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Child Dental Health Survey Australia 2007

30-year trends in child oral health

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Abbreviations

ABS	Australian Bureau of Statistics
AHS	area health service
AIHW	Australian Institute of Health and Welfare
ARCPOH	Australian Research Centre for Population Oral Health
CDHS	Child Dental Health Survey
CI	confidence interval
d	deciduous decayed teeth
D	permanent decayed teeth
dmft	deciduous decayed, missing (due to decay) and filled teeth
DMFT	permanent decayed, missing (due to decay) and filled teeth
DSRU	Dental Statistics and Research Unit
ERP	estimated resident population
f	deciduous filled teeth
F	permanent filled teeth
FaHCSIA	Department of Families, Housing, Community Services and Indigenous Affairs
m	deciduous teeth missing due to decay
M	permanent teeth missing due to decay
n	number
SD	standard deviation
SDS	school dental service
SiC	Significant Caries Index. The SiC Index is calculated by taking the mean DMFT of the one-third of the individuals having the highest of DMFT values in a given population.
SiC^{10}	Significant Caries Index (10%). The SiC^{10} Index is calculated by taking the mean DMFT of the 10 per cent of the individuals having the highest of DMFT values in a given population.
WHO	World Health Organization

Places

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

Symbols

–	nil or rounded to zero
. .	not applicable
n.a.	not available
n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data

Summary

This report describes the state of oral health of Australian children examined by school dental service (SDS) staff in 2007. It also describes trends in oral health of Australian children between 1989 and 2007. The most recent findings are drawn from the 2007 Child Dental Health Survey (CDHS) which analysed the data of 110,014 children aged 4 to 15 from most states and territories. The longer term trends highlight results for children aged 6 and 12 as these are the standard age groups for reporting on dental caries experience in the deciduous and permanent teeth respectively. Due to missing data from Victoria, any comparisons with previous years or international statistics should be made with caution. The figures presented over 30 years are drawn from previous CDHSs and monitoring undertaken by the (then) Commonwealth Department of Health.

Oral health status of Australian children

Just under half (46%) of children aged 6 attending school dental services had a history of decay in their deciduous ('baby') teeth—that is, one or more decayed, missing or filled deciduous teeth (dmft). On average, children aged 6 had almost two dmft per child (dmft = 1.95). The one-tenth of children aged 6 with the most extensive history of deciduous tooth decay had almost 10 deciduous teeth affected, which was over 5 times the national average.

Thirty-nine per cent of children aged 12 and 60% of children aged 15 had some history of decay in their permanent teeth—that is, one or more decayed, missing and filled permanent teeth. On average children aged 12 had just less than one affected tooth (DMFT = 0.95), while children aged 15 had just over two (DMFT = 2.10) decayed, missing and filled permanent teeth. The one-tenth of children aged 12 to 15 with the most extensive history of permanent tooth decay had between 5.21 and 8.60 permanent teeth affected, which was more than 4 times the national average of decayed, missing and filled teeth for children of those ages.

Between 1977 and the mid-1990s, the average number of deciduous teeth affected by caries halved in children aged 6, but increased from the late 1990s. Caries in permanent teeth of children aged 12 has declined even more dramatically. In 1993, children aged 12 had less than one-quarter the number of teeth affected by caries than in 1977. However, this number has increased slightly since 1993.

Caries experience varied between states and territories and over time. However, the differences should be treated with caution as they may be the result of different coverage policies, variations in targeting practices (e.g. high-risk groups), and varying levels of access to service among different states and territories.

Conclusions

A minority of Australian children experienced high levels of dental caries.

Caries has declined markedly in the permanent teeth of children aged 12, but declined far less in the deciduous teeth of children aged 6.

1 Introduction

The purpose of this publication is to describe the patterns of oral health and service provision relating to children's dental health in Australia in 2007. It also describes trends in oral health of Australian children between 1989 and 2007. This report brings together data that most state and territory school dental services (SDS) collected on the oral health of children examined by staff of those services. It provides policy makers and health planners, as well as academics and interested readers, with a summary of the available data on dental decay among children attending a school dental service in Australia. Some states and territories collect the Indigenous status of respondents; however, these data were of insufficient quality for analysis and reporting in a way that would contribute to our better understanding of the oral health of Australia's Indigenous children.

The dental health of children receiving care in a SDS has been monitored since 1977. Between 1977 and 1988 the (then) Commonwealth Department of Health managed the monitoring centrally as an evaluation of the Australian School Dental Scheme. In 1989, responsibility for collecting national data was transferred to the Australian Institute of Health and Welfare Dental Statistics and Research Unit at the University of Adelaide, where monitoring is undertaken using the Child Dental Health Survey (CDHS).

1.1 What is dental decay (caries)?

Dental caries, also known as dental decay or tooth decay, is one of the most common chronic diseases of people worldwide. In Australia, the most frequently reported chronic medical condition among children to age 14 is asthma, which affects 12% of children in this age group (AIHW 2009). In contrast, almost half of Australian children experience caries by the age of 6 (Armfield, Spencer & Brennan 2009). Individuals remain susceptible to tooth decay throughout their life span. Dental caries develops via a complex interaction over time between acid-producing bacteria and fermentable carbohydrates (fermentable carbohydrates break down into sugars in the mouth, which bacteria use to produce acids that are responsible for decay), and many host factors including teeth and saliva.

Dental caries is distinguished by the loss of mineral ions from the tooth (demineralisation), stimulated largely by the presence of bacteria and their by-products (Mount & Hume 2005). Remineralisation occurs when partly dissolved crystals are induced to grow by the redepositing of minerals via saliva. Normally, a balance occurs between the demineralisation and remineralisation of the tooth surface (enamel). However, this balance is disturbed under some conditions and the subsequent chronic demineralisation leads to the formation of holes or cavities in the tooth surface. Cavitation beyond the outer enamel covering of the tooth into the tissues below allows for a bacterial infection which may cause considerable pain and require surgery or the removal of the tooth.

Dental decay is estimated to affect up to five million people in Australia each year. Untreated dental decay afflicts approximately 25% of all adults in any given year (Roberts-Thomson & Do 2007) and can lead to hospital admission (Jamieson & Roberts-Thomson 2008). Dental extractions and restorations are the most common reasons for hospital separations among children, defined as an episode of admitted patient care (AIHW 2011). Although dental decay is associated only rarely with mortality, it is a cause of considerable morbidity

(Spencer & Lewis 1988). Consequences of dental decay include pain, problems associated with eating or drinking, loss of sleep, social embarrassment and time lost to work (Spencer & Lewis 1988). Dental decay resulting in tooth loss impacts on both chewing ability and quality of life (Brennan, Spencer & Roberts-Thomson 2008).

Individuals can have a past history of decay in their teeth that is represented by teeth that have been filled or which are missing due to caries. While these teeth have had decay in the past, they no longer have active decay, but can be described as 'affected by decay' or 'affected by caries'. A person with any teeth affected by decay is described as having had 'caries experience' or 'decay experience'. Knowing about the extent of caries experience is useful because individuals with filled teeth will likely require future dental work on those teeth, replacing fillings over time. Having teeth missing due to caries indicates that timely dental care was not received to fill those teeth before the decay became so extensive that a filling was not feasible. In addition, the accumulation of missing teeth is associated with more oral health impacts and a worse subjective rating of oral health (Gerritsen et al. 2010). A person who has no history of decay in their teeth is described as 'caries free'. When a person is described as having dental decay or untreated decay, they have at least one tooth that is currently decayed and in need of a filling.

1.2 Classifying the extent of decay

Dental decay occurs along a continuum reflecting the extent of tooth demineralisation. At an early stage, precavitated or 'white-spot' lesions are restricted to the outer enamel surface of the tooth, and may be characterised by a loss of normal translucency of the enamel and increased fragility of the surface layer. These precavitated lesions are not normally included as an instance of disease experience. However, when demineralisation progresses through the enamel surface of the tooth into the underlying dentine, causing breakdown of enamel surface and cavitation, this is counted as an instance of disease experience. It is possible to halt the progress of decay at any stage by sealing the cavity and isolating the responsible bacteria from its food source. However, failure to access timely treatment may lead to further damage and the need to remove the tooth.

1.3 Risk factors for dental decay

Dental decay is characterised by chronic demineralisation of the structure of the tooth, a process where several factors play important roles. The five factors found to exert the strongest influence on dental caries are:

- Frequency of carbohydrate intake, which allows bacteria in the plaque to produce concentrations of organic acids that can dissolve the tooth.
- The accumulation and retention of plaque, a potential breeding ground for acid-producing bacteria.
- Frequency of exposure to dietary acids in addition to the bacterial acids.
- Exposure to fluoride and some other trace elements which help in controlling the development of decay.
- Natural protective factors such as saliva which may help prevent or limit the progress of decay (Mount & Hume 2005).

Plaque, a semitransparent layer which adheres to the tooth surface, forms on all teeth and contains many pathogenic organisms including bacteria. Tooth brushing and/or the use of chemical solutions capable of killing the acid-causing bacteria can reduce plaque. However, the frequency of exposure to fermentable carbohydrates, such as sugar, related to the pattern of consumption of certain foods and beverages is the most significant risk factor for dental decay.

Behavioural risk factors for dental decay relate to the five risk and protective factors listed above. These include substandard tooth cleaning, poor diet involving high exposure to acidic foodstuffs as well as fermentable carbohydrates such as sugars, and limited exposure to fluoride available in toothpastes, fluoridated public water, or other sources (Mount & Hume 2005).

1.4 Dental decay prevention

Decline in the prevalence and severity of dental decay over the past three decades points to a substantial improvement in the oral health of Australian children (Armfield & Spencer 2008). Systematic exposure to fluorides has reduced the susceptibility of contemporary child populations to infectious diseases affecting the oral cavity, along with better nutrition, rising standards of living and better access to dental care. In conjunction with the use of fluoride in public water supplies and products such as mouthwash, toothpaste and fluoride supplements, some professional caries-preventive techniques are available which can considerably reduce children's experience of this disease. There is a growing body of research evidence about the effectiveness of preventive methods, which can be easily applied in dental practices. For example, systematic reviews have been published for fluoride gel (Marinho et al. 2002a), fluoride varnish (Marinho et al. 2002b), chlorhexidine, fissure sealants (Ahovuo-Saloranta et al. 2008) and dental health education (Rozier 2001).

Fissure sealant is the most common preventive measure being used in SDS. Fissure sealants are materials that are applied to the pits and fissure surfaces of the teeth by dental professionals. They protect teeth from decay by creating a thin barrier which protects the sealed surface from the bacteria that cause decay.

1.5 Measuring dental decay

At about age 5 or 6, children commence losing their baby or deciduous teeth, and their permanent teeth replace them. Most children have lost all their baby teeth and have gained their permanent teeth (with the exception of wisdom teeth which may erupt several years, or even decades, later) by the time they reach the age of 12. Therefore, analyses of dental decay in teenage children only report the level of disease in permanent teeth. In contrast, younger children generally have a mixture of deciduous and permanent teeth, or mixed dentition from the age of 5 to 12. The convention is to report on these two sets of teeth separately. However, this report will also look at the decay experience for each age group in the combined deciduous and permanent dentition for children aged 12 to 15, as this gives a better picture of total decay experience for each age group.

The dental health status of children sampled covers the three areas listed below:

- Deciduous decay experience, recorded as the number of baby teeth that are decayed, missing and filled because of dental decay, is based on the coding scheme of Palmer et al. (1984). The number of decayed, missing and filled teeth (dmft for deciduous teeth) is a measure of decay experience. Decay refers to cavities, usually detected clinically using visual and/or tactile criteria. In some instances, X-rays may be used. Deciduous dmft was calculated for children aged 5 to 10.
- Permanent decay experience, recorded as the number of adult teeth that are decayed, missing and filled because of dental decay, is based on the World Health Organization protocol (WHO 1997). The number of decayed, missing and filled teeth (DMFT for permanent teeth) is a measure of decay experience for permanent teeth. In some instances, X-rays may be used. DMFT was calculated for children aged 6 to 15.
- Fissure sealants are recorded as the number of teeth, otherwise sound, not restored and not decayed, which have a fissure sealant. This data item was introduced in most states and territories in 1989.

A tooth (deciduous or permanent) is recorded as missing due to caries if the tooth was extracted because of caries. Teeth missing due to caries and those due to other causes can be distinguished by taking a detailed history from the patient. The surface is coded as filled when it has a permanent restoration that, in the clinician's best judgment, was placed because of caries. This excludes fillings placed for reasons other than caries, such as restorations to repair trauma or aesthetic restoration of non-carious lesions.

The average number of decayed, missing and filled teeth can be regarded as a reasonable summary statistic for caries experience of a population. Given that the distribution of dmft/DMFT scores is skewed, mean dmft/DMFT may not reflect the existence of individuals with high levels of caries experience within the same population. The Significant Caries Index (SiC) was developed to target individuals with high caries levels (Bratthall 2000; Nishi et al. 2001). It is computed by obtaining the average decay experience of the one-third of the population with the highest dmft/DMFT scores. The SiC^{10} used here is a slightly modified index which reports the mean dmft/DMFT scores of the 10% of the children with the highest caries levels.

1.6 Data used in this report

Data for this report were derived from two separate sources. Data for Queensland, South Australia, Western Australia, Tasmania, the Northern Territory and the Australian Capital Territory were sourced from the CDHS conducted in the 2007 calendar year. The CDHS is an annual survey which monitors the dental health of children enrolled in school and community dental services operated by the health departments or authorities of Australia's six state and two territory governments. In all jurisdictions children from both public and private schools are eligible for dental care through a SDS.

Data sourced from SDS clinics were collected at the time of routine clinical examinations that dental therapists and dentists conducted. The application of diagnostic criteria employed in this data collection was based on the clinical judgment of the examining dental therapist or dentist. Detailed instructions were provided to clinics to explain the collection of clinical data but there were no formal sessions of instruction in diagnosis undertaken for the purpose of the survey, and no repeat examinations for the purpose of assessing inter- or intra-examiner reliability.

Data for New South Wales were derived from the New South Wales Child Dental Health Survey conducted in 2007 which was a collaborative partnership between the Centre for Oral Health Strategy NSW, area health services, the Australian Research Centre for Population Oral Health (ARCPOH) at the University of Adelaide, and Population Oral Health at the University of Sydney. The survey examined children sampled from primary schools across New South Wales and it represented a more systematic approach to population oral health data collections than those available through public dental service collections or previous risk assessment programs undertaken in New South Wales.

National estimates in this report exclude Victoria, as data for children attending services in Victoria for 2007 were not made available at the time of preparation of this publication. As the child population of Victoria represents a sizeable proportion of the Australian child population, any comparisons with previous national estimates, or with international data, should be made with caution. Caution is also needed when comparing states and territories, as differences between states and territories in SDS coverage, level of enrolment, services policy focus, or access to services in rural or remote areas may affect the overall differences.

A detailed description of data collection and preparation methods for data used in this report can be found in the Appendix.

2 The dental health of Australia's children

2.1 Children's dental health

Deciduous teeth

Age-specific caries experience

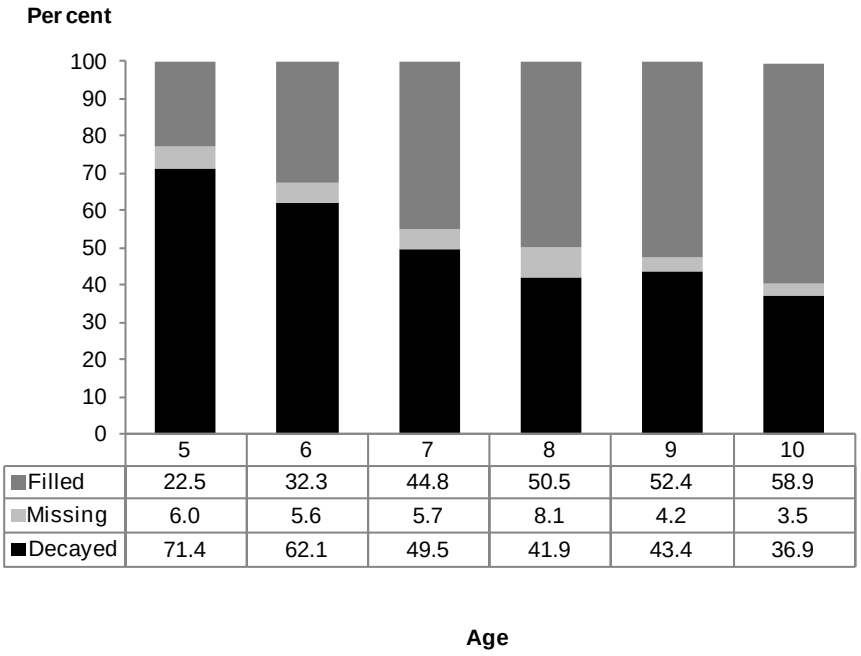
The average number of decayed, missing and filled teeth expresses the decay experience in the deciduous teeth. Table 2.1 shows the averages and 95% confidence intervals (CI) for each of these components for children aged 5 to 10 in 2007. There was an association between age and the average number of decayed teeth. The youngest children (aged 5) had an average of 1.30 teeth with untreated decay while children aged 10 had an average of 0.52 teeth with untreated caries. The average number of teeth per child that were missing due to caries was small across all age groups ranging between 0.05 to 0.18 teeth per child. The pattern shown by filled teeth was more distinct—the average number of filled teeth increased, from 0.41 among children aged 5 to 1.12 among children aged 8, and then fell from 0.99 at age 9 to 0.83 among children aged 10. The average dmft score displayed a similar pattern, rising from 1.82 among children aged 5 to 2.22 among children aged 8 before dropping to 1.41 among children aged 10.

Table 2.1: Deciduous teeth: decayed, missing and filled teeth, 2007

	Decayed teeth (d)		Missing teeth (m)		Filled teeth (f)		dmft	
Age (years)	Average	CI	Average	CI	Average	CI	Average	CI
5	1.30	1.18–1.43	0.11	0.08–0.14	0.41	0.35–0.47	1.82	1.66–1.97
6	1.21	1.11–1.31	0.11	0.09–0.13	0.63	0.56–0.70	1.95	1.81–2.09
7	1.04	0.95–1.13	0.12	0.09–0.14	0.94	0.86–1.02	2.10	1.96–2.23
8	0.93	0.85–1.01	0.18	0.14–0.22	1.12	1.03–1.20	2.22	2.09–2.35
9	0.82	0.75–0.88	0.08	0.06–0.10	0.99	0.93–1.06	1.89	1.78–2.00
10	0.52	0.47–0.57	0.05	0.04–0.07	0.83	0.77–0.90	1.41	1.32–1.50

Figure 2.1 shows the breakdown of decayed, missing and filled components of the dmft index as a percentage in 2007. Untreated decay was the principal component of the dmft score in the youngest age groups with over 60% of the children aged 5 and 6 having decayed teeth. However, the presence of filled teeth because of the gradual accumulation of fillings placed over time represented more than one-half of the dmft index from the age of 8.

Patterns in deciduous caries experience must be interpreted in light of the loss of deciduous teeth, usually between the ages of 6 and 12. When children enter their school years, all 20 deciduous teeth have erupted and there is a moderate amount of caries experience in these teeth. Untreated decay (approximately 71% at age 5) represents a large proportion of decay experience. With continued treatment, decay experience becomes predominantly represented by past caries experience treated with restorations (filled teeth). From around the age of 6, deciduous teeth are shed and replaced with permanent teeth so that the number of deciduous teeth declines. Despite increasing rates of decay and the accumulation of fillings across age groups, the loss of baby teeth results in a reduction in the absolute number of teeth with caries experience (dmft declines from age 9 as in Table 2.1). In addition there is an increased number of children presenting with no deciduous caries experience (as in Figure 2.2 where children aged 10 are less likely than children aged 9 to have any decay experience in their deciduous teeth).



	5	6	7	8	9	10
Filled	22.5	32.3	44.8	50.5	52.4	58.9
Missing	6.0	5.6	5.7	8.1	4.2	3.5
Decayed	71.4	62.1	49.5	41.9	43.4	36.9

Figure 2.1: Decayed, missing and filled deciduous teeth as a percentage of dmft index by age, 2007

Distribution of deciduous caries experience by age

Figure 2.2 shows that by the age of 7, half of Australian children had some caries experience in deciduous teeth in 2007 (52.5%). From age 5 to 9, between 41.7% and 55.4% of children had a dmft score of 1 or more (Figure 2.2 and Figure 2.3). The proportion of children with no decay was highest in children aged 5 and lowest in children aged 9 (Figure 2.3). Children aged 10 had a higher proportion with no decay experience as children at this age have lost a number of deciduous teeth that were previously affected by decay. While most children experienced relatively low levels of deciduous decay with a dmft score of 1 or 2, between 6.1% and 15.3% of children in the age range considered had a dmft score of 6 or more.

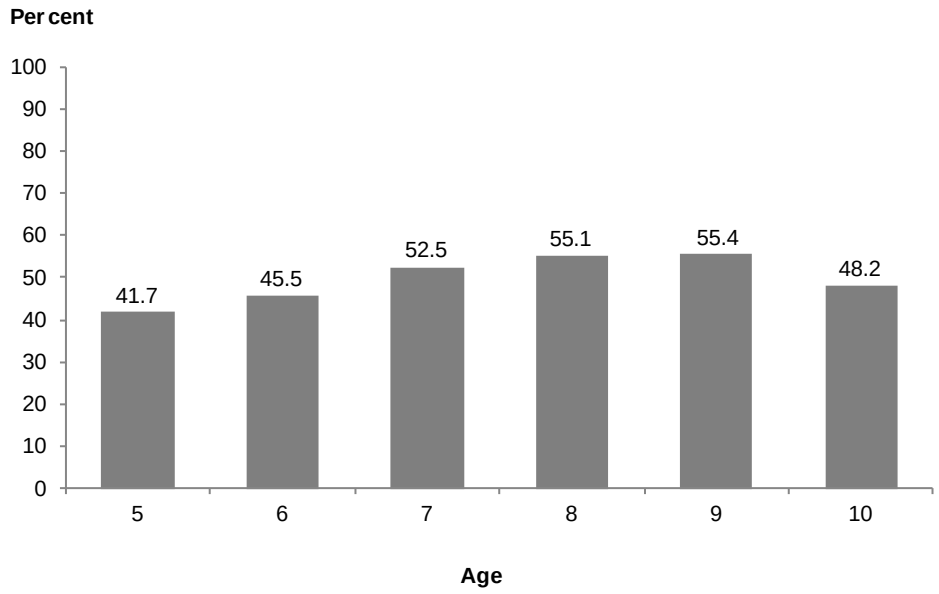
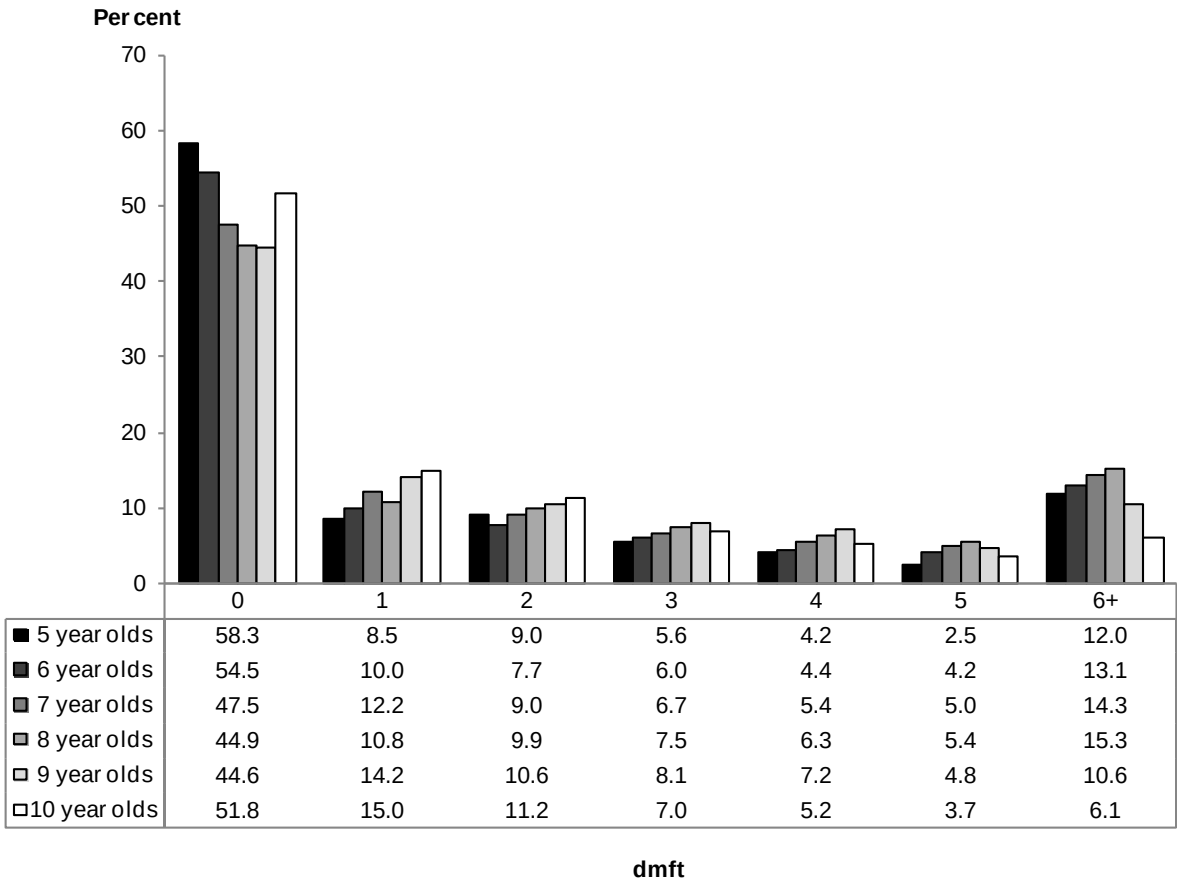


Figure 2.2: Deciduous teeth: children with dmft > 0 by age, 2007



	0	1	2	3	4	5	6+
5 year olds	58.3	8.5	9.0	5.6	4.2	2.5	12.0
6 year olds	54.5	10.0	7.7	6.0	4.4	4.2	13.1
7 year olds	47.5	12.2	9.0	6.7	5.4	5.0	14.3
8 year olds	44.9	10.8	9.9	7.5	6.3	5.4	15.3
9 year olds	44.6	14.2	10.6	8.1	7.2	4.8	10.6
10 year olds	51.8	15.0	11.2	7.0	5.2	3.7	6.1

Figure 2.3: Distribution of deciduous dmft index by age, 2007

Significant Caries Index (SiC^{10})

The Significant Caries Index (SiC^{10}) is computed by obtaining the average decay experience of the one-tenth of the population with the highest dmft/DMFT scores. Figure 2.4 shows a comparison between the SiC^{10} index and the national average dmft index of children aged 5 to 10, by age, for 2007. The SiC^{10} values for deciduous teeth were between 4 and 5 times the national average values for all ages. This indicates that a minority of children experience very high deciduous caries levels.

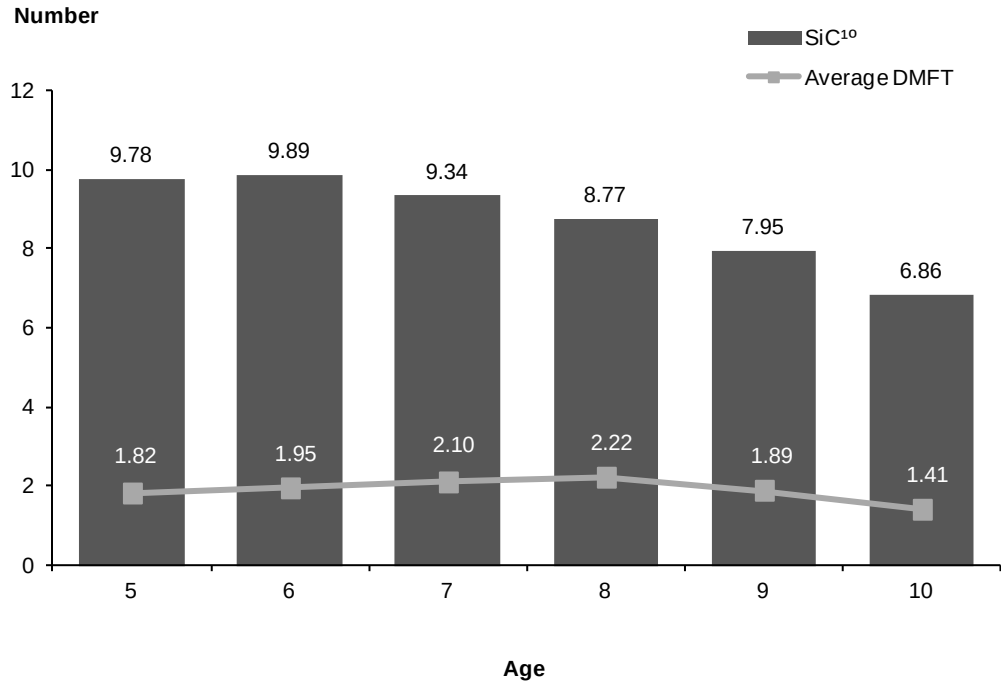


Figure 2.4: SiC^{10} and average dmft index, children aged 5 to 10, by age, 2007

Permanent teeth

Age-specific caries experience in permanent teeth

The mean number of decayed teeth per child increased with age from 0.07 at age 6 to 0.95 at age 15, even though the number of teeth present usually stabilises by around age 13 (Table 2.2). The number of teeth missing due to caries was very low, the average being less than 0.1 teeth per child at all ages. The mean number of filled teeth per child was associated with age. Children aged 6 had an average of 0.01 filled teeth compared with 1.09 filled teeth in children aged 15. A similar pattern was shown by the mean DMFT scores, which were 0.08 among children aged 6 (when 1 to 2 permanent teeth were usually present), and 2.10 among children aged 15 (when an average of 28 permanent teeth were present).

The presence of relatively few permanent teeth at younger ages and the shorter time since their eruption may make them less susceptible to developing decay. This is further demonstrated by a comparison of Table 2.2 with Table 2.1 where mean scores for all DMFT components including the decayed teeth were shown to be lower than the corresponding mean scores for deciduous teeth at each age from 6 to 10.

Table 2.2: Permanent teeth: decayed, missing and filled teeth, 2007

Age (years)	Decayed teeth (D)		Missing teeth (M)		Filled teeth (F)		DMFT	
	Mean	CI	Mean	CI	Mean	CI	Mean	CI
6	0.07	0.05–0.08	0.00	0.00–0.00	0.01	0.00–0.03	0.08	0.06–0.10
7	0.17	0.15–0.20	0.01	0.00–0.03	0.06	0.04–0.07	0.24	0.21–0.27
8	0.22	0.19–0.26	0.01	0.01–0.02	0.11	0.09–0.12	0.34	0.30–0.38
9	0.25	0.21–0.28	0.04	0.01–0.06	0.21	0.18–0.24	0.49	0.44–0.55
10	0.30	0.26–0.34	0.03	0.02–0.05	0.27	0.24–0.30	0.60	0.55–0.65
11	0.37	0.32–0.42	0.03	0.02–0.04	0.40	0.37–0.44	0.80	0.74–0.87
12	0.49	0.42–0.56	0.05	0.02–0.08	0.42	0.38–0.46	0.95	0.85–1.05
13	0.69	0.54–0.83	0.06	0.04–0.09	0.77	0.66–0.88	1.51	1.31–1.71
14	0.65	0.51–0.79	0.08	0.06–0.10	0.87	0.75–1.00	1.60	1.38–1.83
15	0.95	0.54–1.35	0.07	0.05–0.10	1.09	0.91–1.27	2.10	1.68–2.51

The mean number of decayed, missing and filled permanent teeth expressed as a percentage of DMFT index is shown in Figure 2.5. A comparison of Figure 2.5 with Figure 2.1 reveals that the pattern is similar to that in the deciduous teeth. Up to the age of 10, the presence of untreated decay (D) contributed to 50% or more of the DMFT score. By the age of 11, however, filled teeth represented exactly 50% of the DMFT score, indicating that a higher proportion of teeth affected by caries have been treated at this age.

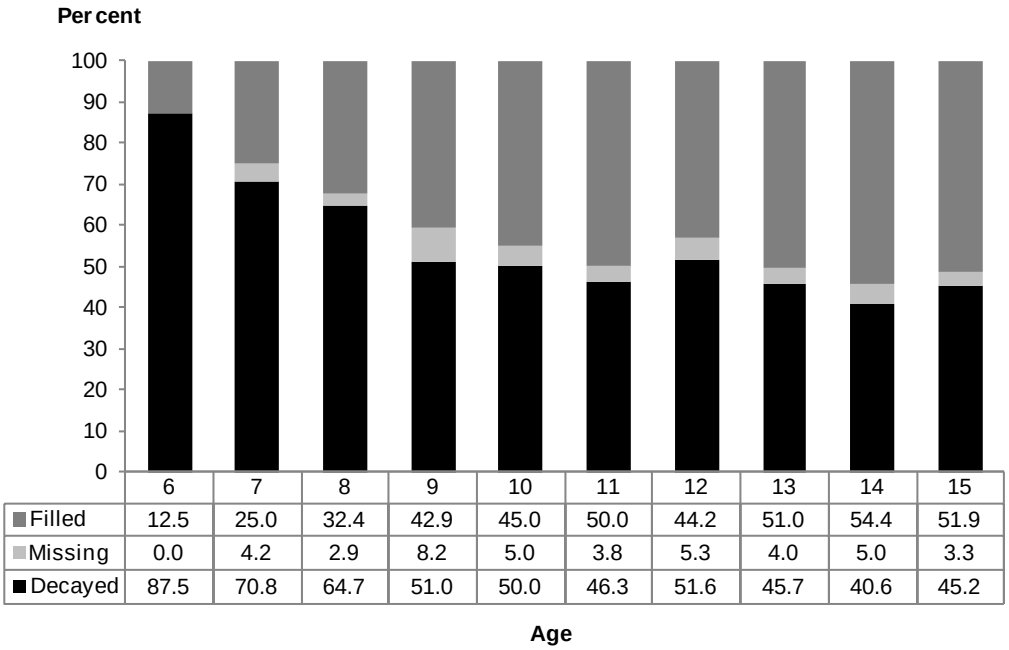


Figure 2.5: Decayed, missing and filled permanent teeth as a percentage of DMFT index by age, 2007

Figure 2.6 shows the proportion of children with a DMFT score greater than zero in 2007. There is a positive association between age and experience of dental caries in permanent teeth. This reflects the increasing time which teeth are at risk of developing decay. The proportion of children aged between 6 and 8 with decay experience in permanent teeth was less than 20%. This figure was 39% and 60% for children aged 12 and 15 respectively.

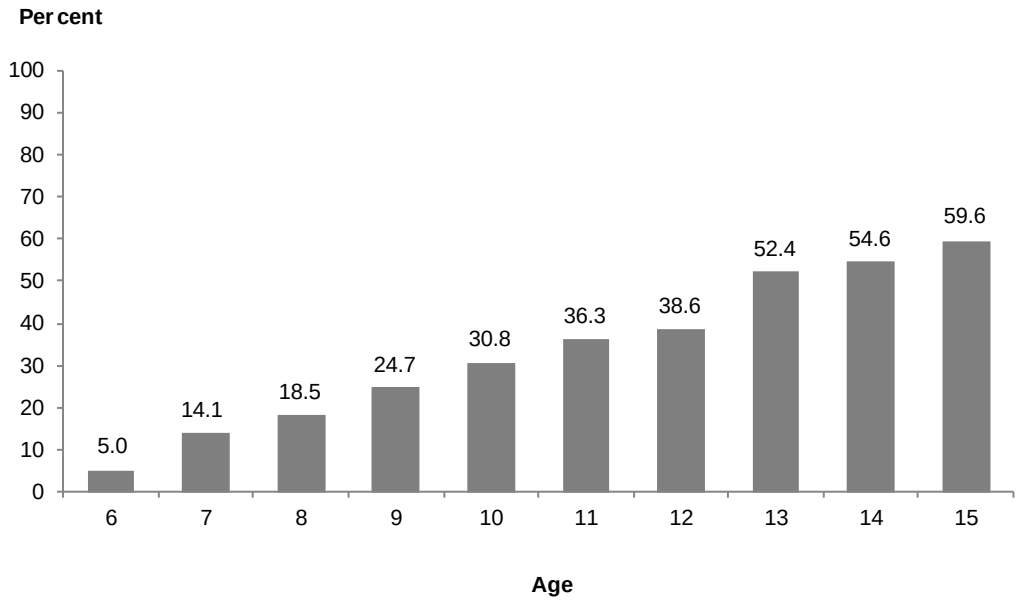
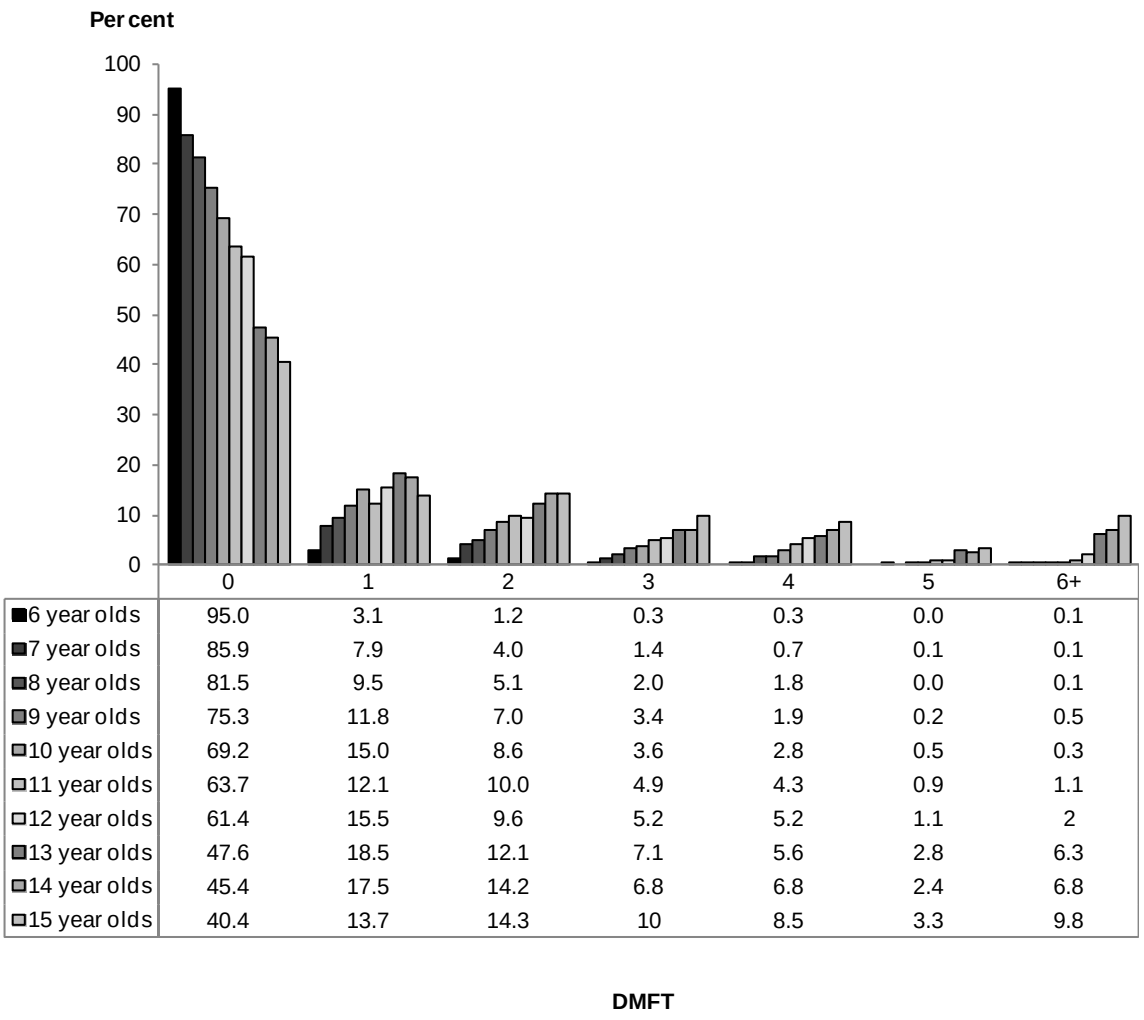


Figure 2.6: Permanent teeth: children with DMFT > 0 by age, 2007

Distribution of permanent caries experience by age

Figure 2.7 shows the distribution of DMFT for Australian children aged between 6 and 15 in 2007. While there was a steady decline in the proportion of children with no decay with increasing age (95% at age 6 to almost 40% at age 15), the prevalence of caries experience in the permanent teeth was associated with age. Among the children with caries experience in permanent teeth, DMFT scores 1 and 2 were more common than other scores. The proportion of children with a DMFT score 6 or more progressively increased from 1.1% at age 11 to 9.8% at age 15.



	0	1	2	3	4	5	6+
6 year olds	95.0	3.1	1.2	0.3	0.3	0.0	0.1
7 year olds	85.9	7.9	4.0	1.4	0.7	0.1	0.1
8 year olds	81.5	9.5	5.1	2.0	1.8	0.0	0.1
9 year olds	75.3	11.8	7.0	3.4	1.9	0.2	0.5
10 year olds	69.2	15.0	8.6	3.6	2.8	0.5	0.3
11 year olds	63.7	12.1	10.0	4.9	4.3	0.9	1.1
12 year olds	61.4	15.5	9.6	5.2	5.2	1.1	2
13 year olds	47.6	18.5	12.1	7.1	5.6	2.8	6.3
14 year olds	45.4	17.5	14.2	6.8	6.8	2.4	6.8
15 year olds	40.4	13.7	14.3	10	8.5	3.3	9.8

Figure 2.7: Distribution of DMFT index for children, 2007

Significant Caries Index (SiC[10])

Figure 2.8 shows those children with the most extensive dental decay as measured by the SiC[10] index in comparison to the national average DMFT scores of children aged 6 to 15 in 2007. For all ages the SiC[10] values for permanent teeth were between 4 and 10 times the overall mean DMFT scores. This reflects the increasing severity of caries experience with age in a minority of children who have high caries levels in permanent teeth.

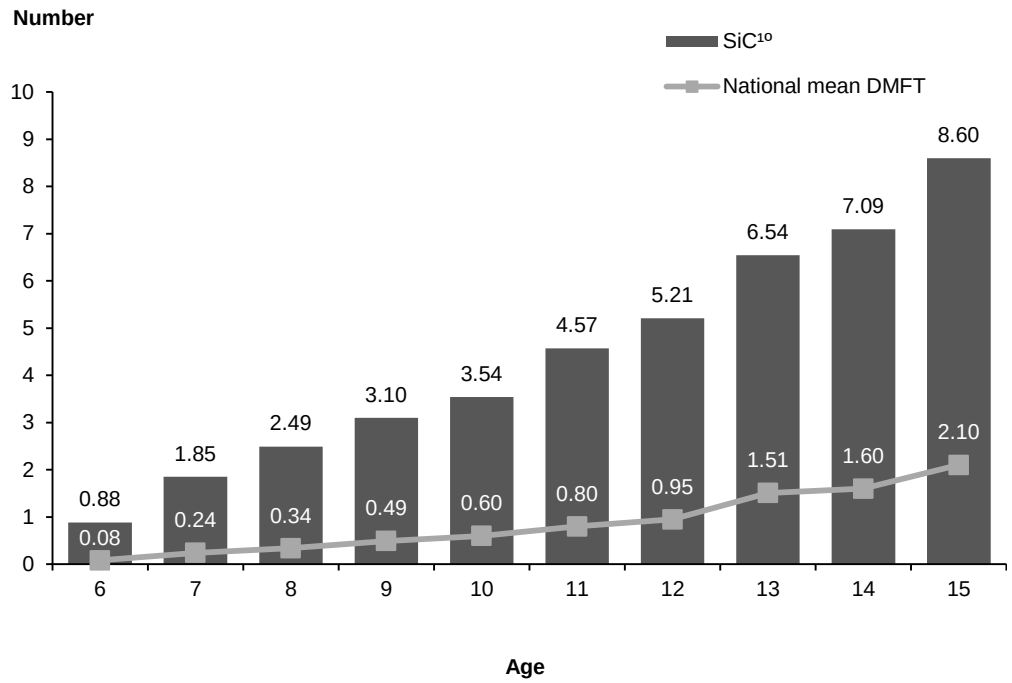


Figure 2.8: Significant Caries Index (SiC[10]) and average DMFT of children aged 6 to 15 by age, 2007

All teeth

All teeth: age-specific caries experience

Table 2.3 shows the combined components of decay experience for both the deciduous and permanent teeth in 2007. This provides an indication of the total amount of disease among Australian children receiving care within a SDS. Given that both deciduous and permanent teeth are likely to be present at the same time in children aged 5 to 12, Table 2.3 depicts the data only for this age range.

Between 28.5% and 42.6% of children aged 5 to 12 (depending on age) had untreated decay in 1 or more teeth in 2007. While the prevalence of untreated decay was highest among children aged 7 and 9 (42.6% and 42.5%, respectively), the extent of untreated decay was greater among the youngest age groups (9.5% of children aged 5 and 9.8% of children aged 6 had 5 or more teeth with untreated decay), compared to older age groups (less than 6% from age 9 onwards). The proportion of children with teeth missing due to caries was relatively low across all age groups, ranging from 2.8% at age 12 to 8.2% at age 8. Between 37.8% and 58.1% of children of all ages had not experienced dental caries in either their deciduous or permanent teeth (dmft + DMFT = 0).

Table 2.3: All teeth: age-specific caries experience, 2007

Age (years)	Children with caries experience by total decayed, total missing, total filled and total DMFT (per cent)								
	D+d[(a)]=0	D+d[(a)]=1	D+d[(a)]=2	D+d[(a)]=3	D+d[(a)]=4	D+d[(a)]=5+	M+m=0[(b)]	F+f=0[(c)]	Dmft+ DMFT=0[(d)]
5	64.2	8.9	9.0	4.9	3.4	9.5	96.6	86.3	58.1
6	61.2	11.3	8.7	5.7	3.3	9.8	95.3	78.1	53.2
7	57.4	15.4	9.3	6.0	4.2	7.8	94.1	67.6	43.7
8	58.5	15.4	8.9	5.9	4.1	7.2	91.8	61.0	41.2
9	57.5	17.4	10.3	5.7	3.3	5.8	94.5	58.3	37.8
10	61.0	18.9	10.0	4.4	2.7	2.9	95.6	57.4	39.5
11	66.5	17.1	8.5	3.3	2.1	2.5	96.4	63.3	45.1
12	71.5	13.9	6.8	3.3	2.2	2.2	97.2	70.4	52.9

(a) Proportion of children with total number of untreated decayed teeth in both deciduous and permanent dentition.

(b) Proportion of children with no missing teeth due to decay in both deciduous and permanent dentition.

(d) Proportion of children with no filled teeth present in both deciduous and permanent dentition.

(d) Proportion of children with no untreated decay, missing or filled teeth present in both deciduous and permanent dentition.

2.2 Dental decay by state and territory

5 to 6 year old dmft by state and territory

The standard age group for reporting on dental caries experience in the deciduous dentition is considered to be combined 5 and 6 year old children (WHO 1997). In addition, many children make their first visit to a SDS when they are either 5 or 6, thus this age group represents the dental health status of children new to these services.

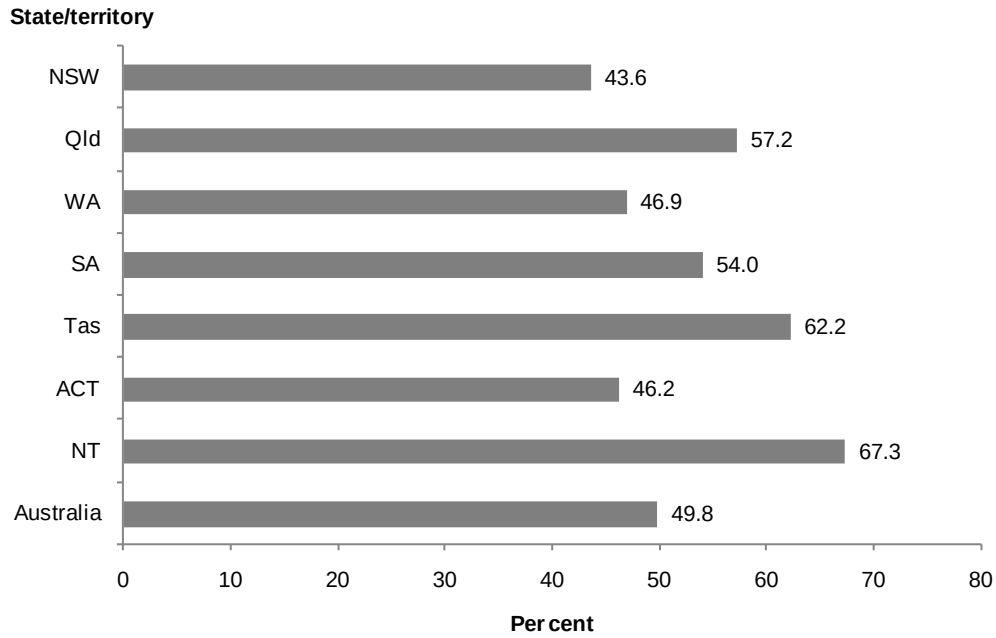
Table 2.4 shows that the Australian Capital Territory had not only the lowest level of dental caries experience in deciduous teeth, but also the fewest number of decayed deciduous teeth per child, as well as the fewest missing deciduous teeth per child due to caries (1.37, 0.72 and 0.04). Both the levels of untreated decay and dental caries experience in deciduous teeth were highest in the Northern Territory (2.57 and 3.75 per child, respectively), while the mean number of missing teeth per child was highest in Tasmania (0.36). The Northern Territory also showed the greatest number of filled teeth per child (1.04), whereas New South Wales had the lowest number of filled teeth per child (0.34).

Table 2.4: Caries experience in the deciduous teeth of 5 to 6 year old children by state/territory, 2007

	Decayed teeth (d)		Missing teeth (m)		Filled teeth (f)		dmft	
State/territory	**Mean**	**CI**	**Mean**	**CI**	**Mean**	**CI**	**Mean**	**CI**
NSW	1.09	0.96–1.22	0.10	0.06–0.13	0.34	0.28–0.39	1.53	1.36–1.70
Qld	1.68	1.48–1.89	0.11	0.06–0.16	0.68	0.55–0.82	2.47	2.19–2.74
WA	0.97	0.88–1.05	0.05	0.03–0.07	0.49	0.44–0.55	1.51	1.40–1.62
SA	1.10	1.05–1.14	0.17	0.15–0.19	0.74	0.71–0.78	2.01	1.95–2.07
Tas	1.15	1.07–1.22	0.36	0.32–0.40	0.70	0.66–0.75	2.21	2.11–2.31
ACT	0.72	0.60–0.84	0.04	0.02–0.06	0.61	0.50–0.72	1.37	1.20–1.54
NT	2.57	2.11–3.03	0.14	–0.01–0.28	1.04	0.66–1.42	3.75	3.11–4.38
Australia	**1.26**	**1.18–1.34**	**0.11**	**0.09–0.13**	**0.52**	**0.47–0.56**	**1.88**	**1.78–1.99**

Note: Results from Victoria are excluded due to lack of access to the data.

Although the nationwide prevalence of decay experience in deciduous teeth among children aged 5 to 6 was nearly 50%, it varied across states and territories (Figure 2.9). New South Wales had the lowest proportion of children aged 5 to 6 with caries experience (43.6%), and the Northern Territory reported the highest proportion of such children (67.3%).



Note: Results from Victoria are excluded due to lack of access to the data.

Figure 2.9: Deciduous teeth: proportion of 5 to 6 year old children with dmft > 0, by state and territory, 2007

12 year old DMFT by state and territory

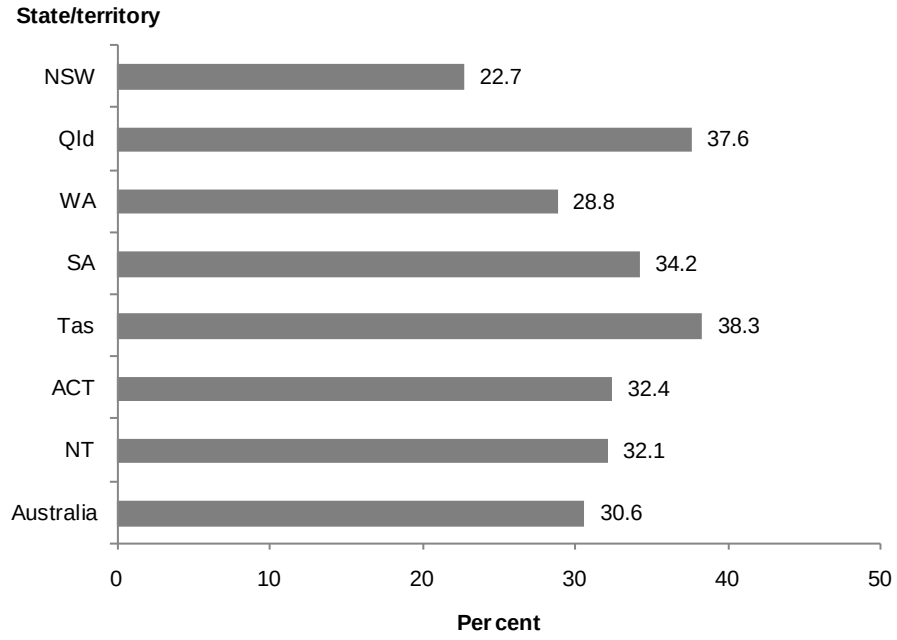
Table 2.5 shows that DMFT and its components in children aged 12 varied between states and territories in 2007. Queensland had the highest mean number of teeth with untreated decay per child (0.69), and the greatest mean DMFT score per child (1.32). The Australian Capital Territory reported the lowest mean number of decayed teeth per child (0.23), and the Northern Territory reported the lowest mean DMFT (0.74). The highest mean number of filled teeth per child was also reported in Queensland (0.56), which was about 87% greater than the lowest mean number of filled teeth per child (0.30), in New South Wales.

Table 2.5: 12 year old caries experience in the permanent dentition by state/territory, 2007

	Decayed teeth (D)		Missing teeth (M)		Filled teeth (F)		DMFT	
State/territory	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**
NSW	0.42	0.35–0.50	0.03	0.01–0.04	0.30	0.25–0.35	0.75	0.65–0.85
Qld	0.69	0.48–0.91	0.07	0.00–0.17	0.56	0.44–0.67	1.32	1.02–1.63
WA	0.40	0.31–0.50	0.07	0.04–0.10	0.41	0.34–0.48	0.84	0.73–0.95
SA	0.40	0.37–0.43	0.02	0.02–0.03	0.51	0.48–0.53	0.93	0.88–0.97
Tas	0.46	0.41–0.52	0.10	0.07–0.13	0.54	0.49–0.59	1.10	1.02–1.19
ACT	0.23	0.16–0.30	0.03	0.01–0.04	0.55	0.45–0.64	0.80	0.68–0.92
NT	0.32	0.17–0.46	0.11	0.00–0.25	0.31	0.16–0.45	0.74	0.44–1.03
Australia	**0.49**	**0.42–0.56**	**0.05**	**0.02–0.08**	**0.42**	**0.38–0.46**	**0.95**	**0.85–1.05**

Note: Results from Victoria are excluded due to lack of access to the data.

Figure 2.10 shows the prevalence of dental caries experience in permanent dentition among Australian children aged 12 in 2007. Tasmania with 38.3% of children aged 12 having dental caries reported the highest prevalence followed by Queensland (37.6%) whereas New South Wales had the lowest prevalence (22.7%). Overall, 30.6% Australian children aged 12 had dental caries in their permanent teeth.



Note: Results from Victoria are excluded due to lack of access to the data.

Figure 2.10: Permanent teeth: proportion of 12 year old children with DMFT > 0, by state and territory, 2007

Dental caries experience of combined deciduous and permanent teeth by state and territory

Combined components of dental caries experience for both the deciduous and permanent teeth are shown in Tasmanian children showed a higher level of missing teeth due to dental caries (21.9%) compared with those in other states and territories, where the corresponding levels were less than 7%. New South Wales and Queensland accounted for the highest and lowest proportions of children aged 5 to 12 without filled teeth (76.4% and 58.7%, respectively). Approximately one-half of children in New South Wales (51.8%) and Western Australia (50%) were free from dental caries in both deciduous and permanent teeth. The corresponding proportions for children in the Queensland, the Northern Territory and Tasmania were less than 40%.

Table 2.6. There was an apparent variation in the dental caries experience of children aged 5 to 12 between states and territories. The proportion of children with an untreated decay score (D+d) of one or more in either deciduous or permanent teeth ranged from 27.4% in the Australian Capital Territory to 52.3% in the Northern Territory. The level of untreated decay (5 or more teeth) was highest in the Northern Territory and lowest in the Australian Capital Territory (10.2% and 2.6%, respectively).

Tasmanian children showed a higher level of missing teeth due to dental caries (21.9%) compared with those in other states and territories, where the corresponding levels were less than 7%. New South Wales and Queensland accounted for the highest and lowest proportions of children aged 5 to 12 without filled teeth (76.4% and 58.7%, respectively). Approximately one-half of children in New South Wales (51.8%) and Western Australia (50%) were free from dental caries in both deciduous and permanent teeth. The corresponding proportions for children in the Queensland, the Northern Territory and Tasmania were less than 40%.

Table 2.6: All teeth caries experience among 5 to 12 year old children by state/territory, 2007

	D+d						M+m=0	F+f=0	dmft+DMFT=0
State/territory	0 %	1 %	2 %	3 %	4 %	5+ %	%	%	%
NSW	63.3	14.5	8.7	4.9	3.3	5.4	95.9	76.4	51.8
Qld	57.3	15.2	9.7	5.5	3.7	8.6	95.1	58.7	39.2
WA	69.4	14.4	7.4	3.6	1.9	3.3	97.7	66.9	50.0
SA	61.9	16.2	9.5	5.1	3.0	4.3	93.9	60.1	42.3
Tas	62.4	13.8	9.6	5.2	3.5	5.6	78.1	60.3	35.4
ACT	72.6	13.3	6.7	3.3	1.5	2.6	96.3	61.8	49.6
NT	47.7	17.6	12.5	7.7	4.3	10.2	96.6	66.4	34.8
Australia	**62.3**	**14.8**	**8.9**	**4.9**	**3.2**	**5.9**	**95.2**	**67.7**	**46.4**

Note: Results from Victoria are excluded due to lack of access to the data.

2.3 Fissure sealants

Sealing or covering the pits and fissures of teeth (usually molars) with a resin or glass-ionomer (cement) material is a frequently used preventive method to effectively halt the development of active decay in permanent teeth (Rozier 2001). Fissure sealants act by preventing the future build-up of plaque and bacteria in the tooth grooves that are more at risk of decay.

Table 2.7 shows that the mean number of teeth with fissure sealants was associated with age, ranging from 0.06 teeth among children aged 6 to 1.32 among children aged 15. The children who had no dental decay experience were less likely to have fissure sealants than children who had experienced dental decay, for all ages. This reflects the practice of providing fissure sealants to the children who are more vulnerable to developing dental decay.

Table 2.7: Fissure sealant age-specific experience, 2007

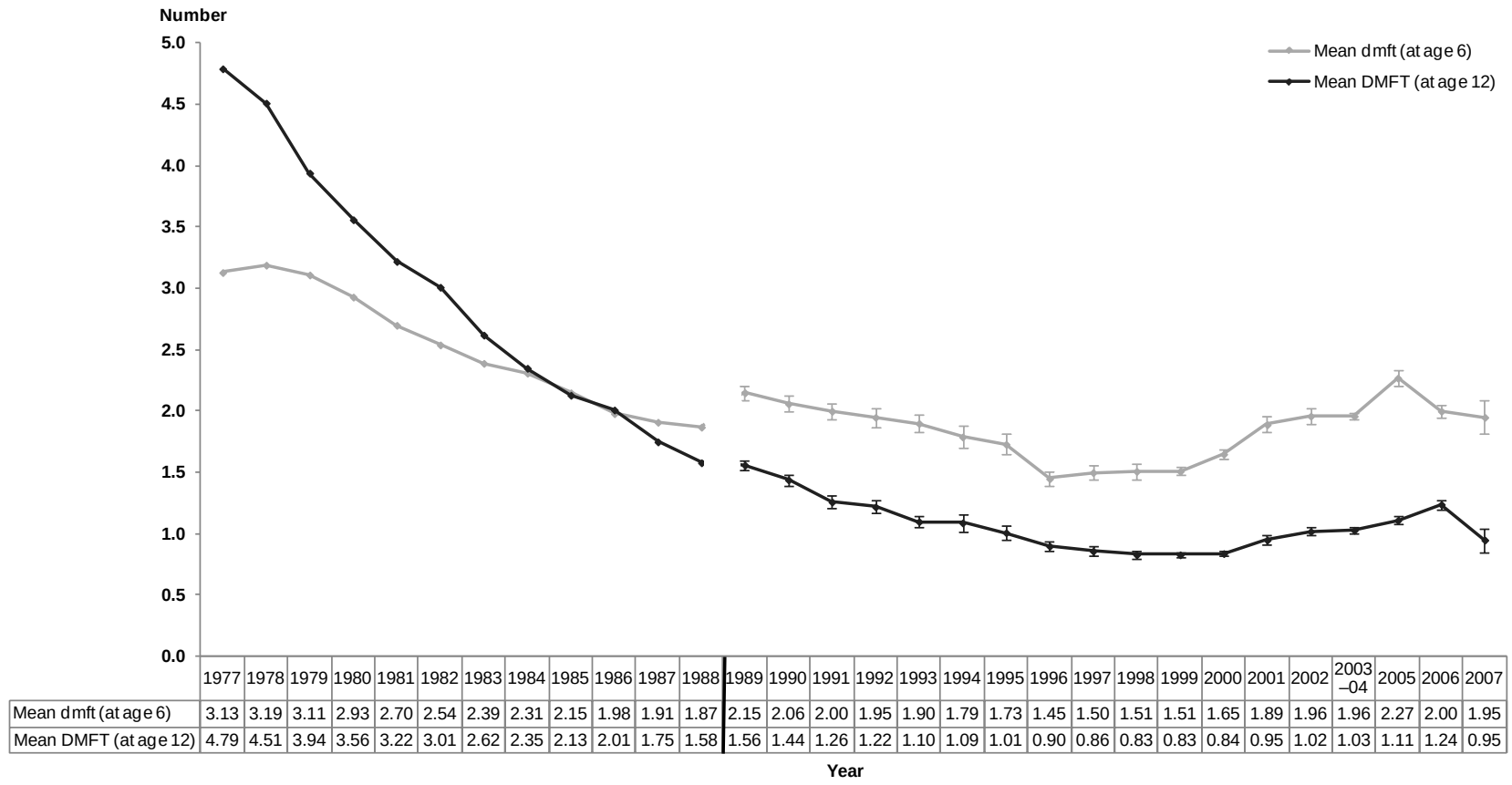
	All children		% of children with fissure sealant among children with DMFT = 0	% of children with fissure sealant among children with DMFT > 0
Age (years)	Mean	CI		
6	0.06	0.04–0.07	2.0	7.1
7	0.21	0.18–0.24	7.5	13.0
8	0.47	0.42–0.52	15.1	21.1
9	0.57	0.51–0.62	18.8	25.8
10	0.60	0.55–0.66	20.2	27.4
11	0.67	0.60–0.74	20.0	30.0
12	0.65	0.57–0.72	18.8	28.6
13	0.86	0.73–0.99	21.3	39.0
14	1.15	0.98–1.31	29.3	42.8
15	1.32	0.91–1.74	24.5	42.9

3 Trends

3.1 National

The trends of caries experience for both deciduous and permanent teeth in Australian children at age 6 and 12 over the past three decades are shown in Figure 3.1. Mean dmft for Australian children aged 6 reduced from 3.19 in 1978 to 1.87 in 1988. After a minor fluctuation around a mean dmft score of 2 between 1989 and 1991, dmft declined again from 1992 onwards until 1996 where the lowest mean dmft score of 1.45 was reported. There has been a slight increase in the deciduous decay experience over the past decade, with mean dmft peaking at 2.27 in 2005. In contrast, the trend of caries experience in permanent teeth of Australian children aged 12 revealed a marked decline over the past 30 years with mean DMFT reducing from 4.79 in 1977 to its lowest value of 0.83 in 1998–99. Thereafter, mean DMFT scores have remained stable at around 1.

Data reported here were collected over two broad timeframes. In 1973, the Australian School Dental Scheme (ASDS) was established and was responsible for monitoring children's oral health. Between 1977 and 1988 data reported here were collected as part of the evaluation of the ASDS, managed centrally by the Commonwealth Department of Health. From 1989, the national data collection was transferred to the Australian Institute of Health and Welfare Dental Statistics and Research Unit (AIHW DSRU) at The University of Adelaide. This national surveillance survey was named Child Dental Health Survey (CDHS) and a number of changes, such as sampling strategies, were introduced. Prior to 1989, the evaluation component of the ASDS also adopted a full enumeration of children presenting for assessment. From 1989, children were sampled at random by selecting those born on specific days of the month with different sampling ratios used across the states and territories.



	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003–04	2005	2006	2007
Mean dmft (at age 6)	3.13	3.19	3.11	2.93	2.70	2.54	2.39	2.31	2.15	1.98	1.91	1.87	2.15	2.06	2.00	1.95	1.90	1.79	1.73	1.45	1.50	1.51	1.51	1.65	1.89	1.96	1.96	2.27	2.00	1.95
Mean DMFT (at age 12)	4.79	4.51	3.94	3.56	3.22	3.01	2.62	2.35	2.13	2.01	1.75	1.58	1.56	1.44	1.26	1.22	1.10	1.09	1.01	0.90	0.86	0.83	0.83	0.84	0.95	1.02	1.03	1.11	1.24	0.95

Note: From 1977 to 1988, data are from the Australian School Dental Scheme evaluation. From 1989 data are from the Child Dental Health Survey.

Figure 3.1: Mean dmft (at age 6) and DMFT (at age 12), Australia, 1977 to 2007

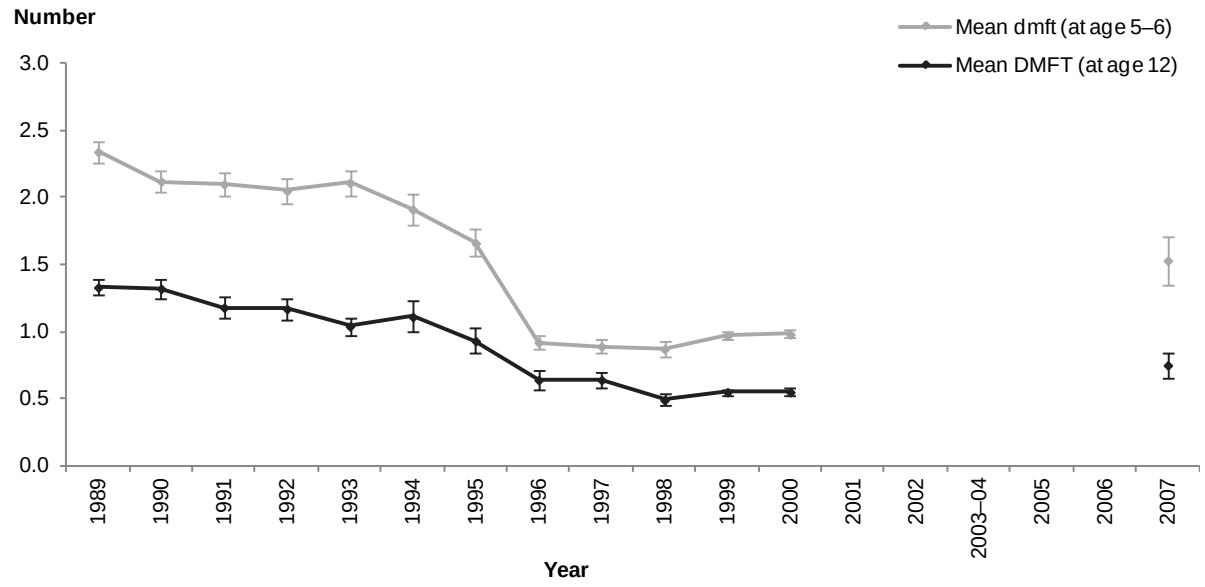
3.2 States and territories

Figures 3.2 to 3.9 show the trends in deciduous (at age 5 to 6) and permanent (at age 12) decay experience of children in each state and territory in Australia from 1989 to 2007. New South Wales, Victoria and Tasmania do not have data for some of the years and hence the trends of caries experience among states may not be directly comparable. However, the general trend of both deciduous and permanent caries experience in children from nearly all states and territories points to a decline up to 1996 and 1997, followed by a small increase thereafter. This pattern is somewhat similar to that of the national trend observed over the same period.

New South Wales

Figure 3.2 represents the trends of deciduous (at age 5 to 6) and permanent (at age 12) decay experience of children in New South Wales. The figure shows a dramatic decline in both mean dmft and mean DMFT between 1993 and 1996. Changes in data collection for New South Wales beginning in 1996 with the implementation of Save Our Kids Smiles (SOKS) program explained the sudden decline in caries experience. Under SOKS only children from Kindergarten and Years 2, 4, 6 and 8 were approached each year and children aged 6, 8, 10, 12 and 14 are under-represented in the survey. Figures for these ages may reflect a bias as those children who are in a school class either above or below the majority of their age cohort may not be representative of the age cohort as a whole. The level of clinical control was also lower under SOKS than previously, and screenings were not conducted in explicit accordance with a study protocol.

From 2001, children from disadvantaged schools were prioritised for treatment, resulting in much smaller numbers of children attending the SDS. Rather than collect information from all children enrolled in or screened by the SDS, as had been done previously, oral health information on children in 2001 was only captured at the point of examination. Therefore data were predominantly only available on children with immediate treatment needs from targeted 'disadvantaged' schools. For this reason, data are not reported from 2001 to 2006.

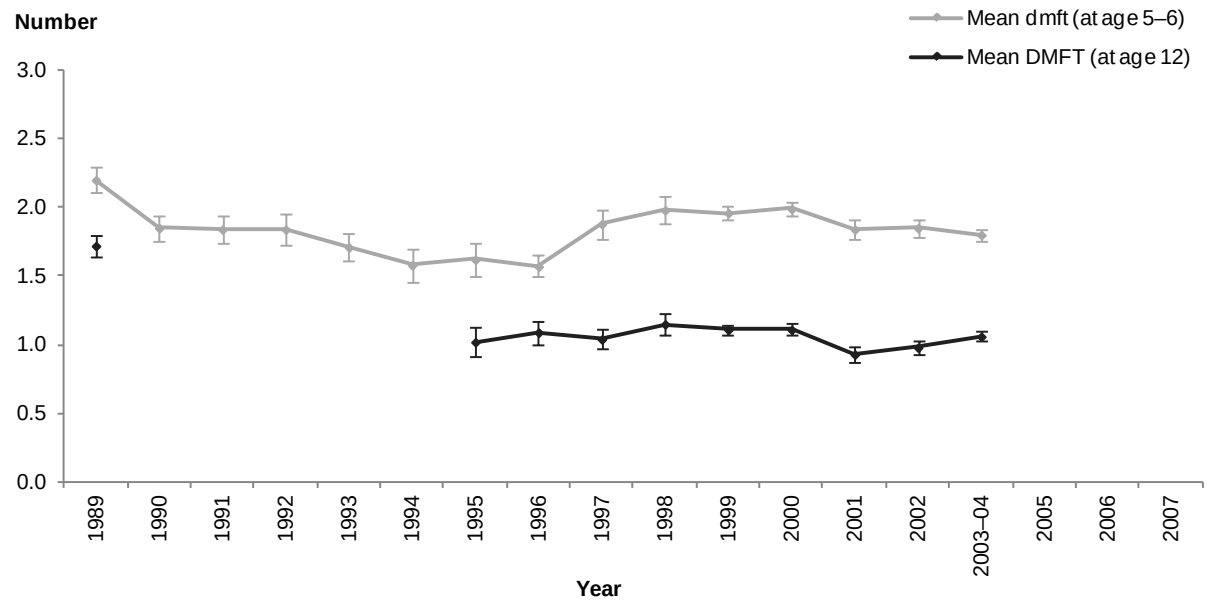


Note: New South Wales was excluded from the data collection from 2001 due to a lack of representativeness of the sample.

Figure 3.2: Mean dmft (at age 6) and DMFT (at age 12), New South Wales, 1989 to 2007

Victoria

Figure 3.3 shows the trends in deciduous (at age 5 to 6) and permanent (at age 12) decay experience of children in Victoria. There was a steady decline in mean dmft since 1989 in Victoria until 1996, followed by an increase from 1998 to 2000, and a further decline from 2001 to 2004. While caries experience data for both dentitions were only provided up to 2004 in Victoria, data for permanent teeth were not available for Victoria from 1990 to 1994. The figure shows that the mean DMFT remained almost stable in Victorian children from 1995 to 2004.



Note: Results from Victoria are excluded in later years due to lack of access to the data.

Figure 3.3: Mean dmft (at age 6) and DMFT (at age 12), Victoria, 1989 to 2007

Queensland

Figure 3.4 shows the trends in deciduous (at age 5 to 6) and permanent (at age 12) decay experience of children in Queensland. The general trend for both deciduous and permanent caries experience of children in Queensland showed a decline up to 1997, followed by a small increase thereafter. However, from the late 1990s, there has been an increase in mean dmft, which returned to a level similar to that at the beginning of the 1990s.

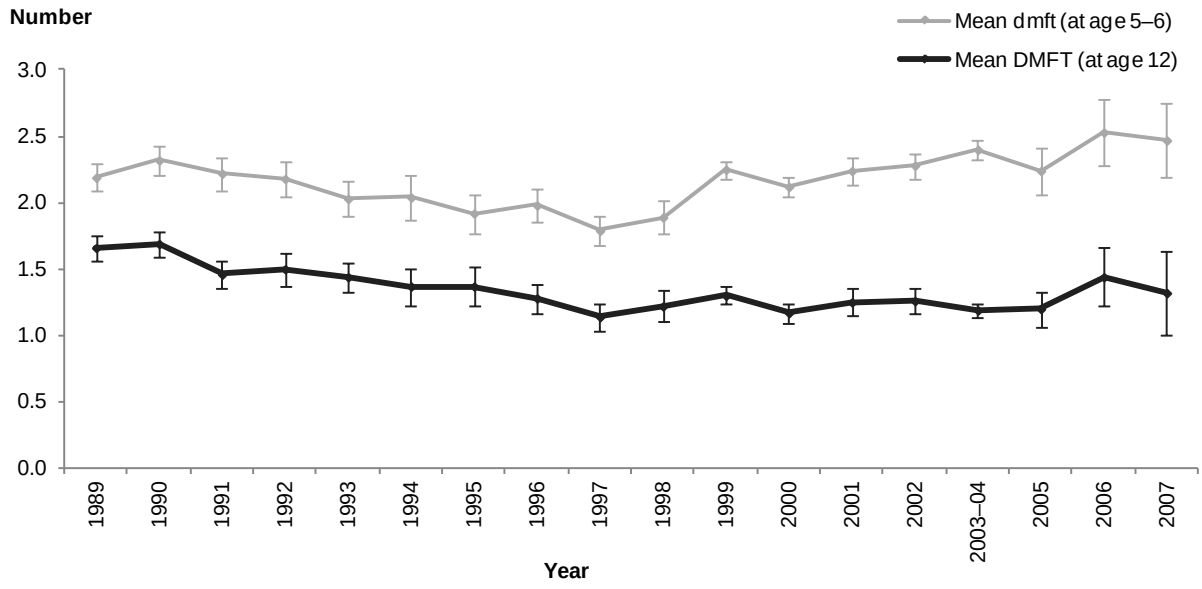


Figure 3.4: Mean dmft (at age 6) and DMFT (at age 12), Queensland, 1989 to 2007

Western Australia

Figure 3.5 shows the trends in deciduous (at age 5 to 6) and permanent (at age 12) decay experience of children in Western Australia. Mean dmft among children aged 5 to 6 in Western Australia fluctuated at 1.4 and reached its lowest score in 1996. Then, mean dmft scores started increasing from 1997 to 2000 and remained somewhat stable from 2001 to 2007. In contrast, mean DMFT scores decreased sharply in the early 1990s and continued to decline until it reached the lowest point in 1999. Mean DMFT remained almost stable from 2000 to 2007.

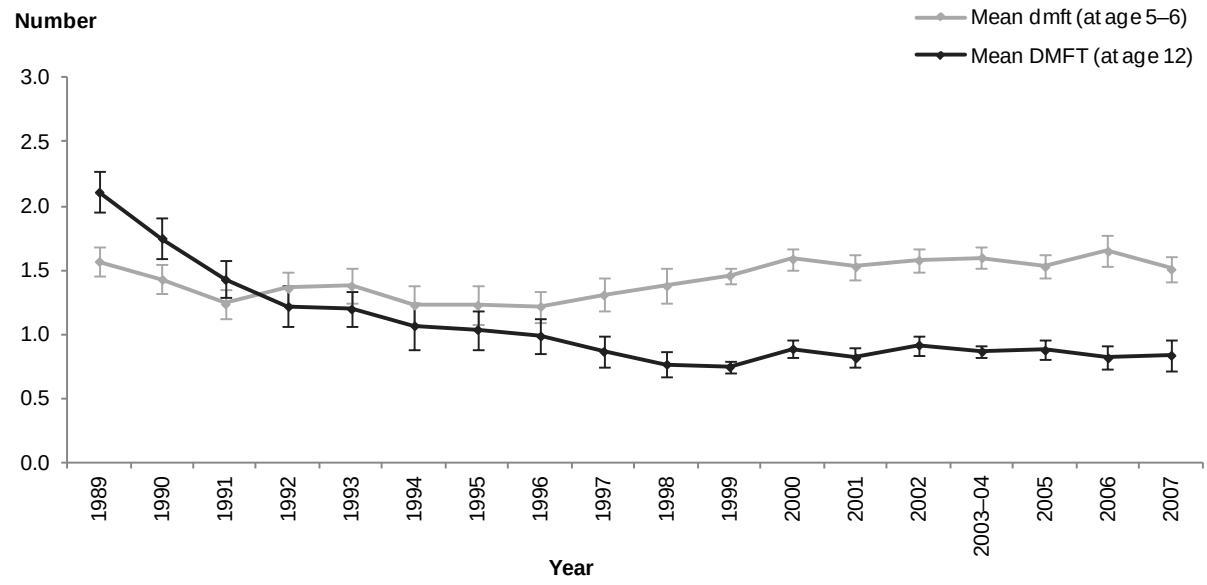


Figure 3.5: Mean dmft (at age 6) and DMFT (at age 12), Western Australia, 1989 to 2007

South Australia

Figure 3.6 shows the trends in deciduous (at age 5 to 6) and permanent (at age 12) decay experience of children in South Australia. Among states and territories with comparatively low dmft and DMFT scores, South Australia showed the greatest decline in dmft and DMFT in the early 1990s and experienced the state's lowest score in 1994, which was followed by a steady increase in decay experience from 1995 to 2007.

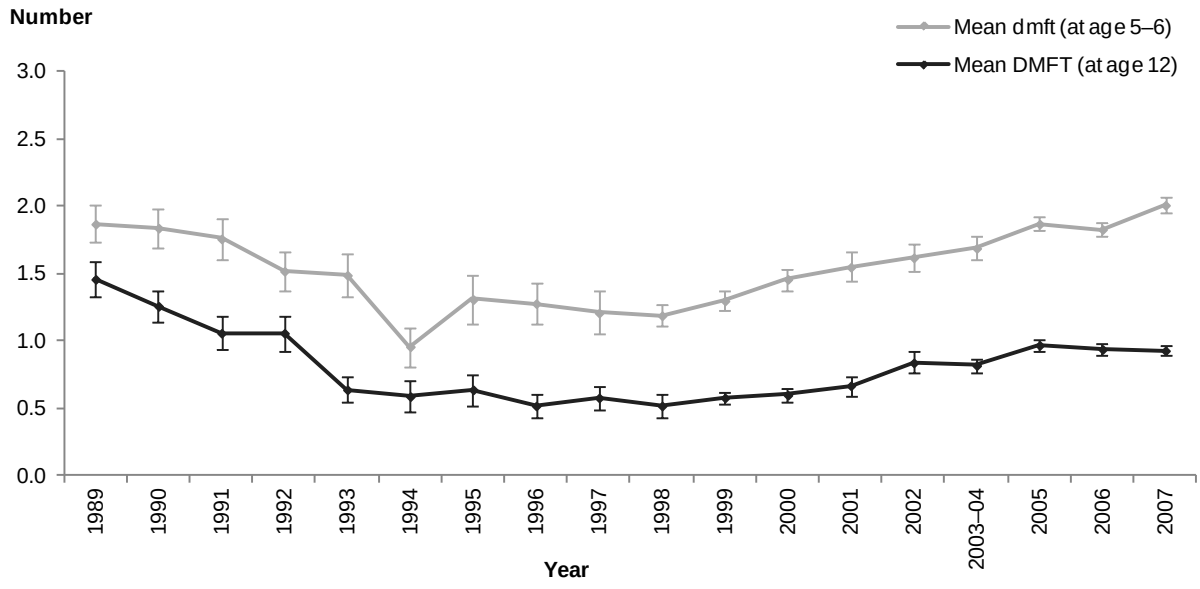


Figure 3.6: Mean dmft (at age 6) and DMFT (at age 12), South Australia, 1989 to 2007

Tasmania

Figure 3.7 shows the trends in deciduous (at age 5 to 6) and permanent (at age 12) decay experience of children in Tasmania. No data were available for Tasmania in 1994. Mean dmft and mean DMFT recorded their lowest scores in 1993 and 1995, respectively. There has been an increase in deciduous caries experience since 1995 with the highest mean dmft score being reported in 2007. The trend for the permanent decay experience, on the other hand, has not been consistent—mean DMFT reached its highest value in 1998, which was followed by a decline until 2000, and stabilisation thereafter.

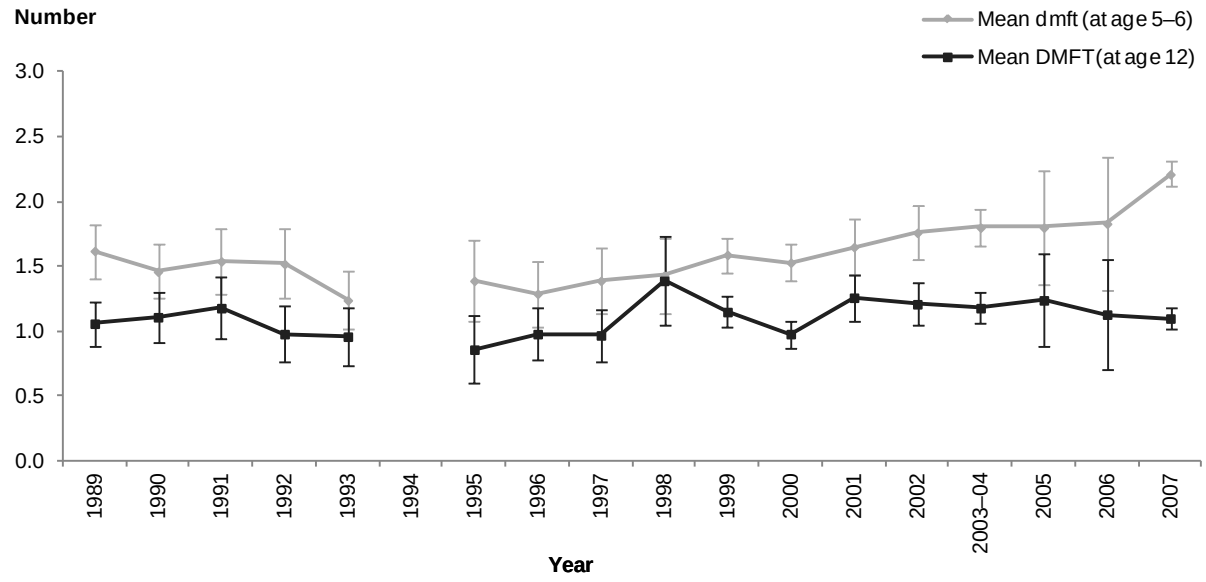


Figure 3.7: Mean dmft (at age 6) and DMFT (at age 12), Tasmania, 1989 to 2007

Australian Capital Territory

Figure 3.8 shows the trends in deciduous (at age 5 to 6) and permanent (at age 12) decay experience of children in the Australian Capital Territory. Mean dmft fluctuated over the period, with the lowest score being reported in 1996. Thereafter, it showed generally an increasing trend with some ups and downs in between until it started declining in 2005. Permanent caries experience declined steadily until 1996, which was followed by an increase, with the highest mean DMFT being reported in 2000. Mean DMFT then declined to 2007.

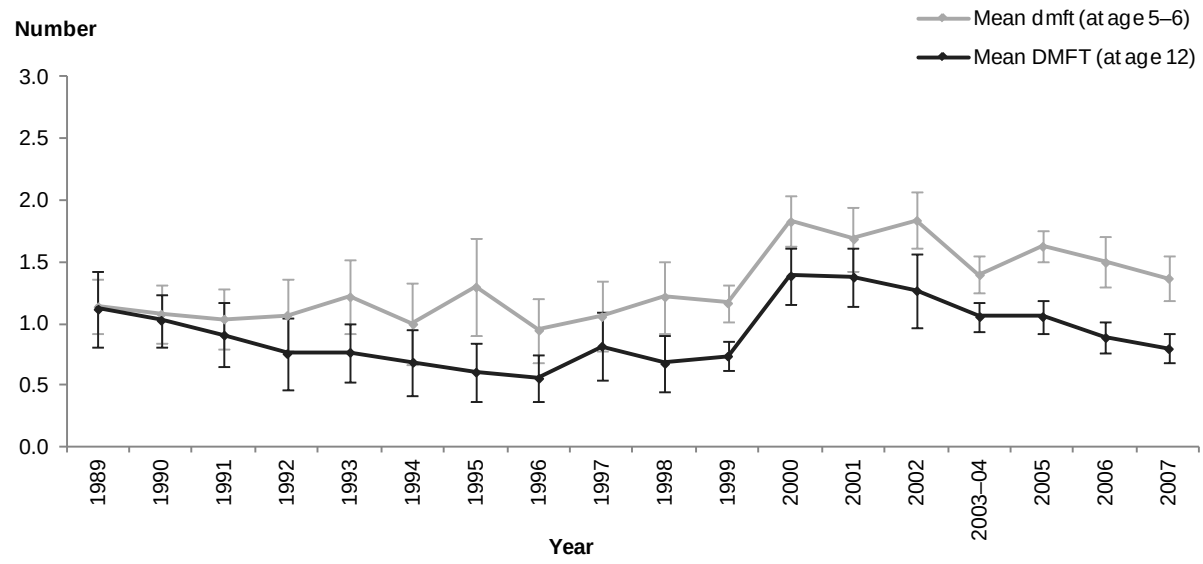


Figure 3.8: Mean dmft (at age 6) and DMFT (at age 12), Australian Capital Territory, 1989 to 2007

Northern Territory

Figure 3.9 shows the trends in deciduous (at age 5 to 6) and permanent (at age 12) decay experience of children in the Northern Territory. Mean dmft has remained stable around 2 until 2001, which was followed by an increase in the deciduous caries experience. The apparent sharp increase in mean dmft for children in the Northern Territory from 2006 to 2007 is in line with the trend that was occurring in the earlier 2000s. Mean DMFT recorded its highest score in 1991 and remained stable until 2003–04. An increase in mean DMFT score in 2005 was followed by a decline.

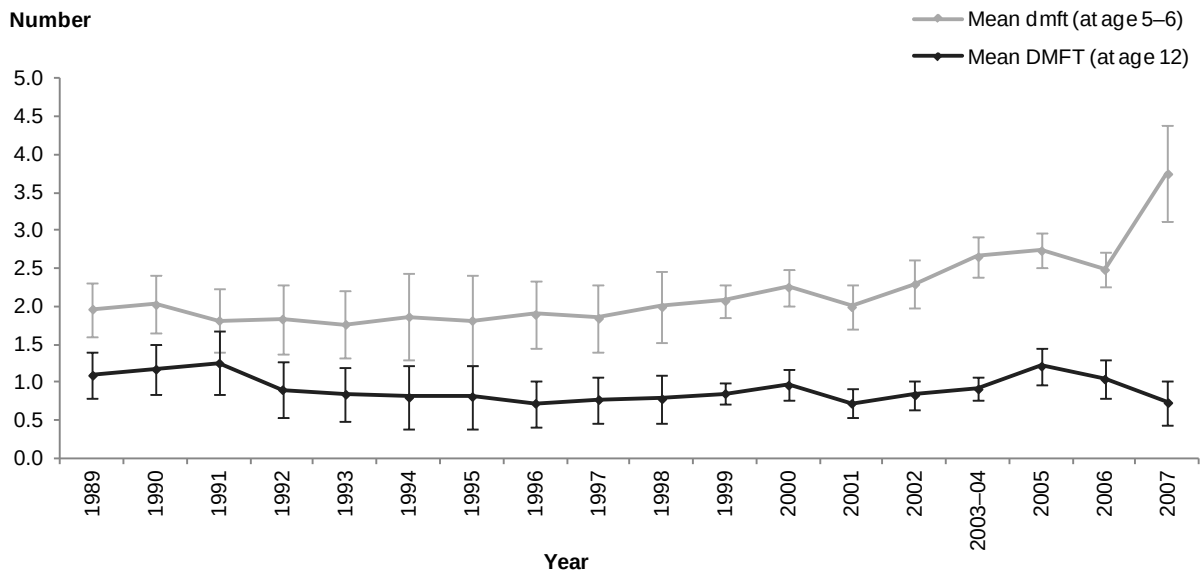


Figure 3.9: Mean dmft (at age 6) and DMFT (at age 12), Northern Territory, 1989 to 2007

Appendix: Description of survey methods

Source of subjects

Data for 2007 were derived from two separate sources. Data for Queensland, South Australia, Western Australia, Tasmania, the Northern Territory and the Australian Capital Territory were sourced from the Child Dental Health Survey (CDHS) conducted in the 2007 calendar year. The CDHS is an annual surveillance survey which monitors the dental health of children enrolled in school and community dental services that the health departments or authorities of Australia's six state and two territory governments operate. In all jurisdictions children from both public and private schools are eligible for dental care through a SDS. The care typically provided in a SDS includes dental examinations, preventive services and restorative treatment as required. However, there are some variations among state and territory programs with respect to priority age groups and the nature of services. In some jurisdictions, caries risk assessment is used to determine recall interval and preventive treatment. Consequently, there are variations in the extent of enrolments in SDS, with some jurisdictions serving more than 80% of primary school children and others serving smaller proportions.

Data sourced from SDS clinics were collected at the time of routine clinical examinations that dental therapists and dentists conducted. The application of diagnostic criteria employed in this data collection was based on the clinical judgment of the examining dental therapist or dentist. Detailed instructions were provided to clinics to explain the collection of clinical data but there were no formal sessions of instruction in diagnosis undertaken for the purpose of the survey, and no repeat examinations for the purpose of assessing inter- or intra-examiner reliability.

Data for New South Wales were derived from the New South Wales Child Dental Health Survey conducted in 2007 which was a collaborative partnership between the Centre for Oral Health Strategy NSW, area health services, the Australian Research Centre for Population Oral Health at the University of Adelaide, and Population Oral Health at the University of Sydney. The survey examined children sampled from primary schools across New South Wales and it represented a more systematic approach to population oral health data collections than those available through public dental service collections or previous risk assessment programs undertaken in New South Wales.

National estimates in this report exclude Victoria due to lack of access to the 2007 data.

Sampling

The data sourced from the annual CDHS are derived from routine examinations of children enrolled in the SDS. Children are sampled at random from SDS clinics by selecting children examined during the 2007 calendar year who were born on specific days of the month or by a similar systematic sampling procedure. The specific days of the month and approximate sampling ratios implemented in each state and territory are provided in Table A1. This sampling scheme ensures a random sample of children enrolled with the SDS is selected but excludes children who are not enrolled with the SDS.

The sampling ratios implemented were designed to provide similar numbers of children from each state and territory. However, due to full enumeration in South Australia, the

number of children included in the survey is considerably larger than for other states and territories. In addition, differences in administration and local data requirements of each SDS create further variation. This variation in the number of children sampled by state and territory is accounted for in the weighting procedure.

Where children received more than one examination during the 2007 calendar year, only data derived from the child's first examination were included in the survey for Queensland, Western Australia and the Northern Territory where survey information was collected on a paper-based survey form by treating clinicians. For South Australia, Tasmania and the Australian Capital Territory, where electronic patient records were used, only data derived from the last examination of the year were included in the survey.

Table A1: Sampling ratios for Australian states and territories, 2007

State/territory	Sampling ratio[(a)]	Days of birth
Queensland		
Gold Coast	1:1	Any
Other Qld	1:15	1st and 6th
Western Australia	1:8.5	28th, 29th, 30th, 31st
South Australia	1:1	Any
Tasmania	1:1	Any
Australian Capital Territory	1:1	Any
Northern Territory		
Darwin	1:1.9	1st to 16th
Other NT	1:1	Any

(a) Sampling ratios are approximate only.

Note: Victoria is excluded due to lack of access to the data.

The sample design implemented for the New South Wales Child Dental Health Survey was a stratified two-stage design where a sample of children aged 5 to 12 was selected from primary schools across New South Wales. A sampling frame of public, Catholic and independent primary schools in New South Wales was created and stratified into eight area health service (AHS) regions. In the first stage of selection a sample of primary schools was selected from each AHS region with probability proportional to school enrolment size. A total of 107 schools were selected across New South Wales. In the second stage of selection approximately 76 children aged 5 to 12 were systematically sampled from each selected school with 8–12 children of a particular age sampled per school.

Survey methodology and data items

The examiner recorded demographic characteristics of each sampled child including the child's age and sex. Country of birth and Indigenous status of both child and mother were also collected and are considered to be two items important to a health monitoring survey (Health Targets and Implementation Committee 1988). Both items were obtained from information on the patient's treatment card or medical history. However, due to the increasingly limited recording of this information by each state and territory SDS, they were not included in this report.

Data sourced from the New South Wales Child Dental Health Survey were collected from standardised oral examinations that teams of trained examiners conducted. Examinations took place in schools using standard portable dental equipment. The examination was a visual assessment using a mirror, a blunt probe, and compressed air. The examination protocol was developed at the Australian Research Centre for Population Oral Health and has been used in a number of oral epidemiological studies in Australia. The protocol measured decayed, missing and filled surfaces of all primary and permanent teeth, including non-cavitated lesions. Dental fluorosis of upper central incisors, using the Thylstrup-Fejerskov index (Thylstrup & Fejerskov 1978) was also collected.

Weighting of data and data analysis

National population estimates presented in this publication have been derived from weighted data. The weighting methodology reflects the sample design implemented in each state and territory. Data sourced from the annual child dental health surveys were weighted at the regional level where region was based on the 2006 Australian Standard Geographical Classification. Where sample size was adequate, regions within a capital city were defined as ABS Statistical Subdivisions and regions outside of capital city areas were defined as Statistical Divisions.

The Australian Bureau of Statistics provided the population counts used in the weighting process. The file supplied was 2007 Estimated Residential Population (ABS 2011) of Australia by Postal Area by Age (5–15 years) which provided population counts by individual age and postcode. Postcodes were mapped to region using the ABS 2006 Statistical Sub-Division 2006 Postcode Concordance File (2905055001 ssd 2006 from poa 2006) and aggregated to produce regional level population counts by individual age.

The initial weight for each person was calculated as the inverse of the child's probability of selection in the survey which was based on the sampling ratios implemented across clinics in each state and territory. As children enrolled in SDS clinics may experience different recall periods, children on recall intervals of 12 months or less have a higher chance of selection during the survey period than children on longer recall intervals. To ensure that children on longer recall intervals, who often have better oral health, were not under-represented in the analysis, data were also weighted by time since last dental examination.

Final weights were derived to reflect the regional age distribution of Australian children aged 5 to 15. Within each state or territory, sub-strata were defined by age (individual age) and region. Survey records were allocated to region based on their postcode and then linked to the estimated resident population (ERP) for that region to derive a final weight for each child.

Data sourced from the New South Wales survey were also weighted at the regional level where region was defined as the eight AHS regions within New South Wales. The Centre for Oral Health Strategy NSW provided regional population counts by age and sex for children aged 5 to 12. The initial weight for each person was calculated as the inverse of the child's probability of selection in the survey, which was determined by the probability of the child's school being selected in the survey and, secondly, by the probability of the child being selected from the sampled school.

Final weights were derived to reflect the regional age–sex distribution of New South Wales children aged 5 to 12. Within each AHS region, sub-strata were defined by age (individual age) and sex. Survey records were allocated to sub-strata and then linked to the ERP for that sub-stratum to derive a final weight for each child.

To enable population estimates from the survey to be compared and inferences made about characteristics of Australian children, 95% confidence intervals (CIs) have been produced for each survey estimate. The CIs have been calculated using SAS Callable SUDAAN software that can incorporate the two-stage sample design implemented in New South Wales and the one-stage sample design implemented in other states and territories. To produce national estimates, stratification was defined as state/territory and region within state/territory. To account for the two-stage sample design in New South Wales, the cluster variable was defined as the school, and for other states and territories, the cluster variable was defined as the record number to reflect the one-stage design. With these specifications it was possible to produce national estimates that incorporated both sample designs. However, national estimates for children aged 13 to 15 excluded data from New South Wales.

The weighting protocol aimed to produce estimates that were representative of Australian children, however, in states and territories where data were sourced from the annual child dental health surveys, only children enrolled in a school dental service were surveyed. Consequently, the results in this report do not represent the complete Australian child population. Enrolment across Australia varies, but in all states and territories it is higher for primary school children than for children in secondary schooling. In some states and territories, older children must meet special eligibility criteria, with the consequence that they may be less representative of their respective age groups within the Australian population than is the case for younger children. Hence, in this publication, estimates for primary school children may not differ substantially from those that would be obtained if all children in the country were surveyed, whereas estimates for secondary school children may vary from those obtained if all children in the country were surveyed. It is therefore necessary to be cautious in drawing inferences from age-related trends, particularly among those children aged 13 to 15.

Number in sample

There were a total of 110,014 children aged between 5 and 15 surveyed in the 2007 calendar year. Table A2 provides the number of children sampled in each state and territory and Table A3 provides the number of children sampled by age.

Table A2: Number of children sampled by state and territory, 2007

State/territory	Number of children sampled
NSW	7,975
Qld	4,026
WA	13,201
SA	55,565
Tas	21,657
ACT	5,178
NT	2,412
Total	**110,014**

Note: Results from Victoria are excluded due to lack of access to the data.

Table A3: Number of children sampled by age, 2007

Age (years)	Number of children sampled
5	11,116
6	11,222
7	11,548
8	11,568
9	11,390
10	11,019
11	11,155
12	10,123
13	8,022
14	6,820
15	6,031
Total	**110,014**

CDHS 2007 trend methodology

Barnard conducted the first epidemiological study of caries experience among Australian children in 1955 (Barnard 1955). After that, periodic studies were undertaken in order to monitor caries experience among Australian children. In 1973, the Australian School Dental Scheme (ASDS) was established and was responsible for monitoring children's oral health. Between 1977 and 1988 the Commonwealth Department of Health managed the evaluation of the ASDS centrally. From 1989, the national data collection was transferred to the Australian Institute of Health and Welfare Dental Statistics and Research Unit (AIHW DSRU) at The University of Adelaide. The national surveillance survey was named Child Dental Health Survey (CDHS) and a number of changes, such as sampling strategies, were introduced.

The results presented in this publication were derived solely from data collected for the evaluation component of the ASDS and the subsequent CDHS. Data were derived from routine examinations of children attending the school dental services. Children in the SDS were enrolled from both public and private schools.

Prior to 1989, the evaluation component of the ASDS also adopted a full enumeration of children presenting for assessment. From 1989, children were sampled at random by selecting those born on specific days of the month with different sampling ratios used across the states and territories.

Data were weighted following standard procedures for stratified samples. The stratum-specific weights were divided by the national estimated resident population (ERP) and total sample size to achieve numerical equivalence between the weighted sample and the original number of processed records. Data were also weighted by time since last dental examination so that children on longer recall intervals, who often have better oral health, were not under-represented in the analysis.

For greater detail, the reader is referred to year-specific CDHS reports from 1997–2006.

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