the assessment criteria for decay in the 2009 survey.

Figure 51: Mean number of decayed teeth (crowns or roots) per person among dentate adults in 1976, 1988 and 2009, by age group (unadjusted mean)



Sources: 1976 Survey of Adult Oral Health, 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Mean number of filled teeth

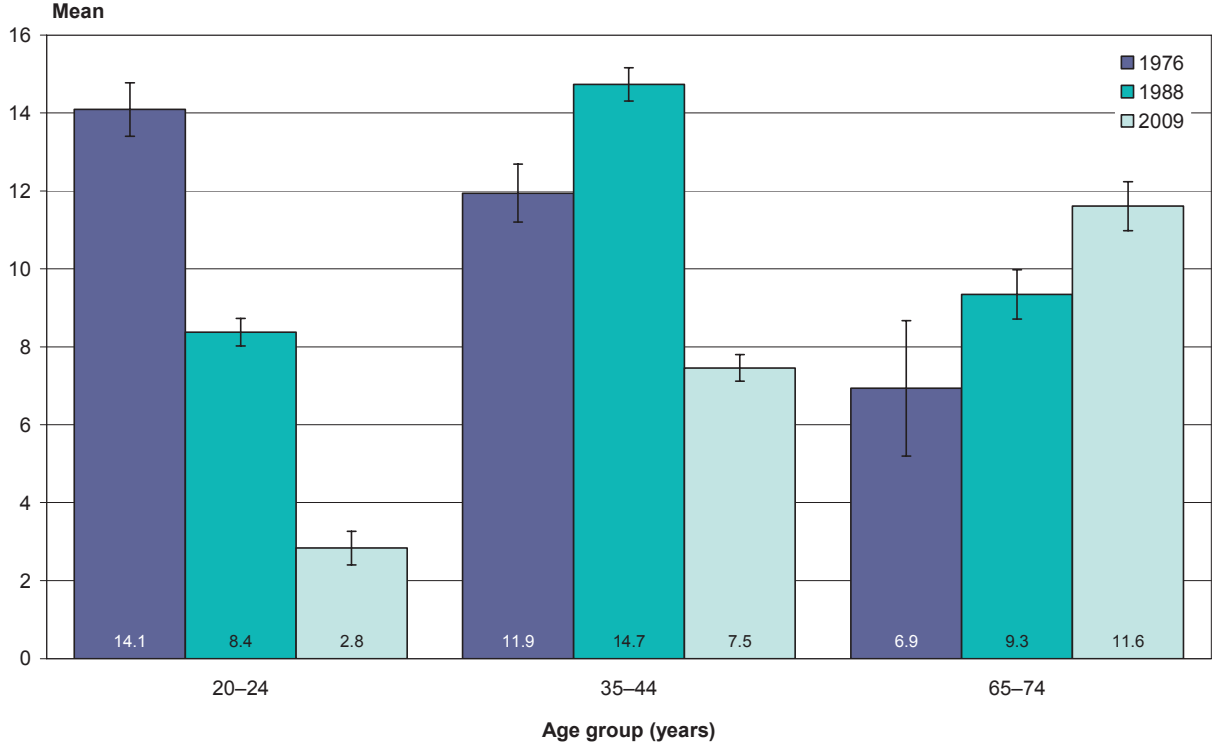
In 2009 the mean number of filled teeth per person for dentate adults aged 20–24, 35–44 and 65–74 years was about two-thirds the mean number in 1976 (SRR: 0.63, 0.57–0.70) and 1988 (SRR: 0.59, 0.54–0.64), after standardising for age.

Figure 52 shows that there has been a dramatic decrease in the mean number of filled teeth among 20–24-year-olds from 1976 (14.1 filled teeth) to 2009 (2.8).

In the 35–44 years age group there was an increase in the mean number of filled teeth from 1976 (11.9) to 1988 (14.7). However, since 1988, there has been a substantial decrease, to an average of 7.5 filled teeth per person in 2009.

The mean number of filled teeth has consistently increased for dentate adults aged 65–74 years since 1976, likely reflecting the larger proportion of adults in this age group with increased numbers of natural teeth in their older age.

Figure 52: Mean number of filled teeth per person, among dentate adults in 1976, 1988 and 2009, by age group (unadjusted mean)



Sources: 1976 Survey of Adult Oral Health, 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Mean number of decayed, missing or filled teeth (DMFT)

The overall severity of dental decay experience is presented using the DMFT index, which sums the number of decayed (D), missing due to pathology (M) and filled (F) teeth (T).

How was this measured?

For this section the DMFT index was calculated using data from previous sections: mean number of teeth with untreated coronal decay, mean number of teeth missing due to pathology, and mean number of filled teeth. It should be noted that the assessment criteria for determining decay have become more sensitive over time, which has likely led to more decay being identified in 2009 than in previous surveys.

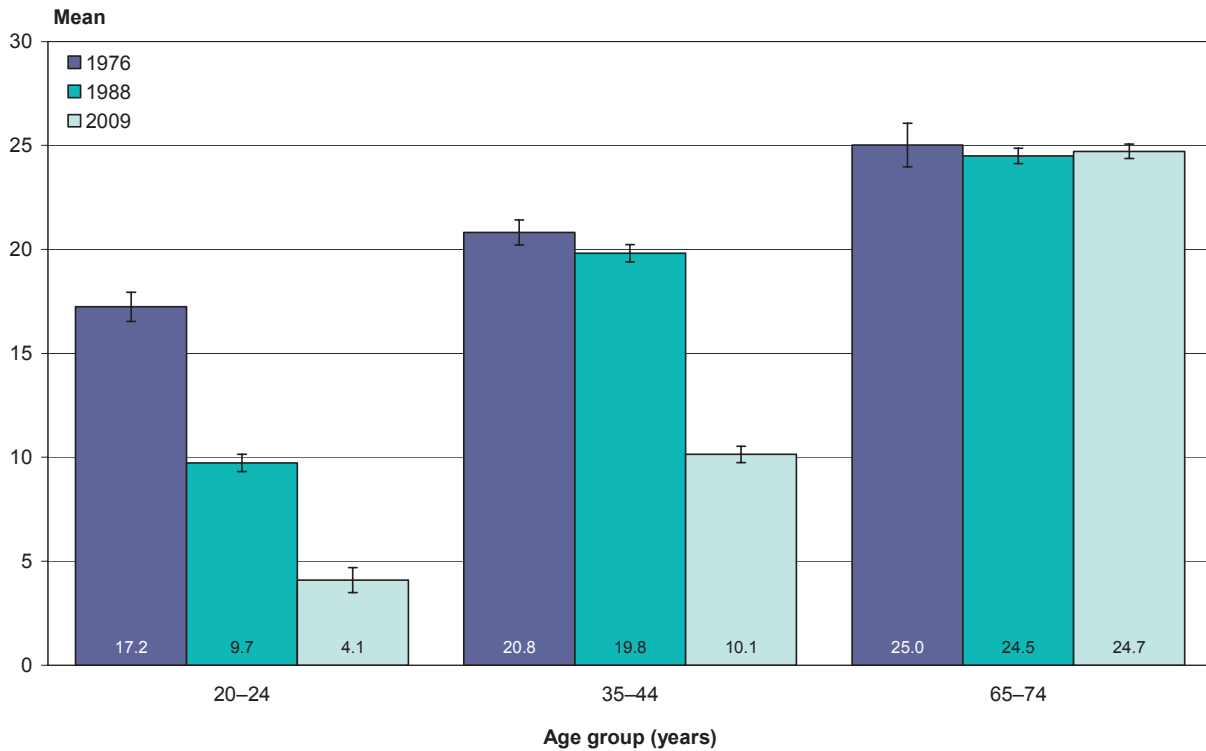
In 2009 the mean DMFT score was just over half the value in 1976 (SRR: 0.56, 0.53–0.59), and about two-thirds of the 1988 value (SRR: 0.63, 0.60–0.67), for the total dentate population aged 20–24, 35–44 and 65–74 years, after standardising for age.

Figure 53 shows that there has been a substantial decrease in the mean DMFT score in the 20–24 and 35–44 years age groups since 1976.

For dentate adults aged 20–24 years, the mean DMFT score decreased from 17.2 in 1976 to 4.1 in 2009, a four-fold decrease. In the 35–44 years age group, there was a significant decrease from 1976 (20.8) to 2009 (10.1), with the DMFT score halving over this time period.

There was no significant change in the mean DMFT score in 65–74-year-old dentate adults from 1976 to 2009.

Figure 53: Mean number of decayed, missing or filled teeth (DMFT) per person, among dentate adults in 1976, 1988 and 2009, by age group (unadjusted mean)



Sources: 1976 Survey of Adult Oral Health, 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Protective behaviours among adults

For the following indicator, comparisons were only possible with 1988 survey data.

Prevalence of brushing teeth at least twice daily with fluoride toothpaste

What were the survey questions?

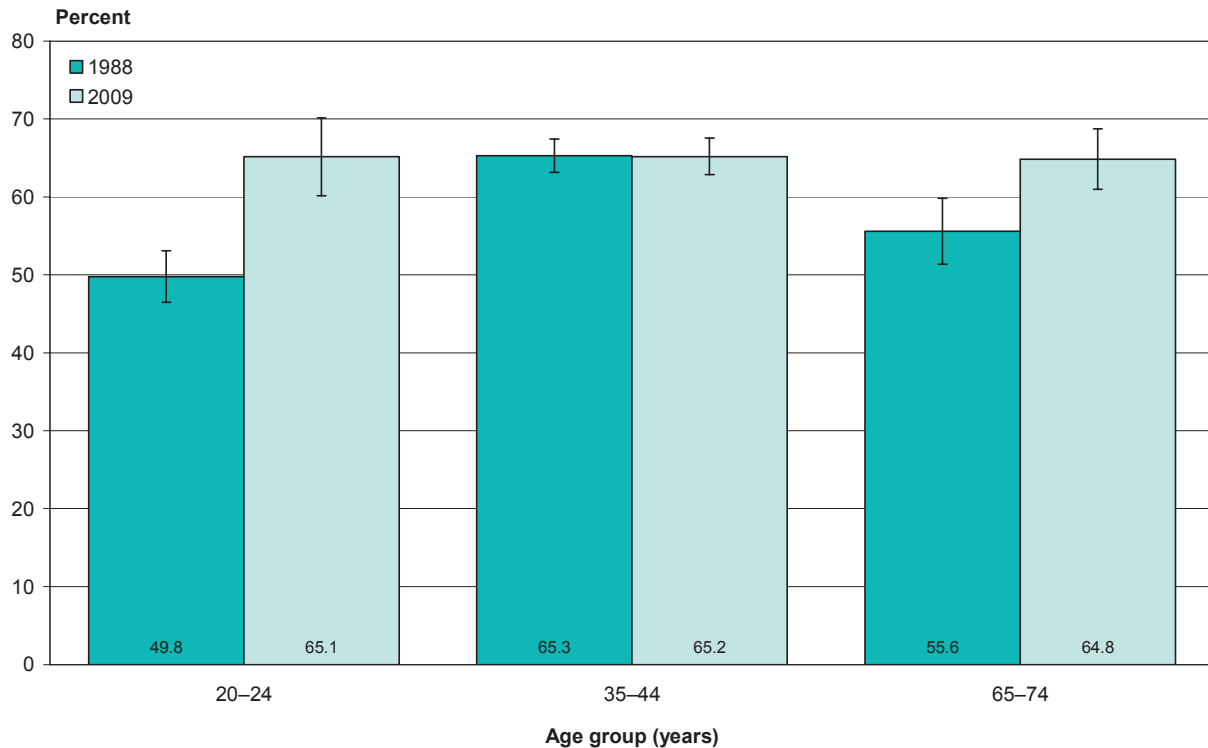
In the 1988 SOHO, dentate adults were asked, *How often do you usually brush your teeth? (No brushing; < 1/day; 1/day; > 1/day)*. They were also asked: *Do you use toothpaste with fluoride? (Yes, no)*.

In the 2009 NZOHS, dentate adults aged 15 years and over were asked, *How often do you brush your teeth? Never; less than once a week; more than twice a week but not once a day; once a day; twice a day; or more than twice a day*. They were also asked, *Do you use toothpaste when you clean your teeth? (Always; often; sometimes; occasionally; never)* and *Which toothpaste do you usually use: (1000 ppm fluoride (adult strength) fluoride toothpaste; 400–500 ppm (children's low fluoride) toothpaste; non-fluoridated toothpaste)*. This indicator refers to the use of 1000 ppm fluoride toothpaste.

There was a statistically significant increase from 1988 to 2009 in the prevalence of brushing teeth at least twice daily with fluoride toothpaste, among dentate adults aged 20–24, 35–44 and 65–74 years, after standardising for age (SRR: 1.09, 1.00–1.18) (p -value < 0.05).

Figure 54 shows that the prevalence of brushing teeth at least twice daily with fluoride toothpaste increased from 1988 to 2009 in the 20–24 years and 65–74 years age groups. There was no significant change for people aged 35–44 years.

Figure 54: Prevalence of brushing teeth at least twice daily with fluoride toothpaste, among dentate adults in 1988 and 2009, by age group (unadjusted prevalence)



Sources: 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Use of oral health services

For the following indicators, comparisons were only possible with 1988 survey data.

Prevalence of having visited a dental professional in the last 12 months

What were the survey questions?

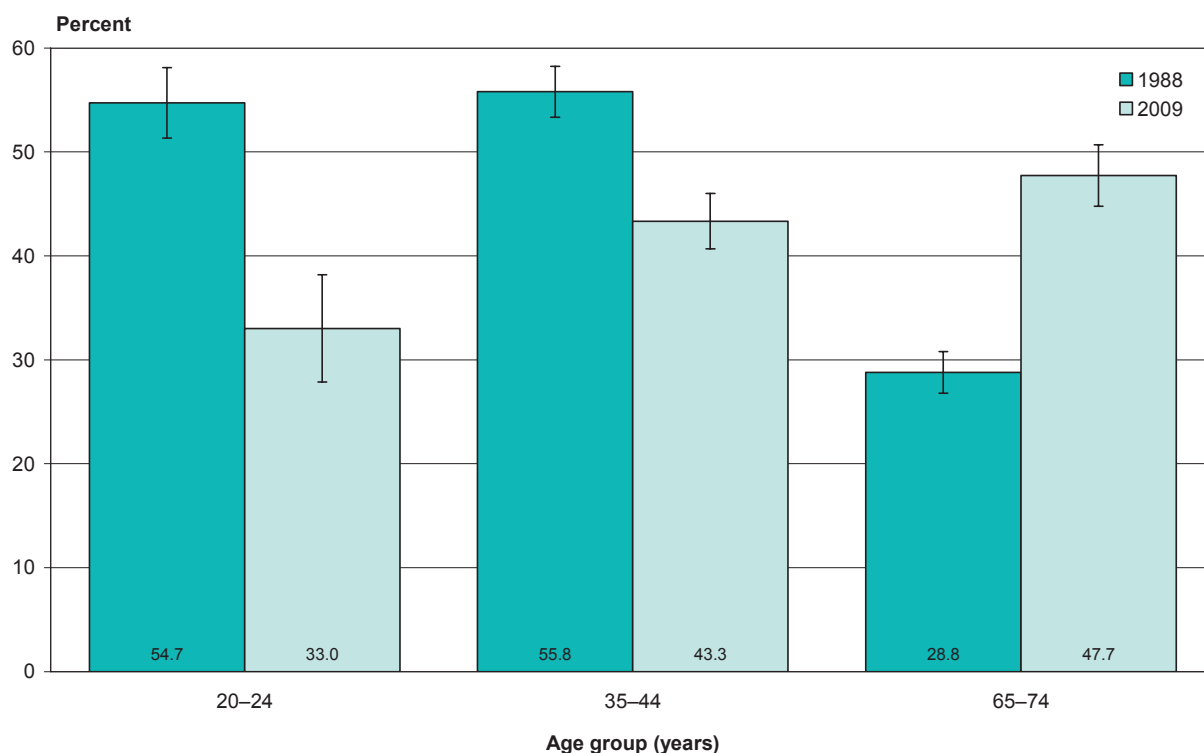
In the 1988 SOHO, adult participants were asked, *How long ago did you receive dental care? (In previous year; > 1 year; Never received dental care).*

In the 2009 NZOHS, adult participants were asked, *Have you been to a dental professional in the last 12 months? (Yes; no).*

In 2009 the prevalence of having seen a dental professional in the last 12 months was significantly lower for all adults aged 20–24, 35–44 and 65–74 years compared with adults of the same ages in 1988 (SRR: 0.87, 0.78–0.97), after standardising for age.

Figure 55 shows that there was a significant decrease in the prevalences of having visited a dental professional in the last 12 months in the 20–24 and 35–44 years age groups since 1988. However, there was a substantial increase in the prevalence among 65–74-year-olds. This could be due to increasing numbers of 65–74-year-olds being dentate over time, and therefore seeking more regular dental visits.

Figure 55: Prevalence of having visited a dental professional in the last 12 months, among adults in 1988 and 2009, by age group (unadjusted prevalence)



Sources: 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Prevalence of having a dental professional they usually see for dental care

What were the survey questions?

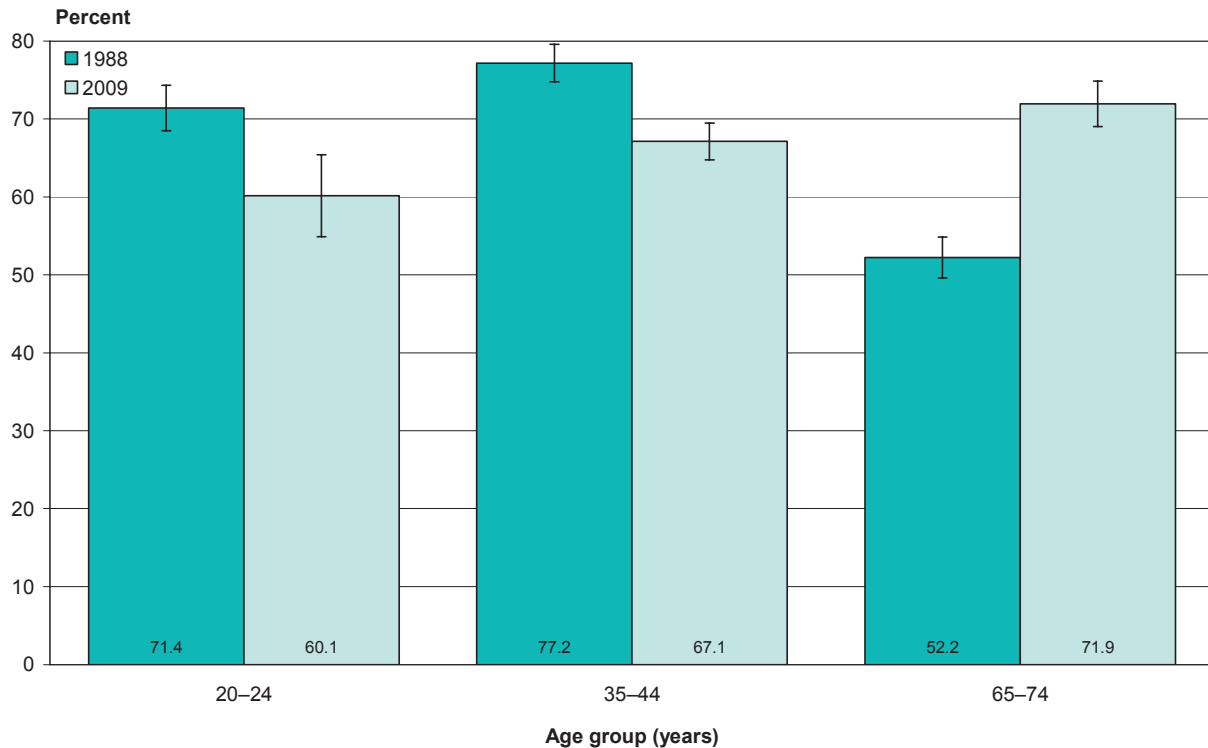
In the 1988 SOHO, adult respondents were asked, *If you needed dental care, do you know a dentist you would go to? (Have usual source of care; know source; no usual source).*

In the 2009 NZOHS, adult respondents were asked, *Is there a particular dental professional who you usually go to if you need dental care or dental advice? (Yes; no).*

In people in the combined age groups 20–24, 35–44 and 65–74 years, there was no significant change from 1988 to 2009 in the prevalence of having a dental professional they usually see for dental care (SRR: 0.96, 0.90–1.03), after standardising for age.

Figure 56 shows differing patterns, by age group, in the change of prevalence of having a dental professional they usually see for care. In the younger age groups of 20–24 and 35–44 years, adults in 2009 were significantly less likely to have a dental professional they usually see compared with adults in 1988. By contrast, in older adults aged 65–74 years, the prevalence had significantly increased over the time period.

Figure 56: Prevalence of having a dental professional they usually see for dental care, among adults in 1988 and 2009, by age group (unadjusted prevalence)



Sources: 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Prevalence of last visit to a dental professional being for a check-up

What were the survey questions?

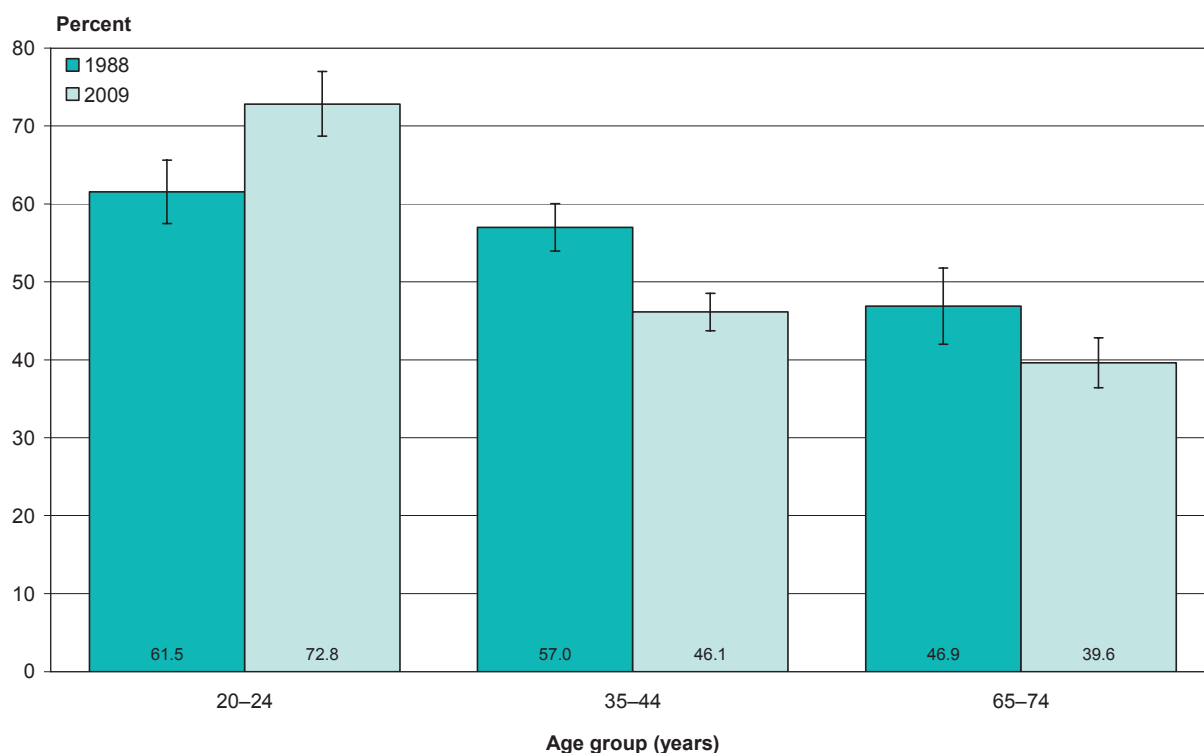
In the 1988 SOHO, adult respondents were asked, *What was the reason you made your most recent visit for dental care? (Asymptomatic; symptomatic).*

In the 2009 NZOHS, adult respondents were asked, *What was the main reason that you last visited a dental professional? (Went in on own for check-up, examination or cleaning; was called in by the dental professional for check-up, examination or cleaning; went for treatment of a condition that dental professional discovered at earlier check-up or examination; something was wrong, bothering or hurting; to get treatment for teeth damaged in an accident.)* The first three options were assumed to be for a check-up.

There was no significant change from 1988 to 2009 in the prevalence of the last dental visit being for a check-up, among adults aged 20–24, 35–44 and 65–74 years, after standardising for age (SRR: 0.91, 0.81–1.00) (p-value > 0.05).

However, there were differing patterns by age groups (Figure 57). Although there was a significant increase in the 20–24 years age group from 1988 to 2009, there were significant decreases among 35–44-year-olds and 65–74-year-olds in the prevalence of the last dental visit being for a check-up rather than for a dental problem.

Figure 57: Prevalence of the last dental visit being for a check-up, among adults in 1988 and 2009, by age group (unadjusted prevalence)



Sources: 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Oral health indicators for adolescents aged 12–13 years

Figure 58 presents the changes from 1988 to 2009 in key oral health indicators for adolescents aged 12–13 years.

Overall, there was a significant improvement in oral health status for adolescents aged 12–13 years, for the following indicators:

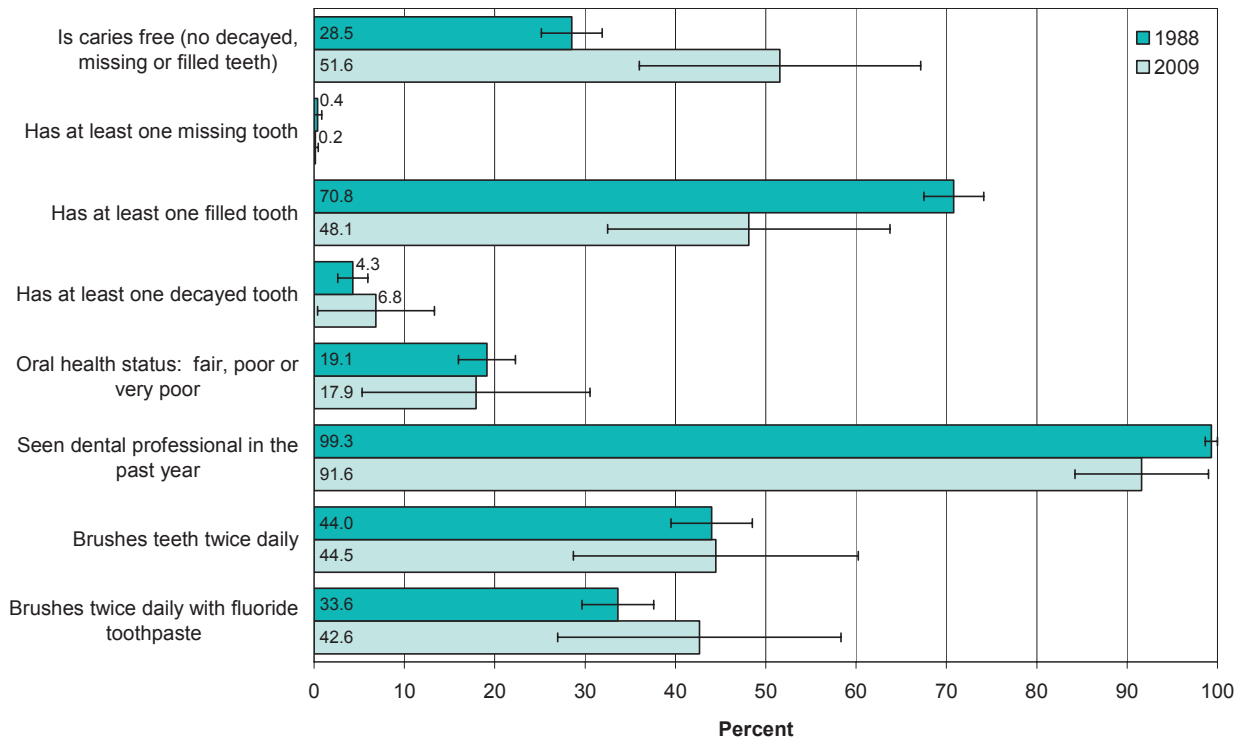
- being caries-free (an increase from 28.5% in 1988 to 51.6% in 2009)
- having at least one filled tooth (a decrease from 70.8% in 1988 to 48.1% in 2009).

However, for adolescents aged 12–13 years, the prevalence of having seen a dental professional at least once in the past year significantly decreased from 1988 (99.3%) to 2009 (91.6%) (p-value < 0.05).

There were no significant changes in the following indicators:

- having at least one missing tooth
- having at least one decayed tooth
- having fair, poor or very poor self-rated oral health status
- brushing teeth twice daily (in general, and with fluoride toothpaste).

Figure 58: Oral health indicators, among adolescents aged 12–13 years, in 1988 and 2009 (unadjusted prevalence)



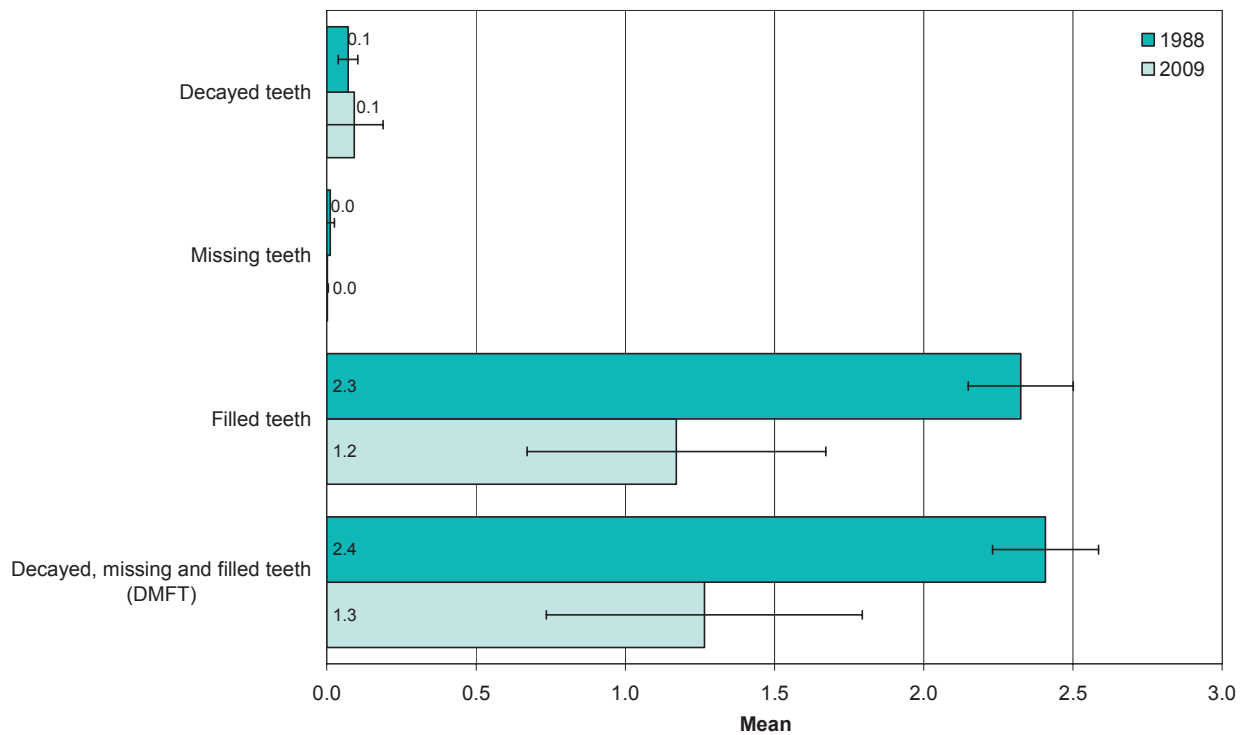
Sources: 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Figure 59 presents the changes from 1988 to 2009 in the mean numbers of decayed, missing or filled teeth for adolescents aged 12–13 years.

Overall, the mean number of decayed, missing or filled teeth (DMFT) decreased significantly among adolescents aged 12–13 years, from 2.4 in 1988 to 1.3 in 2009. Furthermore, there was a significant decrease in the mean number of filled teeth over that time period (from 2.3 in 1988 to 1.2 in 2009).

There were no significant changes among adolescents aged 12–13 years in the mean number of missing teeth or decayed teeth from 1988 to 2009, partly due to the low mean numbers making it difficult to detect changes.

Figure 59: Mean number of decayed teeth, missing teeth, filled teeth, and DMFT (for permanent teeth), among adolescents aged 12–13 years, in 1988 and 2009 (unadjusted mean)



Sources: 1988 WHO Study of Oral Health Outcomes (NZ), 2009 New Zealand Oral Health Survey

Chapter 10: Comparisons with Australia

Key findings

The following findings compare the New Zealand and Australian populations aged 15 years and over, adjusting for age.

- New Zealand adults were significantly more likely than Australian adults to have completely lost all their teeth.

Among dentate adults, New Zealanders were significantly more likely than Australians to:

- have one or more teeth with untreated coronal decay
- have at least one decayed, missing or filled tooth (a DMFT score of 1+)
- have periodontal pocketing of 4 mm or more at one or more sites
- have loss of attachment of 4 mm or more at one or more sites.

Compared with Australian dentate adults, New Zealand dentate adults had:

- a higher mean number of decayed coronal surfaces per person
- a lower mean number of filled root surfaces per person.

New Zealand adults were significantly less likely than Australian adults to have visited a dental professional in the last year.

Introduction

New Zealand now has a unique opportunity to directly compare the oral health of New Zealand and Australian adults on a wide range of indicators due to the similarities between their oral health surveys. Comparisons with oral health surveys from other countries were not included due to differences in methodologies and/or the presentation of results.

In Australia, most adults access dental care through the private sector, with support from private health insurance. The public dental service for adults is organised around general dental practitioners (GDPs) and responds to acute need, providing emergency and limited general dental services for concession card-holders (usually requiring co-payment). Adults on low incomes are eligible for the public dental services, generally if they hold a government concession card (Slade et al 2007). Services are organised at a state or territory level, so there are variations between services across regions (Downer et al 2006; NACOH 2004). Some outreach provision to rural areas occurs. Demand for public services far exceeds supply; waiting lists for publicly-funded services have increased, and emergency dental care has comprised an increasing proportion of the care provided by dental services (NACOH 2004).

Australia has a school dental service, for which salaried dentists and dental therapists provide prevention and routine care to enrolled children. While this is mostly free, some states have introduced co-payments (Birch and Anderson 2005). However, a high proportion of children do not receive care through the school dental service: only about half of dental visits by 5–11-year-olds are at the school dental service, and only one-fifth of 12–17-year-old dental visits are at the school dental service (Birch and Anderson 2005). Increasing staff shortages and an ageing workforce have resulted in services targeting children at higher risk of dental disease.

In 2007, approximately 76% of the Australian population had access to fluoridated water supplies. Water fluoridation varied by region, with access ranging from less than 5% of the population in Queensland and 70% in Northern Territory, to 100% in the Australian Capital Territory (NHMRC 2007). In 2008, Brisbane also started fluoridating water, resulting in 54% of the Queensland population now having access to fluoridated water (Department of Health 2009). The overall proportion of the Australian population with access to fluoridated water is now likely to be higher than 76%.

The Australian National Survey of Adult Oral Health 2004–06

The National Survey of Adult Oral Health 2004–06 (NSAOH) was carried out in Australia to measure the oral health status of adults (Slade et al 2007). The survey was carried out from July 2004 to September 2006.

The survey used a three-stage, stratified clustered sample design, with a sample frame of all telephone numbers in Australia. Stratification was based on metropolitan status. The first stage of sample selection selected postcodes, the second stage selected households, and the third stage selected one respondent from each sampled household. People aged 15 years and over living in private dwellings were eligible to be included in the survey.

Computer-assisted telephone interviews were used to collect information about oral health status, behaviours and perceptions, and respondents with at least one natural tooth were invited to have a dental examination to assess clinical oral health status. The survey included 14,123 interviews and 5505 dental examinations with adults aged 15 years and over. Respondents identifying as Aboriginal comprised 1.3% (1.2–1.8) of the sample, compared with 1.5% in the 2001 Census, while respondents identifying as Torres Strait Islanders made up 0.1% (0.1–0.2) of the sample, compared with 0.0% in the 2001 Census. All survey data were weighted to ensure that survey estimates were representative of the total population.

Comparing New Zealand and Australian oral health surveys

Comparisons between New Zealand and Australian dental examinations are possible due to the comparability of the 2009 NZOHS and the 2004–06 NSAOH.

- The 2009 NZOHS clinical dental examination closely followed the protocol for the Australian oral health survey, including having the same lead examiner to train the dental teams for both surveys.

- Identical criteria were used in the dental examinations for the 2009 NZOHS and the NSAOH, for almost all indicators. However, it should be noted that there was a difference in the periodontal examination between the Australian and New Zealand surveys. The Australian protocol used mesial, mid-buccal and distal sites (all buccal sites), whereas New Zealand used mesial, mid-buccal and disto-lingual sites. The difference in sites may explain any differences in periodontal measures between the two countries.

This section compares New Zealand and Australian adults on 14 oral health indicators, including a self-reported indicator. Overall age-standardised ratios of rates (standardised rate ratios, or SRRs) and means (standardised ratios of means, or SRMs) are presented to show a direct comparison between the two countries. Unadjusted rates for age groups are also presented for both countries. All results refer to the adult population aged 15 years and over.

There are several important differences between the 2009 NZOHS and the NSAOH which mean the results presented below should be interpreted with caution.

- The personal interviews differed in mode between the two surveys. The NSAOH was based on telephone interviews and follow-up dental examinations, whereas the 2009 NZOHS was based on follow-up face-to-face interviews from the 2006/07 NZHS and follow-up dental examinations. As a result, there may have been a higher level of bias in the sample in the NSAOH if people with worse oral health did not have a telephone (eg, due to lower socioeconomic status) and therefore were not eligible to participate in the survey.
- The questions about dental visits in the past year were not identical, so these results should be interpreted with caution.

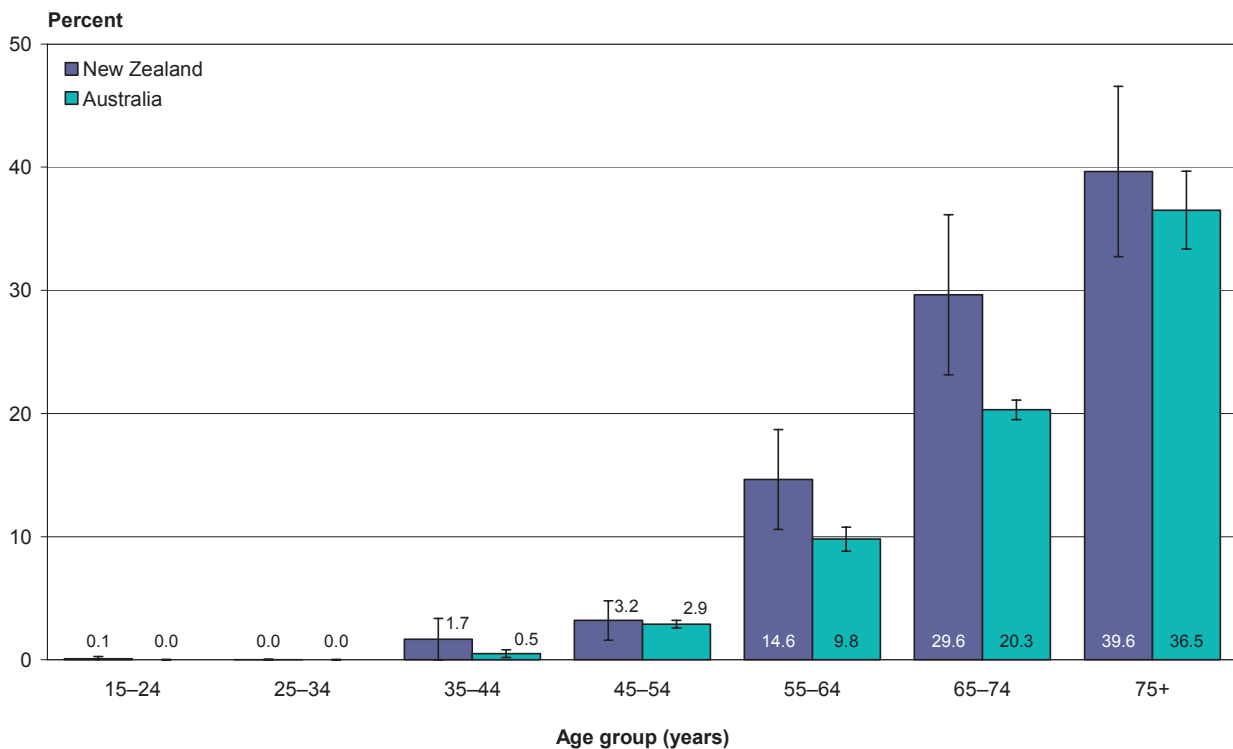
Retention of natural teeth

Prevalence of complete tooth loss (edentulism)

After standardising for age, New Zealand adults were significantly more likely than Australian adults to have lost all of their natural teeth (SRR: 1.35, 1.14–1.57).

The pattern for complete tooth loss across age groups was similar for New Zealand and Australian adults (Figure 60). Edentulism was virtually non-existent in New Zealand and Australian adults aged 15–44 years of age. However, in adults aged 55–74 years, New Zealand adults were significantly more likely than Australian adults to have complete tooth loss. This was particularly noticeable in the 65–74 years age group, where 29.6% of New Zealand adults were edentulous compared with 20.3% of Australians. In adults aged 75 years and over, the prevalence of complete tooth loss was similar between countries.

Figure 60: Prevalence of complete tooth loss, among New Zealand and Australian adults aged 15 years and over, by age group (unadjusted)



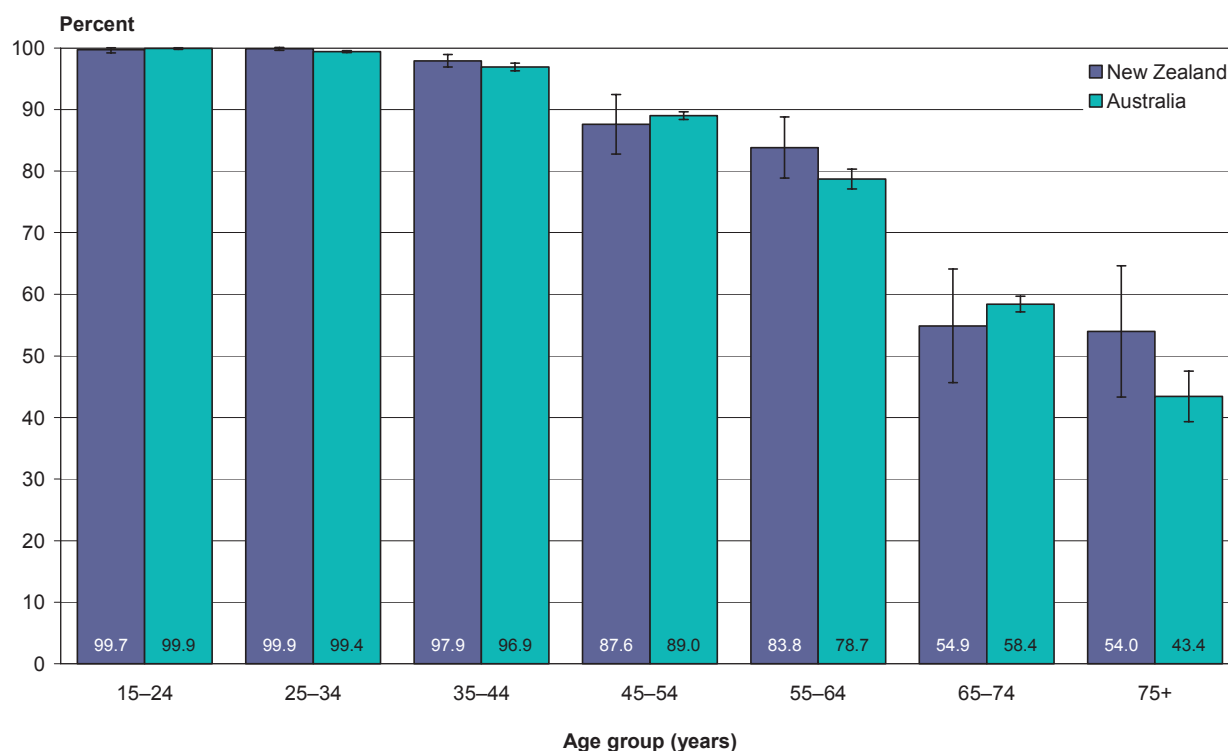
Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

Having a functional dentition (21 or more natural teeth)

After standardising for age, there was no significant difference between New Zealand and Australian dentate adults in the prevalence of having a functional dentition (SRR: 1.01, 0.99–1.03).

Figure 61 shows that, for both New Zealand and Australia, nearly all dentate adults aged 15–44 years had a functional dentition, with older adults having a lower prevalence. New Zealand adults had a significantly higher prevalence of having a functional dentition than Australian adults in the 55–64 years age group (p -value < 0.05).

Figure 61: Prevalence of having a functional dentition, among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004-06

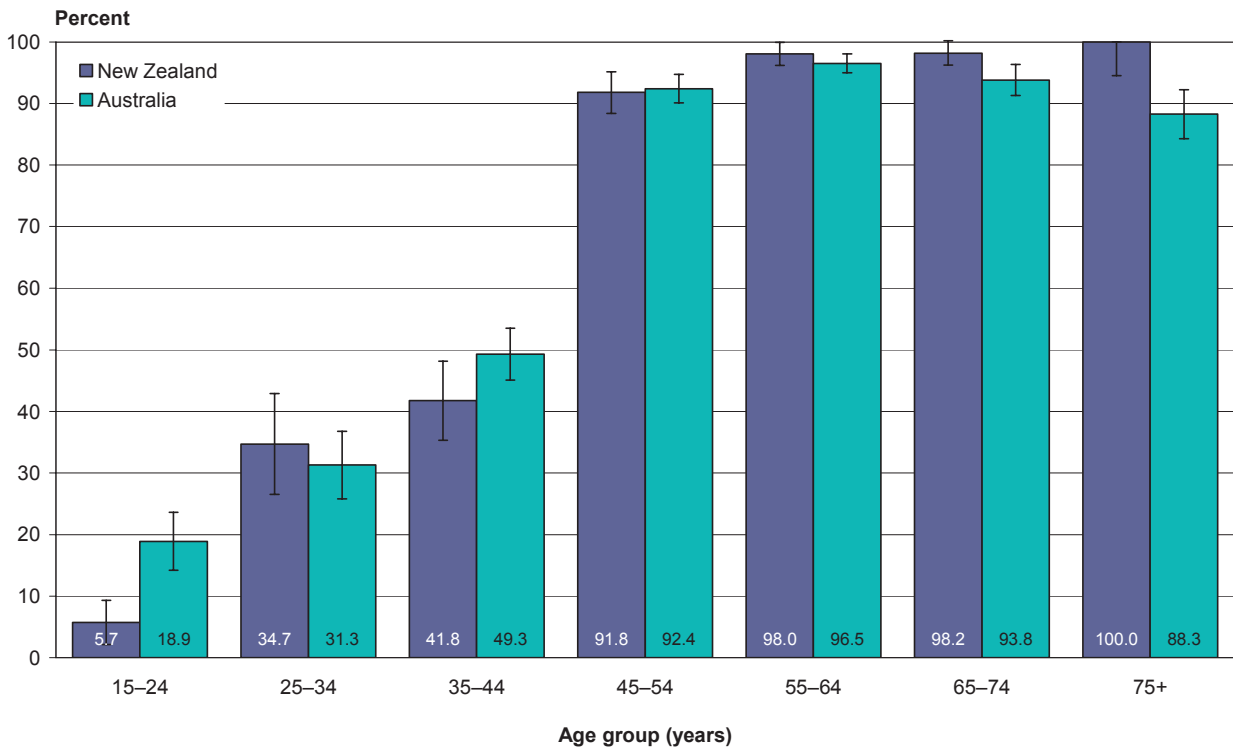
Having one or more teeth missing due to pathology

There was no significant difference between New Zealand and Australian dentate adults in the prevalence of having one or more teeth missing due to pathology (ie, decay or periodontal disease) (SRR: 0.95, 0.89-1.01), after standardising for age.

Figure 62 shows the prevalence of having at least one tooth missing due to pathology, by age group, for New Zealand and Australian dentate adults. Similar patterns were seen across age groups in both countries.

New Zealand adults aged 15-24 years had about one-third of the prevalence of one or more teeth missing due to pathology as Australians of the same age. In older dentate adults aged 75 years and over, all New Zealanders had at least one tooth missing due to pathology, compared with nine in ten Australians in this age group.

Figure 62: Prevalence of one or more teeth missing due to pathology, among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted prevalence)



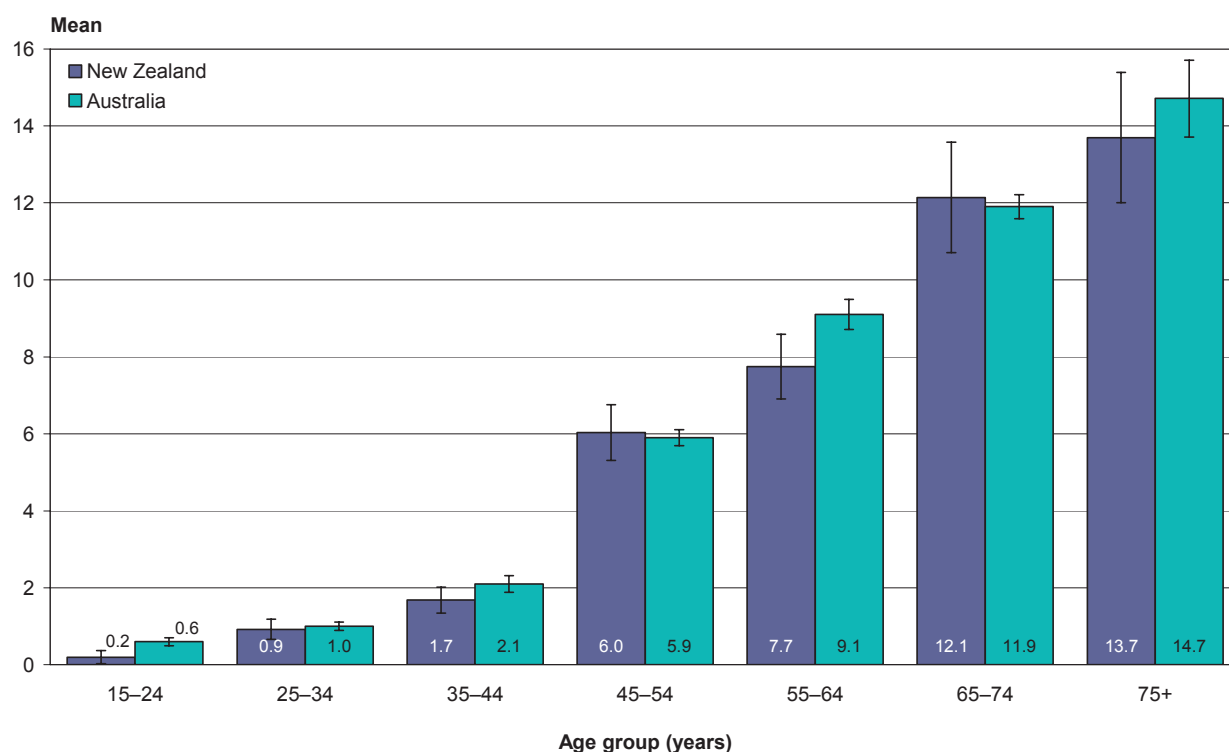
Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

Mean number of teeth missing due to pathology

Among New Zealand dentate adults, there was no significant difference in the mean number of teeth missing due to pathology (ie, decay or periodontal disease) compared with Australian adults (SRR: 0.92, 0.83–1.01), after standardising for age.

Figure 63 shows that, overall, the mean number of teeth missing due to pathology was higher in older age groups in both countries. New Zealand adults aged 15–24, 35–44 and 55–64 years had lost significantly fewer teeth due to pathology than Australian adults of the same age (p -values < 0.05).

Figure 63: Mean number of teeth per person missing due to pathology, among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted mean)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

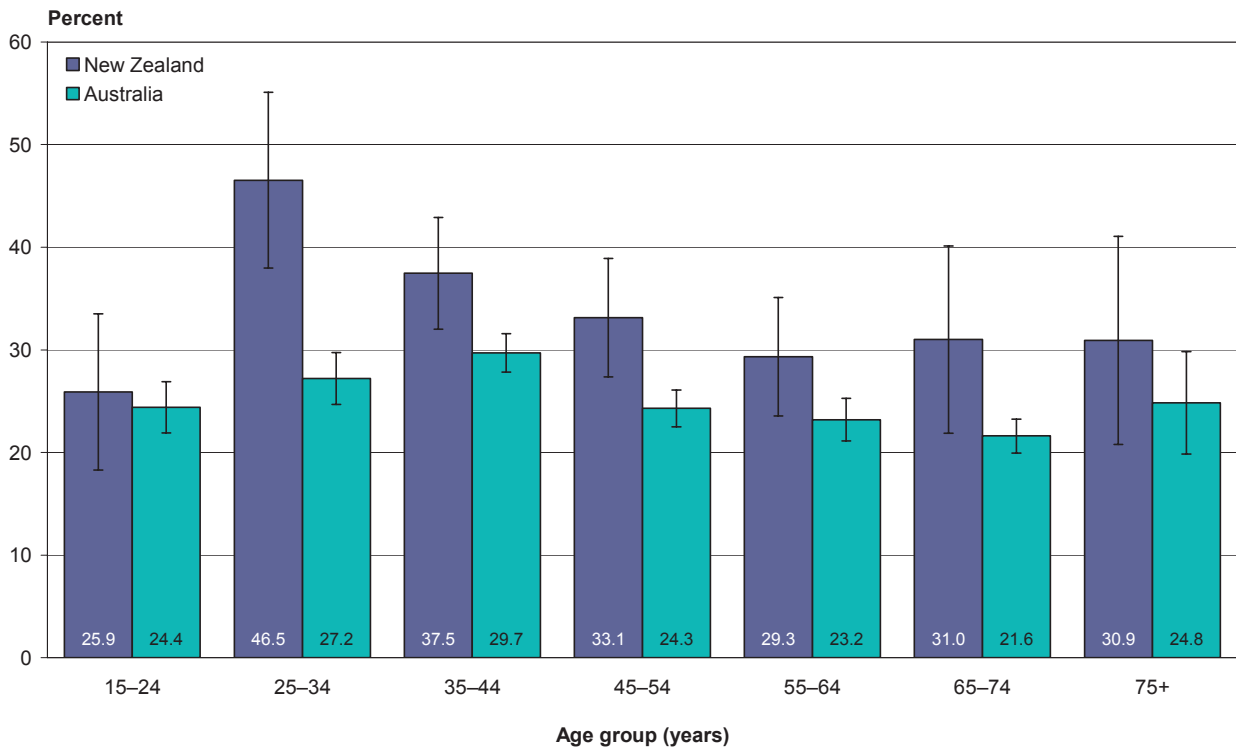
Condition of natural teeth

Having one or more teeth with untreated coronal decay

After standardising for age, New Zealand dentate adults were significantly more likely than Australian adults to have untreated coronal decay on one or more teeth (SRR: 1.34, 1.20–1.49).

In all age groups from 25–74 years, New Zealand dentate adults were significantly more likely to have at least one tooth with untreated decay than Australian dentate adults (p -values < 0.05) (Figure 64). New Zealand dentate adults aged 25–34 years had the highest prevalence of having one or more decayed teeth of all age groups in both countries. Nearly half (46.5%) of New Zealand adults in this age group were affected, compared with one in four Australian adults (27.2%) in this age group.

Figure 64: Prevalence of having one or more teeth with untreated coronal decay, among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

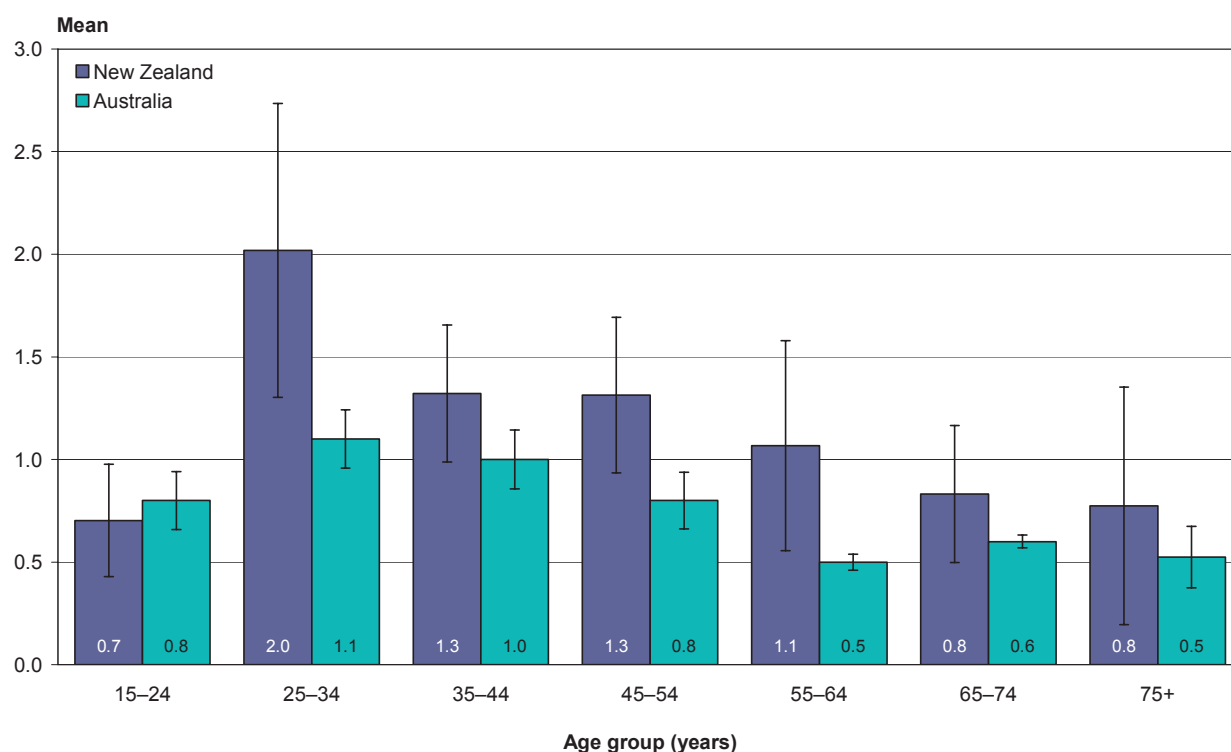
Mean number of decayed coronal surfaces

This section presents the mean number of tooth surfaces per person that had untreated coronal decay, among dentate adults. Note that this is based on surface-level data rather than tooth-level data, and therefore is not directly comparable with previous results in this report.

After standardising for age, New Zealand dentate adults had a significantly higher mean number of decayed coronal surfaces per person than Australian dentate adults (SRM: 1.48, 1.21–1.74).

Figure 65 shows that New Zealand adults had significantly more decayed coronal surfaces on average than Australian adults in the 25–34, 45–54 and 55–64 years age groups. New Zealand adults aged 25–34 years had the highest mean number of decayed surfaces of all population age groups, and nearly twice the mean number of decayed surfaces for Australian adults in that age group.

Figure 65: Mean number of decayed coronal surfaces per person, among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted mean)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

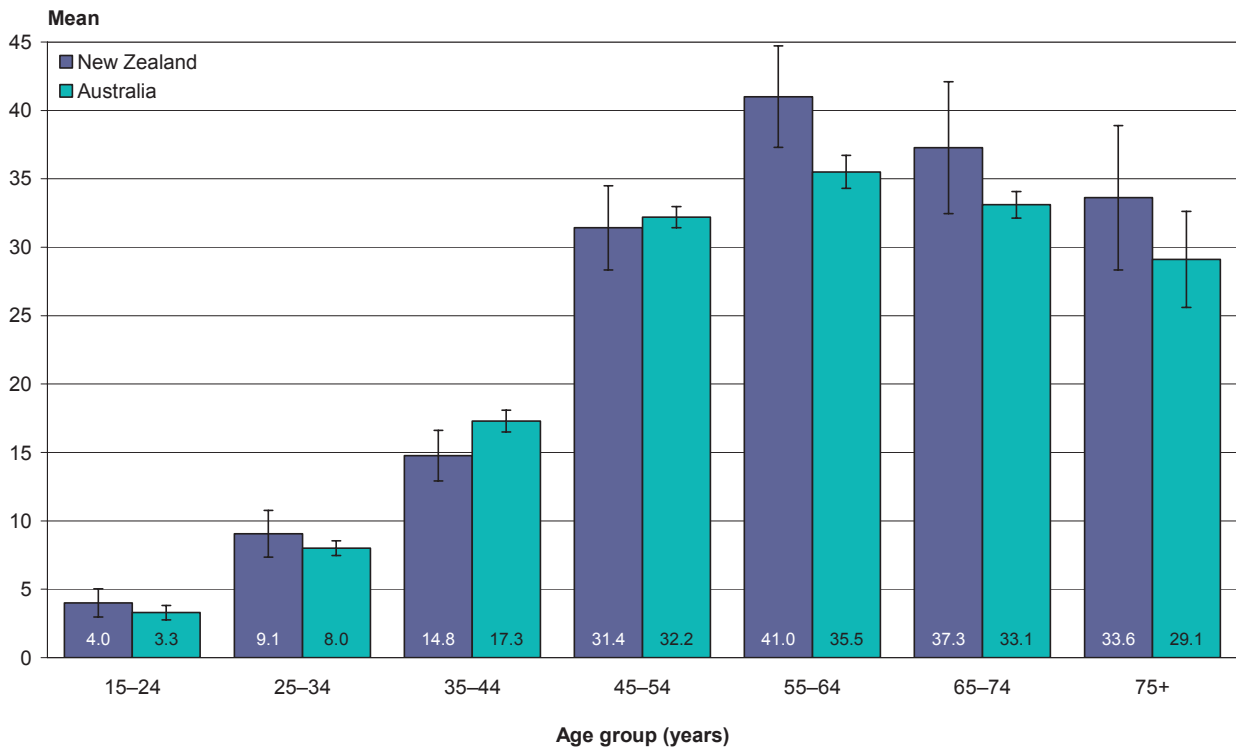
Mean number of filled coronal surfaces

This section compares the mean number of coronal surfaces in which fillings have been placed to treat decay, among New Zealand and Australian dentate adults. Note that this is based on surface-level data rather than tooth-level data, and therefore is not directly comparable with previous results in this report.

After standardising for age, there was no significant difference between New Zealand and Australian dentate adults in the mean number of coronal surfaces in which a filling had been placed to treat decay (SRM: 1.05, 0.97–1.13).

Figure 66 shows that, in both countries, the mean number of filled coronal surfaces was highest in adults aged 55–64 years. Among dentate adults aged 55–64 years, New Zealand adults had significantly more filled surfaces than Australian adults, while in the 35–44 years age group New Zealanders had significantly fewer (p -values < 0.05).

Figure 66: Mean number of filled coronal surfaces per person, among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted mean)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

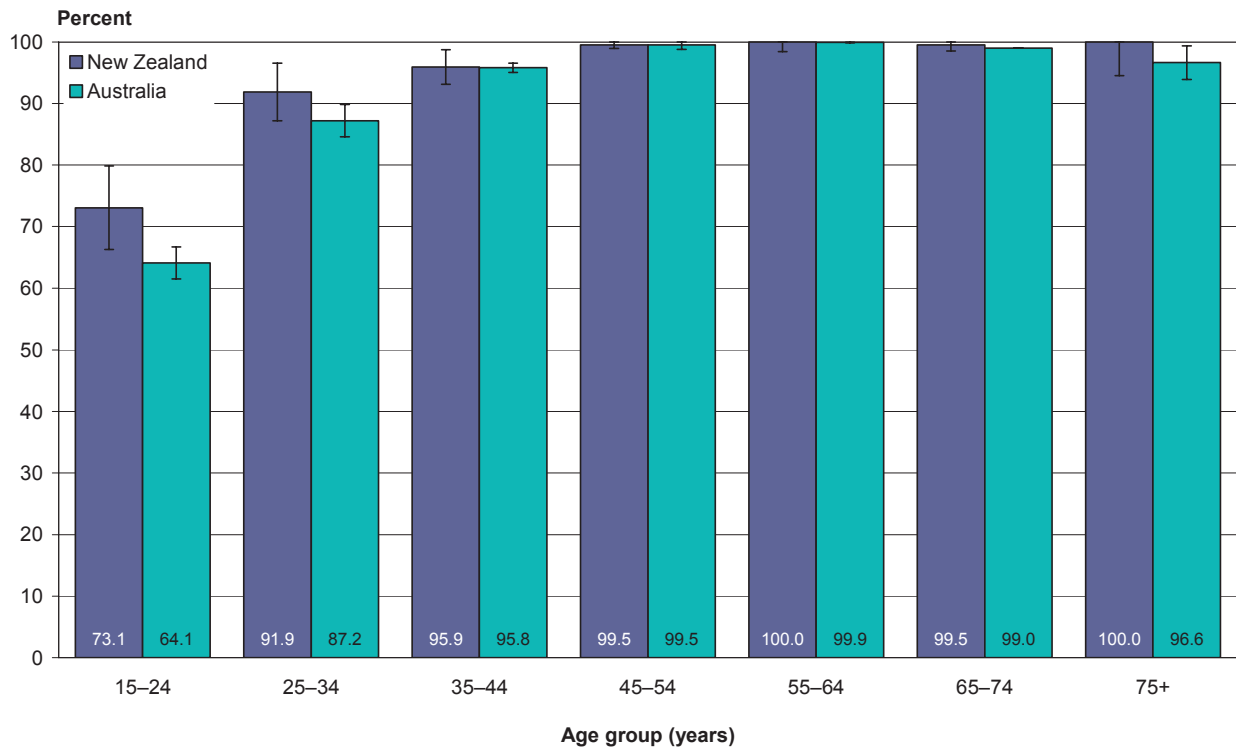
Having one or more decayed, missing or filled teeth (DMFT score of 1 or more)

This section compares the prevalence of having one or more decayed, missing due to pathology (dental decay or periodontal disease) or filled teeth (ie, a DMFT score of 1 or more), among New Zealand and Australian dentate adults.

After standardising for age, New Zealand dentate adults were significantly more likely to have at least one decayed, missing or filled tooth than Australian dentate adults (SRR: 1.04, 1.01–1.07).

Figure 67 shows that nearly all Australian and New Zealand adults aged 35 years and over had at least one tooth that was decayed, missing due to pathology or filled. In adults aged 15–24 years, three in four New Zealand adults (73.1%) and three in five Australian adults (64.1%) were affected.

Figure 67: Prevalence of having at least one decayed, missing or filled tooth (DMFT score 1+), among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted prevalence)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

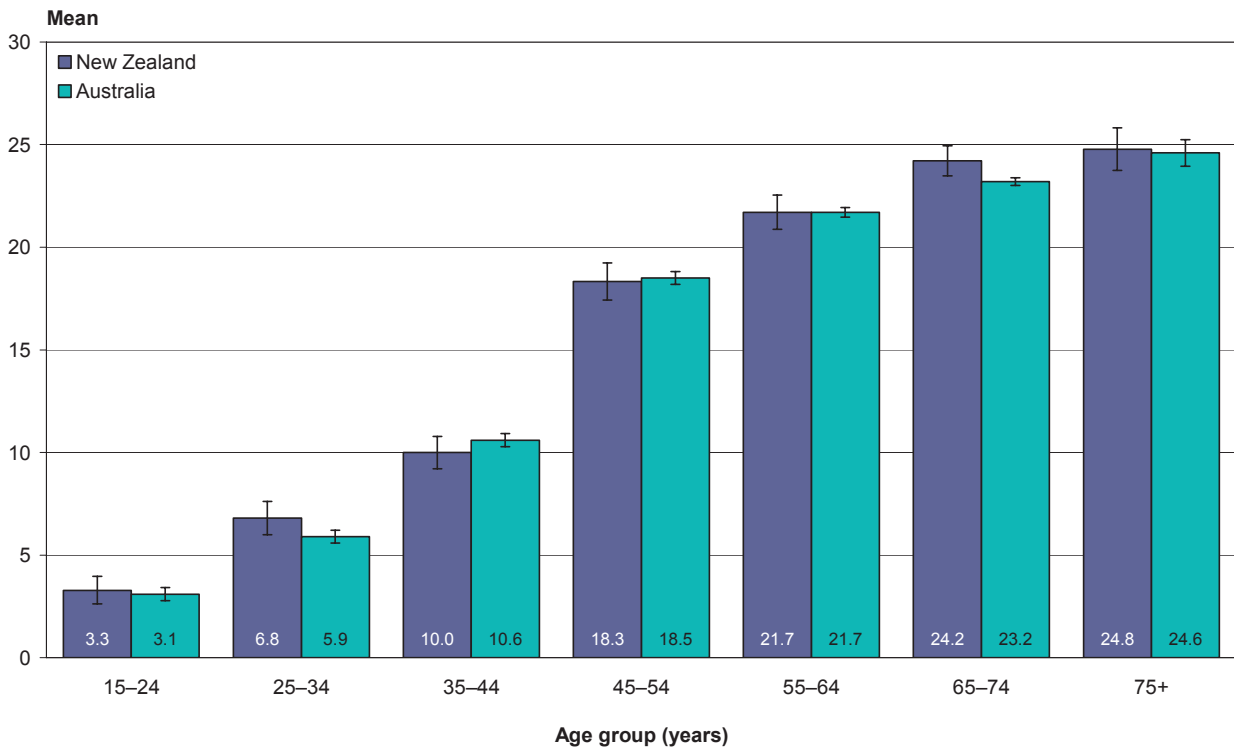
Mean number of decayed, missing or filled teeth (DMFT)

The mean DMFT score records the lifetime history of dental decay experience. It is the combined mean number of decayed, missing or filled teeth per person, and is cumulative. In this section the mean DMFT is based on coronal data.

After standardising for age, there was no significant difference between New Zealand and Australian dentate adults in mean DMFT score (SRM: 1.01, 0.96–1.07).

Figure 68 shows that, overall, the mean DMFT was highest in the older age groups in both New Zealand and Australia. For nearly all age groups, the mean DMFT scores among adults from both countries were similar. However, among dentate adults aged 25–34 years and 65–74 years, the DMFT score was higher for New Zealand adults than for Australian adults, by one whole tooth.

Figure 68: Mean number of decayed, missing or filled teeth (mean DMFT score) per person, among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted mean)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004-06

Mean number of decayed root surfaces

This section compares the mean number of decayed root surfaces among dentate New Zealand and Australian adults.

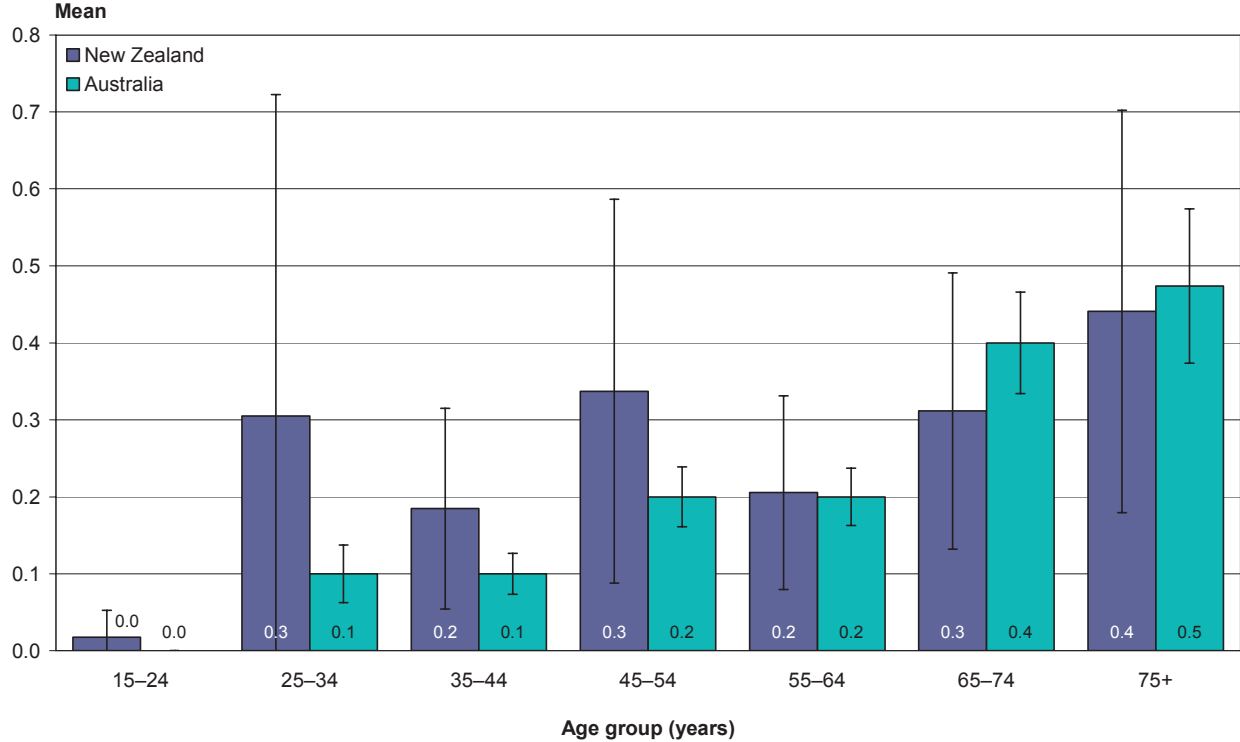
How was this measured?

In both surveys, the roots of teeth were subdivided into four surfaces and each was assessed for the presence of decay, defined as a lesion that was soft to exploration using a periodontal probe. The assessment was made for up to 128 root surfaces per person.

After standardising for age, there was no significant difference in the mean number of decayed root surfaces between New Zealand and Australian dentate adults (SRM: 1.55, 0.67-2.43).

There were no statistically significant differences by age group in the mean number of decayed root surfaces between New Zealand and Australian dentate adults, partly due to the large confidence intervals on the New Zealand estimates (Figure 69).

Figure 69: Mean number of decayed root surfaces per person, among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted mean)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

Mean number of filled root surfaces

This section compares the mean number of root surfaces filled for any reason, per person, among dentate New Zealand and Australian adults.

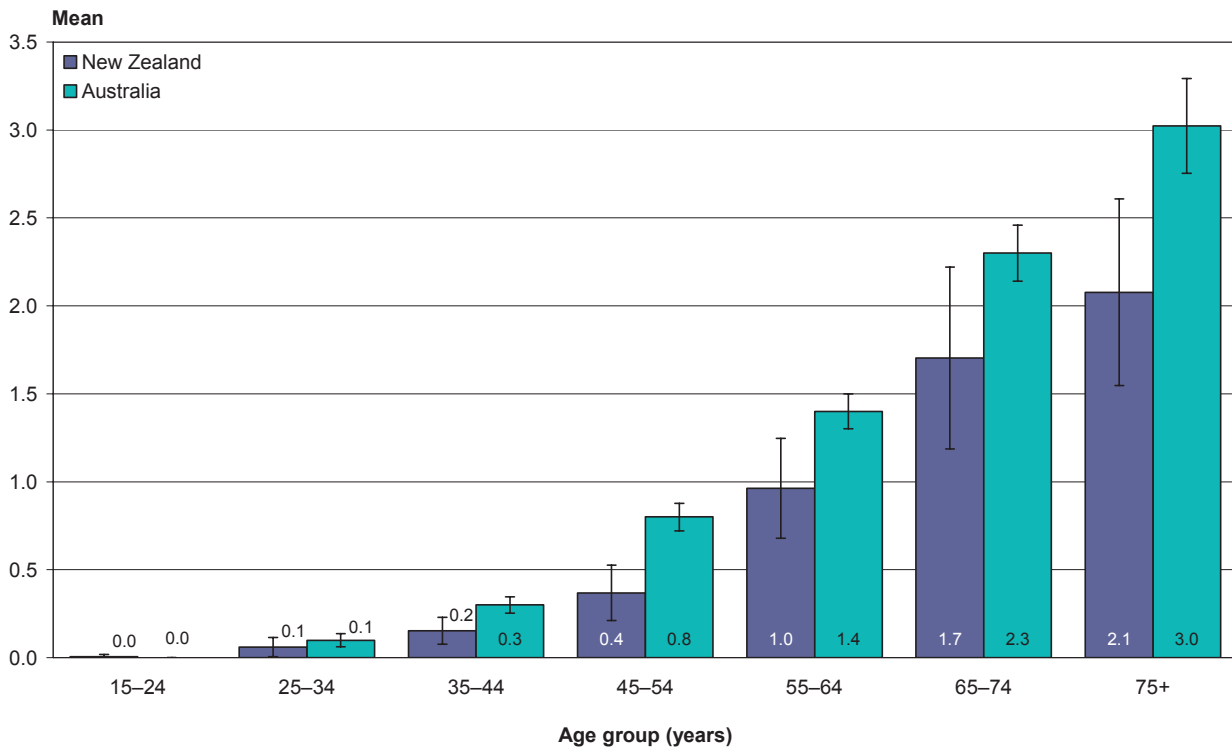
How was this measured?

In both surveys the roots of teeth were subdivided into four surfaces and each was assessed for the presence of a filling. No distinction was made between fillings placed to treat decay and fillings placed to treat wear or for cosmetic reasons. The assessment was made for up to 128 surfaces per person.

After standardising for age, the mean number of filled root surfaces per person was significantly lower among New Zealand dentate adults (SRM: 0.64, 0.51–0.78) than among Australian dentate adults.

Figure 70 shows that, for both New Zealand and Australian dentate adults, the mean number of filled root surfaces per person was higher in the older age groups. Among dentate adults in age groups aged 35 years and over, the mean number of filled root surfaces per person was significantly lower for New Zealanders than for Australians.

Figure 70: Mean number of filled root surfaces per person, among New Zealand and Australian dentate adults aged 15 years and over, by age group (unadjusted mean)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

Condition of supporting structures

Prevalence of periodontal pocketing of 4 mm or more at one or more sites

This section compares the prevalence of periodontal pocketing of 4 mm or more at one or more sites, among New Zealand and Australian dentate adults who were periodontally examined.

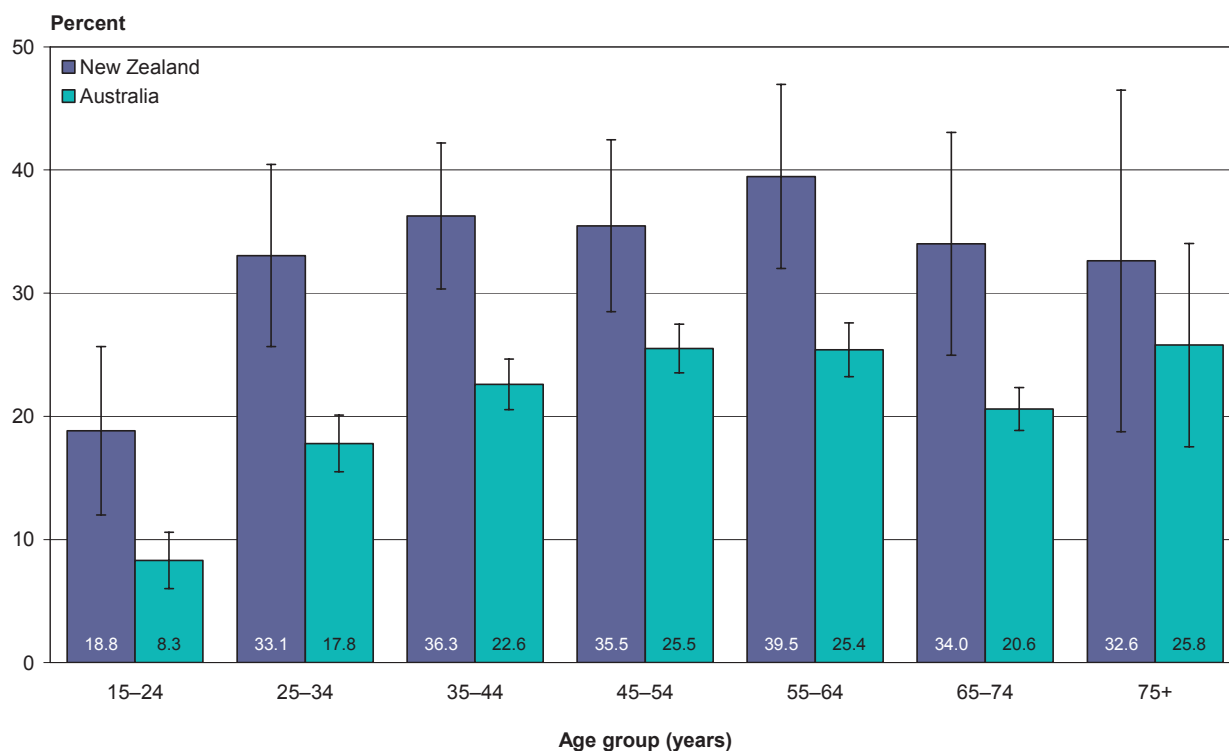
How was this measured?

The New Zealand and Australian surveys used similar methodologies for the periodontal examination. However, the Australian protocol used mesial, mid-buccal and distal sites (all buccal sites), whereas New Zealand used mesial, mid-buccal and disto-lingual sites.

After standardising for age, New Zealand dentate adults were significantly more likely to have periodontal pocketing of 4 mm or more at one or more sites than Australian dentate adults (SRR: 1.65, 1.43–1.87).

Figure 71 shows that, for all age groups aged 15–74 years, New Zealand adults were significantly more likely than Australian adults to have at least one site with periodontal pocketing of 4 mm or more. Furthermore, New Zealand adults aged 15–34 years were about twice as likely as Australian adults of the same age to have at least one site with periodontal pocketing of 4 mm or more.

Figure 71: Prevalence of having one or more sites with periodontal pocketing of 4 mm or more, among New Zealand and Australian periodontally examined dentate adults aged 15 years and over, by age group (unadjusted prevalence)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

Prevalence of loss of attachment of 4 mm or more at one or more sites

This section presents the prevalence of loss of attachment of 4 mm or more at one or more sites among New Zealand and Australian adults. These results refer only to dentate adults who were periodontally examined.

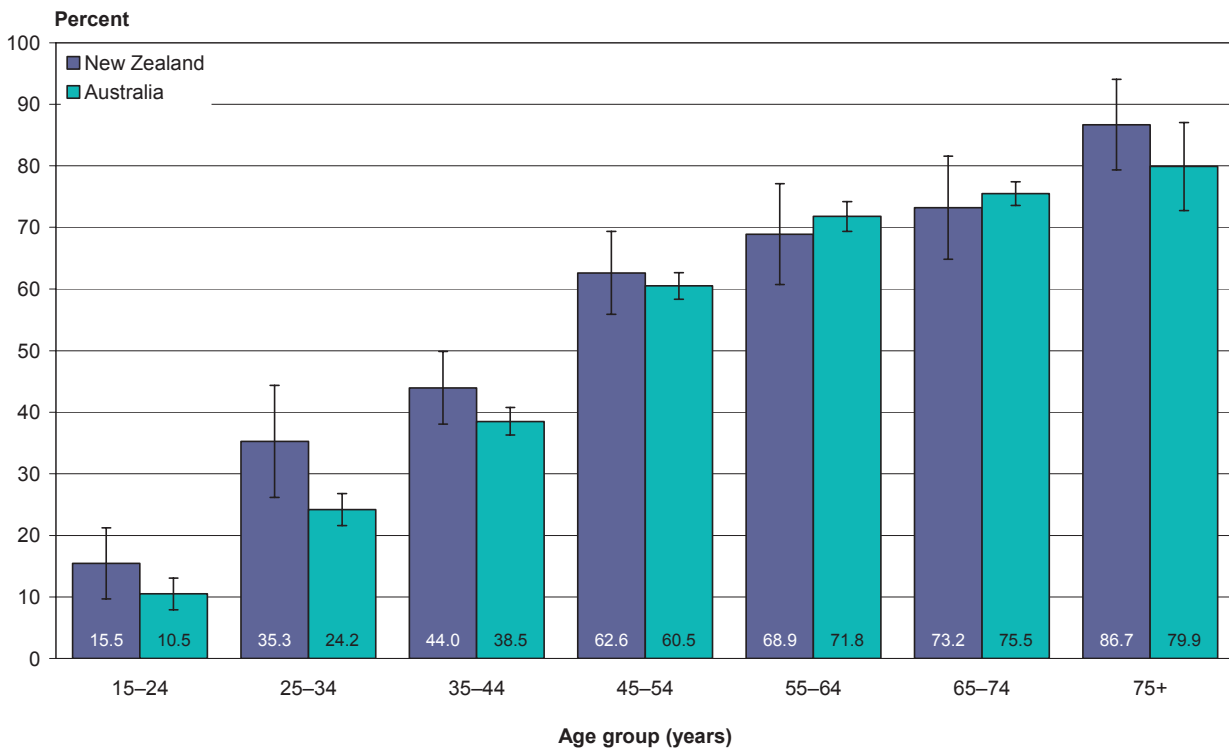
How was this measured?

The New Zealand and Australian surveys used similar methodologies for the periodontal examination. However, the Australian protocol used mesial, mid-buccal and distal sites (all buccal sites), whereas New Zealand used mesial, mid-buccal and disto-lingual sites.

After standardising for age, New Zealand dentate adults were significantly more likely to have loss of attachment of 4 mm or more at one or more sites than Australian dentate adults (SRR: 1.11, 1.01–1.21). For both New Zealand and Australian adults, the prevalence of loss of attachment of 4 mm or more at one or more sites was higher among older age groups (Figure 72).

New Zealanders aged 25–34 years were significantly more likely to have loss of attachment of 4 mm or more at one or more sites than Australians in the same age group. The greatest increase in prevalence of loss of attachment of 4 mm or more was seen between adults aged 15–24 and 25–34 years in both countries, where the prevalence was almost twice as high in the older age group.

Figure 72: Prevalence of having one or more sites with loss of attachment of 4 mm or more, among New Zealand and Australian periodontally examined dentate adults aged 15 years and over, by age group (unadjusted prevalence)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

Use of oral health services

Prevalence of having visited a dental professional in the last 12 months

What were the survey questions?

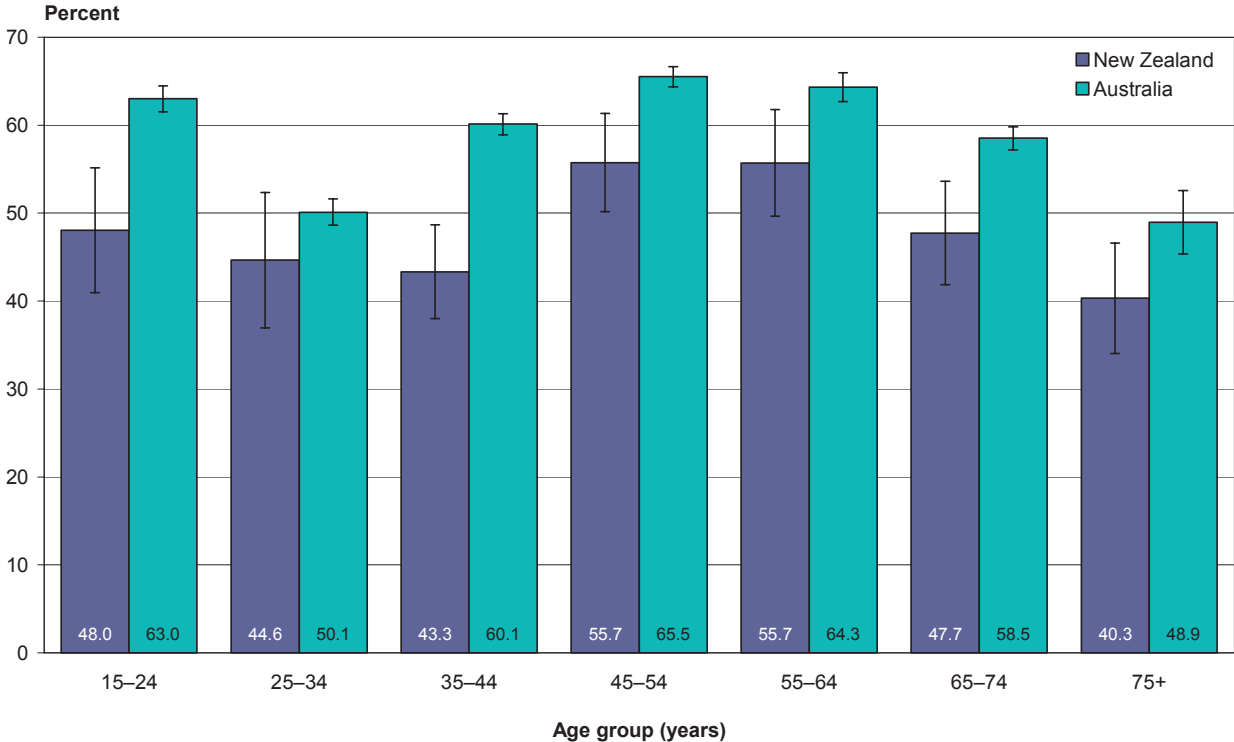
In the 2009 NZOHS, adults were asked the following question: *Have you been to a dental professional in the last 12 months?* Adults who answered yes were classified as having visited a dental professional in the last 12 months.

In the NSAOH, adults were asked the following question: *How long ago did you last visit a dental professional about your teeth, dentures or gums?* *Less than 12 months, 1–2 years, 2–5 years, 5–10 years, 10+ years, never visited, don't know.* Those who answered *less than 12 months* were classified as having visited a dental professional in the last 12 months.

After standardising for age, New Zealand adults were significantly less likely than Australian adults to have visited a dental professional in the last 12 months (SRR: 0.81, 0.76–0.86).

In all age groups except 25–34 years, New Zealand adults were significantly less likely than Australian adults to have visited a dental professional in the last 12 months (p-values < 0.05) (Figure 73). The prevalence was highest in the 45–64 years age groups in both New Zealand and Australia.

Figure 73: Prevalence of having visited a dental professional in the last 12 months, among New Zealand and Australian adults aged 15 years and over, by age group (unadjusted prevalence)



Sources: 2009 New Zealand Oral Health Survey; Australian National Survey of Adult Oral Health 2004–06

Chapter 11: Summary and Conclusion

Introduction

This report presents a snapshot of oral health in New Zealand in 2009. Although large improvements have been seen since the 1970s and 1980s in the oral health status of New Zealanders, dental decay and periodontal disease remain among the most prevalent chronic diseases in New Zealand (Ministry of Health 2008c). Furthermore, survey findings showed that disparities in oral health status and access to services still exist, particularly for Māori, Pacific people and people of low socioeconomic status. This chapter summarises the key findings for children and adults and by population group, the strengths and limitations of this survey, and implications for policy makers and the dental profession.

Key findings

Children and adolescents

Children and adolescents are a key priority group in the New Zealand oral health vision, and they are eligible to receive free, publicly-funded oral health services in New Zealand up until the age of 18 years. Although the School Dental Service collects clinical data for all five-year-olds and children in Year 8, the 2009 NZOHS provides valuable clinical and parent- or self-reported information about all children and adolescents aged 2–17 years covered by the publicly-funded oral health system.

Oral health status

Overall, children and adolescents had relatively good oral health, although it was somewhat worse in the older age groups. Key measures used to describe oral health status included the prevalence of being caries-free,⁸ the prevalence of having untreated coronal decay (ie, in the crown of the tooth), and the dmft (or DMFT) score (the mean number of decayed, missing or filled primary (or permanent) teeth).

The survey showed that the oral health of preschool children (aged 2–4 years) was relatively good, although some were still caries-active. About 80% of preschool children were caries-free in their primary teeth, while about 15% had untreated coronal decay in at least one primary tooth. This age group had a mean dmft score of 0.8 (ie, an average of 0.8 decayed, missing or filled primary teeth).

Children aged 5–11 years experienced a higher level of dental decay in their primary teeth than preschool children, with about 51% being caries-free in their primary teeth. About 17% had untreated coronal decay in their primary teeth. When examining permanent teeth, almost eight in ten (77.5%) children in this age group were caries-free in their permanent teeth, and only a very small proportion (2.7%) had untreated coronal decay in their permanent teeth. For this age group, the mean dmft score (for primary teeth) was 1.9, and the mean DMFT score (for permanent teeth) was 0.5.

⁸ Caries-free means having no teeth that were decayed, missing due to dental decay or gum disease, or filled.

Adolescents aged 12–17 years were less likely than 5–11-year-olds to be caries-free in their permanent teeth (at 44.7%), with 12.7% having untreated coronal decay on at least one permanent tooth. Their mean DMFT score (in permanent teeth) was 1.9, compared with 0.5 for 5–11-year-olds (although it should be noted that 12–17-year-olds had twice as many permanent teeth as 5–11-year-olds on average). In addition, about one in four adolescents aged 12–17 years had experienced trauma to one of their six upper front permanent teeth (23.4%).

When looking at the combined dentitions (ie, combined primary and permanent teeth) of children and adolescents, the prevalence of being caries-free decreased from 79.7% in 2–4-year-olds to 42.5% in 5–11-year-olds and 44.0% in 12–17-year-olds.

Parent-reported (or self-reported for 15–17-year-olds) information also showed that fair or poor oral health affected a reasonable proportion of children and adolescents. About 13% of children and adolescents aged 2–17 years had parent-reported or self-reported fair or poor oral health. Among children aged 2–14 years, 7.0% had experienced a toothache (sometimes, often or always) in the previous year, and 13.0% of children and adolescents aged 2–17 years had taken time off school or normal activities in the past year because of problems with their teeth or mouth.

Toothbrushing

The Ministry of Health recommends that children brush their teeth twice a day using fluoride toothpaste of 1000 ppm or greater, as this regime provides the most effective self-care protection against dental decay. The survey found that about 63.5% of children and adolescents aged 2–17 years brushed their teeth at least twice a day (with or without fluoride toothpaste), with little variation by age group. However, only 43.0% of 2–17-year-olds brushed twice daily with fluoride toothpaste of 1000 ppm or greater, with marked differences by age group: only 15.3% of 2–4-year-olds met this recommendation, compared with 40.4% of 5–11-year-olds and 57.1% of 12–17-year-olds. With the majority of children and adolescents not meeting recommendations for toothbrushing, there is clearly room for improvement in self-care behaviour, and a need for more health promotion messages.

Use of oral health care services

Survey results showed that 81.2% of children and adolescents aged 2–17 years had visited a dental professional in the previous year. The highest prevalence was among children aged 5–11 years, at about 90.3%, compared with 79.9% of 12–17-year-olds and 59.7% of 2–4-year-olds. The lower uptake of using oral health services, particularly among preschool children and adolescents, should be a focus of future work.

Inequalities

Although the publicly-funded oral health system aims to meet the oral health needs of all children in New Zealand, the results of this survey show that significant disparities still exist, particularly for Māori and Pacific children. Māori and Pacific children and adolescents were less likely to have accessed oral health services in the previous year. They were also less likely to have caries-free primary teeth than non-Māori and non-Pacific children, respectively. Māori children and adolescents had higher dental decay experience in primary and permanent teeth than non-Māori, mainly due to greater severity of decay in primary teeth and greater severity of decay and fillings in permanent teeth.

For children and adolescents, there were no differences in past-year access to oral health services by neighbourhood deprivation. However, those in the most deprived areas still experienced disparities in some aspects of oral health, including being less likely to meet toothbrushing recommendations, and missing more primary teeth due to decay.

Changes over time

Comparisons with the 1988 national oral health survey suggest that large improvements in oral health have occurred for children since the 1980s. The proportion of 12–13-year-olds who were caries-free almost doubled between 1988 (28.5%) and 2009 (51.6%), while the mean DMFT score significantly decreased (from 2.4 to 1.3). The survey found, however, that 12–13-year-olds were significantly less likely to have visited a dental professional in the past year in 2009 (91.6%) compared with in 1988 (99.3%).

Adults

This survey has provided important clinical and self-reported information on the oral health status of New Zealanders, and shows that there have been major improvements over time.

Tooth loss

Tooth loss, and in particular complete tooth loss (edentulism), diminishes people's quality of life, is related to poorer general health and has been shown to have psychosocial and functional consequences, particularly among older people. In 2009, 9.4% of adults aged 18 years and over had lost all of their natural teeth. Edentulism was higher in the older age groups, with about 40% of adults aged 75 years and over having lost all their natural teeth. This reflects a sizeable proportion of adults (particularly older adults) who are edentulous, who may therefore be experiencing impacts on their diet, nutrition, general wellbeing and self-rated health.

Among dentate adults aged 18 years and over (ie, the 90.6% of adults who have at least one natural tooth), three in five (61.8%) were missing one or more teeth due to decay or periodontal disease; the average number of missing teeth per dentate adult was 4.6. Missing one or more teeth was more prevalent in older adults, with a substantial difference in prevalence between the 18–24 years age group (8.8%) and the 25–34 years age group (34.7%), and almost all adults aged 45 years and over having lost at least one tooth.

Functional dentition

The retention of 21 or more natural teeth throughout a person's lifetime is considered to comprise a 'functional dentition' through which the functional, dietary and aesthetic needs of most people can be met with natural teeth alone. In 2009, 88.6% of dentate adults had a functional dentition (defined as 21 or more natural teeth). The prevalence of having a functional dentition was higher in younger adults, with almost all adults younger than 45 years having a functional dentition, compared with about one in two dentate adults aged 65 years and over. These findings suggest that the need for dentures is likely to increase with increasing age in order to meet people's functional, dietary and aesthetic needs.

Dental decay experience

New Zealand adults still experience a high level of untreated tooth decay, and results show that dental decay is one of the most prevalent chronic diseases in the country (Ministry of Health 2008c). Among dentate adults, 35.3% had untreated coronal decay on one or more teeth, and 9.5% had one or more root surfaces with untreated decay. The prevalence of untreated coronal decay was significantly higher among 25–34-year-olds (46.5%) than among 18–24-year-olds (31.5%). Older adults aged 75 years and over had a similar prevalence of untreated coronal decay as other adult age groups, but they also had the highest prevalence of untreated root decay, with 29.3% affected. This large amount of untreated decay may lead to a greater demand for complex dental services in the future and affect future dental workforce needs.

The overall severity of dental decay experience reflects a person's lifetime experience of dental decay, and is presented as the DMFT score, combining the mean number of decayed, filled and missing (due to decay or periodontal disease) teeth. Among dentate adults aged 18 years and over, these components were 0.8 decayed, 4.6 missing teeth and 8.5 filled teeth, to give an overall mean DMFT score of 13.9 in 2009. DMFT was higher in the older age groups; people aged 18–24 years had, on average, 3.7 decayed, missing or filled teeth compared with 24.8 decayed, missing or filled teeth among people aged 75 years and over. The mean DMFT was significantly higher among 45–54-year-olds (18.3) than among 35–44-year-olds (10.0).

Periodontal disease

The supporting structures of natural teeth (gingivae, periodontal ligaments and bone) can be affected by periodontal diseases, which are characterised by inflammation and, in the case of chronic periodontitis, by the loss of the tissues supporting the natural teeth. The progressive loss of supporting structures can be quantified by measuring periodontal pocketing and gingival recession, often considered together as 'clinical attachment loss'. Pocketing is a measure of the severity of the destructive process of the disease periodontitis. Loss of attachment includes both pocketing and periodontal tissue recession and indicates the amount of attachment lost from the tooth over its lifetime.

A large proportion of adults were affected by periodontal disease at levels where clinicians become concerned (measurements of 4 mm or more). About one in three (33.5%) dentate adults had periodontal pocketing of 4 mm or more on at least one tooth,⁹ while 10.5% had moderate pocketing and 5.1% had deep pocketing. The prevalence of periodontal pocketing did not appear to differ significantly with age, as 25–34-year-olds had a similar prevalence of any periodontal pocketing as older age groups. Of concern is that adults aged 25–34 years had as high a prevalence of deep pocketing as any of the older adult age groups. In addition, 49.9% of dentate adults had any loss of attachment,¹⁰ 27.5% had moderate loss of attachment and 13.4% had severe loss of attachment. The prevalence of loss of attachment was higher in older age groups.

The survey findings support published research from the longitudinal Dunedin Multidisciplinary Health and Development Study, which showed that periodontal disease was well established in a small proportion of young adults (Thomson, Hashim et al 2000).

Perceptions and impacts of oral health status

The self-reported survey results show that a reasonable proportion of the population were affected by poor oral health. Overall, 26.6% of adults described the health of their teeth or mouth as fair or poor, and 25.4% had experienced pain in their mouth, jaw or face in the previous four weeks. About 10.2% of working-age adults (18–64 years) had taken time off work or school in the previous year due to dental problems, showing the impact that oral health can have on productivity and lost working days.

⁹ Periodontal pocketing is divided into 'any' (4 mm or more), 'moderate' (5 mm or more), and 'deep' (6 mm or more).

¹⁰ Loss of attachment is divided into 'any' (4 mm or more), 'moderate' (5 mm or more), and 'severe' (6 mm or more)

Toothbrushing

Survey results showed that 65.3% of adults brushed their teeth with fluoride toothpaste at least twice a day, with little variation by age group. This shows that about one in three adults do not meet the Ministry of Health recommendations for brushing teeth. Given the high prevalences of coronal decay, root decay, periodontal pocketing and loss of attachment among the adult dentate population, considerable improvements in oral health status could be achieved by improving self-care practices and following recommendations known to reduce plaque levels and dental decay.

Use of oral health services

In New Zealand, oral health care for most adults is performed by private dentists on a user-pays basis, although free or partially-funded oral health care is available for some adults (namely some low-income adults, and special needs and medically compromised patients). Regular dental visiting allows for the early detection of disease, and the provision of treatment and preventive measures.

The survey found that 47.1% of adults had used oral health care services in the past year, with lower prevalences for 18–24-year-olds (36.9%) and people aged 75 years and over (40.3%). These results supported findings from the Dunedin Multidisciplinary Health and Development Study, which suggested that the prevalence of routinely visiting a dental professional dropped dramatically between the ages of 15 and 32 years (Thomson et al 2010).

A low proportion (38.9%) of adults reported usually visiting a dental professional for a check-up rather than for a dental problem. People who visited only for a dental problem had considerably worse clinically measured and self-reported oral health than regular users; these results are discussed later in this chapter.

The majority of people (84.2%) reported that their dental professional 'always' listened carefully to what they had to say.

Unmet need for oral health services

There was clear evidence of unmet need for dental care from the survey. Over half (55.3%) of all adults reported feeling they did not see a dental professional often enough, with the highest prevalence among 18–34-year-olds (about 70%). One in two adults (45.9%) felt they currently needed dental treatment.

Cost was a key barrier to accessing oral health services. About 44.1% of adults had avoided dental care due to cost in the last year, and 25.3% had gone without recommended routine dental treatment in the past year due to cost. These results suggest that cost is an important reason why people do not regularly visit dental professionals and do not get recommended treatment. Given that regular visits to a dental professional have been shown in studies to result in better oral health outcomes, financial barriers are likely to exacerbate inequalities in oral health in future.

Time trends

The findings from this survey show that oral health in New Zealand has improved dramatically in the past 20 years, particularly in terms of tooth loss.

Trends show that a far smaller proportion of people were missing one or more teeth due to pathology in 2009 than in 1988, with prevalences almost halving among 20–24-year-olds and 35–44-year-olds. There has been a dramatic decrease in the prevalence of edentulism, with particularly large reductions among 35–44-year-olds (12.8 to 1.7%) and 65–74-year-olds (61.6 to 29.6%).

In addition, there has been a significant increase since 1988 in the prevalence of having a functional dentition among dentate adults, particularly among 35–44-year-olds (88.0 to 97.9%) and 65–74-year-olds (43.8 to 54.9%).

Although the prevalence and severity of untreated decay appear to have increased since 1988, some (or all) of this may be due to the use of more sensitive criteria for assessing decay in 2009. The 1998 United Kingdom Adult Dental Survey showed that including visual caries in the assessment criteria increased the prevalence of caries from 42% to 55%, and the mean number of teeth affected from 1.0 to 1.5, with the greatest effect for adults younger than 35 years of age. If these findings were applied to the 2009 New Zealand data, it is likely that the prevalence and severity of untreated decay would be lower than the 1988 levels among 20–24-year-olds and 35–44-year-olds, with little change being seen in the 65–74 years age group. However, there is no way to test this assumption, so it should be treated with caution.

Overall, the DMFT score (reflecting a person's lifetime experience of dental decay) had almost halved since 1988 in people aged 20–24 and 35–44 years, showing the vast improvements in oral health that have occurred over the past 20 years in New Zealand. Although the DMFT index score has remained relatively stable for 65–74-year-olds since 1976 and 1988 (at about 25 teeth), there has been a shift in the components of the index. Between 1976 and 2009, dentate adults in this age group had, on average, five fewer teeth missing due to pathology and had five more filled teeth. Since 1988, tooth loss had decreased among 65–74-year-olds by two teeth, on average, and filled teeth had increased by the same number.

A further positive finding from the survey was the significant increase in the proportion of dentate adults aged 20–24 and 65–74 years meeting toothbrushing recommendations since 1988.

There was, however, a large drop since 1988 in the proportion of people who had visited a dental professional in the past year, with decreases among 20–24-year-olds (54.7 to 33.0%) and 35–44-year-olds (55.8 to 43.3%). The prevalence had increased for the older age group of 65–74-year-olds (28.8 to 47.7%).

International comparisons

The use of virtually identical clinical protocols and criteria for the New Zealand and Australian oral health surveys (including for dental decay) has allowed comparisons to be made across the two countries. Overall, New Zealanders had poorer oral health than Australians across a range of clinical indicators.

New Zealand adults were more likely to be edentulous than Australian adults. Furthermore, among dentate adults there were higher prevalences among New Zealanders than Australians for untreated coronal decay and having at least one decayed, missing or filled tooth. New Zealand dentate adults also had significantly more teeth surfaces with untreated coronal decay than Australian adults. Of particular concern was the high prevalence and severity of untreated coronal decay among 25–35-year-old New Zealanders; people in this age group had the highest prevalence and severity of untreated decay of all adult age groups in New Zealand and Australia.

New Zealand adults also had a higher prevalence of periodontal disease than Australian adults. Periodontal pocketing and loss of attachment of 4 mm or more was more prevalent among New Zealand adults than among Australian adults, particularly so in the prevalence of pocketing. (However, it should be noted that the clinical protocols for periodontal measures were slightly different in the Australian and New Zealand surveys.)

Also of concern was the lower past-year use of oral health services among New Zealanders compared to Australian adults.

Priority population groups

‘Good oral health for all, for life’ is the strategic vision for oral health policy in New Zealand. It is based on the evidence available at the time it was written (2006), acknowledging that there was a lack of data for many population groups. This survey is a key source of information on these groups and will help inform the next steps to progress the vision.

The New Zealand oral health vision has four priority groups:

- children and adolescents
- older adults
- people experiencing inequalities in outcome (eg, Māori, Pacific and low-income populations)
- people of all ages with physical, intellectual, behavioural or cognitive disabilities, or who are medically compromised.

Although the latter group was unable to be examined in this report, the survey findings provide important information for furthering the vision with respect to the first three priority groups. In particular, inequalities still exist in oral health. Examining the oral health status of particular population groups helps identify key areas of need and where future improvements can be made.

Children and adolescents

All New Zealand children and adolescents are eligible to receive free, publicly-funded basic oral health care. The aim of free oral health services for children and adolescents is to have equitable access to oral health care, and good oral health status for all children and adolescents. Even so, this survey found disparities between child and adolescent population groups, particularly by ethnic group and age group.

There was strong evidence of disparities by ethnic group among children in oral health status and service use. Māori and Pacific children were less likely to have accessed oral health care services in the past year and generally had poorer oral health outcomes. Since childhood oral health predicts oral health in adulthood as shown in the Dunedin Multidisciplinary Health and Development Study (Thomson et al 2004), it will be crucially important to address these disparities and to ensure that free oral health services reach, and are appropriate for, all children and adolescents, particularly Māori and Pacific.

More generally, the findings suggest that, for preschoolers, attention could be focused on preventive measures, such as early enrolment in the School Dental Service or with other dental providers, establishing regular visits to a dental professional, and brushing teeth twice a day with fluoride toothpaste of 1000 ppm or greater. The findings also suggested there was a drop-off in the use of oral health services through adolescence. The Ministry of Health and DHBs are working to increase the proportion of adolescents who are accessing free basic dental services to 85% nationally.

Older adults

Until quite recently the common thinking among the dental profession was that dental decay only affected younger adults. However, this survey found that large proportions of older adults had untreated coronal and/or root decay, supporting recent research showing that older adults are a caries-active group (Thomson 2004).

Survey results also confirmed the trend of New Zealand having an increasingly dentate older population (ie, with natural teeth). Increasing numbers of older adults are retaining their natural teeth, and for longer, have heavily filled teeth and are caries-active. Older adults aged 75 years and over have the additional burden of the highest prevalence of untreated root decay, with one in three affected. At this point in time cost did not appear to be as strong a barrier to accessing oral health care services for community-dwelling older adults as for younger adults. However, financial barriers to accessing services will be important to monitor in future surveys.

Research has suggested possible strategies to manage the oral health of older adults, including intensive monitoring, efforts to prevent decay at the clinical practice and public health levels, and evidence-based preventive interventions such as the use of fluoride (Thomson 2004).

It should be noted that this survey only covered people living in permanent private dwellings. It therefore excluded other people, such as those living in rest homes, who may have different oral health status and oral health needs compared with the rest of the population.

Māori

This survey identified that Māori experienced disparities in oral health, across a range of indicators, from oral health outcomes to access to services. Tooth loss and untreated dental decay continued to feature prominently in oral health outcomes for Māori adults in 2009, with Māori adults being almost twice as likely to be edentulous as non-Māori adults. In addition, dentate Māori were significantly less likely than non-Māori to have a functional dentition, and had more teeth missing due to pathology. In terms of dental caries, they had, on average, nearly twice as many teeth with untreated coronal decay, fewer filled teeth and a significantly higher lifetime dental decay experience (DMFT). Māori adults also had a significantly higher prevalence of untreated root decay than non-Māori adults. Periodontally, dentate Māori had significantly higher prevalences of periodontal pocketing and loss of attachment at the three depth levels reported. This confirms similar findings from previous national oral health surveys, which showed that Māori adults had substantially worse oral health than non-Māori adults in 1988.

Clinically measured poor oral health was mirrored in the self-report and quality of life findings for Māori adults. Māori adults were significantly more likely than non-Māori adults to rate their oral health as fair or poor and to have had one or more oral health impacts that affected their quality of life.

Furthermore, there were significant access issues identified in the 2009 survey for Māori, with cost being an important barrier to access. Māori adults had a significantly higher perceived need for dental treatment, and in the previous year were more likely to have avoided dental care due to cost and to have gone without recommended routine dental treatment due to cost. They were also significantly less likely to have visited a dentist in the past year and were less likely to visit regularly for check-ups. Efforts to reduce inequalities in oral health for Māori may need to address the barrier of cost in access to services in future by providing appropriate support to increase both the capacity and capability of existing Māori oral health providers. Appropriate support would also be required to enable other Māori health providers to establish clinical dental services where none currently exist. Other efforts could include a Whānau Ora approach to the provision of oral health services and the integration of oral health services with other health services.

Māori adults were significantly less likely than non-Māori adults to brush their teeth twice a day with toothpaste. Appropriate support for the Māori oral health sector to develop positive oral health behaviour promotion initiatives could lead to improved oral health outcomes for Māori adults.

As mentioned previously, Māori children also experienced poorer oral health and were less likely to have visited a dental professional in the previous year. Māori children were also less likely to brush their teeth twice a day with 1000 ppm fluoride toothpaste. These findings confirmed previous findings from research based on School Dental Service data showing inequalities for Māori children.

To reduce inequalities for Māori in the future, these disparities in access to publicly-funded oral health services need to be addressed. As with adult Māori, the promotion of brushing teeth twice a day with fluoride toothpaste could lead to improvements in dental decay for Māori children and adolescents. In addition, work to reduce disparities in oral health between Māori and non-Māori could draw on research that has examined Māori perceptions of health care, and barriers to accessing health care services (Mauri Ora Associates 2009).

Pacific peoples

Little research has previously been done on the oral health status of Pacific peoples, so the 2009 New Zealand Oral Health Survey is an important source of information for future policy development for Pacific peoples.

Survey findings showed that Pacific adults had poorer oral health in many clinical indicators and lower use of oral health services. On average, dentate Pacific adults had significantly more teeth missing due to pathology, nearly twice as many teeth with untreated decay, and half the number of filled teeth, compared with non-Pacific people. However, at the same time, Pacific people had more sound teeth than non-Pacific people and a lower mean number of decayed, missing or filled teeth (DMFT). Periodontally, Pacific adults were significantly more likely to have pocketing at all three measurement levels and loss of attachment at the moderate and severe levels than non-Pacific adults.

Self-report and quality of life findings also showed poor oral health for Pacific adults. Pacific adults were significantly more likely to have fair or poor self-rated oral health, and to have experienced one or more oral health impacts affecting their quality of life, than non-Pacific adults.

The use of oral health care services in the previous year was much lower among Pacific than non-Pacific people. Furthermore, Pacific people had a higher perceived need for dental treatment, were more likely to have avoided dental care due to cost in the past year and were less likely to have continuity and regularity of care. They were only about half as likely as non-Pacific people to usually visit the same dentist for dental care, and to usually visit a dental professional for a check-up. Cost also emerged as an important barrier to visiting the dentist for Pacific people, and to receiving recommended dental treatment. These results show the disparities in oral health care that Pacific people experience, which need to be addressed in future.

The survey also showed disparities for Pacific children, who were less likely to have visited a dental professional in the past year and were less likely to be caries-free in their primary teeth. This confirmed findings from School Dental Service data and regional studies. Reducing disparities in childhood access to care is an important step for improving the oral health of all Pacific people in the future.

People living in areas of high socioeconomic deprivation

The results of the survey confirmed that inequalities exist by socioeconomic status in oral health status and access to services, consistent with findings in 1976 and 1988.

High levels of tooth loss and dental decay were prominent findings for this group of people in 2009. People living in areas of high deprivation were almost three times as likely to have completely lost all their teeth, and dentate adults in this group had higher prevalence and severity of partial tooth loss than people in areas of low deprivation. There were large disparities in dental decay experience, with people living in areas of high deprivation having nearly three times more teeth with untreated coronal decay. Periodontally, they were more likely to have loss of attachment at all three measurement levels than people in areas of low deprivation.

People living in areas of high socioeconomic deprivation also had significantly poorer self-rated oral health and oral-health-related quality of life. They were twice as likely to rate their oral health as fair or poor, and nearly three times as likely to have had one or more oral health impacts that affected their quality of life, as people in areas of low deprivation.

Furthermore, access to oral health care services was low for people living in areas of higher deprivation, with cost identified as a key reason for not visiting the dentist in the past year and for going without recommended routine dental treatment.

Disparities by socioeconomic status were also seen for children, although there were no significant differences in visiting a dental professional in the past year. However, children living in areas of high socioeconomic deprivation had fewer sound primary teeth, and significantly more primary teeth missing due to dental decay, than children in areas of low deprivation, and were less likely to brush their teeth at least twice a day.

Other key population groups

In addition, the 2009 NZOHS identified key oral health issues for other population groups in New Zealand, which are also highly relevant to the development of the strategic vision.

People visiting a dental professional only for dental problems

This survey found that people who usually visit a dentist for check-ups had better oral health outcomes than people who usually visit for dental problems. This supported similar findings from previous studies.

Overall, adults who usually only visited for dental problems had more severe dental decay experience (DMFT), were more likely to report having experienced orofacial pain (in mouth, jaw or face) in the previous month, and were twice as likely to have experienced impacts on their lives in the previous year due to their oral health. These findings support the value of regularly visiting a dental professional for check-ups to improve oral health status.

People living in areas with non-fluoridated water

A key focus of current debate in the public domain and in furthering the strategic vision for oral health is the issue of water fluoridation. Although this survey was not designed as an in-depth fluoridation study, results were examined for any protective effect of fluoride against dental decay, as well as for the prevalence and severity of dental fluorosis (a possible side-effect of constant exposure to elevated levels of fluoride during early tooth development). The survey findings support a number of previous studies in New Zealand (including those based on School Dental Service data) showing significant benefits of water fluoridation.

The 2009 survey was the first opportunity to look at the effect of fluoride on dental health across all age groups in the population. The survey found that children and adults living in fluoridated areas had significantly lower lifetime dental decay experience (ie, lower dmft/DMFT) than children and adults living in non-fluoridated areas. Although this analysis is only a snapshot, these findings suggest that fluoridation of community water supplies confers protection against dental decay across all age groups of the New Zealand population. This difference is found despite the fact that the majority of people brush their teeth with fluoridated toothpaste. This, together with migration of people into and out of areas with fluoridated reticulated water supplies, means that the true protective effect of water fluoridation may have been underestimated in this study.

Furthermore, the survey found a very low overall prevalence of moderate fluorosis among people aged 8–30 years (about 2%, with no severe fluorosis found). The levels of moderate and severe fluorosis were used in the analysis because these are the levels that are often raised in public debates as public health issues; also, dental fluorosis is not considered to be a public health issue when it is found in communities only in its mildest forms. The survey found no significant difference in the prevalence of moderate fluorosis (or any of the milder forms of dental fluorosis) between people living in fluoridated and non-fluoridated areas.

These findings should provide reassurance that the prevalence of moderate fluorosis is very low, that severe fluorosis is extremely rare in New Zealand, and that adults and children living in fluoridated areas had significantly better oral health than adults and children living in non-fluoridated areas.

Adults aged 18–34 years

Although children and adolescents under 18 years of age had relatively good oral health status in 2009, this survey found evidence that, compared with this age group, the oral health status was considerably worse in young adults aged 18–34 years, and especially among adults aged 25–34 years.

In particular, the prevalence of untreated coronal decay was significantly higher in 25–34-year-olds (46.5%) than in 12–17-year-olds (12.7%) and 18–24-year-olds (31.5%). The severity of lifetime dental decay experience (mean DMFT) was also significantly higher among 25–34-year-olds (6.8) than among 12–17-year-olds (1.9) and 18–24-year-olds (3.7). Of particular concern is the high prevalence and severity of untreated coronal decay among 25–35-year-old New Zealanders; people in this age group had the highest prevalence and severity of untreated decay of all adult age groups in New Zealand and Australia.

Also of concern is the large increase in the prevalence of pocketing at all three measures between younger adults aged 18–24 years and 25–34 years. In particular, adults aged 25–34 years had the highest prevalence of deep pocketing of any of the adult age groups, confirming the findings of the Dunedin Multidisciplinary Health and Development Study that periodontal disease is well established in younger adults (Thomson, Hashim et al 2000). From a clinical perspective, severe destruction of the supporting tissues of the tooth in early adulthood may place the teeth of those people who have deeper pocketing at greater risk of tooth loss later in life. Further research, for example into the role that smoking plays in the higher prevalence of deep pocketing, may enable better understanding of the situation.

There was a high degree of unmet need for oral health services among young adults, with cost identified as a key barrier to access. Only 36.9% of 18–24-year-olds and around 44% of 25–44-year-olds had been to an oral health care service in the previous year, a drop from about 80% in 12–17-year-olds. The majority (about 70%) of 18–34-year-olds felt that they did not see a dental professional often enough. In addition, the following measures were highest in the 25–34 years age group: feeling they currently needed dental treatment (59.5%), avoiding the dentist due to cost in the past year (61.7%), cost preventing recommended routine dental treatment in the past year (35.7%), experiencing pain in the mouth or jaws in the previous 4 weeks (35.1%), and having taken time off work or school in the previous year due to dental problems (13%).

However, there has been a considerable improvement since 1976 and 1988 in the oral health status of adults aged 20–24 years, including a large decrease in the mean number of decayed teeth, missing teeth and filled teeth (DMFT), from 9.7 in 1988 to 4.1 in 2009. These improvements in oral health care status may be due to the use of fluoride (eg, in toothpaste and water), as well as the change in approach by the dental profession from extraction to restoration of teeth and the prevention of decay and periodontal disease.

It was predicted in the 1988 SOHO report that the benefits of good oral health among children during the 1980s would spread through the population as the generation grew older. However, the findings of this survey suggest that young adults (particularly 18–34-year-olds) experience large increases in dental decay and periodontal pocketing on exit from publicly-funded oral health services, and experience a large amount of unmet need in the user-pays oral health system. Owing to the chronic, irreversible nature of dental disease, the high experience of dental decay and periodontal disease in this age group may lead to poorer oral health and general health for these people in the future, and may lead to considerable pressure on the oral health workforce.

Adults aged 35–64 years

Of note, considerable improvement has also been seen since 1976 and 1988 in the slightly younger age group of 35–44-year-olds, particularly in the retention of natural teeth and a lower overall severity of dental decay experience (DMFT). Adults aged 35–44 years now have considerably fewer teeth missing due to decay or periodontal disease, fewer teeth with untreated decay, and fewer filled teeth, than in 1976. Factors that may have influenced this improvement were the change in the approach to decay treatment from surgical to preventive measures in the late 1970s, and the introduction of water fluoridation and fluoridated toothpastes.

Although the strategic vision focuses on older adults, this survey found that adults aged 45–64 years (the ‘baby boom’ generation) also showed signs of poor oral health. In particular, there were considerable differences in oral health status between 35–44-year-olds and 45–54-year-olds on a number of different measures. While almost all (97.9%) 35–44-year-old dentate adults had a functional dentition (of 21 or more natural teeth), this was the case for only 87.6% of 45–54-year-old dentate adults and 83.8% of 55–64-year-olds. The DMFT score was higher among 55–64-year-olds (21.7) than among 35–44-year-olds (10.0) and 45–54-year-olds (18.3). Furthermore, there was a large difference in the prevalence of root decay between 35–44-year-olds (5.0%) and 45–64-year-olds (about 13.4%). Dentate adults aged 45 years and over also experienced a significantly higher prevalence of clinical loss of attachment than younger age groups.

Concerns have been raised about the oral health of the ‘baby boom’ generation, who appeared to be retaining more natural teeth for longer but have heavily filled teeth. As this generation moves into retirement age, there was concern that they would have complex dental needs but would not have the income to cover the costs. The results from this study confirm that the baby boom generation are indeed keeping more natural teeth, and that, on average, 11–13 of these teeth are already filled and one is decayed. Further research could investigate future possible impacts on the dental workforce and on likely future unmet need for dental treatment in this generation.

Men and women

The survey identified that men had worse oral health status, and were less likely to practise oral self-care behaviours and visit dental professionals, than women. Men had more coronal and root decay and higher prevalences of periodontal pocketing and loss of attachment than women. Men also had a higher prevalence of dental trauma than women. Men were less likely to meet toothbrushing guidelines and to have visited a dental professional in the previous year. However, women were more likely than men to have avoided dental care, or gone without recommended dental treatment, due to cost.

Asian peoples

Overall, Asian adults had better oral health than non-Asian adults, with a lower mean number of decayed, missing or filled teeth (DMFT). However, an oral health issue of concern for Asian people was the high prevalence of periodontal pocketing and clinical attachment loss, which are risk factors for later tooth loss.

Other population groups and risk factors

This report has covered only a portion of what is possible using the 2009 NZOHS. The Ministry of Health will make the survey data set available to researchers for academic purposes. Future analysis of the 2009 NZOHS data set could examine oral health status with regard to:

- oral-health-related quality of life
- household oral health
- the link between the oral health status of the primary caregiver and child
- general health and other chronic conditions (such as diabetes and cardiovascular disease)
- smoking status
- diet (such as sugar intake, fizzy drink intake)
- older adults
- preschool children
- adolescents
- dental appearance by socioeconomic status
- urban/rural status
- toothbrushing practices (time of day, rinsing compared with spitting toothpaste)
- flossing
- knowledge of and attitudes to oral health
- knowledge of and attitudes to water fluoridation
- developmental defects of enamel
- dental anxiety
- use of mouthguards
- knowledge of ACC cover for dental trauma.

Strengths and limitations of study

The 2009 NZOHS had a robust methodology and had almost 5000 New Zealanders of all ages as respondents, from throughout New Zealand. This included population groups about which there was little knowledge, including young children, and increased numbers of Māori and Pacific people, to allow better representation of these groups. Although the response rate was relatively low, at 49%, it was considered acceptable, given the follow-up nature of the survey, the clinical dental examination, and that there did not appear to be any large biases by population group in response rate. This response rate is comparable to national oral health surveys carried out in other countries (such as Australia), where there is evidence that despite low response rates for oral health surveys, the results are generally not biased.

The target population for the 2009 NZOHS was the usually resident population living in permanent private dwellings in New Zealand. It should be noted that the results of this study may not necessarily apply to the total New Zealand population, if the group of people who were not included in the survey (such as people in prisons, hospitals, institutions such as rest homes and homeless people) have a different oral health status from other people in the population.

The dental examinations carried out for this survey were robust and have provided clinical assessments of the oral health status of New Zealanders. Dental examiners attended a multi-day training course, and some of their clinical assessments were compared with those of a 'gold standard examiner' to assess reliability. Overall, an excellent level of reliability was found for almost all measures. Furthermore, having the same lead examiner and dental examination protocols as the Australian survey has ensured comparability between these surveys. To our knowledge, the New Zealand survey was also the first population-based oral health survey in the world to take clinical photos as part of the assessment, which provides valuable information for future research.

The follow-up nature of this survey, where NZOHS participants were selected from among the 2006/07 New Zealand Health Survey participants, will allow future research to examine the association between general health status and oral health status.

It should be noted that the non-clinical results presented in this report were self-reported, and for the children were answered by a parent or caregiver. Therefore, these responses may have some recall error.

Implications of these findings

Implications for oral health policy

The results of the 2009 NZOHS will be used to inform the progression and future development of the strategic vision for oral health in New Zealand, 'Good oral health for all, for life', as well as oral health policies and programmes. In particular, the findings of the 2009 NZOHS can help to identify the issues and population groups on which to focus efforts. The following are some key implications for oral health policy.

- New Zealand remains a high-carries population, despite considerable improvements in oral health since previous surveys in 1976 and 1988. Given that dental decay is the most prevalent chronic (irreversible) disease in New Zealand, we cannot be complacent about oral health.
- New Zealand has relatively high levels of access to dental care for children and adolescents. However, the publicly-funded oral health care system for children and adolescents is currently not fully meeting the needs of Māori and Pacific children, who were less likely than other children to have visited a dental professional in the previous year. Attention needs to be focused on addressing these disparities. There was also lower use of oral health care services in the past year among preschool children and adolescents.

- Policy initiatives could focus on three key preventive measures for improving oral health examined in this survey: regularly visiting a dental professional, toothbrushing and having access to fluoridated water. All three measures showed disparities that need to be addressed through policy and health promotion.
 - Only two in five adults reported that they usually visit a dental professional for a check-up. These people had significantly better oral health status than people who reported usually visiting a dental professional for dental problems.
 - Fewer than one in two people had visited a dental professional in the past year. The prevalence of having visited a dental professional in the past year was lower among preschool children, adolescents, 18–24-year-olds, Māori, Pacific adults, men, and adults living in high deprivation areas.
 - The cost of dental visits and treatment was a considerable barrier for many people, particularly younger adults, Māori, Pacific adults and adults living in high deprivation areas. Over two in five adults had avoided dental care in the past year due to cost.
 - Only two in three people met the Ministry of Health toothbrushing guidelines, of brushing at least twice a day with fluoride toothpaste of 1000 ppm or greater. The prevalence was lower among children (particularly preschool children), males and Māori.
 - Adults and children living in areas with fluoridated water had lower levels of dental decay experience than people in non-fluoridated areas. Results from the survey suggest that, at the population level, fluoridation of water supplies has oral health benefits.
- Some results from this survey suggest trends that may have an impact on the future oral health workforce.
 - Younger adults have high levels of untreated decay, which may lead to increased oral health service needs for these age groups later on in life.
 - In general, adults are retaining more teeth over time, and this in turn will place pressures on the oral health workforce in future.
 - The survey showed that older adults are caries-active, experiencing high prevalences of root decay and coronal decay. Furthermore, older adults have heavily filled teeth and are retaining their teeth for longer, which may lead to increased need for services. They are also likely to be on limited incomes in the future, which may lead to unmet need.
- Dental decay and periodontal disease are among the most prevalent chronic diseases in New Zealand. The current burden of disease and unmet need suggest other options could be explored for addressing these issues; for example:
 - integrating oral health into primary health care (eg, by primary health care practitioners providing advice to patients about the importance of good oral health)
 - raising awareness among policy makers and the public of the important role oral health plays in general health, and that oral health is integral to general health
 - integrating oral health into Whānau Ora approaches
 - integrating oral health into general health care policies and programmes

- highlighting the associations between oral health and diabetes, cardiovascular disease and low birthweight and pre-term babies
- integrating oral health into medical care plans, and allowing affordable access to oral health care, for patients diagnosed with diabetes or cardiovascular disease, since research has suggested that periodontal treatment can help the management of systemic conditions such as these
- addressing the financial barriers to accessing oral health care services, particularly for at-risk population groups such as young adults, Māori, Pacific people and people living in areas of high deprivation
- improving access to and the affordability of oral health services for pregnant women, to improve birth outcomes and also the oral health of the child
- ensuring oral health is included in policies for older people, children and youth
- continuing to use the common risk factor approach in policy development for chronic diseases (including oral diseases) (eg, health and nutrition promotion and smoking cessation)
- highlighting the role of sugars and refined carbohydrates in the diet as risk factors for dental caries, through oral health promotion.

Implications for dental professionals

The 2009 NZOHS also provides valuable information for dental professionals.

- The survey findings show the importance of regularly visiting a dental professional, with people who usually go to a dental professional for a check-up having substantially better oral health outcomes than people who go for a dental problem.
- The vast majority (90.6%) of New Zealand adults are now dentate, with the mean number of natural teeth in dentate adults ranging from 29 in 18–24-year-olds to 18 in people aged 75 years and over.
- Dental decay is highly prevalent among New Zealand adults, with one in three affected overall.
- Periodontal pocketing and loss of attachment are highly prevalent, with one in three adults having pocketing of 4 mm or more and one in two having loss of attachment of 4 mm or more. Continuing to promote smoking cessation to patients (eg, through Quitline) will be valuable in helping to reduce not only periodontal disease but also oral cancer.
- Younger adults (aged 25–34 years) had a high prevalence of untreated coronal decay, showing greater treatment need. Younger adults have similar prevalences of periodontal pocketing as older adults. People aged 25–34 years had as high a prevalence of deep pocketing as older adult age groups.
- Clinical results from the survey showed the age group of 45–54-year-olds to have substantially worse oral health than younger adults, including having an increased prevalence of root decay and clinical attachment loss (which can lead to tooth loss).

- The results from the survey confirm that older people are caries-active; that is, their teeth continue to decay into older age. Not only do older adults aged 75 years and over have a similar prevalence of coronal decay to other adults, but they also have a higher prevalence of untreated root decay. This is an important finding, as it focuses attention back on the older age groups in terms of treating dental decay. Future oral health delivery for this population group will require the dental workforce to focus on plaque control, preventive strategies and treatments for both coronal and root decay.
- Cost was a key barrier to people visiting oral health services, and to receiving treatment, particularly among younger adults (aged 18–34 years), Māori, Pacific people, and people living in areas of high socioeconomic deprivation.
- The majority of people (84%) reported that their dental professional ‘always’ listened carefully to what they had to say. However, Māori, Pacific adults and people who usually visited for a dental problem were less likely to report always being listened to carefully.

Conclusion

This report has presented the most up-to-date and comprehensive information on the oral health status of New Zealanders. Overall, the oral health of New Zealand adults and children has improved considerably over the past 20–30 years. However, disparities still exist in oral health status in New Zealand. Examining the oral health status of particular population groups helps to identify key problems and challenges for future improvement.

Free, publicly-funded oral health care is available for all New Zealand children, with the aim of having equitable access to oral health care and good oral health status among all children. Even so, the survey found disparities, with poorer access among Māori and Pacific children, and worse oral health outcomes among these children and among those living in areas of higher socioeconomic deprivation. For adults, poorer oral health and a lower prevalence of regular dental attendance were found among men, younger adults, Māori, Pacific people and people living in areas of higher deprivation. Given that cost was identified as an important barrier to accessing services, this will be a crucial area for attention. Furthermore, the trend for adults to retain increasing numbers of natural teeth into older age is likely to have an impact on the oral health workforce in the future.

These key findings from the 2009 New Zealand Oral Health Survey and the comparisons with earlier surveys, alongside other data sources, provide information for the further development of many oral health policies and programmes. Appendix A contains an overview of the key results from this survey. Academic researchers, policy analysts, dental professionals and non-governmental organisations are encouraged to undertake or commission their own analyses of the 2009 NZOHS data.

Glossary

95% confidence interval	An indicator of the accuracy of a survey estimate. The 95% confidence interval (95% CI) is the interval that would be expected to contain the true population value 95% of the time, if many samples were taken. In this report, 95% confidence intervals have been presented in parentheses after estimates in the text, and as error bars in graphs.
Adjustment	This is where rates or results have been adjusted to take account of differences in the distribution of other factors (such as age) between different groups (eg, different ethnic groups).
Bridge	A prosthesis used to replace a tooth or teeth, which is cemented on to a natural tooth or teeth nearby and is not intended for removal by the patient.
Canine	One of the four 'eye teeth' positioned next to the incisors and used for tearing food.
Caries	The process by which tooth structure is destroyed by acid produced by bacteria in the mouth. See <i>Dental decay</i> .
Caries-active	Having clinically diagnosed dental decay.
Caries-free	Having no teeth that were decayed, missing due to pathology (dental decay or periodontal disease), or filled (ie, a dmft/DMFT score of 0).
Cemento-enamel junction	The point on a tooth surface where the tooth crown joins the tooth root.
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 is usually visible in the mouth.
Deciduous teeth	The first set of teeth that appear in childhood. Also referred to as primary teeth, baby teeth or temporary teeth.
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 recorders	Interviewers from CBG Health Research Ltd who were present at the clinical examinations to record the information provided by the dental examiners during the examinations.
Dentate	Having one or more natural teeth.
Dentine	The hard, calcified tissue which forms the major part of the tooth. It encloses the dental pulp, but is covered by enamel on the coronal surfaces.
Dentition	The set of natural teeth. The adult dentition comprises 32 teeth, while the primary dentition comprises 20 teeth.

Denture	A removable dental prosthesis that substitutes for missing natural teeth and adjacent tissues.
dmfs	An index of dental caries experience measured by counting the number of decayed (D), missing (M) and filled (F) surfaces (S) of primary teeth.
dmft	An index of dental caries experience measured by counting the number of decayed (D), missing (M) and filled (F) primary teeth (T).
DMFS	An index of dental caries experience measured by counting the number of decayed (D), missing (M) and filled (F) surfaces (S) of permanent teeth.
DMFT	An index of dental caries experience measured by counting the number of decayed (D), missing (M) and filled (F) permanent teeth (T).
Edentulous	<i>(edentulism, edentate)</i> A state of complete loss of all natural teeth.
Enamel	Hard, white mineralised tissue covering the crown of a tooth.
Erupted tooth	A tooth that has emerged through the gums into the mouth.
Extraction	Removal of a natural tooth.
Fissure sealant	A material, usually a resin, that has been placed in the pits and fissures of teeth to protect against the development of caries. Sealants are also used in conjunction with filling materials.
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.
Functional dentition	The minimum number of teeth required to allow attributes such as eating comfortably and socialising without embarrassment. For this report, a functional dentition was defined as having 21 or more natural teeth, although at an individual level the above attributes could be achieved with fewer teeth.
Gingiva	Gum tissue.
Gold standard examiner	A dental examiner whose role was to conduct replicate examinations for about six survey participants per examiner, to ensure consistency between the dental examiners. For the 2009 NZOHS the gold standard examiner was Dr Robyn Haisman.
Incisor	One of eight front teeth used during eating for cutting food.
Intra-class coefficient (ICC)	A statistical term referring to a measure of agreement between two or more examiners.
Lead examiner	An examiner who led the training and calibration course for the dental examiners. For the 2009 NZOHS, the lead examiner was Associate Professor Kaye Roberts-Thomson.
Loss of attachment	The distance in millimetres measured from the edge of the enamel of a tooth to the gum tissue that is attached to its root.

Mean	The arithmetic average of a set of values.
Molar	One of 12 back teeth used in grinding food.
Natural teeth	A person's own teeth as opposed to artificial teeth.
Neighbourhood deprivation	A measure of the socioeconomic status of an area (see <i>NZDep2006</i>).
NSAOH	Australian National Survey of Adult Oral Health 2004–06.
NZDep2006	New Zealand Index of Socioeconomic Deprivation 2006, an area-level (meshblock) measure of the socioeconomic status of an area.
NZHS	New Zealand Health Survey.
NZOHS	New Zealand Oral Health Survey.
Orofacial pain	Pain located in the face, jaw, temple, in front of the ear or in the ear.
Percentage point difference	The absolute difference between prevalence estimates. For example, if men have a prevalence of 40%, and women have a prevalence of 30%, this represents a 10 percentage point difference.
Periodontal attachment	The fibrous connection between the tooth root and the supporting bone and gum. Where periodontal disease has occurred, some of this attachment between the tooth and supporting bone is lost.
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	Adults' teeth (secondary teeth).
Plaque	A film composed of bacteria and food debris that adheres to the tooth surface.
Premolar	A permanent tooth situated between the permanent canine and molar teeth.
Prevalence	The proportion of people with a defined disease within a defined population.
Probing pocket depth	The measured depth of the periodontal pocket.
P-value	An indication of statistical significance. A p-value less than 0.05 (p-value < 0.05) indicates that a result is statistically significant at the 5% level of significance.

Quintile	A quintile contains a fifth (20%) of the data. For example, each quintile of the New Zealand Index of Socioeconomic Deprivation (NZDep2006) contains approximately 20% of the population.
Rate	The proportion affected within a defined population and a defined time period (ie, prevalence).
Rate ratio	How prevalent an indicator is in one population group (eg, men) compared with another (eg, women).
Relative index of inequality	A way of calculating a relative inequality, which uses all of the data from several groups (eg, all five NZDep2006 quintiles), rather than just selected groups (eg, NZDep2006 quintiles 1 and 5). In this report, the data from all NZDep2006 quintiles (1–5) were used to calculate a line of best fit (regression line), adjusted for age group, sex and ethnic group. This provided adjusted estimates for the minimum deprived (slightly 'less deprived' than quintile 1) and the maximum deprived (slightly 'more deprived' than quintile 5), which were then used to calculate the relative index of inequality in a similar way to the rate ratio.
Restoration	The material end result of operative procedures that restore the form, function and appearance of a tooth.
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.
SAOH	1976 Survey of Adult Oral Health, conducted in New Zealand.
SOHO	1988 Survey of Oral Health Outcomes, conducted in New Zealand as part of a WHO international study.
Standardised mean ratio	A ratio of two means, standardised for one or more other factors (such as age).
Standardised rate ratio	A ratio of two prevalence rates, standardised for one or more other factors (such as age).
Total response ethnicity	A categorisation of ethnicity whereby each person is assigned to all those ethnicities they identify with. Total response ethnicity has been used in this publication.
Unadjusted prevalence	A rate that has not been adjusted for other factors (such as age). This is an unadjusted (or 'crude') rate that shows the burden on a population group, and can be used to estimate the number of people affected in a population.
Unerupted tooth	A tooth that has not emerged through the gums into the mouth.
WHO	World Health Organization.
Wisdom tooth	One of four molars, each one positioned at the back of the mouth.

Appendix A: Summary Tables of Results

Table A1 presents the response rates for the 2009 New Zealand Oral Health Survey, by demographic group. For the 95% confidence intervals of prevalence estimates, please see the appropriate results chapter.

Table A1: Summary results for children and adolescents aged 2–17 years, by age group (unadjusted prevalence or mean)

Indicator	Pg	Age group (years)					
		2–4	5–11	12–17	2–11	5–17	2–17
Mean number of primary teeth (2–11 years)	118	19.5	10.6		13.1		
Mean number of sound primary teeth (2–11 years)	120	18.8	8.8		11.6		
Prevalence of having caries-free primary teeth (2–11 years)	122	79.7%	51.0%		59.1%		
Prevalence of untreated coronal decay on one or more primary teeth (2–11 years)	124	14.9%	17.3%		16.6%		
Mean number of primary teeth with untreated coronal decay (2–11 years)	126	0.4	0.3		0.3		
Mean number of filled primary teeth (2–11 years)	128	0.3	1.5		1.1		
Prevalence of missing one or more primary teeth due to decay (2–11 years)	130	1.4%	4.9%		3.9%		
Mean number of primary teeth missing due to dental decay (2–11 years)	132	0.0	0.1		0.1		
Mean dmft score (in primary teeth) (2–11 years)	134	0.8	1.9		1.6		
Mean number of permanent teeth (5–17 years)	136		12.8	27.0		19.8	
Mean number of sound permanent teeth (5–17 years)	138		12.4	25.1		18.6	
Prevalence of having caries-free permanent teeth (5–17 years)	140		77.5%	44.7%		61.3%	
Prevalence of untreated coronal decay on one or more permanent teeth (5–17 years)	142		2.7%	12.7%		7.6%	
Mean number of permanent teeth with untreated coronal decay (5–17 years)	144		0.0	0.2		0.1	
Mean number of filled permanent teeth (5–17 years)	146		0.4	1.7		1.1	
Mean number of permanent teeth missing due to decay (12–17 years)	148			0.0			
Prevalence of missing one or more permanent teeth due to decay (12–17 years)	148			0.2%			
Mean DMFT score (in permanent teeth) (5–17 years)	148		0.5	1.9		1.2	
Prevalence of any trauma to upper six front permanent teeth (7–17 years)	150		6.2%	23.4%		16.0%	
Prevalence of having caries-free teeth (all primary and permanent) (2–17 years)	152	79.7%	42.5%	44.0%			49.3%
Prevalence of untreated coronal decay on one or more primary or permanent teeth (2–17 years)	154	14.9%	19.3%	12.7%			15.9%
Prevalence of brushing teeth at least twice daily (2–17 years)	160	65.6%	66.9%	59.0%			63.5%
Prevalence of brushing teeth at least twice daily with fluoride toothpaste of 1000 ppm or greater (2–17 years)	160	15.3%	40.4%	57.1%			43.0%
Prevalence of having visited a dental professional in the last year (2–17 years)	174	59.7%	90.3%	79.9%			81.2%
Prevalence of having parent-rated (or self-rated) fair or poor oral health (2–17 years)	226	4.9%	13.9%	14.4%			12.6%
Prevalence of wellbeing reported to have been affected a lot or very much by condition of teeth, lips, jaws and mouth (2–14 years)	229	6.6%	6.4%	5.2%			6.1%
Prevalence of having experienced toothache (sometimes, often or always) in the last year (2–14 years)	232	1.4%	7.8%	9.6%			7.0%
Prevalence of having taken time off school or normal activities in the past year because of problems with teeth or mouth (2–17 years)	235	7.5%	11.3%	17.0%			13.0%
Prevalence of caregiver having taken time off school or normal activities in the past year because of problems with child's teeth or mouth (2–14 years)	237	5.8%	13.2%	13.0%			11.6%

Source: 2009 New Zealand Oral Health Survey

Table A2: Summary results for adults aged 18 years and over, by age group (unadjusted prevalence or mean)

Indicator	Pg	Age group (years)							
		All	18–24	25–34	35–44	45–54	55–64	65–74	75+
Prevalence of complete tooth loss (edentulism)	57	9.4%	0.1%	0.0%	1.7%	3.2%	14.6%	29.6%	39.6%
Prevalence of missing one or more teeth due to pathology (D)	59	61.8%	8.8%	34.7%	41.8%	91.8%	98.0%	98.2%	100.0%
Mean number of missing teeth (D)	62	4.6	0.3	0.9	1.7	6.0	7.7	12.1	13.7
Mean number of natural teeth (D)	65	25.9	28.5	29.1	27.7	25.6	24.0	19.7	18.1
Prevalence of having a functional dentition (D)	68	88.6%	99.6%	99.9%	97.9%	87.6%	83.8%	54.9%	54.0%
Mean number of sound and untreated teeth (D)	72	16.5	25.1	23.1	19.4	13.1	9.8	7.5	6.9
Prevalence of untreated coronal decay on one or more teeth (D)	77	35.3%	31.5%	46.5%	37.5%	33.1%	29.3%	31.0%	30.9%
Mean number of teeth with untreated coronal decay (D)	80	0.8	0.8	1.3	0.9	0.8	0.6	0.6	0.5
Mean number of filled teeth (D)	83	8.5	2.7	4.6	7.4	11.5	13.3	11.5	10.6
Mean DMFT score (D)	86	13.9	3.7	6.8	10.0	18.3	21.7	24.2	24.8
Prevalence of any root decay (D)	90	9.5%	1.3%	4.6%	5.0%	13.4%	13.5%	15.5%	29.3%
Prevalence of any trauma in upper six front teeth (D)	93	23.4%	17.1%	19.4%	32.9%	27.3%	18.8%	17.6%	17.0%
Prevalence of periodontal pocketing of 4 mm or more (DP)	97	33.5%	20.7%	33.1%	36.3%	35.5%	39.5%	34.0%	32.6%
Prevalence of periodontal pocketing of 5 mm or more (DP)	97	10.5%	3.6%	10.5%	10.3%	12.1%	13.1%	11.9%	15.9%
Prevalence of periodontal pocketing of 6 mm or more (DP)	97	5.1%	2.8%	7.0%	4.3%	5.5%	5.5%	5.5%	5.1%
Prevalence of loss of attachment of 4 mm or more (DP)	104	49.9%	17.9%	35.3%	44.0%	62.6%	68.9%	73.2%	86.7%
Prevalence of loss of attachment of 5 mm or more (DP)	104	27.5%	8.0%	13.1%	19.5%	36.1%	42.6%	50.4%	67.7%
Prevalence of loss of attachment of 6 mm or more (DP)	104	13.4%	4.5%	6.8%	8.4%	18.4%	18.4%	22.6%	41.3%
Prevalence of any mucosal condition (D)	113	17.3%	15.7%	17.0%	10.1%	15.5%	18.7%	32.2%	32.8%
Prevalence of brushing teeth at least twice daily with fluoride toothpaste of 1000 ppm or greater (D)	163	65.3%	62.8%	64.1%	65.2%	65.7%	69.7%	64.8%	63.3%
Prevalence of having visited a dental professional in past year	176	47.1%	36.9%	44.6%	43.3%	55.7%	55.7%	47.7%	40.3%
Prevalence of last visit being for a check-up	180	47.9%	76.9%	46.9%	46.1%	44.0%	40.5%	39.6%	43.2%
Prevalence of usually visiting a dental professional for a check-up	182	38.9%	47.2%	34.5%	37.4%	35.5%	44.0%	38.7%	37.1%
Prevalence of usually visiting the same dental professional	185	67.0%	58.8%	52.6%	67.1%	76.2%	76.1%	71.9%	63.2%
Prevalence of always being listened to carefully by a dental professional	189	84.2%	84.0%	82.8%	83.3%	80.1%	86.0%	89.6%	88.7%
Prevalence of feeling they do not see a dental professional often enough	193	55.3%	70.5%	71.0%	67.5%	54.8%	42.3%	31.7%	25.1%
Prevalence of perceiving the need for dental treatment	196	45.9%	42.8%	59.5%	50.7%	52.9%	43.9%	28.9%	21.5%
Prevalence of having avoided dental care in the last year due to cost	200	44.1%	52.3%	61.7%	57.0%	44.5%	31.2%	22.8%	16.6%
Prevalence of cost preventing recommended routine dental treatment	203	25.3%	25.0%	35.7%	30.1%	28.6%	21.3%	12.3%	9.1%
Prevalence of fair or poor self-rated oral health	212	26.6%	22.2%	31.2%	26.9%	35.9%	24.7%	20.2%	14.1%
Prevalence of having experienced impacts due to their oral health in past year (OHIP-14)	214	15.6%	15.6%	16.1%	14.6%	20.0%	14.0%	12.5%	13.0%
Prevalence of experiencing orofacial pain in last 4 weeks	218	25.4%	30.0%	35.1%	26.2%	24.5%	22.8%	19.4%	12.1%
Prevalence of having taken time off work / school in past year due to dental problems (18–64 years)	223	10.2%	9.2%	13.2%	8.5%	12.3%	7.3%	–	–

Source: 2009 New Zealand Oral Health Survey

Notes:

(D) Among dentate adults

(DP) Among dentate periodontally examined adults

For Table A3 and Table A4, only significant results have been presented.

Table A3: Summary results for children and adolescents aged 2–17 years, by population group (adjusted ratio of rates or means)

Indicator	Adjusted ratio of rates or means by population group				
	Boys vs girls	Māori vs non-Māori	Pacific vs non-Pacific	Asian vs non-Asian	Most deprived vs least deprived
Mean number of primary teeth (2–11 years)	1.1*				
Mean number of sound primary teeth (2–11 years)	1.1*	0.9*			0.8*
Prevalence of having caries-free primary teeth (2–11 years)		0.8*	0.7*		
Prevalence of untreated coronal decay on one or more primary teeth (2–11 years)		2.0*	1.7*		
Mean number of primary teeth with untreated coronal decay (2–11 years)		2.3*			
Mean number of filled primary teeth (2–11 years)					
Prevalence of missing one or more primary teeth due to decay (2–11 years)					5.8*
Mean number of primary teeth missing due to dental decay (2–11 years)					14.5*
Mean dmft score (in primary teeth) (2–11 years)		1.5*			
Mean number of permanent teeth (5–17 years)	0.9*				
Mean number of sound permanent teeth (5–17 years)	0.9*				
Prevalence of having caries-free permanent teeth (5–17 years)					
Prevalence of untreated coronal decay on one or more permanent teeth (5–17 years)					
Mean number of permanent teeth with untreated coronal decay (5–17 years)		2.4*			
Mean number of filled permanent teeth (5–17 years)		1.7*			
Mean DMFT score (in permanent teeth) (5–17 years)		1.8*			
Prevalence of any trauma to upper six front permanent teeth (7–17 years)					
Prevalence of having caries-free teeth (all primary and permanent) (2–17 years)		0.7*	0.7*		
Prevalence of untreated coronal decay on one or more primary or permanent teeth (2–17 years)		1.9*			
Prevalence of brushing teeth at least twice daily (2–17 years)	0.9*	0.8*			0.6*
Prevalence of brushing teeth at least twice daily with fluoride toothpaste of 1000 ppm or greater (2–17 years)		0.8*			
Prevalence of having visited a dental professional in the last year (2–17 years)		0.9*	0.9*		
Prevalence of having parent-rated (or self-rated) fair or poor oral health (2–17 years)		1.4*			
Prevalence of wellbeing reported to have been affected a lot or very much by condition of teeth, lips, jaws and mouth (2–14 years)			0.4*	0.3*	
Prevalence of having experienced toothache (sometimes, often or always) in the last year (2–14 years)			2.2*		
Prevalence of having taken time off school or normal activities in the past year because of problems with teeth or mouth (2–17 years)					
Prevalence of caregiver having taken time off school or normal activities in the past year because of problems with child's teeth or mouth (2–14 years)					

Source: 2009 New Zealand Oral Health Survey

* Indicates a statistically significant result (p-value < 0.05). Non-significant results are not shown.

Table A4: Summary results for adults aged 18 years and over (adjusted ratio of rates or means)

Indicator	Adjusted ratio of rates or means by population group					
	Men vs women	Māori vs non-Māori	Pacific vs non-Pacific	Asian vs non-Asian	Most deprived vs least deprived	Usually visit for a problem vs check-up
Prevalence of complete tooth loss (edentulism)		1.9*		0.4*	2.8*	–
Prevalence of missing one or more teeth due to pathology (D)		1.1*	1.2*	0.9*	1.2*	1.1*
Mean number of missing teeth (D)		1.6*	1.3*	0.8*	1.4*	1.4*
Mean number of natural teeth (D)		0.9*		1.0*	1.0*	0.9*
Prevalence of having a functional dentition (D)		0.9*	0.9*			0.9*
Mean number of sound and untreated teeth (D)	1.1*	0.9*	1.2*	1.2*		1.0*
Prevalence of untreated coronal decay on one or more teeth (D)	1.4*	1.5*	1.7*		1.6*	1.9*
Mean number of teeth with untreated coronal decay (D)	1.5*	1.9*	1.9*		2.6*	2.3*
Mean number of filled teeth (D)	0.9*	0.9*	0.5*	0.6*	0.7*	0.9*
Mean DMFT score (D)	0.9*	1.1*	0.8*	0.6*		1.1*
Prevalence of any root decay (D)	1.7*	1.7*			2.3*	1.5*
Prevalence of any trauma in upper six front teeth (DP)	1.4*					
Prevalence of periodontal pocketing of 4 mm or more (DP)	1.4*	1.5*	1.4*	1.5*		
Prevalence of periodontal pocketing of 5 mm or more (DP)	1.7*	1.9*	2.2*	2.4*		
Prevalence of periodontal pocketing of 6 mm or more (DP)		1.6*	2.3*	3.0*		
Prevalence of loss of attachment of 4 mm or more (DP)	1.2*	1.3*			1.3*	
Prevalence of loss of attachment of 5 mm or more (DP)	1.4*	1.4*	1.4*	1.5*	1.6*	
Prevalence of loss of attachment of 6 mm or more (DP)	1.5*	1.9*	1.8*	1.9*	1.8*	
Prevalence of any mucosal condition (D)						
Prevalence of brushing teeth twice daily with fluoride toothpaste of 1000 ppm or greater (D)	0.8*	0.7*		1.2*		0.9*
Prevalence of having visited a dental professional in the past year	0.9*	0.8*	0.7*		0.6*	0.5*
Prevalence of last visit being for a check-up		0.8*	0.7*		0.7*	–
Prevalence of usually visiting a dental professional for a check-up	0.9*	0.6*	0.5*		0.5*	–
Prevalence of usually visiting the same dental professional	0.9*	0.8*	0.5*	0.8*	0.7*	0.7*
Prevalence of always being listened to carefully by a dental professional		0.9*	0.8*	1.1*		0.9*
Prevalence of feeling they do not see a dental professional often enough		1.3*	1.3*		1.7*	2.2*
Prevalence of perceiving the need for dental treatment		1.2*	1.3*	0.8*	1.3*	1.3*
Prevalence of having avoided dental care in the last year due to cost	0.8*	1.3*	1.4*		1.8*	1.9*
Prevalence of cost preventing recommended routine dental treatment	0.8*	1.5*	1.7*		2.2*	1.9*
Prevalence of fair or poor self-rated oral health	1.3*	1.7*	1.3*		2.0*	2.0*
Prevalence of having experienced impacts due to their oral health in past year	0.7*	1.6*	1.5*		2.6*	2.1*
Prevalence of experiencing orofacial pain in last four weeks				0.7*		1.4*
Prevalence of having taken time off work or school in past year due to dental problems (18–64 years)						

Source: 2009 New Zealand Oral Health Survey

* Indicates a statistically significant result (p-value < 0.05). Non-significant results are not shown.

– Indicates that the result was not calculated.

Notes:

(D) Among dentate adults

(DP) Among dentate periodontally examined adults

Table A5: Summary results for New Zealand, 2009 compared with 1976 and 1988, among adults aged 20–24, 35–44 and 65–74 years (age-standardised ratios of rates and means)

Indicator	SRR or SRM (95% confidence interval)	
	2009 vs 1976	2009 vs 1988
Prevalence of complete tooth loss (edentulism)	0.26 (0.19–0.32)*	0.37 (0.29–0.46)*
Mean number of natural teeth (D)	1.18 (1.14–1.23)*	1.08 (1.06–1.10)*
Prevalence of having a functional dentition (21 or more natural teeth) (D)	1.36 (1.26–1.46)*	1.10 (1.06–1.14)*
Prevalence of missing one or more teeth due to pathology (D)	0.65 (0.58–0.72)*	0.70 (0.63–0.76)*
Mean number of teeth missing due to pathology (D)	0.44 (0.37–0.50)*	0.63 (0.55–0.70)*
Prevalence of having one or more teeth (crowns or roots) with untreated decay (D)	0.79 (0.66–0.92)*	1.14 (0.94–1.35)
Mean number of teeth (crowns and roots) with untreated decay (D)	0.65 (0.49–0.81)*	1.34 (1.02–1.67)*
Mean number of filled teeth (D)	0.63 (0.57–0.70)*	0.59 (0.54–0.64)*
Mean DMFT (D)	0.56 (0.53–0.59)*	0.63 (0.60–0.67)*
Prevalence of brushing teeth twice daily with toothpaste (D)		1.09 (1.00–1.18)*
Prevalence of having visited a dentist in the last 12 months		0.87 (0.78–0.97)*
Prevalence of usually visiting the same dental professional		0.96 (0.90–1.03)
Prevalence of the last visit being for a check-up		0.91 (0.81–1.00)

Sources: 1976 Survey of Adult Oral Health; 1988 WHO Study of Oral health Outcomes (NZ); 2009 New Zealand Oral Health Survey

* Indicates a statistically significant result (p-value < 0.05)

(D) Among dentate adults

Table A6: Summary results for New Zealand compared with Australia, among adults aged 15 years and over (age-standardised ratios of rates and means)

Indicator	SRR or SRM NZ vs Australia (95% confidence interval)
Prevalence of complete tooth loss	1.35 (1.14–1.57)*
Prevalence of having a functional dentition (D)	1.01 (0.99–1.03)
Prevalence of having one or more missing teeth due to pathology (D)	0.95 (0.89–1.01)
Mean number of teeth missing due to pathology (D)	0.92 (0.83–1.01)
Prevalence of having one or more teeth with untreated coronal decay (D)	1.34 (1.20–1.49)*
Mean number of teeth surfaces with untreated coronal decay (D)	1.48 (1.21–1.74)*
Mean number of filled teeth surfaces (D)	1.05 (0.97–1.13)
Prevalence of having one or more decayed, missing or filled teeth (DMFT > 0) (D)	1.04 (1.01–1.07)*
Mean number of decayed, missing or filled teeth (DMFT) (D)	1.01 (0.96–1.07)
Mean number of decayed root surfaces (D)	1.55 (0.67–2.43)
Mean number of filled root surfaces (D)	0.64 (0.51–0.78)*
Prevalence of periodontal pocketing of 4 mm or more (DP)	1.65 (1.43–1.87)*
Prevalence of loss of attachment of 4 mm or more (DP)	1.11 (1.01–1.21)*
Prevalence of having visited a dental professional in the last year	0.81 (0.76–0.86)*

Sources: 2009 New Zealand Oral Health Survey and Australian National Survey of Adult Oral Health 2004–06

* Indicates a statistically significant result (p-value < 0.05)

(D) Among dentate adults

(DP) Among dentate adults who were periodontally examined

Appendix B: Tables of Clinical Results for Children and Adults

The following tables present detailed clinical results for dmft and DMFT scores among children and adolescents, and DMFT scores and periodontal measures among adults.

Table B1: Mean number of decayed, missing or filled primary teeth (dmft), among children aged 2–11 years

Age at time of survey (years)		Population: Children aged 2–11 years							
		Number of teeth with caries experience				Number of coronal surfaces with caries experience			
		dt Mean (95% CI)	mt Mean (95% CI)	ft Mean (95% CI)	dmft Mean (95% CI)	ds Mean (95% CI)	ms Mean (95% CI)	fs Mean (95% CI)	dmfs Mean (95% CI)
All ages		0.3 (0.3, 0.4)	0.1 (0.0, 0.1)	1.1 (0.9, 1.4)	1.6 (1.2, 1.9)	0.5 (0.3, 0.7)	0.2 (0.1, 0.4)	2.3 (1.6, 3.0)	3.0 (2.2, 3.8)
Gender	Females	0.3 (0.2, 0.4)	0.1 (0.0, 0.2)	1.1 (0.7, 1.5)	1.5 (1.1, 1.9)	0.4 (0.2, 0.7)	0.2 (0.0, 0.4)	2.4 (1.2, 3.6)	3.1 (1.9, 4.3)
	Males	0.4 (0.2, 0.5)	0.1 (0.0, 0.2)	1.2 (0.8, 1.5)	1.6 (1.2, 2.1)	0.6 (0.4, 0.8)	0.2 (0.0, 0.4)	2.2 (1.5, 2.9)	3.0 (2.0, 3.9)
Ethnicity	Māori	0.6 (0.4, 0.8)	0.1 (0.1, 0.2)	1.4 (1.0, 1.7)	2.1 (1.7, 2.5)	0.9 (0.6, 1.2)	0.3 (0.1, 0.6)	2.9 (2.1, 3.7)	4.2 (3.1, 5.2)
	Non-Māori	0.3 (0.2, 0.4)	0.1 (0.0, 0.2)	1.1 (0.7, 1.4)	1.4 (1.0, 1.8)	0.4 (0.2, 0.6)	0.2 (0.0, 0.4)	2.1 (1.2, 3.0)	2.7 (1.7, 3.7)
2–4 years		0.4 (0.2, 0.5)	0.0 (0.0, 0.2)	0.3 (0.1, 1.8)	0.8 (0.3, 1.2)	0.5 (0.3, 0.7)	0.1 (0.0, 0.6)	1.2 (0.0, 3.1)	1.8 (0.4, 7.8)
Gender	Females	0.4 (0.2, 0.6)	0.1 (0.0, 0.4)	0.5 (0.0, 1.2)	0.9 (0.2, 1.7)	0.5 (0.2, 0.8)	0.2 (0.0, 0.4)	2.0 (0.0, 5.5)	2.6 (0.0, 6.1)
	Males	0.4 (0.2, 0.6)	0.0 (0.0, 0.0)	0.1 (0.0, 0.2)	0.5 (0.3, 0.8)	0.6 (0.3, 0.9)	0.0 (0.0, 0.1)	0.2 (0.0, 0.4)	0.8 (0.4, 1.2)
Ethnicity	Māori	0.9 (0.5, 1.4)	0.1 (0.0, 0.8)	0.4 (0.2, 0.6)	1.5 (0.8, 2.1)	1.3 (0.6, 1.9)	0.4 (0.0, 0.9)	0.8 (0.3, 1.3)	2.5 (1.3, 3.7)
	Non-Māori	0.2 (0.1, 0.4)	0.0 (0.0, 0.0)	0.3 (0.0, 0.8)	0.5 (0.2, 1.9)	0.3 (0.1, 0.5)	0.0 (0.0, 0.0)	1.3 (0.0, 3.8)	1.6 (0.0, 4.1)
5–11 years		0.3 (0.2, 0.4)	0.1 (0.0, 0.2)	1.5 (1.1, 1.8)	1.9 (1.5, 2.3)	0.5 (0.3, 0.7)	0.3 (0.1, 0.5)	2.7 (2.1, 3.4)	3.5 (2.7, 4.3)
Gender	Females	0.3 (0.1, 0.5)	0.1 (0.0, 0.3)	1.4 (1.0, 1.9)	1.8 (1.3, 2.2)	0.4 (0.1, 1.3)	0.3 (0.1, 0.9)	2.6 (1.9, 3.4)	3.3 (2.4, 4.2)
	Males	0.4 (0.2, 0.6)	0.1 (0.0, 0.3)	1.5 (1.0, 2.0)	2.0 (1.4, 2.5)	0.6 (0.3, 0.8)	0.3 (0.0, 0.6)	2.8 (1.9, 3.8)	3.7 (2.5, 4.9)
Ethnicity	Māori	0.5 (0.3, 0.7)	0.1 (0.1, 0.2)	1.7 (1.3, 2.2)	2.3 (1.8, 2.9)	0.8 (0.5, 1.1)	0.3 (0.1, 0.6)	3.7 (2.6, 4.8)	4.8 (3.4, 6.1)
	Non-Māori	0.3 (0.1, 0.4)	0.1 (0.0, 0.3)	1.4 (0.9, 1.8)	1.7 (1.2, 2.2)	0.4 (0.1, 0.7)	0.3 (0.1, 0.8)	2.4 (1.6, 3.2)	3.1 (2.1, 4.1)

Table B2: Mean number of decayed, missing or filled permanent teeth (DMFT), among children and adolescents aged 5–17 years

Age at time of survey (years)		Population: Children and adolescents aged 5–17 years							
		Number of teeth with caries experience				Number of coronal surfaces with caries experience			
		DT Mean (95% CI)	MT Mean (95% CI)	FT Mean (95% CI)	DMFT Mean (95% CI)	DS Mean (95% CI)	MS Mean (95% CI)	FS Mean (95% CI)	DMFS Mean (95% CI)
All ages	All	0.1 (0.1, 0.2)	0.0 (0.0, 0.0)	1.1 (0.9, 1.3)	1.2 (1.0, 1.4)	0.1 (0.1, 0.2)	0.0 (0.0, 0.0)	1.5 (1.1, 1.8)	1.6 (1.3, 2.0)
	Gender								
	Females	0.1 (0.1, 0.2)	0.0 (0.0, 0.0)	1.2 (0.9, 1.4)	1.3 (1.0, 1.6)	0.2 (0.1, 0.3)	0.0 (0.0, 0.0)	1.7 (1.3, 2.1)	1.8 (1.4, 2.3)
	Males	0.1 (0.1, 0.3)	0.0 (0.0, 0.0)	1.0 (0.6, 1.3)	1.1 (0.7, 1.4)	0.1 (0.1, 0.3)	0.0 (0.0, 0.1)	1.3 (0.8, 1.8)	1.5 (0.9, 2.0)
	Ethnicity								
Māori	0.2 (0.1, 0.4)	0.0 (0.0, 0.1)	1.5 (1.1, 1.9)	1.7 (1.3, 2.2)	0.3 (0.2, 0.5)	0.1 (0.0, 0.2)	2.2 (1.6, 2.9)	2.6 (1.8, 3.3)	
Non-Māori	0.1 (0.0, 0.2)	0.0 (0.0, 0.0)	0.9 (0.7, 1.2)	1.0 (0.8, 1.3)	0.1 (0.1, 0.2)	0.0 (0.0, 0.0)	1.2 (0.9, 1.6)	1.4 (0.9, 1.8)	
5–11 years	All	0.0 (0.0, 0.1)	0.0 (0.0, 0.0)	0.4 (0.3, 0.6)	0.5 (0.3, 0.6)	0.0 (0.0, 0.1)	0.0 (0.0, 0.1)	0.5 (0.3, 0.7)	0.6 (0.4, 0.8)
	Gender								
	Females	0.0 (0.0, 0.1)	0.0 (0.0, 0.0)	0.5 (0.3, 0.8)	0.6 (0.4, 0.9)	0.0 (0.0, 0.1)	0.0 (0.0, 0.0)	0.6 (0.4, 1.0)	0.7 (0.4, 1.1)
	Males	0.0 (0.0, 0.1)	0.0 (0.0, 0.1)	0.3 (0.2, 0.7)	0.4 (0.2, 0.7)	0.0 (0.0, 0.2)	0.1 (0.0, 0.2)	0.4 (0.2, 0.8)	0.5 (0.3, 0.9)
	Ethnicity								
Māori	0.1 (0.0, 0.2)	0.0 (0.0, 0.1)	0.4 (0.3, 0.7)	0.5 (0.4, 0.8)	0.1 (0.0, 0.2)	0.1 (0.0, 0.3)	0.5 (0.3, 0.8)	0.7 (0.4, 1.0)	
Non-Māori	0.0 (0.0, 0.1)	0.0 (0.0, 0.0)	0.4 (0.3, 0.6)	0.4 (0.3, 0.6)	0.0 (0.0, 0.1)	0.0 (0.0, 0.0)	0.5 (0.3, 0.7)	0.5 (0.4, 0.8)	
12–17 years	All	0.2 (0.1, 0.3)	0.0 (0.0, 0.0)	1.7 (1.3, 2.1)	1.9 (1.5, 2.4)	0.3 (0.2, 0.4)	0.0 (0.0, 0.0)	2.5 (1.8, 3.1)	2.7 (2.0, 3.4)
	Gender								
	Females	0.2 (0.1, 0.3)	0.0 (0.0, 0.0)	1.9 (1.4, 2.4)	2.1 (1.6, 2.6)	0.3 (0.2, 0.5)	0.0 (0.0, 0.0)	2.8 (2.0, 3.6)	3.1 (2.2, 3.9)
	Males	0.2 (0.1, 0.5)	0.0 (0.0, 0.0)	1.6 (1.1, 2.3)	1.8 (1.2, 2.4)	0.2 (0.1, 0.5)	0.0 (0.0, 0.0)	2.2 (1.2, 3.2)	2.4 (1.4, 3.5)
	Ethnicity								
Māori	0.4 (0.2, 0.6)	0.0 (0.0, 0.1)	2.8 (1.9, 3.6)	3.2 (2.2, 4.1)	0.5 (0.3, 0.9)	0.0 (0.0, 0.2)	4.3 (2.8, 5.9)	4.9 (3.3, 6.6)	
Non-Māori	0.2 (0.1, 0.3)	0.0 (0.0, 0.0)	1.5 (1.0, 1.9)	1.6 (1.1, 2.1)	0.2 (0.1, 0.4)	0.0 (0.0, 0.0)	2.0 (1.2, 2.7)	2.1 (1.4, 2.9)	

Table B3: Mean number of decayed, missing or filled permanent teeth (DMFT), among adults aged 18 years and over

Age at time of survey (years)	Population: Dentate adults aged 18 years and over							
	Number of teeth with caries experience				Number of coronal surfaces with caries experience			
	DT Mean (95% CI)	MT Mean (95% CI)	FT Mean (95% CI)	DMFT Mean (95% CI)	DS Mean (95% CI)	MS Mean (95% CI)	FS Mean (95% CI)	DMFS Mean (95% CI)
All ages	0.8 (0.7, 0.9)	4.6 (4.3, 4.9)	8.5 (8.1, 8.8)	13.9 (13.5, 14.2)	1.3 (1.1, 1.5)	13.8 (12.9, 14.6)	22.3 (21.2, 23.3)	37.3 (36.2, 38.4)
Gender Females	0.7 (0.6, 0.8)	4.6 (4.3, 5.0)	8.9 (8.5, 9.3)	14.1 (13.7, 14.6)	1.0 (0.9, 1.2)	13.8 (12.8, 14.9)	23.5 (22.2, 24.8)	38.3 (36.9, 39.8)
Gender Males	1.0 (0.8, 1.2)	4.6 (4.1, 5.0)	8.0 (7.5, 8.5)	13.6 (13.1, 14.1)	1.6 (1.2, 1.9)	13.7 (12.4, 15.0)	20.9 (19.4, 22.5)	36.2 (34.4, 38.0)
Ethnicity Māori	1.5 (1.2, 1.7)	4.4 (3.8, 5.0)	6.4 (5.9, 6.9)	12.3 (11.5, 13.1)	2.4 (1.9, 2.9)	13.3 (11.4, 15.1)	14.7 (13.3, 16.1)	30.4 (28.2, 32.6)
Ethnicity Non-Māori	0.8 (0.6, 0.9)	4.6 (4.3, 4.9)	8.7 (8.4, 9.1)	14.1 (13.7, 14.5)	1.1 (1.0, 1.3)	13.8 (12.9, 14.8)	23.2 (22.1, 24.3)	38.2 (36.9, 39.4)
18–24	0.8 (0.5, 1.2)	0.3 (0.1, 0.8)	2.7 (1.9, 3.4)	3.7 (2.8, 4.7)	0.9 (0.6, 1.5)	0.9 (0.1, 1.7)	4.5 (2.9, 6.0)	6.3 (4.2, 8.4)
Gender Females	0.7 (0.4, 1.3)	0.4 (0.1, 1.4)	3.4 (2.2, 4.5)	4.5 (3.0, 6.0)	0.9 (0.5, 1.5)	1.1 (0.3, 4.1)	5.8 (3.2, 8.4)	7.8 (4.4, 11.2)
Gender Males	0.8 (0.4, 1.6)	0.2 (0.0, 1.1)	1.8 (1.2, 2.7)	2.8 (1.9, 3.8)	1.0 (0.5, 2.0)	0.7 (0.1, 3.2)	2.8 (1.6, 4.0)	4.5 (2.7, 6.2)
Ethnicity Māori	1.1 (0.7, 1.7)	0.5 (0.1, 3.2)	2.7 (2.0, 3.5)	4.3 (2.9, 5.6)	1.4 (0.8, 2.3)	1.4 (0.2, 9.5)	4.1 (3.1, 5.1)	6.8 (4.2, 9.4)
Ethnicity Non-Māori	0.7 (0.4, 1.2)	0.3 (0.1, 1.0)	2.6 (1.8, 3.5)	3.6 (2.5, 4.7)	0.8 (0.5, 1.4)	0.8 (0.2, 2.9)	4.5 (2.7, 6.4)	6.2 (3.8, 8.6)
25–34	1.3 (0.9, 1.7)	0.9 (0.7, 1.2)	4.6 (3.9, 5.3)	6.8 (6.0, 7.6)	2.0 (1.3, 2.7)	2.8 (2.0, 3.5)	9.1 (7.4, 10.8)	13.8 (11.8, 15.9)
Gender Females	1.2 (0.9, 1.6)	1.2 (0.8, 1.6)	4.9 (3.9, 5.9)	7.3 (6.1, 8.5)	1.9 (1.3, 2.5)	3.5 (2.3, 4.7)	10.0 (7.6, 12.5)	15.4 (12.2, 18.6)
Gender Males	1.3 (0.8, 2.4)	0.7 (0.4, 1.0)	4.3 (3.3, 5.2)	6.3 (5.2, 7.3)	2.2 (0.8, 3.5)	2.0 (1.1, 2.9)	8.0 (5.5, 10.4)	12.1 (9.4, 14.9)
Ethnicity Māori	2.0 (1.5, 2.4)	1.0 (0.7, 1.2)	4.8 (4.0, 5.5)	7.7 (6.6, 8.7)	3.1 (2.3, 3.9)	2.9 (2.1, 3.7)	9.2 (7.5, 10.9)	15.2 (12.7, 17.7)
Ethnicity Non-Māori	1.2 (0.7, 1.6)	0.9 (0.6, 1.2)	4.6 (3.8, 5.4)	6.6 (5.7, 7.6)	1.8 (1.0, 2.7)	2.7 (1.8, 3.7)	9.0 (7.1, 11.0)	13.6 (11.2, 16.0)
35–44	0.9 (0.7, 1.0)	1.7 (1.3, 2.0)	7.4 (6.8, 8.1)	10.0 (9.2, 10.8)	1.3 (1.0, 1.7)	5.0 (4.0, 6.0)	14.8 (12.9, 16.6)	21.1 (18.9, 23.4)
Gender Females	0.6 (0.5, 0.8)	1.8 (1.4, 2.3)	7.6 (6.9, 8.3)	10.0 (9.1, 11.0)	0.9 (0.6, 1.1)	5.5 (4.1, 6.9)	14.7 (12.7, 16.7)	21.1 (18.4, 23.7)
Gender Males	1.2 (0.8, 1.5)	1.5 (1.1, 1.9)	7.3 (6.2, 8.4)	9.9 (8.8, 11.1)	1.8 (1.1, 2.5)	4.5 (3.2, 5.8)	14.9 (12.0, 17.7)	21.2 (18.0, 24.5)
Ethnicity Māori	1.5 (1.0, 2.0)	3.4 (2.2, 4.6)	7.8 (6.9, 8.6)	12.7 (11.3, 14.1)	2.4 (1.4, 3.4)	10.2 (6.5, 13.9)	16.8 (13.7, 19.9)	29.4 (24.6, 34.2)
Ethnicity Non-Māori	0.8 (0.6, 1.0)	1.4 (1.1, 1.7)	7.4 (6.6, 8.2)	9.6 (8.7, 10.5)	1.2 (0.8, 1.5)	4.3 (3.3, 5.2)	14.5 (12.4, 16.5)	19.9 (17.4, 22.4)

Age at time of survey (years)	Population: Dentate adults aged 18 years and over									
	Number of teeth with caries experience				Number of coronal surfaces with caries experience					
	DT Mean (95% CI)	MT Mean (95% CI)	FT Mean (95% CI)	DMFT Mean (95% CI)	DS Mean (95% CI)	MS Mean (95% CI)	FS Mean (95% CI)	DMFS Mean (95% CI)		
45–54		0.8 (0.6, 1.0)	6.0 (5.3, 6.7)	11.5 (10.6, 12.4)	18.3 (17.4, 19.2)	1.3 (0.9, 1.7)	18.1 (16.0, 20.2)	31.4 (28.4, 34.5)	50.8 (47.6, 54.0)	
	Gender	Females	0.6 (0.4, 0.8)	5.7 (5.0, 6.4)	12.2 (11.2, 13.3)	18.5 (17.4, 19.6)	1.0 (0.5, 1.5)	17.0 (14.9, 19.1)	33.6 (29.9, 37.4)	51.6 (47.8, 55.5)
		Males	1.0 (0.7, 1.3)	6.5 (5.2, 7.7)	10.7 (9.4, 11.9)	18.1 (16.9, 19.4)	1.7 (1.1, 2.3)	19.4 (15.6, 23.1)	28.9 (24.9, 32.9)	49.9 (45.5, 54.4)
	Ethnicity	Māori	1.7 (1.2, 2.2)	8.4 (7.4, 9.3)	9.6 (8.4, 10.8)	19.6 (18.7, 20.6)	3.2 (1.6, 4.7)	25.1 (22.2, 28.0)	25.4 (21.8, 29.0)	53.7 (50.4, 57.1)
		Non-Māori	0.7 (0.5, 0.9)	5.8 (5.0, 6.6)	11.7 (10.7, 12.7)	18.2 (17.2, 19.2)	1.1 (0.8, 1.5)	17.4 (15.1, 19.7)	32.0 (28.7, 35.3)	50.5 (47.1, 54.0)
55–64		0.6 (0.4, 0.8)	7.7 (6.9, 8.6)	13.3 (12.3, 14.4)	21.7 (20.9, 22.5)	1.1 (0.6, 1.6)	23.2 (20.7, 25.7)	41.0 (37.3, 44.7)	65.3 (62.0, 68.6)	
	Gender	Females	0.4 (0.3, 0.6)	8.8 (7.5, 10.1)	13.9 (12.6, 15.2)	23.1 (22.1, 24.1)	0.6 (0.3, 0.8)	26.5 (22.6, 30.4)	44.3 (39.3, 49.2)	71.3 (66.9, 75.8)
		Males	0.8 (0.5, 1.4)	6.8 (5.6, 8.0)	12.9 (11.1, 14.6)	20.5 (19.0, 21.9)	1.5 (0.5, 2.5)	20.4 (16.7, 24.0)	38.1 (32.2, 44.1)	60.0 (54.7, 65.3)
	Ethnicity	Māori	1.3 (0.8, 2.0)	12.3 (9.7, 14.9)	9.5 (7.3, 11.7)	23.0 (21.6, 24.4)	2.1 (1.2, 3.6)	36.8 (29.0, 44.7)	27.4 (20.9, 33.9)	66.3 (61.6, 71.0)
		Non-Māori	0.6 (0.4, 0.9)	7.4 (6.5, 8.3)	13.6 (12.5, 14.7)	21.6 (20.7, 22.5)	1.0 (0.4, 1.5)	22.2 (19.6, 24.9)	42.0 (38.1, 45.9)	65.2 (61.7, 68.8)
65–74		0.6 (0.4, 0.9)	12.1 (10.7, 13.6)	11.5 (10.3, 12.7)	24.2 (23.5, 24.9)	0.8 (0.5, 1.2)	36.4 (32.1, 40.7)	37.3 (32.5, 42.1)	74.5 (71.5, 77.5)	
	Gender	Females	0.4 (0.3, 0.8)	11.1 (9.6, 12.6)	12.6 (11.2, 14.0)	24.2 (23.2, 25.2)	0.7 (0.3, 1.3)	33.4 (28.9, 37.8)	42.4 (36.4, 48.5)	76.5 (71.7, 81.3)
		Males	0.7 (0.4, 1.3)	13.3 (11.0, 15.7)	10.2 (8.3, 12.0)	24.2 (22.9, 25.5)	1.0 (0.6, 1.9)	39.9 (32.9, 47.0)	31.3 (25.4, 37.2)	72.2 (67.8, 76.7)
	Ethnicity	Māori	0.6 (0.3, 1.4)	16.7 (13.1, 20.4)	6.5 (3.8, 9.2)	23.8 (22.2, 25.4)	1.1 (0.3, 3.6)	50.2 (39.3, 61.2)	18.5 (10.3, 26.6)	69.8 (64.3, 75.2)
		Non-Māori	0.6 (0.4, 0.9)	11.9 (10.4, 13.4)	11.8 (10.5, 13.1)	24.2 (23.5, 25.0)	0.8 (0.5, 1.3)	35.7 (31.1, 40.2)	38.3 (33.2, 43.4)	74.8 (71.6, 77.9)
75+		0.5 (0.3, 0.8)	13.7 (12.0, 15.4)	10.6 (9.1, 12.1)	24.8 (23.7, 25.8)	0.8 (0.3, 1.9)	41.1 (36.0, 46.1)	33.6 (28.4, 38.8)	75.5 (71.8, 79.2)	
	Gender	Females	0.4 (0.2, 1.1)	14.2 (11.8, 16.7)	10.5 (8.3, 12.6)	25.1 (23.6, 26.7)	1.0 (0.2, 4.5)	42.7 (35.3, 50.2)	32.6 (25.0, 40.2)	76.3 (70.7, 81.9)
		Males	0.5 (0.3, 0.8)	13.1 (10.9, 15.3)	10.8 (8.8, 12.8)	24.4 (23.1, 25.7)	0.6 (0.4, 0.9)	39.4 (32.7, 46.0)	34.7 (27.3, 42.1)	74.6 (69.3, 80.0)
	Ethnicity	Māori	0.2 (0.1, 0.6)	19.0 (14.1, 23.9)	5.4 (2.7, 11.0)	24.6 (21.7, 27.5)	0.4 (0.1, 1.1)	56.9 (42.2, 71.6)	14.9 (3.5, 26.4)	72.2 (61.7, 82.7)
		Non-Māori	0.5 (0.3, 0.8)	13.6 (11.9, 15.3)	10.7 (9.2, 12.2)	24.8 (23.7, 25.8)	0.8 (0.3, 1.9)	40.8 (35.6, 45.9)	34.0 (28.6, 39.3)	75.5 (71.7, 79.3)

Table B4: Periodontal measures (prevalence of probing pocket depth and loss of attachment), among periodontally examined dentate adults aged 18 years and over

Age at time of survey (years)	Population: Periodontally examined dentate adults aged 18 years and over					
	Probing depth (1+ sites with)			Loss of attachment (1+ sites with)		
	≥ 4 mm Percentage (95% CI)	≥ 5 mm Percentage (95% CI)	≥ 6 mm Percentage (95% CI)	≥ 4 mm Percentage (95% CI)	≥ 5 mm Percentage (95% CI)	≥ 6 mm Percentage (95% CI)
All ages	33.5 (30.7, 36.3)	10.5 (8.8, 12.3)	5.1 (3.9, 6.4)	49.9 (47.0, 52.7)	27.5 (25.1, 29.9)	13.4 (11.5, 15.2)
Gender Females	28.5 (25.1, 31.9)	7.9 (5.9, 10.0)	4.1 (2.7, 5.8)	45.1 (41.0, 49.1)	22.9 (19.8, 26.0)	10.8 (8.4, 13.1)
Gender Males	38.9 (34.2, 43.6)	13.3 (10.3, 16.4)	6.2 (4.1, 8.4)	55.2 (50.2, 60.1)	32.6 (28.4, 36.7)	16.2 (13.3, 19.2)
Ethnicity Māori	46.2 (41.1, 51.2)	16.4 (12.9, 19.9)	7.3 (5.5, 9.2)	53.9 (48.9, 59.0)	28.9 (25.2, 32.7)	18.3 (14.3, 22.4)
Ethnicity Non-Māori	31.9 (28.8, 35.0)	9.8 (7.8, 11.7)	4.8 (3.5, 6.2)	49.4 (46.2, 52.6)	27.4 (24.7, 30.0)	12.8 (10.7, 14.8)
18–24	20.7 (12.9, 30.4)	3.6 (0.7, 10.3)	2.8 (0.3, 9.9)	17.9 (10.7, 27.2)	8.0 (3.1, 16.3)	4.5 (1.1, 12.0)
Gender Females	18.2 (8.5, 32.0)	3.1 (0.2, 13.4)	2.5 (0.1, 13.7)	14.9 (6.8, 26.9)	2.8 (0.1, 13.5)	2.7 (0.1, 13.6)
Gender Males	23.7 (10.9, 41.2)	4.3 (0.3, 17.3)	3.2 (0.1, 16.9)	21.4 (9.2, 39.1)	14.1 (4.5, 30.7)	6.7 (1.0, 20.8)
Ethnicity Māori	30.2 (15.2, 49.0)	1.8 (0.0, 11.8)	0.0 (0.0, 4.7)	24.0 (10.9, 42.1)	3.3 (0.2, 14.1)	0.4 (0.0, 5.8)
Ethnicity Non-Māori	18.6 (9.6, 31.2)	4.0 (0.7, 12.4)	3.5 (0.4, 12.0)	16.5 (8.5, 27.7)	9.0 (3.2, 19.1)	5.4 (1.2, 14.4)
25–34	33.1 (25.7, 40.4)	10.5 (6.4, 16.0)	7.0 (3.7, 11.8)	35.3 (26.3, 44.3)	13.1 (7.7, 20.5)	6.8 (3.4, 12.0)
Gender Females	31.8 (23.0, 40.6)	8.8 (5.1, 14.0)	6.2 (2.8, 11.7)	37.7 (27.0, 49.4)	14.0 (7.6, 22.8)	7.0 (2.7, 14.3)
Gender Males	34.4 (23.4, 46.7)	12.3 (5.2, 23.6)	7.8 (2.6, 17.1)	32.7 (20.5, 46.9)	12.3 (5.4, 22.9)	6.6 (2.0, 15.4)
Ethnicity Māori	41.8 (32.6, 51.1)	9.5 (5.5, 15.0)	4.0 (1.8, 7.7)	41.2 (31.5, 50.8)	10.5 (5.7, 17.5)	5.3 (2.1, 10.9)
Ethnicity Non-Māori	31.5 (23.2, 39.8)	10.7 (6.0, 17.2)	7.5 (3.8, 13.1)	34.2 (24.2, 45.5)	13.6 (7.3, 22.4)	7.0 (3.1, 13.2)
35–44	36.3 (30.4, 42.1)	10.3 (7.4, 13.3)	4.3 (2.6, 6.7)	44.0 (38.1, 49.8)	19.5 (15.5, 23.4)	8.4 (5.7, 11.2)
Gender Females	28.0 (21.0, 35.0)	5.3 (3.4, 7.8)	1.8 (1.1, 2.9)	36.3 (28.5, 44.0)	12.7 (8.7, 17.6)	5.1 (3.2, 7.8)
Gender Males	45.6 (35.9, 55.4)	16.0 (10.6, 22.7)	7.2 (3.8, 12.2)	52.7 (42.5, 62.9)	27.1 (19.1, 35.2)	12.2 (7.8, 17.9)
Ethnicity Māori	52.8 (43.0, 62.6)	27.4 (17.3, 39.5)	12.2 (7.6, 18.3)	60.0 (49.8, 70.2)	34.5 (24.1, 46.1)	22.1 (12.2, 34.8)
Ethnicity Non-Māori	33.9 (27.2, 40.6)	7.8 (4.9, 11.7)	3.2 (1.4, 6.2)	41.7 (35.0, 48.3)	17.3 (12.7, 21.8)	6.5 (4.0, 9.8)

Age at time of survey (years)	Population: Periodontally examined dentate adults aged 18 years and over					
	Probing depth (1+ sites with)			Loss of attachment (1+ sites with)		
	≥ 4 mm Percentage (95% CI)	≥ 5 mm Percentage (95% CI)	≥ 6 mm Percentage (95% CI)	≥ 4 mm Percentage (95% CI)	≥ 5 mm Percentage (95% CI)	≥ 6 mm Percentage (95% CI)
45–54	35.5 (28.5, 42.4)	12.1 (8.0, 17.3)	5.5 (3.3, 8.7)	62.6 (55.9, 69.3)	36.1 (30.0, 42.2)	18.4 (14.0, 22.9)
Gender Females	29.2 (22.3, 36.1)	13.0 (8.0, 19.7)	6.5 (3.2, 11.5)	54.6 (45.2, 64.0)	29.4 (21.8, 37.0)	14.3 (9.5, 20.4)
Gender Males	42.5 (30.5, 55.2)	11.1 (5.5, 19.4)	4.5 (1.8, 9.0)	71.7 (60.7, 82.7)	43.7 (32.3, 55.1)	23.0 (14.8, 33.1)
Ethnicity Māori	55.8 (46.0, 65.7)	27.0 (17.9, 37.8)	10.6 (5.2, 18.5)	79.0 (71.4, 86.6)	53.4 (43.8, 63.0)	32.2 (22.5, 43.2)
Ethnicity Non-Māori	33.5 (26.2, 40.8)	10.7 (6.4, 16.4)	5.0 (2.7, 8.5)	61.0 (53.7, 68.3)	34.4 (27.7, 41.1)	17.1 (12.2, 21.9)
55–64	39.5 (32.1, 46.9)	13.1 (8.8, 18.5)	5.5 (2.8, 9.6)	68.9 (60.8, 77.0)	42.6 (34.6, 50.7)	18.4 (12.6, 24.1)
Gender Females	32.9 (22.6, 44.6)	9.3 (4.5, 16.6)	4.3 (1.3, 10.2)	66.8 (56.8, 76.7)	38.1 (29.2, 47.0)	16.2 (9.5, 25.0)
Gender Males	45.8 (34.1, 57.5)	16.8 (9.4, 26.7)	6.7 (2.5, 14.1)	71.0 (59.0, 83.0)	47.0 (34.0, 60.2)	20.4 (12.0, 31.3)
Ethnicity Māori	61.7 (42.1, 78.8)	23.5 (11.0, 40.7)	16.1 (5.3, 33.9)	85.6 (66.1, 96.2)	65.5 (52.2, 78.8)	49.3 (34.3, 64.3)
Ethnicity Non-Māori	37.9 (30.2, 45.6)	12.3 (7.8, 18.3)	4.8 (2.0, 9.3)	67.7 (59.1, 76.3)	41.0 (32.4, 49.5)	16.1 (10.5, 23.2)
65–74	34.0 (25.0, 43.0)	11.9 (6.6, 19.1)	5.5 (2.0, 11.6)	73.2 (64.9, 81.5)	50.4 (41.5, 59.4)	22.6 (15.2, 31.5)
Gender Females	33.4 (21.9, 46.5)	8.3 (3.4, 16.4)	2.4 (0.5, 6.9)	69.7 (59.7, 79.7)	49.4 (37.7, 61.1)	19.9 (11.2, 31.4)
Gender Males	34.7 (20.3, 51.6)	16.2 (6.7, 30.8)	9.1 (2.5, 21.9)	77.5 (64.1, 90.8)	51.7 (35.0, 68.0)	25.9 (13.8, 41.4)
Ethnicity Māori	41.5 (12.9, 75.2)	3.4 (0.3, 12.7)	0.0 (0.0, 10.3)	87.6 (69.4, 97.0)	65.9 (39.6, 86.6)	45.8 (18.6, 74.9)
Ethnicity Non-Māori	33.6 (24.3, 42.9)	12.3 (6.8, 20.0)	5.7 (2.1, 12.2)	72.5 (63.9, 81.1)	49.7 (40.3, 59.0)	21.4 (14.0, 30.5)
75+	32.6 (19.6, 48.0)	15.9 (7.5, 28.0)	5.1 (1.5, 12.3)	86.7 (79.4, 94.0)	67.7 (55.9, 79.6)	41.3 (27.7, 55.9)
Gender Females	28.2 (11.3, 51.2)	6.2 (0.8, 20.0)	4.0 (0.2, 18.3)	77.2 (58.2, 90.5)	67.2 (48.8, 82.4)	40.2 (22.6, 59.9)
Gender Males	36.2 (20.3, 54.6)	23.6 (10.8, 41.2)	6.0 (1.2, 16.7)	94.2 (87.3, 101.1)	68.2 (48.6, 83.9)	42.2 (24.4, 61.5)
Ethnicity Māori	60.2 (31.7, 84.3)	16.9 (1.3, 54.1)	16.9 (1.3, 54.1)	92.8 (63.3, 99.9)	85.6 (55.7, 98.4)	74.3 (38.8, 95.3)
Ethnicity Non-Māori	32.1 (18.9, 47.8)	15.9 (7.4, 28.2)	4.9 (1.3, 12.3)	86.6 (79.2, 94.0)	67.4 (55.3, 79.5)	40.7 (27.0, 55.6)

Appendix C: Detailed Response Rates

Table C1 presents the response rates for the 2009 New Zealand Oral Health Survey, by demographic group. Overall, these rates show there was no strong evidence of bias in the survey response rate by population group.

Table C1: Response rates for the 2009 New Zealand Oral Health Survey, by demographic group

Variable	Group	Survey response rate	Survey refusal rate	Survey non-contact rate	Exam co-operation rate	Exam refusal rate	Exam 'no show' rate	Exam response rate (overall)
All		70%	20%	10%	83%	8%	9%	56%
	<i>Adjusting for NZHS response rate</i>	<i>49%</i>			<i>83%</i>			<i>41%</i>
Demographic group	Adults	70%	20%	10%	84%	7%	7%	57%
	Children	69%	19%	12%	80%	9%	12%	55%
Gender	Males	70%	20%	10%	82%	9%	9%	56%
	Females	70%	20%	10%	84%	8%	9%	57%
Age group	2–4 years	79%	14%	7%	74%	13%	13%	58%
	5–9 years	81%	12%	6%	75%	8%	17%	61%
	10–14 years	67%	21%	12%	77%	11%	12%	52%
	15–17 years	70%	18%	12%	83%	10%	7%	58%
	18–24 years	61%	17%	22%	83%	4%	13%	48%
	25–44 years	68%	21%	12%	83%	8%	9%	56%
	45–64 years	75%	20%	6%	85%	8%	7%	61%
65 years and over	76%	22%	3%	84%	14%	2%	56%	
Ethnic group	Māori	64%	18%	18%	78%	5%	17%	47%
	Pacific	63%	15%	21%	77%	5%	19%	47%
	Asian	62%	24%	15%	85%	8%	7%	51%
	European/Other	72%	20%	8%	84%	9%	8%	59%
NZDep2006 quintile	1 (least deprived)	74%	19%	7%	80%	13%	7%	58%
	2	72%	21%	8%	87%	5%	8%	61%
	3	72%	19%	9%	84%	8%	7%	59%
	4	67%	22%	11%	84%	7%	9%	54%
	5 (most deprived)	64%	20%	16%	80%	6%	14%	48%

Notes: The survey response rate, survey refusal rate, survey non-contact rate and examination response rate (overall) are among NZHS re-contactable participants who were selected into the 2009 NZOHS. The examination co-operation rate, examination refusal rate and examination 'no show' rate are among NZOHS survey participants. The row in italics provides the overall response rates for the NZOHS, taking into account the response rate for the NZHS as well.

The following tables present the sample size numbers for children and adolescents, and for adults.

Table C2: Sample size numbers and design effects (DEFFs) for children and adolescents aged 2–17 years, for the 2009 New Zealand Oral Health Survey, by demographic group

Children and adolescents (2–17 years)	Population size	Numbers interviewed	Numbers dentally examined	Example design effects (DEFFs)		
				Fair or poor oral health status	Brush teeth twice daily with adult strength fluoride toothpaste	DMFT
All	900,000	1431	987	3.4	3.4	2.4
Females	430,000	693	474	2.9	2.4	1.8
Males	470,000	738	513	3.0	3.2	2.8
2–4 years	150,000	280	195	0.9	2.8	2.0
5–11 years	390,000	642	438	3.3	3.4	2.5
12–17 years	360,000	509	354	2.8	3.2	2.3
Māori	200,000	694	461	1.6	1.5	1.6
Pacific	100,000	269	184	1.8	1.6	2.1
Asian	70,000	237	171	4.0	3.7	1.7
European/Other	700,000	817	570	2.6	3.1	2.4
NZDep2006 quintile 1	180,000	182	118	2.9	2.5	2.6
NZDep2006 quintile 2	180,000	225	167	2.1	3.0	2.4
NZDep2006 quintile 3	190,000	266	187	3.2	3.1	3.3
NZDep2006 quintile 4	160,000	323	217	3.6	3.3	2.5
NZDep2006 quintile 5	180,000	435	298	2.0	1.7	1.6

Table C3: Sample size numbers and design effects (DEFFs) for adults aged 18 years and over, for the 2009 New Zealand Oral Health Survey, by demographic group

Adults (18+ years)	Population size	Numbers interviewed	Numbers dentally examined	Numbers periodontally examined	Example design effects (DEFFs)		
					Fair or poor oral health status	Usually visit dentist for check-up	DMFT
All	2,930,000	3475	2209	2048	2.0	2.1	0.8
Females	1,530,000	2110	1355	1265	1.7	1.8	0.9
Males	1,400,000	1365	854	783	2.2	2.3	0.7
18–24 years	360,000	268	168	163	2.2	3.2	2.1
25–34 years	460,000	549	364	352	1.8	2.8	2.0
35–44 years	570,000	783	578	560	2.2	2.2	2.4
45–54 years	550,000	687	464	433	2.1	2.3	2.1
55–64 years	440,000	510	303	269	2.0	1.7	1.5
65–74 years	290,000	375	202	176	1.7	1.2	1.1
75+ years	240,000	303	130	95	1.6	1.6	1.6
Māori	330,000	1267	781	723	2.1	2.0	1.5
Pacific	150,000	353	219	209	1.4	1.9	1.3
Asian	250,000	518	380	363	2.6	3.3	2.2
European/Other	2,430,000	2125	1353	1248	1.8	1.5	1.1
NZDep2006 quintile 1	610,000	519	340	316	1.8	1.9	2.5
NZDep2006 quintile 2	600,000	599	418	389	1.8	2.0	2.1
NZDep2006 quintile 3	570,000	639	415	396	2.0	2.7	2.4
NZDep2006 quintile 4	590,000	787	483	446	1.9	2.5	2.7
NZDep2006 quintile 5	570,000	931	553	501	2.6	3.1	2.7

Appendix D: Dental Surgeries and Facilities that Offered Assistance for the 2009 NZOHS

The following dental surgeries and facilities are thanked for providing their dental surgeries for survey dental examinations for the 2009 NZOHS (for the pilot survey, dress rehearsal and/or main survey).

Northland DHB

Brett McDiarmid Dental Surgery (Kamo), Northland District Health Board Oral Health Services, Hokianga Health Trust Enterprise, Lumino Dargaville, Lumino Whangarei, Marino Dental Health Centre (Kaihohe), Paihia Dental, Redwoods Dental Centre (Kerikeri), The Gentle Dental Company (Whangarei Heads), Kensington Dental Centre (Whangarei), Kowhai Court Dental Centre Ltd (Whangarei), Maunu Dental Ltd (Whangarei), Paul Reeves Dental (Kaitaia).

Waitemata DHB

Dental Care West (Glen Eden), Dental on the Shore (Albany), Lumino The Dentists – Red Beach, Lumino The Dentists – New Lynn, Lumino The Dentists – Takapuna, McIntosh Dental Centre (Henderson), Corkill Dental Surgery (Northcote), Lumino The Dentists – Smile Studio Orewa, Village Dental Care (Titirangi Village), Warkworth Dental Practice Ltd, Westgate Dental Centre (Massey), Douglas Waters – Periodontist (Takapuna), Lumino The Dentists – Henderson, Massey Dental Centre, Northcote Dental Centre, Smile Dental – Albany, Smile Dental – North Shore, Auckland Regional Dental Service – North Western Area.

Auckland DHB

Dentistry for Chickens (Greenlane), Eden Dental Centre Ltd, Belich Dental (Epsom), Kool Dental (Auckland CBD), Lumino The Dentists – Panmure, Mt Wellington Dental Centre, Rockfield Dental Centre (Penrose), Three Kings Dental Centre (Mt Roskill), The Dentists (Hillsborough), Lumino The Dentists – Mt Eden, Parnell Dentistry, Smile Dental – Remuera, Auckland Regional Dental Service – Central Area, Waiheke Dental.

Counties Manukau DHB

Buckland Road Southern Cross Campus – Mangere, Mighty Mouth Chapel Downs, Kerry Pegler's Dental Surgery (Papatoetoe), Mighty Mouth Dental (Manukau City), SR and YR Ltd (Papakura), The Dental Company (Pukekohe), Lumino The Dentists – Botany, Dentart Limited (Howick), Drury Dental Centre, Dental World – Botany, Kilimanjaro Dental Centre (Howick), Queen Street Dental (Pukekohe), Smile Dental – Manukau, Smile Dental – Otahuhu, Auckland Regional Dental Service – Southern Area, Fraser Smith Lowe Dentists (Pakuranga), Sanjay Sathe (Manukau).

Waikato DHB

Anglesea Clinic Dental Care (Hamilton), Cambridge Dental Practice, Family Dental Centre (Morrinsville), Huntly Dental Centre, Busfield Dental Care (Tokoroa), Lumino The Dentists – Dinsdale, Lumino The Dentists – Te Awamutu, Matamata Dental Care, The Old Villa Dental Centre (Hamilton), Otorohanga Dental Surgery, Paeroa Central School Dental, Ruapehu Dental Excellence (Taumarunui), South Waikato Dental Surgery (Putaruru), Te Kuiti Dental Centre, Thames Dental and Podiatry Clinic, Waipa Primary School Dental Clinic (Ngaruawahia), Hamilton West School, Mackie Dental specialists (Anglesea Clinic), Raukura Hauora O Tainui, Collingwood Dental Care (Hamilton), Lindsay Robinson (Hamilton), Lumino The Dentists – Five Crossroads (Hamilton), Waikato District Health Board School Dental Service, South City Dental Limited (Hamilton), Whitianga Dental Centre.

Lakes DHB

The Dentists (Taupo), InCity Dental (Rotorua), Lakes Care Dental Centre (Rotorua), Warwick Hay Dental Surgeon (Turangi), Rotorua Dental Centre.

Bay of Plenty DHB

The Dental Centre (Te Puke), Chris Ingram Periodontal (Tauranga), Dental Solutions (Tauranga), East Bay Dental Centre (Whakatane), Opotiki Dental Services Ltd, DentalPlus (Mount Maunganui), Corson Dental (Tauranga), The Dentists (Cherrywood), 11th Ave Dental Care Ltd (Tauranga), Dental Implant Centre (Tauranga), Murray J Hayes and Associates (Whakatane), Dental on Seventh (Tauranga), Tauranga OMS.

Tairāwhiti DHB

Dental Centre Ltd (Gisborne), Ngati Porou Hauora Inc (Ruatoria).

Taranaki DHB

Taranaki District Health Board Dental Services, Hawera Hospital Dental Clinic, Inglewood Dental Surgery Medical Centre, Mary Anne Costelloe (Stratford), Taylor Dental Practice (New Plymouth), Vivian Street Dental Centre (New Plymouth), Wairehu Hikaka (Waitara), Sandie Pryor's Dental Surgery (Patea), Dianne Lance (Waverley), Taranaki District Health Board Patea Health Centre.

Hawke's Bay DHB

Aesthetic Dental Ltd (Hastings), Bishops Dental Surgery (Waipukurau), Bishop and Kay Family Dental Centre (Napier), Te Taiwhenua o Heretaunga (Hastings), Dental Health Wairoa, Hawke's Bay District Health Board Napier Health Centre, Hawke's Bay Oral Health Services, Smile Centre (Hastings).

Whanganui DHB

Dental Care Marton, The Dentists (Whanganui), Taihape Dental Centre, Ohakune Dental Centre.

MidCentral DHB

Carpenters Dental (Palmerston North), Queen Street Dental Centre (Levin), Dannevirke Family Dentists Ltd, GH Clark Dental Ltd (Feilding), Feilding Dental Centre, Main Street Dental Health Centre (Palmerston North), Ross Murray Dentist (Palmerston North), Vivian Street Dental (Palmerston North), Manawatu Dental Group (Palmerston North), The Robert Joe Dental Practice (Palmerston North).

Hutt DHB

Gee Dental Centre (Lower Hutt), Naenae Dental Clinic (Lower Hutt), Eastbourne Dental Centre, Graeme Yee Dental Care Trust (Lower Hutt), JD Beere Dental Practice (Lower Hutt), Christopher Allan (Upper Hutt), Michael Walton (Upper Hutt), Hutt Valley District Health Board Dental Unit, Supreme Dental Concepts (Lower Hutt).

Capital and Coast DHB

Kenepuru Community Dental Unit (Porirua), Kilbirnie Dental Centre (Wellington), LR Jackson Dental Surgeon (Wellington), Moira Smith Dental Surgery (Wellington), Raumati Dental Centre (Raumati Beach), Symes de Silva and Associates Limited (Wellington), The Wellington Dental Practice, Angela McKeefry Cosmetic and General Dentistry Ltd (Wellington), Lumino The Dentists (Catherine Lloyd and Associates) – Wellington, Lumino The Dentists (Geoff Hunt Dental) – Wellington, Lumino The Dentists (Miramar Dental Health Centre) – Wellington, Ora Toa Dental Centre Te Runanga O Toa Rangatira Inc (Porirua), Richard Greenwood Dental Ltd (Wellington City), Smile Creations (Waikanae), Tennyson Dental Centre (Wellington), Wellington Orthodontic Associates, Deborah Creagh Endodontics, Matt Barker – Orthodontics, Woodward Street Dental (Wellington), Smile Creations (Otaki).

Wairarapa DHB

Lumino The Dentists – Masterton, The Dental Clinic (Masterton).

Nelson Marlborough DHB

Gilchrist Dental Surgery Ltd (Blenheim), Nelson Dental Centre, Tahunanui Dental Centre, Andrew Spence (Blenheim), Nelson Marlborough District Health Abord Dental Department, Golden Bay Dental Centre (Takaka), Joyes Dental Services Ltd (Stoke), Koorey & Leonard Dental Care (Blenheim), Picton Dental Surgery, Steph Wills Dental Centre (Motueka).

West Coast DHB

Garry Rae (Greymouth), Mobile Surgical Services, Family Dental Centre (Greymouth).

Canterbury DHB

Dental Arts (Christchurch), David Chambers Dental Ltd (Riccarton), North Canterbury Dental Centre (Kaiapoi), Park Street Dental Care (Ashburton), Waltham Dentists Ltd (Christchurch), Dental Care on Barrington (Spreydon), Halswell Dental Centre (Christchurch), Merivale Orthodontics (Strowan), Redcliffs Dental Centre, Canterbury District Health Board Community Dental Service.

South Canterbury DHB

Providential Ltd – Lumino Temuka, Tony Page – Brunswick Dental Chambers (Timaru), Mark Goodhew Ltd (Timaru), Phillips Dental Ltd (Timaru), Silver Birches Dental Centre (Timaru), Stafford Dental Centre (Timaru), Timaru Hospital Dental Department.

Southern DHB

Aspiring Dental Service (Wanaka), Lumino The Dentists (Shearer Dental) – Oamaru, University of Otago School of Dentistry (Dunedin), Frankton Dental Surgery (Queenstown), Fiordland Dental Centre Ltd (Te Anau), Hokanui Dental Care (Gore), Jordan & Robertson (Invercargill), Anne Corrigall Dental Surgery (Dunedin), Burns House Dental Specialists (Dunedin), Davit Tait (Balclutha), F & F Dental Care Ltd (Oamaru), John Boyens – Periodontist (Dunedin), Knox Dental Centre Ltd (Dunedin), Mike Jameson Endodontist (Dunedin), Milton Dental Surgery (R J Wilton Dental Surgeon), Mosgiel Dental Centre, Dentistry on Musselburgh (Dunedin), Chalmers & Dunbar (Dunedin), Winifred Harding (Dunedin), Graham York Dental (Balclutha), Gore Dental Centre.

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