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The Child Dental Health Survey, Australia 1999

Trends across the 1990s

JM Armfield, KF Roberts-Thomson, AJ Spencer

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Contents

List of tables

List of figures

Abbreviations

d	deciduous decayed teeth
D	permanent decayed teeth
dmft	deciduous decayed, missing (due to caries) and filled teeth
DMFT	permanent decayed, missing (due to caries) and filled teeth
f	deciduous filled teeth
F	permanent filled teeth
m	deciduous teeth missing due to caries
M	permanent teeth missing due to caries
SD	standard deviation
SiC	Significant Caries Index
SiC^{10}	Significant Caries Index (10%)

Purpose of the report

This report provides descriptive epidemiological and service provision data concerning children's dental health in Australia. Data for the report have been derived from the Child Dental Health Survey that monitors the dental health of children in each State and Territory of Australia. The tables and figures contained in this report describe the demographic composition of the sample, deciduous and permanent caries experience, extent of immediate treatment needs, prevalence of fissure sealants and other relevant information. State/Territory comparisons follow the national tables and precede an examination of selected national trends and international comparisons. The report also presents a description of the survey methods and discussion of the findings presented in the national tables.

Description of survey methods

Source of subjects

Data for the report have been derived from the Child Dental Health Survey, which monitors the dental health of children enrolled in school dental services operated by the health departments or authorities of Australia's six State and two Territory governments. Children are enrolled from both public and private schools. In New South Wales the School Dental Service has adopted a targeted Statewide screening program termed Save Our Kids Smiles (SOKS). Whereas SOKS involves screening children every two years from Kindergarten to Year 8, the other school dental services provide dental care principally to primary school aged children. The care typically provided by the school dental services 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. As a consequence there are variations in the extent of enrolment in school dental services, with some jurisdictions serving more than 80% of primary school children and others serving lower percentages.

Sampling

The data for the Child Dental Health Survey are derived from the routine examinations of children enrolled in the school dental service. At the time of examination, children are sampled at random by selecting those born on specific days of the month. Victoria and Tasmania adopt other systematic sampling procedures based on selecting every *n*th case. In New South Wales full enumeration of all available consenting children is carried out.

Different sampling ratios, and consequently different days of birth, are used across the States and Territories according to the scheme presented in Table 1. National data for the Child Dental Health Survey therefore constitute a stratified random sample of children from the school dental services. Children not enrolled with the school dental service or not consenting to participate in the SOKS program are not represented in the sample.

Table 1: Sampling ratios for Australian States and Territories, 1999

State	Sampling Ratio[a]	Days of Birth
New South Wales	1:1	Any
Victoria	1:8	Systematic
Queensland	1:15	1st and 6th
	1:1	Any[b]
Western Australia	1:12.5	29th, 30th, 31st
South Australia	1:12	13th, 30th, 31st
	1:5	13th, 26th to 31st[c]
Tasmania	1:2.5	Systematic
Australian Capital Territory	1:2.5	1st to 16th
Northern Territory	1:1.9	1st to 16th[d]
	1:1	Any[e]

(a) Sampling ratios are approximate only.

(b) 6- and 12-year-old children from the Gold Coast.

(c) From non-metropolitan clinics who have previously participated in the Child Fluoride Study.

(d) Includes Darwin.

(e) Includes all Northern Territory outside of Darwin.

The intention of stratification was to provide approximately equivalent numbers of children from each State and Territory. However, due to full enumeration in New South Wales, the number of children sampled in this State is considerably larger than for the other States and Territories. In addition, differences in administration and local data requirements of the services have created some variation among the other States and Territories in terms of the number of children sampled.

It is necessary to be cautious in drawing inferences from age-related trends, particularly among those aged over 12 years. In most States and Territories, access to school dental services for older children tends to be restricted in comparison with access for younger children. Often the 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. Also, in New South Wales and Victoria no children aged older than 14 years are included in the analysis, so current estimates for 15-year-old children do not take those States into account.

Data items

Data items in the Child Dental Health Survey are collected at the time of routine clinical examinations conducted by dental therapists and dentists. The recorded characteristics of sampled children encompass some demographic information, including the child's age and sex.

The birthplace and the Indigenous status of both child and mother are considered to be two items important to a health monitoring survey (Health Targets and Implementation Committee 1988) and have previously been obtained from information from the patient's treatment card or medical history. However, due to the increasingly limited recording of this

information by the State and Territory School Dental Services, it has not been included in the current report.

Service provision information includes the dates of current and previous examinations (if the child had been examined previously within the School Dental Service) and is dealt with in detail within State- and Territory-specific reports. Information on last examinations was not collected in New South Wales (where screenings take place every two years).

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

1. Deciduous caries experience is recorded as the number of deciduous teeth that are decayed, missing because of dental caries or filled because of dental caries, and is based on the coding scheme of Palmer et al. (1984).

2. Permanent caries experience is recorded as the number of permanent teeth that are decayed, missing because of dental caries or filled because of dental caries, and is based on the World Health Organization protocol (WHO 1997).

3. Immediate treatment needs are designated if, in the opinion of the examiner, the child has, or is likely to develop within four weeks, pain, infection or a life-threatening condition (WHO 1997). In New South Wales immediate treatment needs are indicated for children assessed as requiring treatment within a 24–48 hour period. Data collected for the current study on immediate treatment needs do not include children from Victoria, Western Australia, Tasmania or the Australian Capital Territory.

4. Fissure sealants are recorded as the number of teeth, otherwise sound and not restored, which have a fissure sealant. This data item was introduced in most States and Territories in 1989.

Some data items are not collected uniformly by all States and Territories. Consequently, some of the tables in this report refer only to specific States and Territories.

The diagnostic criteria employed are based on the clinical judgement of the examining dental therapist or dentist. They follow written criteria for the data items described above; however, there are no formal sessions of calibration or instruction in diagnosis undertaken for the purpose of the survey and there are no repeat examinations for the purpose of assessing inter- or intra-examiner reliability.

Data analysis and weighting of data

National data contained in this report consist of counts, means, standard deviations and percentages that have been weighted to represent the relevant State- and Territory-specific population of children aged 4–15 years. Where computed State or Territory age-specific indices resulted in a relative standard error exceeding 40%, or the percentage of children sampled was considered very low, the age group for that jurisdiction was excluded from the analysis. As a result, 15-year-old children from New South Wales (sample n = 307) were excluded, as were both 4-year-old and 15-year-old children from Victoria (sample n = 68 and 7, respectively).

The weighting procedure is necessary since the Australian sample does not contain representative percentages of children from each State and Territory. Unweighted estimates would result in over-representation by children from New South Wales or from less populous States or Territories and under-representation by those from more populous jurisdictions. The relative sample sizes and population estimates by State and Territory as a percentage of the total sample and of the Australian population (4–15 years of age) are shown in Figure 1.

The weighting method follows standard procedures for weighting stratified samples using external data sources (Foreman 1991). State and Territory estimates (ABS 2000) of the 1999 Estimated Resident Population within individual ages are used to provide numerators for weights that are divided by the age-specific number of cases in the samples from respective States and Territories. Hence, observations from more populous States achieve relatively greater weight. The stratum-specific weights are further divided by the national Estimated Resident Population and total sample size to achieve numerical equivalence between the weighted sample and the original number of processed records.

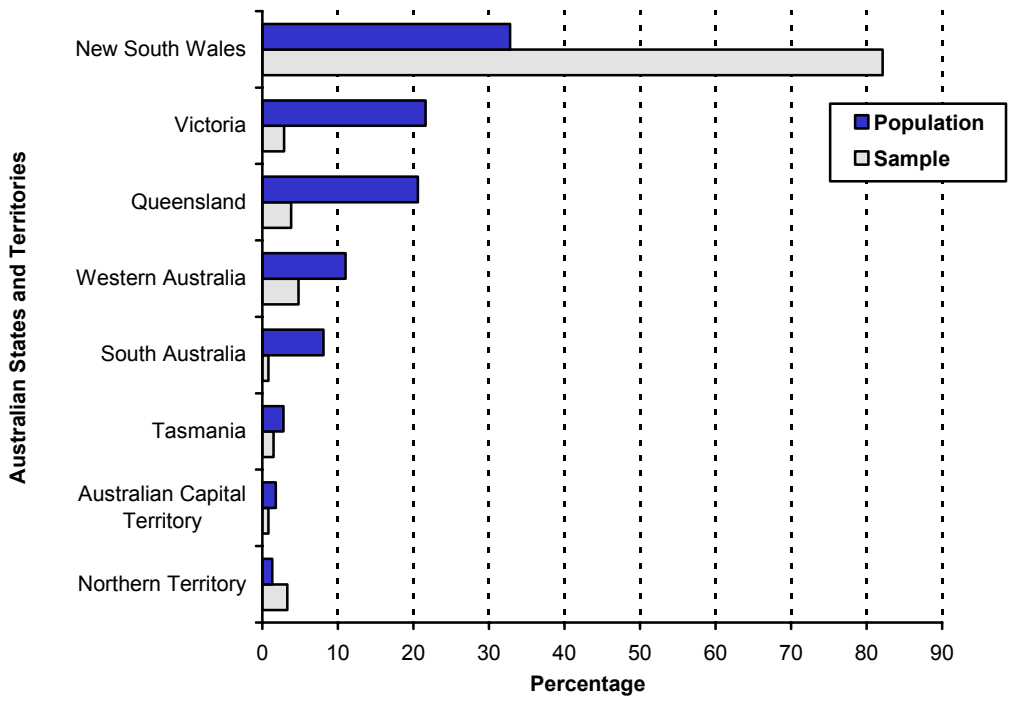


Figure 1: Percentage of children by State and Territory for sample and for State and Territory population, 1999

Within the State and Territories, data were also weighted according to sampling frame, region of sampling or time since last dental examination, this being consistent with statistical analyses presented in State- and Territory-specific reports. In 1999 data within Victoria, Queensland, Western Australia, South Australia, Tasmania, the Australian Capital Territory and the Northern Territory were weighted on the basis of area of sampling and sampling fraction so as to give a more representative result for that State or Territory. Data within Queensland, Western Australia, South Australia, Tasmania, the Australian Capital Territory and the Northern Territory were 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. Details of these weighting procedures are provided in the relevant State and Territory reports.

Indices of caries experience were calculated from data collected over a 12-month period. Where children received more than one examination during this period, the information derived from examinations other than the first has been excluded.

Adjustments for the under-reporting of decay in New South Wales

In 1996, the NSW Health, through the School Dental Service, implemented the Save Our Kids Smiles (SOKS) program, incorporating three main components – oral health education, risk assessment and clinical care. A major change accompanying the program was the move from clinic-based examinations to oral assessments in the field as the primary environment for data collection. In the clinic, better lighting and the availability of other facilities such as compressed air optimise conditions for assessing oral health.

Between 1995 and 1996, at the time the SOKS program was introduced, there was an apparent substantial improvement in the oral health of children in NSW. There was, for example, a 44% reduction in 5-6-year-old mean decay, a 57% reduction in 12-year-old mean decay, and a 12% increase in the percentage of 5-6-year-old children free of caries experience (dmft = 0) in their deciduous dentition.

In 1999 NSW Health commenced a wide-ranging review of SOKS, with one aspect being a quality assurance project aimed at assessing the reliability and validity of data collected under SOKS assessment conditions. The technical report (NSW Health Department 2001) found that, while there were no statistically significant differences in the reporting of missing and filled teeth between a field SOKS-style assessment and a clinical examination, there was a persistent and statistically significant under-reporting of the number of decayed teeth under field compared to clinic conditions. In deciduous teeth, the mean decay score for the SOKS assessment was 36% lower than that collected in the clinic, while the mean decay score for permanent teeth was 41% lower. Such an underestimation of decay also resulted in a significant underestimation in the dmft and DMFT indices.

As a result of these findings, and the consistency of the results with the reported reductions in caries experience in NSW between 1995 and 1996, the current report has included in Appendix A (Tables A1–A4) national figures adjusted for the under-estimation of decay in NSW. For children in NSW an additional weight of 1.56 was given for calculations of deciduous decay and 1.68 for calculations of permanent decay. Although it is believed that these adjusted figures may represent a more accurate estimation of caries experience in NSW and therefore Australia, for the purpose of consistency with previous reports the data obtained via the SOKS assessments from NSW are retained for calculations in the body of this report.

Administration of the survey

The monitoring of children's dental health has been conducted since 1977. Between 1977 and 1988 it was managed centrally by the Commonwealth Department of Health as an evaluation of the Australian School Dental Scheme. In 1989 responsibility for the national data collection was transferred to the Australian Institute of Health and Welfare's Dental Statistics and Research Unit at The University of Adelaide and conducted through the Child Dental Health Survey.

Description of national findings

Number in sample and Estimated Resident Population

There were a total of 371,871 children aged between 4 and 15 years reported for the 1999 calendar year. Children aged 3 years or less and those aged 16 years or more were excluded from this sample as the small number of children receiving care in those age groups across Australia results in poor reliability of computed statistics for those ages. Furthermore, these children are outside the main target group of many of the school dental services, and it is likely that they have some special characteristics that make them less representative of their respective age groups within the Australian population.

The effects of the statistical weighting procedure can be appreciated from examining Table 2. The relatively large numbers of reported cases from New South Wales and the Northern Territory receive substantially lower weightings compared with other States and Territories. Therefore, the weighted numbers of cases, which were used for estimates listed in subsequent tables, represent smaller numbers of children from those jurisdictions. Consequently, the national sample was representative of the relative populations of States and Territories, rather than the number of reported cases.

Table 2: Number in sample and Estimated Resident Population, 1999

State/Territory	Processed cases	Estimated Resident Population (ERP)	Weight	Weighted cases
	n	*n*		*n*
New South Wales [(a)]	305,391	971,255	0.39	117,781.20
Victoria [(b)]	10,824	640,626	7.16	77,534.34
Queensland	14,115	608,420	6.09	85,957.32
Western Australia	17,804	324,089	2.24	39,802.23
South Australia	2,978	240,359	9.85	29,322.14
Tasmania	5,401	82,816	1.88	10,175.28
Australian Capital Territory	2,992	52,556	2.07	6,192.18
Northern Territory	12,366	39,474	0.41	5,106.31
Total	**371,871**	**2,959,595**	**1.00**	**371,871.00**

(a) Excludes 15-year-old children.

(b) Excludes 4-year-old and 15-year-old children.

Deciduous teeth

Caries experience in the deciduous dentition is expressed as the mean number of decayed, missing (due to caries) and filled teeth. The means and standard deviations for each of these components for the ages 4–12 years are given in Table 3. There was a steady decline in the presence of clinically detectable decay with increasing age, from 1.15 teeth among 4-year-olds to 0.16 teeth among 12-year-olds. A different pattern was shown by the mean number of filled teeth, increasing from 0.22 at age 4 to 1.00 teeth at age 9, before declining rapidly to 0.24 teeth at age 12. Across all age groups the number of teeth indicated as missing due to caries was small, with scores ranging from 0.01 to 0.10 teeth. The mean number of decayed, missing (due to caries) and filled teeth (dmft) increased from 1.44 to 1.81 teeth between the ages of 4 and 8 years before declining to 0.41 teeth for 12-year-olds.

Patterns in deciduous caries experience must be interpreted in light of the exfoliation of deciduous teeth with age. Table 3 shows the steady decline in the mean number of deciduous teeth present as children increase in age. From the age of 5 years, children exfoliate on average 2 to 3 deciduous teeth per year, reducing the total number from 19.64 teeth on average at age 5 to an average of 2.05 teeth at age 12.

The decayed, missing and filled components as a percentage of the dmft index are shown in Figure 2. In the youngest age groups the dmft score is composed principally of clinically detectable untreated decay. However, with the accumulation of restorations placed over time, the majority of the dmft index from the age of 8 years is represented by the presence of fillings. Relative stability in the percentages of decayed, missing and filled teeth occurs between the ages of 9 and 12 years.

Table 3: Deciduous dentition – decayed, missing and filled teeth, 1999

Age (years)	Children	Teeth present	Decayed (d)		Missing (m)		Filled (f)		dmft	
	n	mean	mean	SD	mean	SD	mean	SD	mean	SD
4	24,324	19.88	1.15	2.45	0.06	0.52	0.22	1.00	1.44	2.87
5	32,019	19.64	1.12	2.22	0.07	0.54	0.35	1.19	1.55	2.76
6	28,705	17.51	0.95	1.93	0.07	0.55	0.48	1.32	1.51	2.62
7	33,822	14.49	0.83	1.58	0.08	0.53	0.78	1.61	1.69	2.57
8	34,480	12.33	0.72	1.34	0.10	0.59	0.98	1.78	1.81	2.56
9	34,973	10.75	0.61	1.19	0.07	0.52	1.00	1.74	1.69	2.37
10	34,093	7.98	0.45	0.99	0.05	0.43	0.81	1.50	1.31	2.06
11	34,008	4.59	0.27	0.75	0.02	0.22	0.50	1.17	0.79	1.60
12	29,130	2.05	0.16	0.60	0.01	0.20	0.24	0.77	0.41	1.16

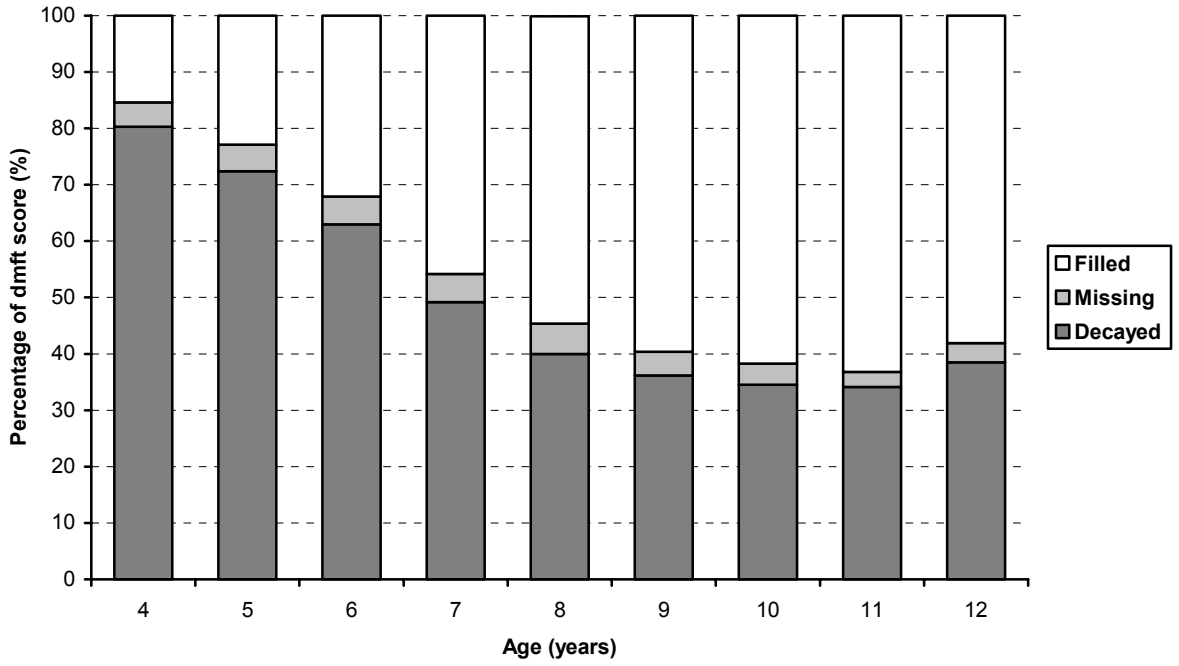
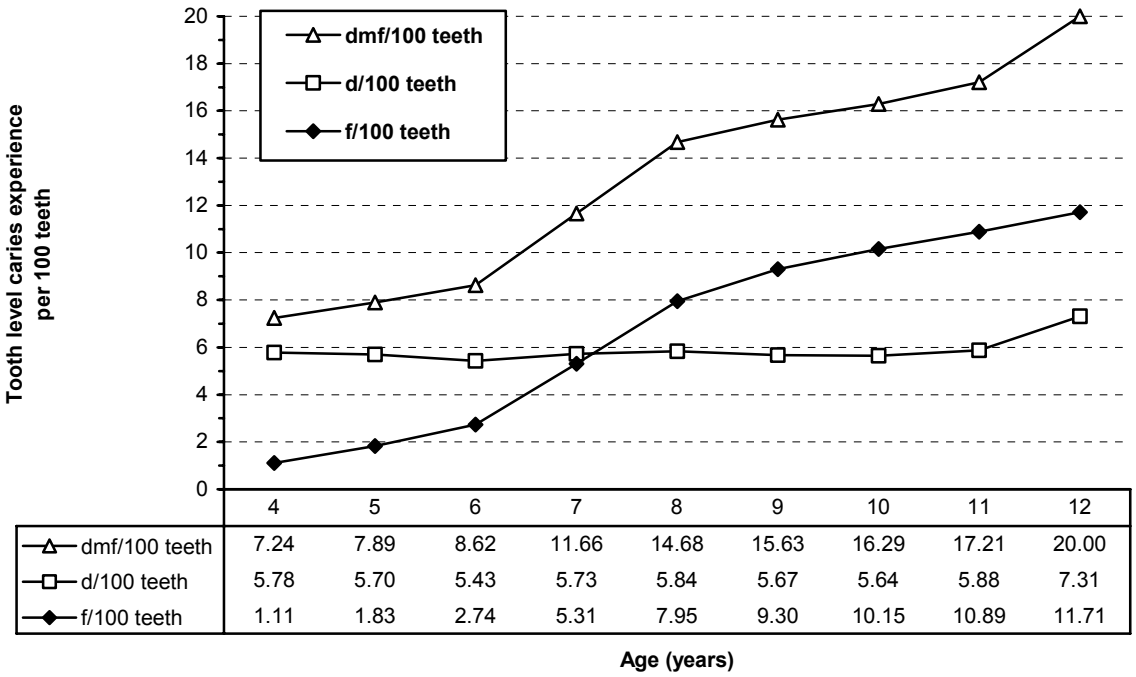


Figure 2: Decayed, missing and filled deciduous teeth as a percentage of dmft score by age, 1999

Figure 3 shows caries experience, expressed in terms of clinically detectable untreated decay, fillings and the mean dmft score, after controlling for the number of deciduous teeth present. Although the mean number of clinically decayed untreated teeth was shown to decrease consistently with age, Figure 3 indicates that this is principally a product of the exfoliation of deciduous teeth. Indeed, the rate of untreated decay in 1999 remained relatively stable with age, from 5.78 teeth per 100 teeth at age 4 to 5.88 teeth per 100 teeth at age 11, with an increase only occurring for 12-year-olds to 7.31. The percentage of deciduous teeth with fillings increased with age and together these caries experience indicators combine to produce an increase in the dmft index per 100 teeth across age groups. The percentage of deciduous teeth that were decayed, missing or filled increased from 7.2% at age 4 to 20.0% at age 12.

The percentage of children with no deciduous caries experience (dmft = 0) steadily declined across the age range 4–8 years, from 66.0% to 50.2%; however, this percentage subsequently increased and at 12 years of age 82.6% of children had no evidence at their examination of caries experience in their deciduous dentition (see Figure 4). The d/dmft ratio was highest among younger children (83.2%) and declined to 36.3% for children aged 11 years.



	4	5	6	7	8	9	10	11	12
dmf/100 teeth	7.24	7.89	8.62	11.66	14.68	15.63	16.29	17.21	20.00
d/100 teeth	5.78	5.70	5.43	5.73	5.84	5.67	5.64	5.88	7.31
f/100 teeth	1.11	1.83	2.74	5.31	7.95	9.30	10.15	10.89	11.71

Figure 3: Tooth level deciduous caries experience per 100 deciduous teeth by age, 1999

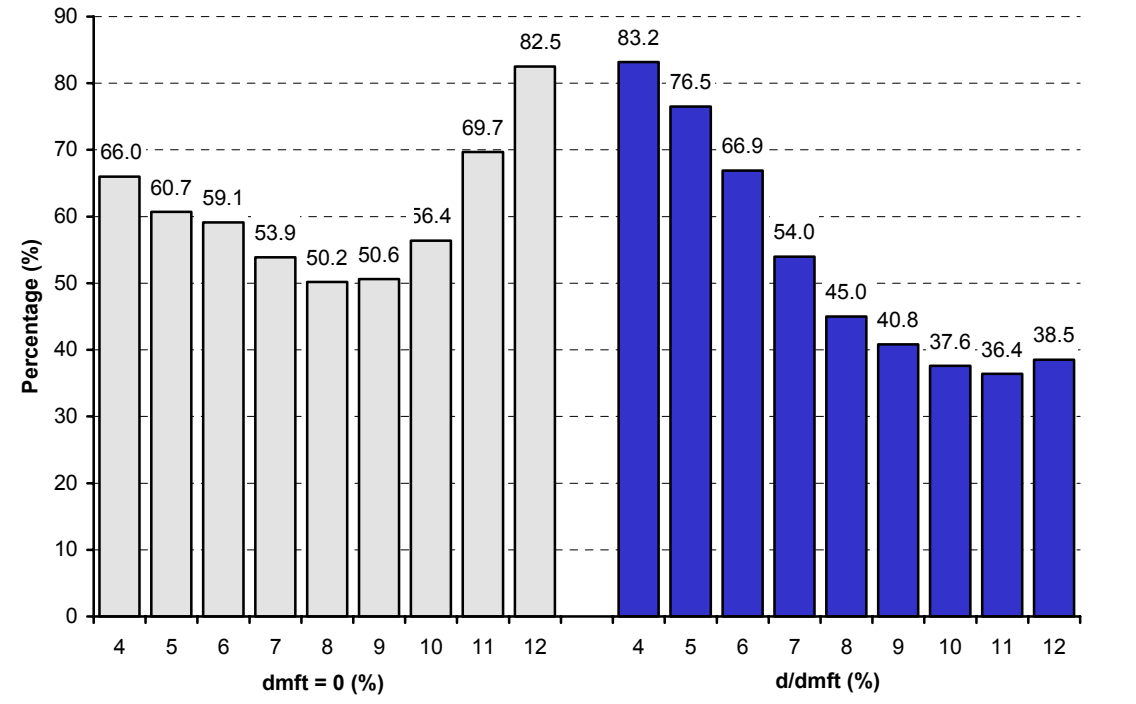
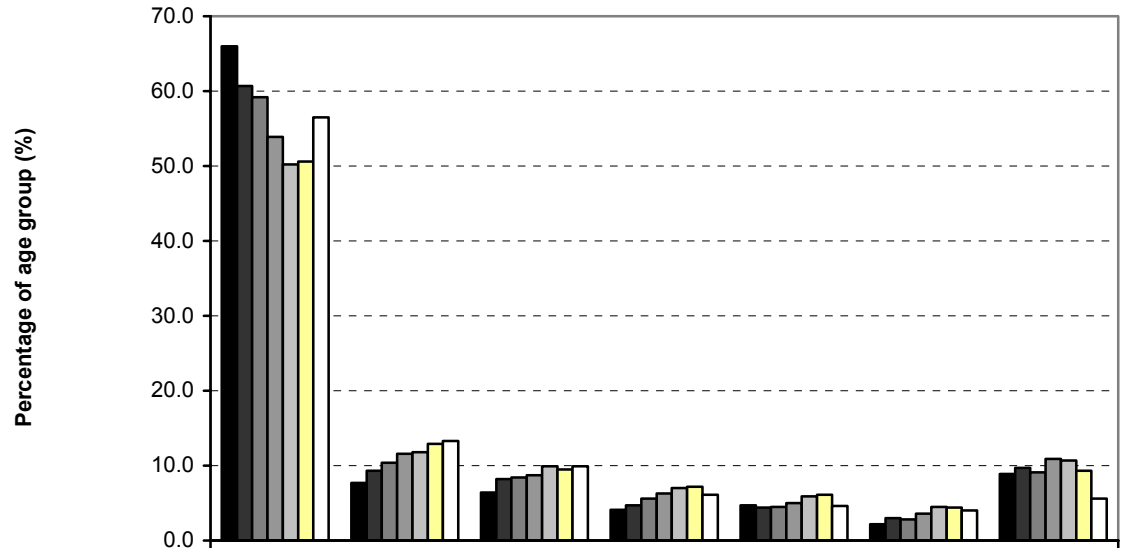


Figure 4: Deciduous dentition – dmft = 0 and d/dmft, 1999

While Australian children have relatively low deciduous caries experience there remains a minority of children who experience a considerable caries burden. Figure 5 shows the distribution of deciduous caries experience by age. As previously shown in Figure 4, between 50.2% and 66.0% of children in any age group had no clinically detectable deciduous caries experience. Between 7.7% and 13.3% of children in any age group had a deciduous dmft score of 1, with these scores increasing with increasing age of the children. The percentage of any age group with between 2 and 5 decayed, missing of filled teeth did not exceed 10%, with less than 5% of children in any age group having a dmft score of 5 teeth. However, children with 6 or more decayed, missing or filled teeth comprised between 5.6% and 10.9% of children in any age group.



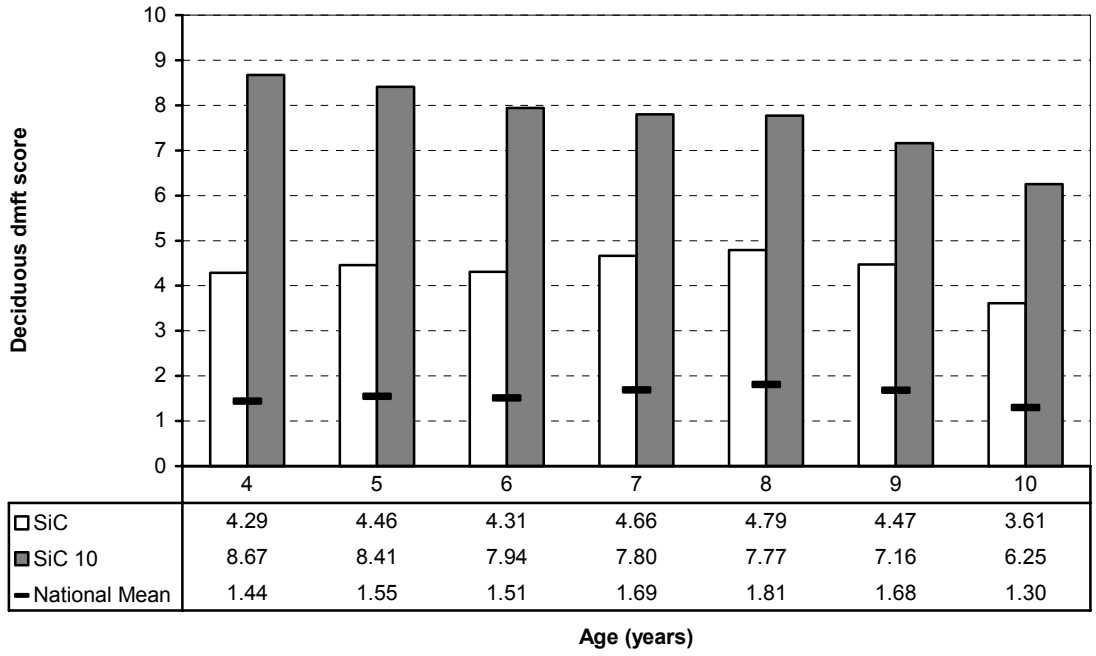
	0	1	2	3	4	5	6+
4-year-olds	66.0	7.7	6.4	4.1	4.7	2.2	8.9
5-year-olds	60.7	9.3	8.2	4.7	4.4	3.0	9.7
6-year-olds	59.2	10.4	8.4	5.6	4.5	2.8	9.1
7-year-olds	53.9	11.6	8.7	6.3	5.0	3.6	10.9
8-year-olds	50.2	11.8	9.9	7.0	5.9	4.5	10.7
9-year-olds	50.6	12.9	9.5	7.2	6.1	4.4	9.3
10-year-olds	56.5	13.3	9.9	6.1	4.6	4.0	5.6

Deciduous dmft score

Figure 5: Distribution of deciduous dmft scores by age group, 1999

While average caries experience scores for a population provide good summary statistics they can hide the existence of people within that population who have considerable caries experience. The Significant Caries Index (SiC) was designed to bring attention to those individuals with the highest scores in a population (Bratthal, 2000; Nishi et al., 2001). The SiC Index is the mean dmft of the one third of the population with the highest caries scores. A modified index, the SiC^{10}, is the mean dmft of the 10% of children with the highest dmft scores. Figure 6 shows the SiC and SiC^{10} indices for the deciduous dentition of 4–10-year-olds. For those children in the highest one-third, dmft scores are considerably higher than the mean scores for the entire age group, and range between 3.61 and 4.79 dmft units. The disproportionate burden of disease is dramatically demonstrated for children with the highest 10% of dmft scores. For these children, scores range from four (8-year-olds) to six times higher (4-year-olds) than corresponding mean scores for the entire age group.

The patterns in deciduous caries experience suggest that children enter their school years with moderate caries experience in the deciduous dentition – a large proportion of it manifested as clinically detectable untreated decay (approximately 83% at 4 years of age). With continued treatment in the school dental services, decay experience becomes predominantly represented by past experience, indicated by the presence of fillings, rather than current experience. Despite steady increases in dmft scores and the accumulation of fillings across the ages 4–10 years, the exfoliation of teeth results in a reduction in the absolute number of untreated decayed teeth and increased numbers of children presenting with no deciduous caries experience. The majority of caries experience is represented in a minority of children.



	4	5	6	7	8	9	10
SiC	4.29	4.46	4.31	4.66	4.79	4.47	3.61
SiC 10	8.67	8.41	7.94	7.80	7.77	7.16	6.25
National Mean	1.44	1.55	1.51	1.69	1.81	1.68	1.30

Figure 6: Significant Caries Indices (SiC and SiC^{10}) and mean deciduous dmft scores of 4–10-year-old children, 1999

Permanent teeth

The mean numbers of clinically detectable untreated decayed permanent teeth were smaller than the corresponding means for deciduous teeth across the age range 5–10 years (see Table 4). This primarily reflects reduced time-at-risk of those teeth present and, at younger ages, the low number of permanent teeth present. Mean decay for permanent teeth increased with age before stabilising from 13 years of age. The mean number of teeth indicated as missing due to caries was very low for most ages but increased slightly to 0.11 teeth for 15-year-old children. The pattern with filled teeth was a consistent increase across the age ranges, from 0.01 for 5-year-olds to 1.14 teeth for 15-year-olds. Mean DMFT scores also increased consistently with age, from 0.03 at age 5 (at which time less than 1 permanent tooth on average was present) to 1.86 teeth at age 15 (when an average of 27.43 teeth were present). The mean DMFT score for 12-year-old children was 0.83 teeth.

The mean number of decayed, missing and filled permanent teeth expressed as percentages of the DMFT index is shown in Figure 7. The pattern is similar to that shown in the deciduous dentition. In the youngest ages the DMFT score is primarily represented by the presence of clinically detectable untreated decay. By the age of 10 years, however, less than 50% of the DMFT score was attributable to untreated decayed teeth.

Table 4: Permanent dentition – decayed, missing and filled teeth, 1999

Age (years)	Children	Teeth present	Decayed (D)		Missing (M)		Filled (F)		DMFT	
	n	mean	mean	SD	mean	SD	mean	SD	mean	SD
5	32,019	0.73	0.02	0.22	0.00	0.05	0.01	0.09	0.03	0.28
6	28,705	4.28	0.08	0.41	0.00	0.02	0.01	0.17	0.09	0.45
7	33,822	8.57	0.16	0.54	0.00	0.10	0.04	0.28	0.20	0.63
8	34,480	11.11	0.20	0.64	0.01	0.11	0.09	0.42	0.30	0.81
9	34,973	12.88	0.24	0.68	0.01	0.15	0.17	0.58	0.42	0.95
10	34,193	16.02	0.26	0.73	0.02	0.20	0.25	0.70	0.53	1.09
11	34,008	20.49	0.34	0.83	0.02	0.23	0.34	0.84	0.69	1.28
12	29,130	24.04	0.42	1.02	0.04	0.32	0.38	0.90	0.83	1.51
13	34,650	26.24	0.64	1.46	0.04	0.33	0.60	1.25	1.28	2.17
14	34,416	27.39	0.59	1.50	0.07	0.48	0.67	1.33	1.33	2.17
15	17,151	27.43	0.61	1.36	0.11	0.61	1.14	1.80	1.86	2.59

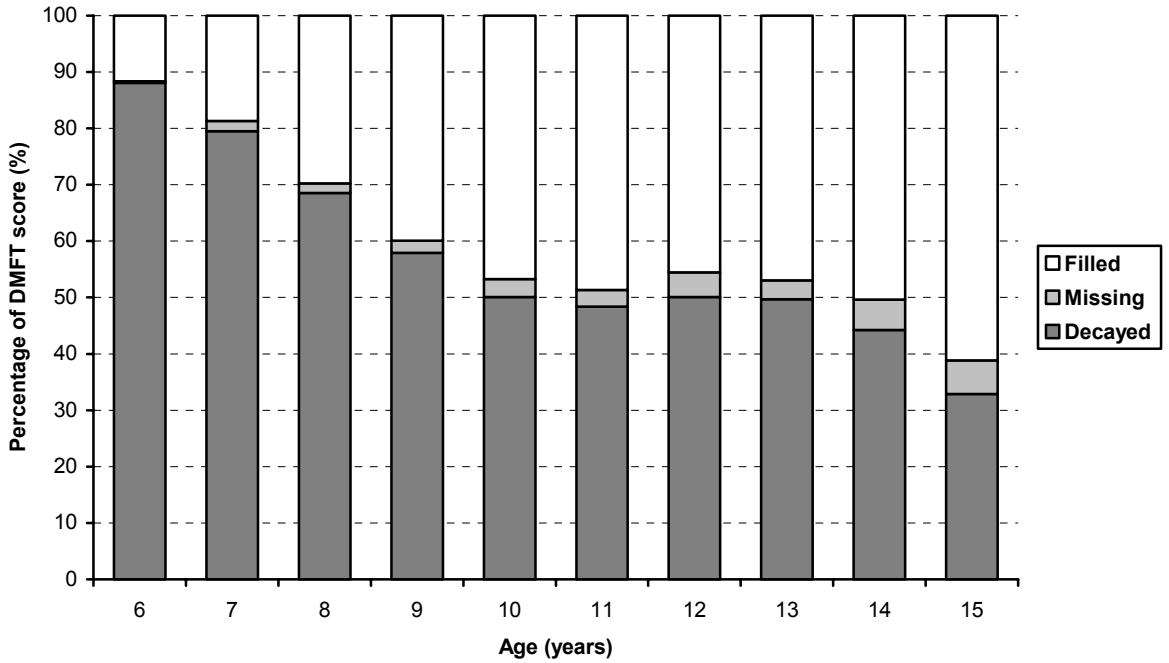


Figure 7: Decayed, missing and filled permanent teeth as a percentage of DMFT score by age, 1999

In excess of 80% of children in each age group 8 years old or less had no permanent tooth caries experience (DMFT = 0) and even by the end of their primary school years 64.5% of 12-year-olds had no permanent caries experience (see Figure 8). However, by the age of 15 years only 44.1% of children presented as caries-free in their permanent dentition.

After controlling for the number of permanent teeth present, an increase in the rate of caries experience could be seen with increasing age, although the trend was not consistent (see Figure 9). Between the ages of 7 and 10 years, clinically detectable new decay decreased from 1.87 to 1.62 teeth per 100 permanent teeth present, before increasing to 2.22 for 15-year-olds. From the age of 12 years DMFT per 100 teeth begins to climb sharply, increasing from 3.5% to 6.8% of teeth at age 15.

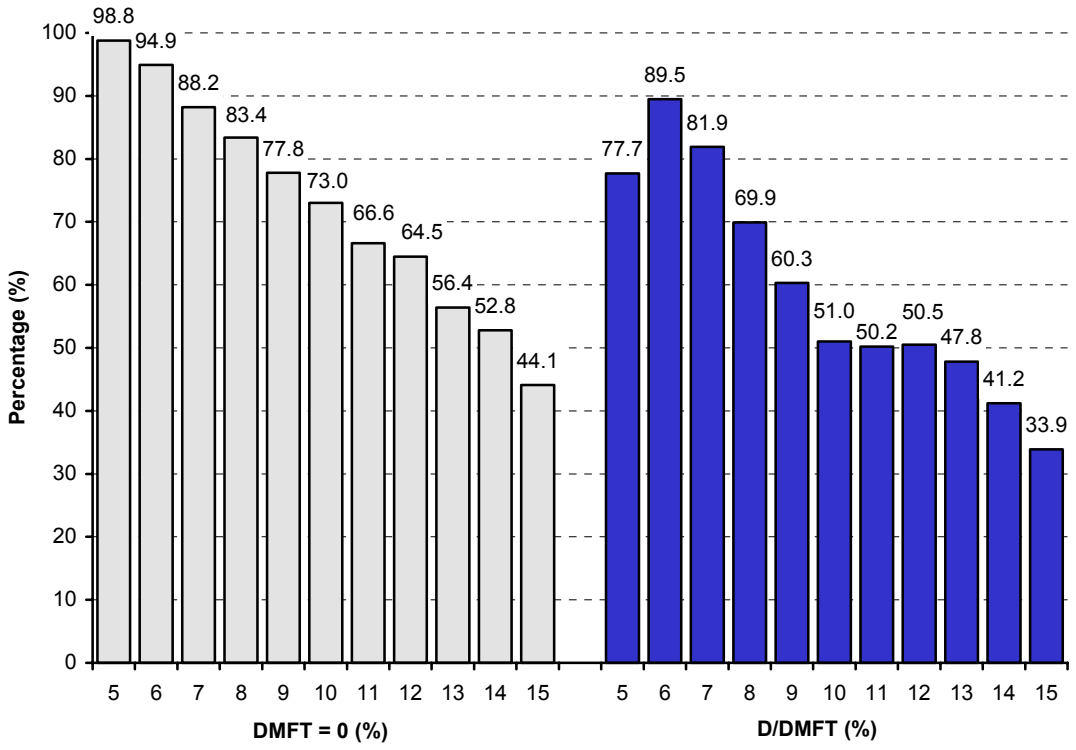
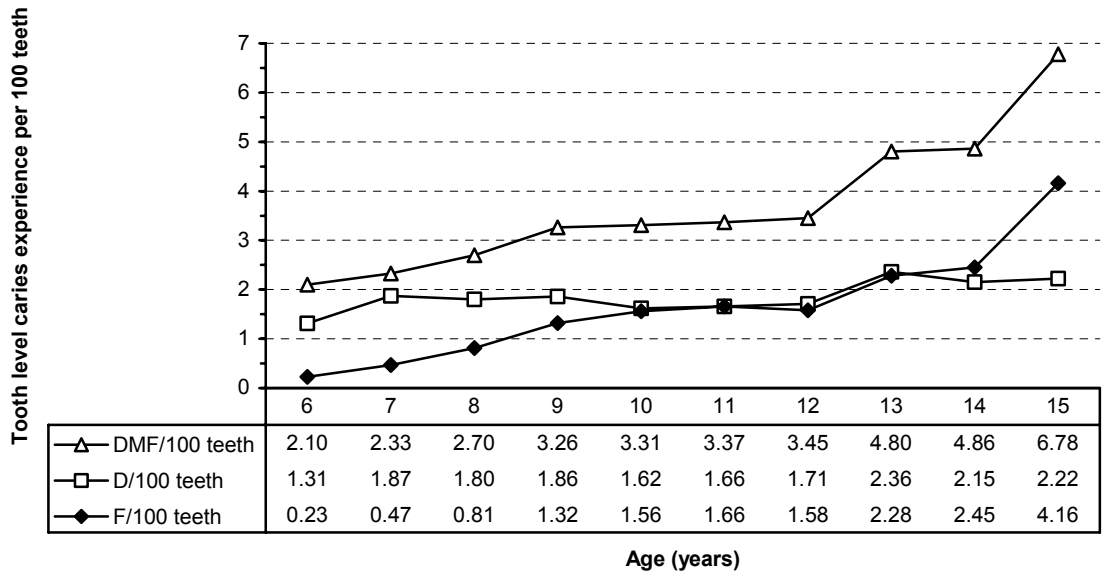


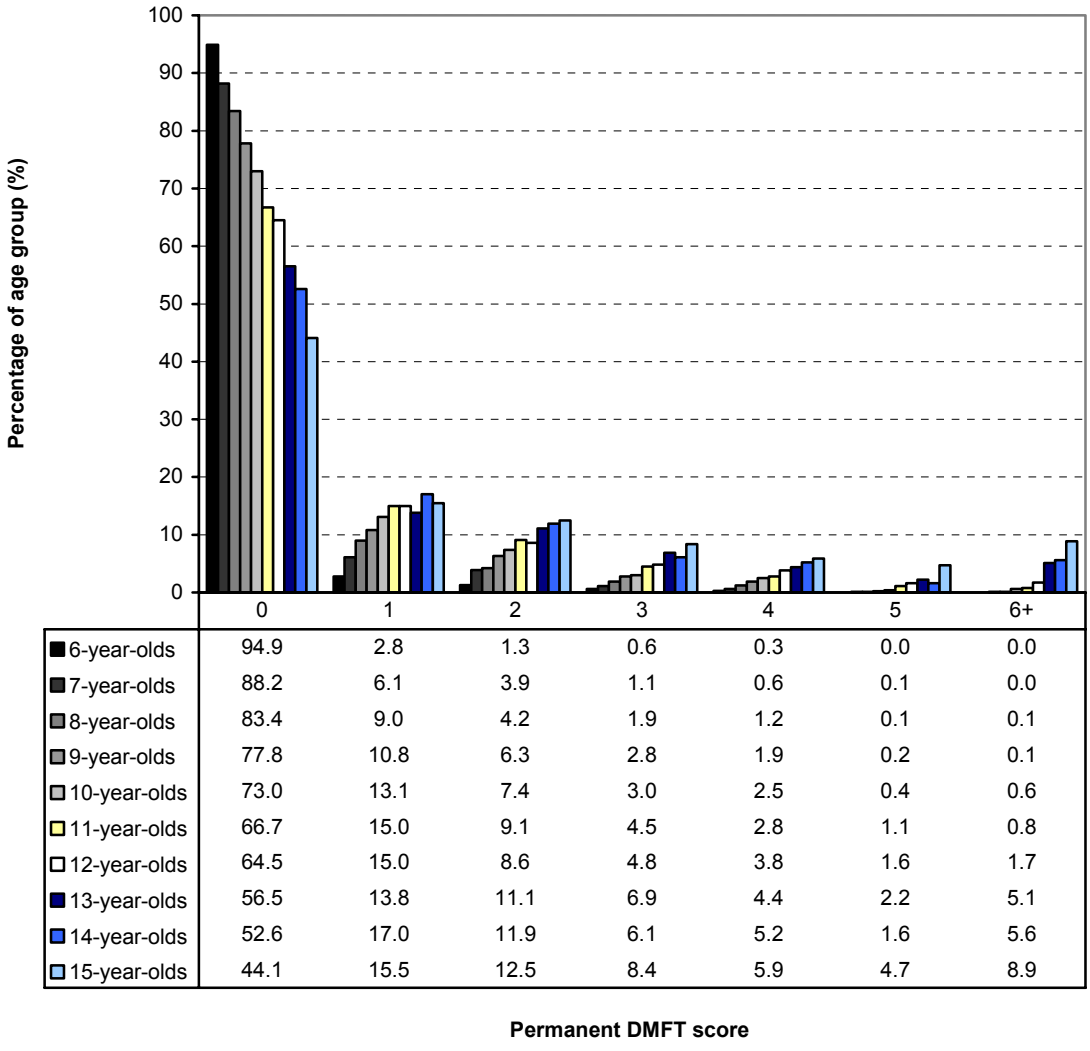
Figure 8: Permanent dentition – DMFT = 0 and D/DMFT, 1999



	6	7	8	9	10	11	12	13	14	15
DMF/100 teeth	2.10	2.33	2.70	3.26	3.31	3.37	3.45	4.80	4.86	6.78
D/100 teeth	1.31	1.87	1.80	1.86	1.62	1.66	1.71	2.36	2.15	2.22
F/100 teeth	0.23	0.47	0.81	1.32	1.56	1.66	1.58	2.28	2.45	4.16

Figure 9: Tooth level permanent caries experience per 100 permanent teeth by age, 1999

Figure 10 shows the distribution of permanent DMFT scores for children aged between 6 and 15. As previously shown in Figure 8, there is a consistent decline across the ages 6 to 18 years old in the percentage of children without caries experience in the permanent dentition, represented by reductions in the percentage of children with DMFT = 0. However, for the other permanent DMFT scores presented, there are generally consistent increases across older ages. Between the ages 13 and 15 years, between 5.1% and 8.9% of children have a DMFT score of 6 or greater.



	0	1	2	3	4	5	6+
6-year-olds	94.9	2.8	1.3	0.6	0.3	0.0	0.0
7-year-olds	88.2	6.1	3.9	1.1	0.6	0.1	0.0
8-year-olds	83.4	9.0	4.2	1.9	1.2	0.1	0.1
9-year-olds	77.8	10.8	6.3	2.8	1.9	0.2	0.1
10-year-olds	73.0	13.1	7.4	3.0	2.5	0.4	0.6
11-year-olds	66.7	15.0	9.1	4.5	2.8	1.1	0.8
12-year-olds	64.5	15.0	8.6	4.8	3.8	1.6	1.7
13-year-olds	56.5	13.8	11.1	6.9	4.4	2.2	5.1
14-year-olds	52.6	17.0	11.9	6.1	5.2	1.6	5.6
15-year-olds	44.1	15.5	12.5	8.4	5.9	4.7	8.9

Figure 10: Distribution of permanent DMFT scores by age group, 1999

Figure 11 indicates the burden of disease in the permanent dentition of those children most affected by caries experience. Although the SiC and SiC[10] Indices are relatively low compared to those shown in the deciduous dentition, especially in children up to the age of 10 years, it should be remembered that permanent DMFT scores for all children in these age groups is very low, rising to only 0.53 for 10-year-olds. Between the ages of 6 and 10 years, children with the highest 10% of DMFT scores (SiC[10]) had mean scores between 6 and 10 times higher than permanent caries experience scores for the corresponding entire age group. Scores for children aged between 11 and 15 years were some 4 times (15-year-olds) to 5½ times (11-year-olds) higher for children with the highest 10% of scores in each age group than for the entire age group. The SiC Index increased from 0.27 DMFT units for 6-year-olds to 4.70 DMFT units for 15-year-olds, and for each age group ranged from 2.5 to 3 times higher than the mean national DMFT.

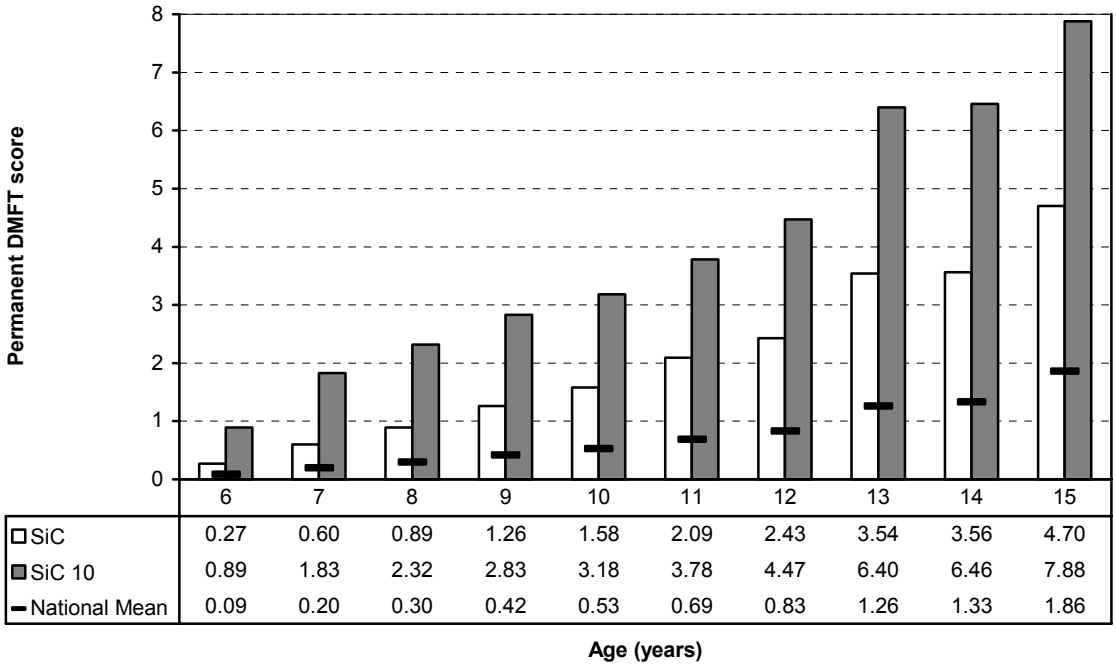


Figure 11: Significant caries indices (SiC and SiC[10]) and mean permanent DMFT scores of 6–15-year-old children, 1999

All teeth

Table 5 combines components of caries experience from both the deciduous and permanent dentition to provide an indicator of the total burden of disease among children receiving care within school dental services.

Untreated clinically detectable decay (d+D ≥ 1) in the combined deciduous and permanent dentition was present for between 26.7% and 38.8% of children in the age range 5–15 years. The highest prevalence of untreated decay was observed among 8-year-olds (where only 61.2% had d+D = 0) while the greatest severity of clinically detectable untreated decay occurred in the youngest ages (for example, 11.4% of 5-year-olds had 4 or more teeth with clinically detectable untreated decay). Based on observations from previous tables the largest contribution to caries experience among younger children came from deciduous teeth.

Missing teeth due to caries were relatively uncommon among children aged 5–15 years. The percentage of children with no fillings (f+F = 0) and no caries experience (dmft+DMFT = 0) showed a bimodal distribution, driven by changes in caries experience resulting from the exfoliation of deciduous teeth and the subsequent eruption of the permanent dentition. Among the key age range of 5–12 years, at least 43% of children in any age group had no caries experience in either dentition.

Table 5: All teeth – age-specific caries experience, 1999

Age		d+D =								dmft+
(years)	Children	0	1	2	3	4	5+	m+M = 0	f+F = 0	DMFT = 0
	n	%	%	%	%	%	%	%	%	%
5	32,019	65.4	10.3	8.3	4.6	3.6	7.8	97.0	87.5	60.3
6	28,705	65.0	12.0	8.2	4.8	3.7	6.3	96.9	81.6	57.6
7	33,822	61.9	14.2	9.9	5.3	3.2	5.6	95.8	71.8	50.5
8	34,480	61.2	16.2	9.5	5.5	3.0	4.6	94.7	64.0	45.9
9	34,973	62.2	16.5	9.4	5.0	3.4	3.5	96.2	60.4	43.6
10	34,193	65.9	16.6	8.4	4.1	2.5	2.6	96.6	60.2	45.2
11	34,008	68.8	16.4	7.6	3.3	2.0	1.9	97.6	65.2	49.7
12	29,130	71.7	14.7	6.2	3.8	1.7	1.9	97.3	71.4	55.2
13	34,650	69.6	13.2	7.8	4.1	1.8	3.5	97.3	68.1	52.3
14	34,416	73.3	12.4	7.3	2.5	1.8	2.7	96.4	66.5	50.4
15	17,151	70.2	13.7	8.2	3.3	1.7	2.9	94.8	56.0	42.0

Fissure sealants

The mean number of fissure sealants present increased with increasing age (see Table 6) and for all ages exceeded the mean number of decayed permanent teeth for each respective age group. Children aged 6–14 years with permanent caries experience (DMFT ≥ 1) were from 35.1% to 400.0% more likely to have a fissure sealant than children with no permanent caries experience (DMFT = 0); and this is presented graphically in Figure 12.

Table 6: Fissure sealants – age-specific experience, 1999

Age (years)	Children	Sealants		DMFT = 0		DMFT ≥ 1	
				Children	With fissure sealants	Children	With fissure sealants
	n	mean	SD	*n*	%	*n*	%
6	28,705	0.05	0.40	27,232	1.6	1,473	8.0
7	33,822	0.26	0.94	29,846	8.1	3,976	13.4
8	34,480	0.51	1.23	28,762	15.9	5,718	26.7
9	34,940	0.71	1.37	27,213	22.9	7,727	32.5
10	34,193	0.81	1.51	24,946	25.3	9,247	39.1
11	34,008	0.88	1.59	22,661	27.6	11,348	37.3
12	29,130	0.95	1.71	18,779	28.0	10,351	39.2
13	34,650	0.94	1.77	19,540	24.3	15,110	38.2
14	34,416	1.03	1.85	18,163	20.9	16,253	44.9
15	17,151	0.96	1.83	7,567	25.3	9,584	37.0

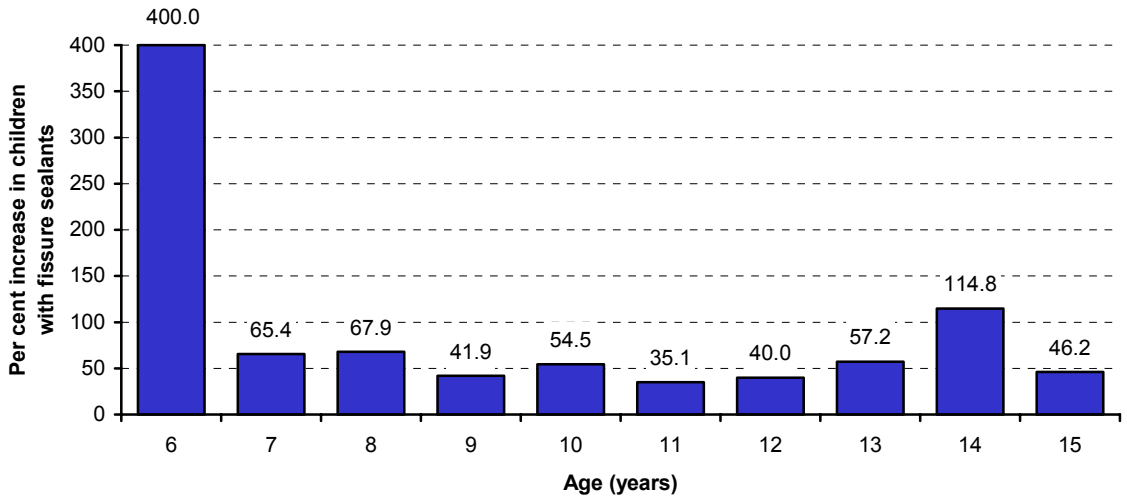


Figure 12: Per cent increase in percentage of children with fissure sealants between children with DMFT = 0 and children DMFT ≥ 1, 1999

As an example, 39.3% of 12-year-old children with DMFT ≥ 1 had fissure sealants compared with 28.0% among those with DMFT = 0. This can be interpreted as a tendency towards the preferential provision of fissure sealants to children deemed to have a greater likelihood of developing dental caries.

Immediate treatment needs

Immediate treatment need was not recorded in Victoria, Western Australia or the Australian Capital Territory in 1999. Additionally, the protocol for assigning immediate treatment needs in New South Wales differs from other States and Territories, with a more imminent expectation of pain required for this classification (24–48 hours, in contrast to a four-week period adopted in other States and Territories). The percentage of children with immediate needs was highest for 4-year-olds (12.1%) and lowest for children aged 11 years (5.4%, see Table 7).

Children with immediate treatment needs were found to have greater caries experience in comparison to children judged not to be in immediate need. Age-specific means for dmft and DMFT tended to be approximately 1½–3 times higher than the national averages listed in previous tables. For example, 5-year-olds with immediate treatment needs had a mean dmft of 4.49 (compared with 1.55 in Table 3) and 28.3% had d+D ≥ 5 (compared with 7.8% in Table 5).

Table 7: Immediate treatment needs – age-specific distribution, 1999

Age		Children in need of immediate treatment										
								d+D =				
(years)	Children			dmft		DMFT		1	2	3	4	5+
	n	*n*	%	mean	SD	mean	SD	%	%	%	%	%
4	6,930	840	12.1	6.50	5.55	0.00	0.00	1.8	0.6	5.6	9.2	54.5
5	6,875	538	7.8	4.49	4.52	0.36	1.23	2.5	16.1	7.9	5.2	28.3
6	3,402	327	9.6	3.53	3.60	0.50	1.30	5.9	19.1	7.7	6.2	23.2
7	8,440	721	8.5	4.42	3.50	0.26	0.79	8.5	30.9	9.5	9.2	11.5
8	8,417	813	9.7	2.77	2.67	0.60	1.29	29.7	14.5	10.0	1.7	4.8
9	8,692	710	8.2	2.72	2.82	0.71	1.31	13.4	11.8	4.0	11.9	4.0
10	8,557	666	7.8	2.72	2.68	0.79	1.26	26.0	5.2	9.0	5.7	2.5
11	8,282	449	5.4	1.30	2.21	0.98	1.30	20.4	21.0	1.5	0.9	3.4
12	3,646	235	6.5	1.02	1.81	1.37	2.17	14.0	19.7	4.0	1.3	5.5
13	8,799	681	7.7	0.47	1.41	2.88	3.19	23.2	13.9	7.4	7.4	5.8
14	9,111	754	8.3	0.38	1.39	1.87	2.60	7.2	6.3	2.8	4.4	10.5
15	9,699	765	7.9	0.59	2.30	3.75	4.03	16.8	18.2	11.0	5.2	17.6

It should be emphasised that the percentage of those deemed to be requiring immediate treatment reflects both the accumulated amount of dental disease and the methods of targeting and delivering school dental services. For example, clinics which provide care for a relatively small proportion of a population and which assign priority to treating those with symptoms will almost certainly record higher percentages of immediate treatment need than other clinics which have universal coverage of all children on a constant recall basis.

Perhaps the most important interpretation of Table 7 is that a subgroup of children with a substantial burden of dental caries can be identified within school dental services. Their state of poor dental health contrasts with the previous observation that approximately 40–60% of 5- to 14-year-olds have no caries experience.

Interstate comparison – 5- to 6-year-old dmft

Combined 5- and 6-year-olds represent a standard age group (cited, for example, within World Health Organization publications); this group is, moreover, a useful one to consider in relation to school dental services since it represents, predominantly, the dental health status of children new to these services.

Table 8 shows that considerable differences existed across the States and Territories between the lowest mean dmft (New South Wales, mean = 0.97) and the highest mean dmft score (Queensland, mean = 2.25). Decay scores were lowest for New South Wales and the Australian Capital Territory (mean = 0.69) and highest in Victoria, Queensland and the Northern Territory (1.45, 1.42 and 1.42, respectively). Recorded fillings also varied appreciably and were more than 3 times higher in Queensland (mean = 0.73) than in New South Wales (mean = 0.23). In assessing these differences it should be noted that there are historical differences in caries prevalence, as well as marked variations in population density, demography and levels of water fluoridation between these two jurisdictions. As well, there are differences in the organisation and delivery of school dental services between different States and Territories and these differences have increased with the introduction of the SOKS program in New South Wales. In NSW the adoption of oral assessments in the field resulted in an estimated reduction of 44% in recorded decay in that State.

Another notable characteristic of the statistics contained in Table 8 is that, in general, the mean dmft was correlated more strongly with the mean number of deciduous teeth with clinically detectable untreated decay than with the mean number of fillings present.

Variation can also be seen in the percentage of dmft attributable to clinically detectable untreated decay, ranging from a low of 61.1% in Tasmania up to 78.1% in Victoria (see Figure 13). The variation in the percentage of children with no caries experience (dmft = 0), while representing to some degree the converse of mean dmft, showed less variation than that for mean dmft, ranging from 52.2% in Queensland to 68.9% in New South Wales. In other words, while less than one-half of 5- to 6-year-old children in any jurisdiction had caries experience, the amount of accumulated disease (mean dmft) was variable across States and Territories.

Table 8: Interstate comparison – 5- to 6-year-old dmft, 1999

State/ Territory	Children	Decayed (d)		Missing (m)		Filled (f)		dmft	
	n	mean	SD	mean	SD	mean	SD	mean	SD
NSW[(a)]	21,522	0.69	1.58	0.05	0.47	0.23	0.89	0.97	1.98
Vic	15,598	1.45	2.45	0.13	0.69	0.38	1.19	1.96	3.06
Qld	9,527	1.42	2.57	0.10	0.58	0.73	1.72	2.25	3.33
WA	6,084	0.93	1.93	0.02	0.35	0.50	1.33	1.46	2.50
SA	4,678	0.73	1.58	0.03	0.30	0.54	1.41	1.30	2.38
Tas	1,575	0.93	1.84	0.10	0.81	0.56	1.38	1.59	2.73
ACT	964	0.69	1.64	0.03	0.38	0.45	1.28	1.17	2.35
NT	776	1.42	2.47	0.11	0.59	0.55	1.42	2.08	3.11
Australia	**60,724**	**1.04**	**2.09**	**0.07**	**0.54**	**0.42**	**1.25**	**1.53**	**2.69**

(a) NSW decayed teeth scores are from field examinations that underestimate decay experience. See Appendix A for adjusted estimates.

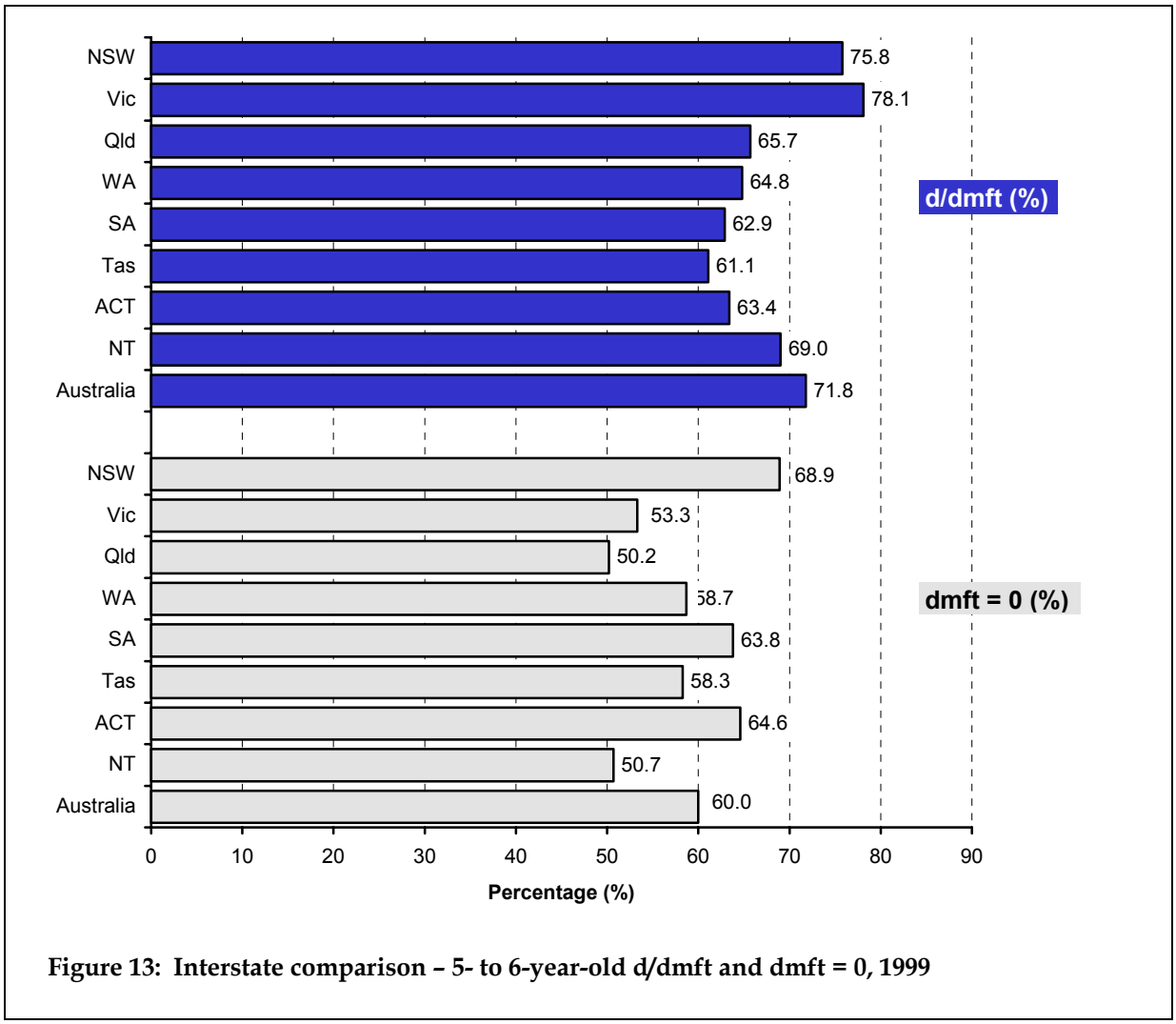


Figure 13: Interstate comparison – 5- to 6-year-old d/dmft and dmft = 0, 1999

Interstate comparison – 12-year-old DMFT

There was substantial variation in the mean DMFT scores between States and Territories (see Table 9) with the highest mean score (1.30 in Queensland) being almost 2½ times that of the lowest (0.55 in New South Wales). In the case of permanent teeth there was again quite a strong correspondence between mean DMFT and the mean number of decayed teeth, with the correlation between DMFT scores and the mean number of filled teeth being much weaker.

New South Wales had the highest percentage of children with no caries experience, having almost 75% of children with DMFT = 0 (see Figure 14). By contrast, Queensland had the lowest percentage of children with DMFT = 0, with only 51.7% of 12-year-olds in that State presenting without a history of caries experience. There was also quite large variation in the ratio of D/DMFT, percentages ranging from 38.5% in Western Australia to 59.7% in Victoria.

Table 9: Interstate comparison – 12-year-old DMFT, 1999

State/ Territory	Children	Decayed (D)		Missing (M)		Filled (F)		DMFT	
	n	mean	SD	mean	SD	mean	SD	mean	SD
NSW [(a)]	10,520	0.28	0.81	0.01	0.17	0.26	0.77	0.55	1.20
Vic	7,729	0.66	1.32	0.04	0.34	0.41	0.87	1.11	1.73
Qld	3,233	0.54	1.19	0.08	0.55	0.68	1.19	1.30	1.91
WA	3,361	0.28	0.76	0.08	0.45	0.38	0.90	0.75	1.37
SA	2,557	0.26	0.67	0.01	0.10	0.31	0.75	0.58	1.07
Tas	846	0.43	0.98	0.06	0.38	0.66	1.30	1.15	1.77
ACT	478	0.28	0.68	0.00	0.00	0.46	0.99	0.74	1.30
NT	404	0.48	1.18	0.08	0.45	0.31	0.81	0.86	1.54
Australia	**29,130**	**0.42**	**1.02**	**0.04**	**0.32**	**0.38**	**0.90**	**0.83**	**1.51**

(a) NSW decayed teeth scores are from field examinations that underestimate decay experience. See Appendix A for adjusted estimates.

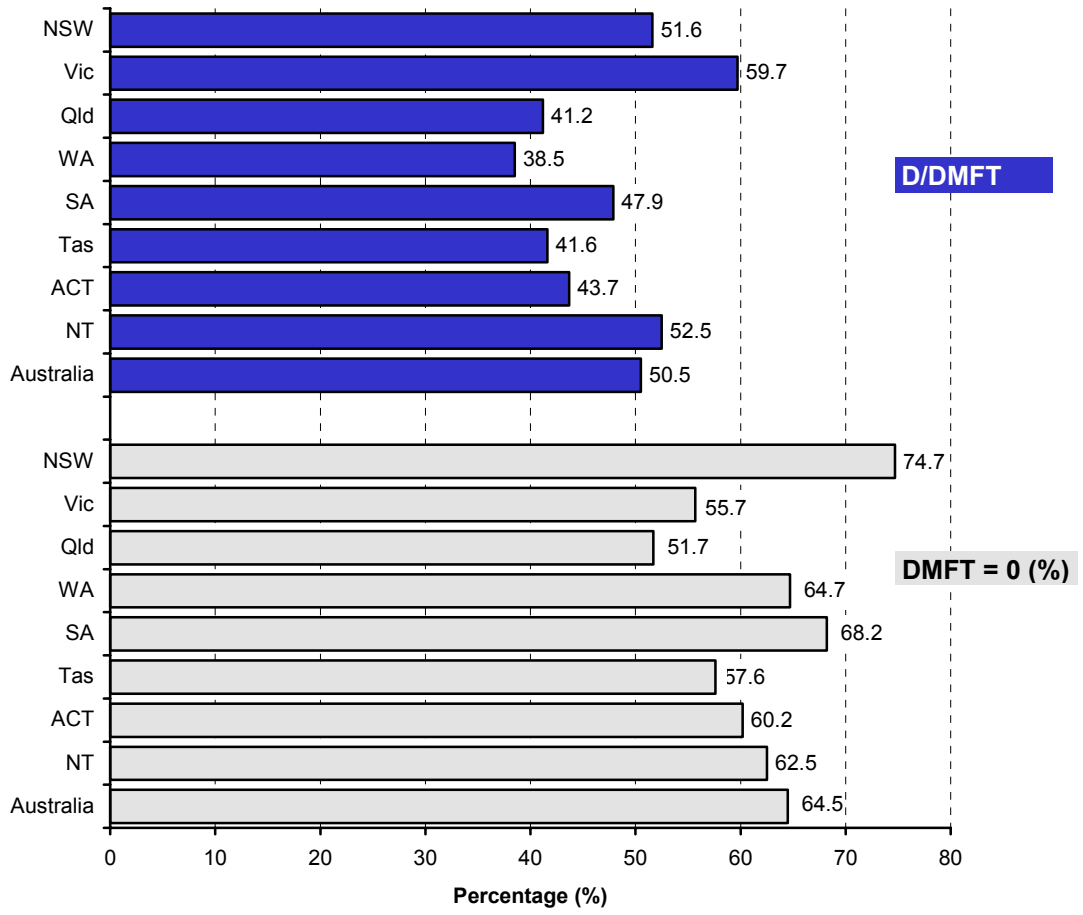


Figure 14: Interstate comparison – 12-year-old D/DMFT and DMFT = 0, 1999

Interstate comparison – all teeth

Age-standardised data were used for Table 10 in order to bring together data from all ages (children aged between 5 and 12 years) in all jurisdictions. This is useful in the event that any age-specific statistics (for example, for 5- to 6-year-olds) provide an unrepresentative picture of conditions in a specific State or Territory. The purpose of age-standardisation is to adjust among States and Territories for possible differences in the proportion of specific age groups, which is important because of the age-relatedness of most dental caries measures.

Table 10 illustrates further areas of inter-State variation in caries experience. For example, there are appreciable differences in the percentage of children with 5 or more decayed teeth (d+D ≥ 5). Victoria, the Northern Territory and Queensland have the highest levels of untreated decay (d+D), whereas South Australia, the Australian Capital Territory, Western Australia and New South Wales have the lowest levels of clinically detectable untreated decay. The percentage of children with no caries experience (dmft+DMFT = 0) was highest in New South Wales (63.4%). Consistent with Tables 8 and 9, the lowest percentages of children with no caries experience were found in Queensland (40.2%) and Victoria (42.3%).

Table 10: Interstate comparison – all teeth age-standardised caries experience, 1999

State/ Territory	Children	Children with d+D =						m+M = 0	f+F = 0	dmft+ DMFT = 0
		0	1	2	3	4	5+			
	n	%	%	%	%	%	%	%	%	%
NSW	85,811	73.8	11.8	6.7	3.2	2.0	2.5	97.9	81.8	63.4
Vic	62,247	54.3	16.9	10.5	6.7	4.3	7.3	93.7	68.0	42.3
Qld	53,299	60.1	16.1	9.9	5.3	3.4	5.2	95.9	56.3	40.2
WA	25,981	68.9	14.9	8.2	3.4	1.9	2.7	97.8	65.3	49.4
SA	19,974	69.7	16.2	6.5	3.4	2.4	1.8	98.2	67.9	53.3
Tas	6,585	65.5	14.3	9.5	4.8	2.5	3.4	97.7	65.0	47.9
ACT	4,210	68.9	16.5	7.6	2.9	2.5	1.6	99.5	68.4	52.5
NT	3,222	62.6	14.4	8.9	4.6	3.5	6.0	95.1	71.4	47.1
Australia	**261,329**	**65.1**	**14.7**	**8.5**	**4.5**	**2.9**	**4.2**	**96.5**	**69.8**	**50.7**

National summary

Age-standardised data were used for Table 11 in order to bring together data from all children aged between 5 and 12 years in all jurisdictions. Again, Queensland is shown to have the highest levels of caries experience for deciduous teeth (mean dmft = 2.00, 49.6% dmft = 0), while children in New South Wales were found to have the least caries experience (mean dmft = 0.81, 71.0% dmft = 0). The highest levels of permanent caries experience were found in Queensland (mean DMFT = 0.54, 75.8% DMFT = 0) and Victoria (mean DMFT = 0.51, 75.2% DMFT = 0) while the lowest levels were seen in New South Wales (mean DMFT = 0.24, 87.3% DMFT = 0) and South Australia (mean DMFT = 0.25, 84.6% DMFT = 0).

Table 11: National summary of caries experience of 5- to 12-year-old children, 1999

State/ Territory	Children in sample	dmft		dmft = 0	DMFT		DMFT = 0	d+D = 0
	n	mean	SD	%	mean	SD	%	%
NSW	85,811	0.81	1.68	71.0	0.24	0.75	87.3	73.8
Vic	62,247	1.70	2.60	53.5	0.51	1.14	75.2	54.3
Qld	53,299	2.00	2.84	49.6	0.54	1.20	75.8	60.1
WA	25,981	1.22	2.05	59.4	0.36	0.92	80.5	68.9
SA	19,978	1.19	2.07	61.4	0.25	0.69	84.6	69.7
Tas	6,585	1.36	2.29	58.8	0.47	1.11	78.4	65.5
ACT	4,210	1.05	1.90	62.8	0.33	0.83	80.5	68.9
NT	3,222	1.50	2.45	56.9	0.37	0.97	81.7	62.6
Australia	**261,329**	**1.36**	**2.32**	**59.9**	**0.39**	**0.99**	**80.8**	**65.1**

Figure 15 uses Australia-wide data to describe the combined dmft and DMFT indices and their components for individual age groups. It should be noted that the rate of decline and subsequent increase across age groups in the percentage of children with no caries experience in the deciduous dentition is set against a pattern of exfoliation of deciduous teeth.

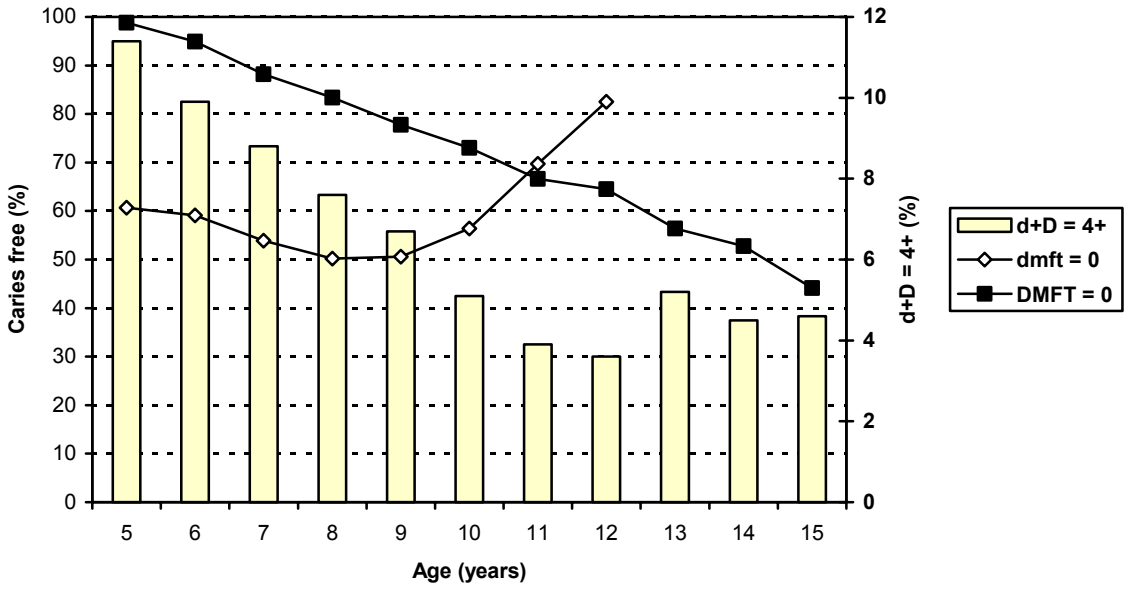


Figure 15: Percentage of children nationally with dmft = 0, DMFT = 0 and d+D = 4+ by age, 1999

Trends across the 1990s

Figures 16–34 relate to trends in caries experience and fissure sealant usage between 1990 and 1999. Trends are presented for deciduous and permanent teeth. While no statistical analyses of these data have been conducted, these trends allow an insight into changes in children's oral health at the end of the 20th century. An examination of changes across this time period is also instructive for predicting future changes in oral health in this country. The knowledge of changes to oral health can serve as a guide for policy makers and dental organisations for future structural and labour force planning.

Trends in deciduous teeth, 1990–1999

Deciduous caries experience expressed as clinically detectable untreated decay is lower at the end of the 1990s than in 1990 (Figure 16). Although there was a jump in mean decay scores from 1990 to 1991, the subsequent years up to 1996 saw steady declines for all age groups. However, and contrary to over two decades of recorded declines in decay experience, the end of the 1990s saw a period of increasing decay scores across all age groups. This was most evident for 5-year-olds who, between 1996 and 1999, experienced a 21.7% increase in recorded decay. Increases for other age groups were not as marked, but still represent a significant alteration in the trend in deciduous decay experience in Australia.

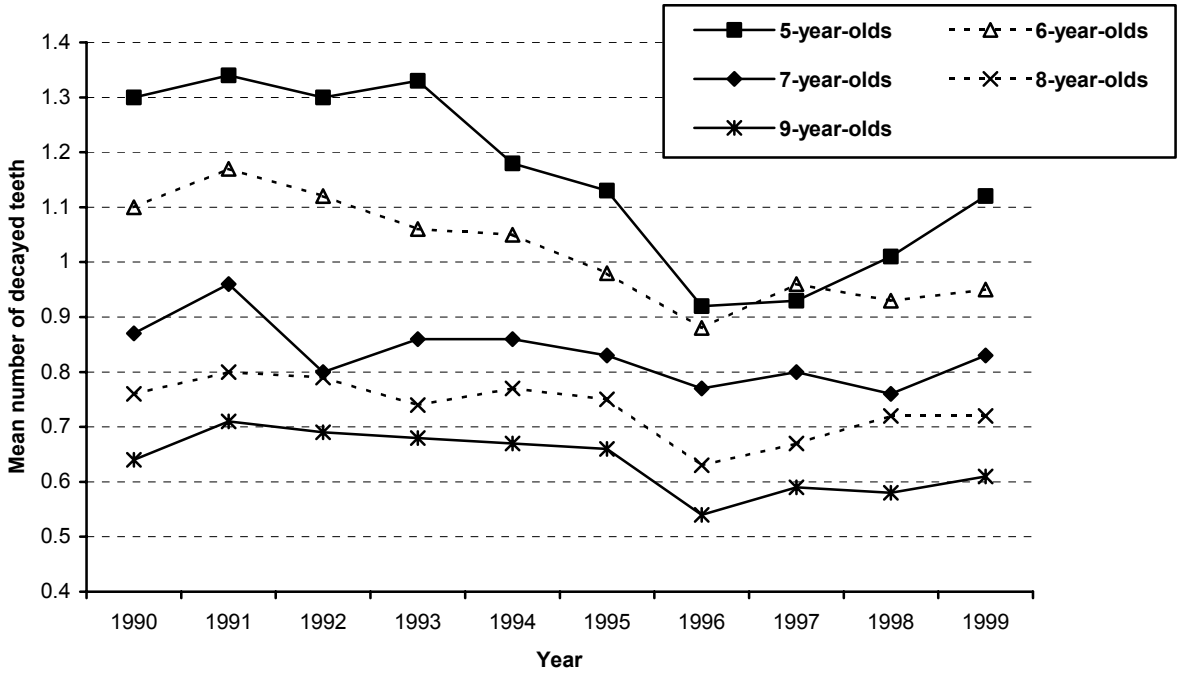


Figure 16: Mean decayed deciduous teeth for 5–9-year-old children in Australia from 1990 to 1999

The mean number of filled deciduous teeth declined across the 1990s with scores by 1999 between 21.7% and 44.8% lower than at the beginning of the decade (Figure 17). Although the trends in mean filled teeth are not as pronounced as those revealed for mean decay scores, there again appears to be a cessation of the decline in the numbers of filled teeth from 1996. It should be noted that because the mean number of filled teeth represents past caries experiences, changes in the mean number of decayed teeth might not produce immediate and concomitant changes in the numbers of filled teeth present. It is apparent though, that the decline in the mean number of filled teeth has been arrested at the end of the 1990s.

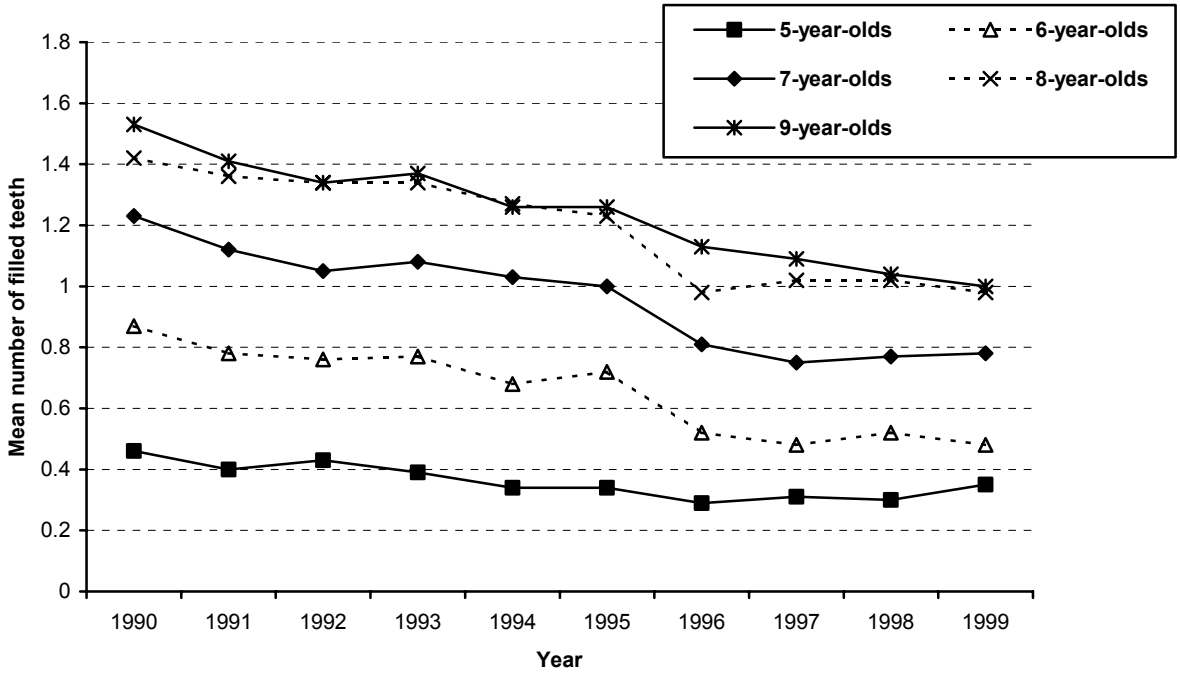


Figure 17: Mean filled deciduous teeth for 5–9-year-old children in Australia from 1990 to 1999

Given trends in both decayed and filled deciduous teeth across the 1990s, it is not surprising that dmft scores show similar patterns across all age groups (Figure 18). Again a decline can be seen from 1990 to 1996, followed by three years of increased dmft scores at the end of the 1990s. The only age group not to follow this trend was 9-year-olds, where a levelling off of dmft scores was observed between 1996 and 1999.

For children aged between 5 and 9 years, dmft scores fell between 24.5% and 31.9% between 1990 and 1996, with the steepest decline being for 5-year-olds. The largest decline occurred, for all age groups, between 1995 and 1996.

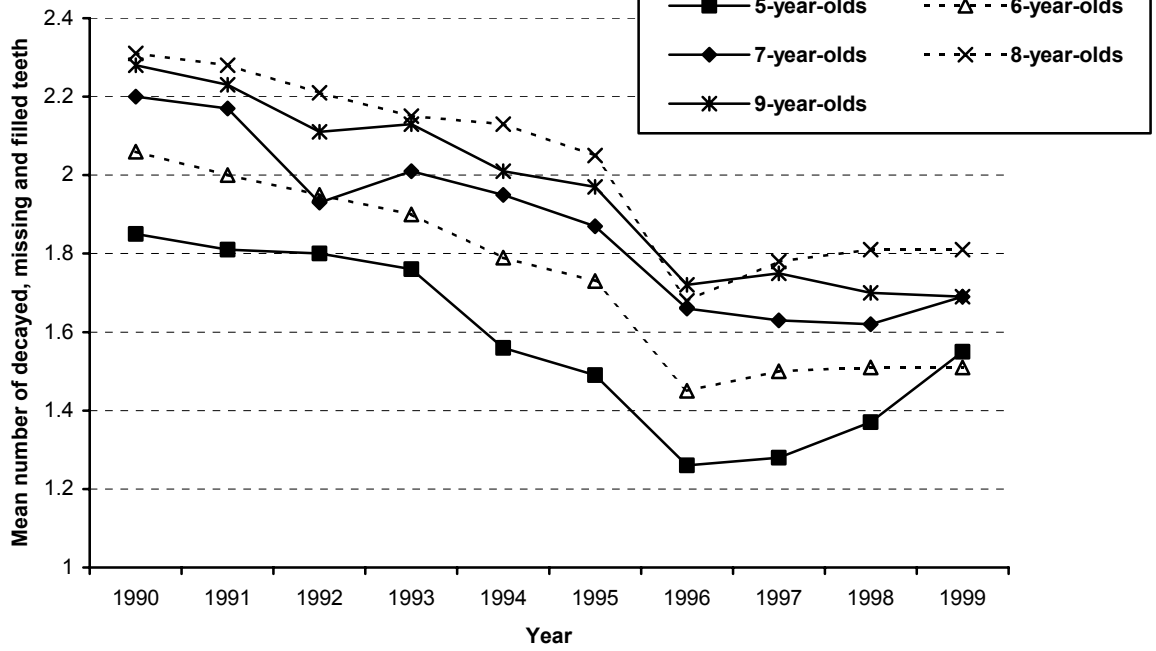


Figure 18: Mean deciduous dmft scores for 5–9-year-old children in Australia from 1990 to 1999

The percentage of caries experience accounted for by the decayed component increased between 1990 and 1999 (Figure 19). Although Figure 16 showed that an increase in decay scores only occurred from 1996, decayed teeth as a percentage of all deciduous teeth with caries experience steadily increased across the entirety of the 1990s.

The percentage of deciduous d/dmft increased by 4.1%, 11.4%, 11.1%, 9.2% and 9.5% between 1990 and 1999 for children aged 5, 6, 7, 8 and 9 years, respectively.

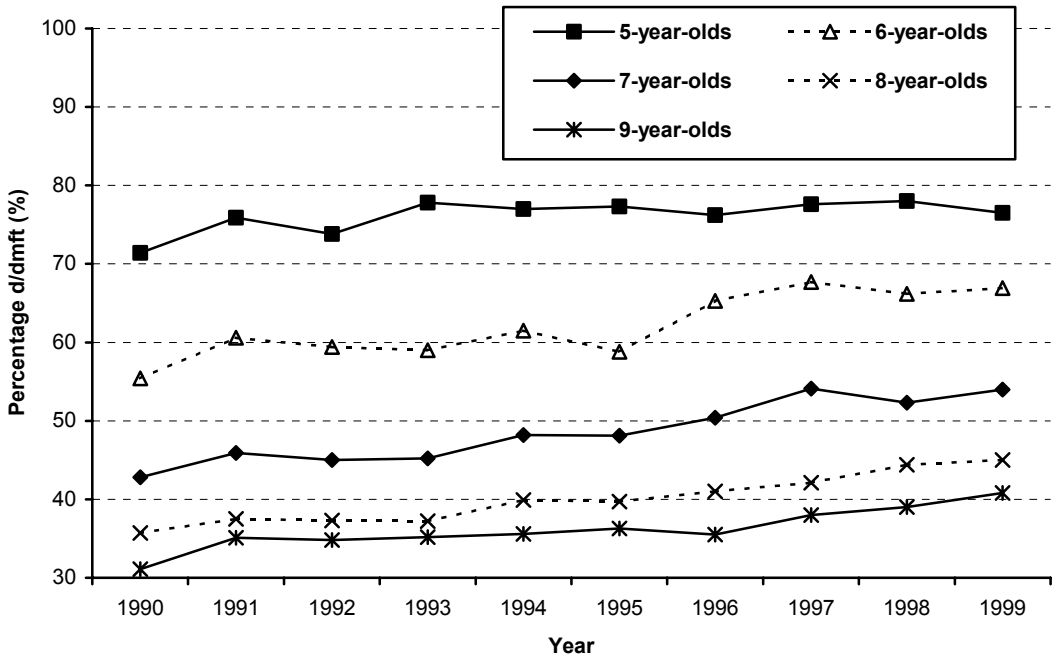


Figure 19: Percentage deciduous d/dmft for 5–9-year-old children in Australia from 1990 to 1999

The percentage of children who presented to the School Dental Service with no current or previous caries experience in the deciduous dentition increased from 1990, peaking in 1996 for 6–9-year-olds and in 1997 for 5-year-olds (Figure 20). This indicates that the increases in mean number of clinically detectable untreated decayed teeth seen from 1996 onwards is a result of more children presenting with decay, rather than children with previous caries experience simply presenting with additional decay. The reversal in the increasing number of children without deciduous caries experience from 1996 is a significant change and may indicate a rebound from historically low rates of deciduous caries experience among Australian children.

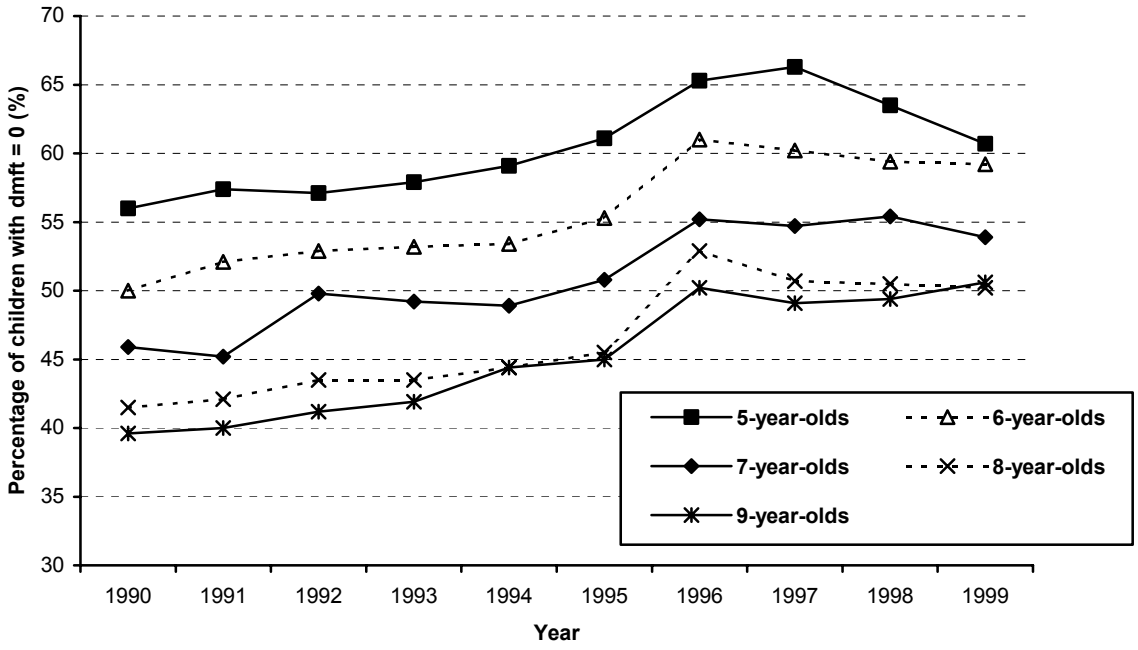


Figure 20: Percentage of 5–9-year-old children with deciduous dmft = 0 in Australia from 1990 to 1999

Trends in 5–6-year-old untreated decayed deciduous teeth for Australian States and Territories are shown in Figure 21. Distinct groups are evident, with three State or Territory jurisdictions having decay scores with an average above one across the 1990s, and four jurisdictions having decay scores below one across the period 1990–1999. The only State or Territory not to fall into these groups is New South Wales, which in 1990 had the highest clinically detectable untreated decay among 5–6-year-old children in the country, yet recorded the second lowest average decay score in 1999. Decay in 1999 was 45.4% of that recorded in 1991, with the biggest reduction occurring between 1995 and 1996 when average decay scores fell by 0.53 or 44.2%. This coincides with the introduction of SOKS in that State and dramatically indicates how changes in service delivery can influence the results of epidemiological collections.

Towards the end of the 1990s, all States and Territories, including New South Wales, experienced an increase in clinically detectable decayed deciduous teeth. In Victoria, the low point occurred in 1995 when the average number of decayed teeth per child was 1.12, but by the end of the 1990s this figure had climbed to 1.42. Similarly, Queensland, which had experienced a decline in average decay from 1.26 in 1990 to 1.07 in 1995, began to increase and recorded a score of 1.42 at the end of the decade. The Northern Territory, which experienced its lowest recorded average decay score in 1993 (mean = 1.17), also showed an increase in decay and in 1999 the average 5–6-year-old child had 1.42 decayed deciduous teeth.

Among the States and Territories with relatively low numbers of untreated decayed teeth, the low points for Western Australia, South Australia and the Australian Capital Territory all occurred in 1994, while the lowest recorded decay score for Tasmania occurred in 1993. Western Australia demonstrated the most consistent trend across the 1990s, with increases for every year except for between 1993 and 1994. Decayed deciduous teeth scores in Western Australia increased from 0.62 in 1990 to 0.93 in 1999. South Australia and Tasmania also had a higher prevalence of decayed deciduous teeth in 1999 than in 1990. The Australian Capital Territory was the only State or Territory other than New South Wales to have lower average decay scores at the end of the decade than at the beginning.

The changes in the number of decayed deciduous teeth in Australia from year to year are a result of changes occurring at the State and Territory level. This is represented in Figure 22, which shows the percentage of total change in Australian deciduous decayed teeth scores accounted for by each State and Territory. For each year, the bar totals to 100%, which equals the summation of change in the Australian score accounted for by all of the States and Territories. Some States and Territories experience an increase in decayed teeth scores and these are shown in the top half of the graph as producing 'positive change'. Other States and Territories have experienced decreases in decayed teeth score from one year to the next, and these are shown in the bottom half of the graph as producing 'negative change'.

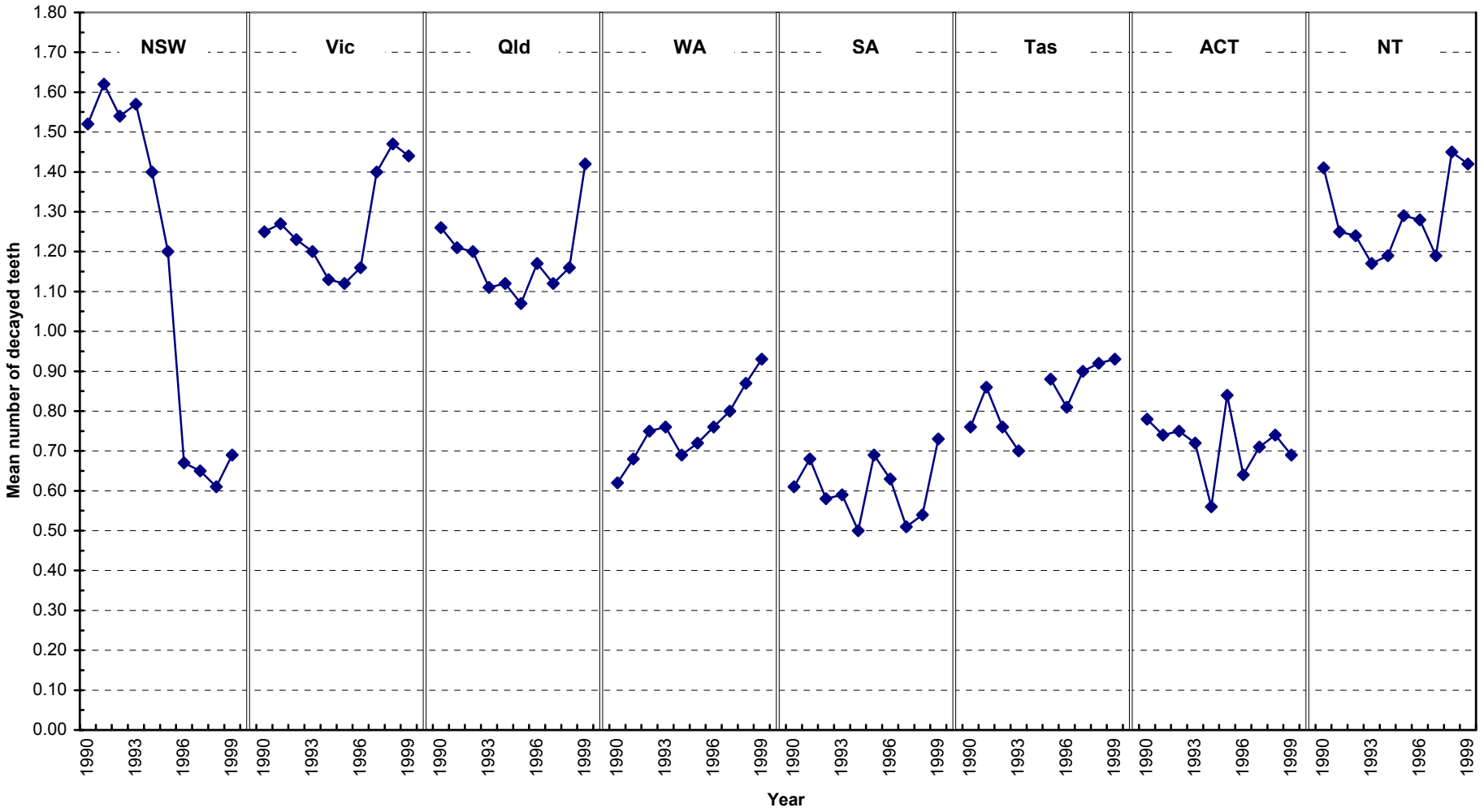


Figure 21: Mean decayed deciduous teeth for 5–6-year-old children by State and Territory from 1990 to 1999

Not surprisingly, given the high percentage of the total number of Australian children residing in New South Wales, this State has been dominant in its influence on the Australian score. This is most evident between the years 1993 and 1996, when New South Wales accounted for between 64.5% and 80.9% of the total change contributed by all the States and Territories. These years represent the final years of the decline in decay scores experienced in Australia up to the end of the 1990s. It is interesting to note that since 1996 increases in Australian decay scores have largely been driven by changes in Victoria (in 1997 and 1998) and Queensland (in 1999). Across the final three years of the decade, these two States combined contributed 70.6%, 45.7% and 59.5% of the total change in the Australian score.

Despite some often large changes in decay experienced by the other States and Territories, the smaller populations in these jurisdictions resulted in them having relatively little effect on the Australian score.

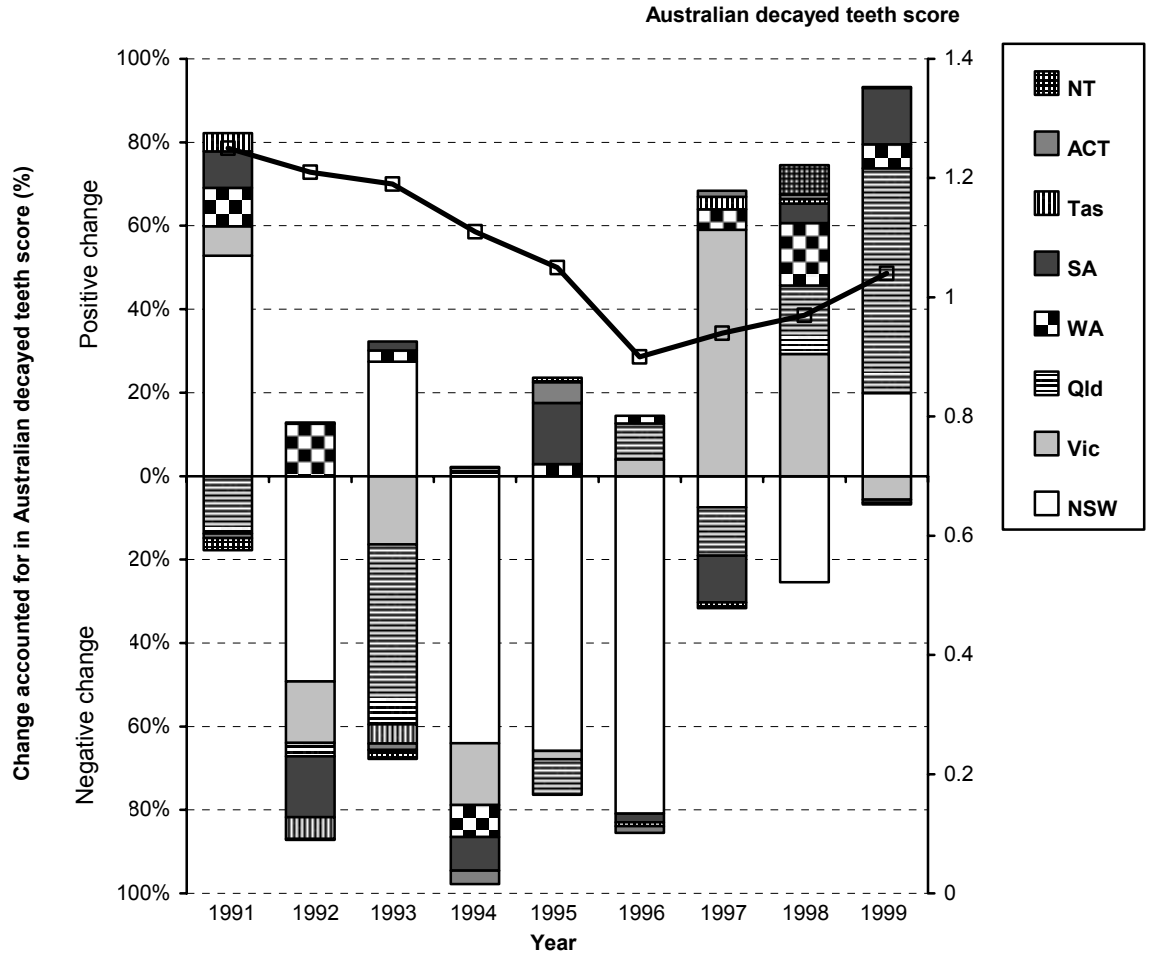


Figure 22: Percentage of total change in 5–6-year-old Australian deciduous decayed teeth scores accounted for by each State and Territory from 1990 to 1999

The trends shown in untreated decayed deciduous teeth scores for Australian States and Territories are approximately replicated in dmft scores (Figure 23). Again, New South Wales shows a dramatic decline between 1993 and 1996 in the average number of decayed, missing and filled teeth, reducing from 2.11 to 0.92 teeth across this 3-year period. This reduction of 56.3% resulted in New South Wales going from having the second highest dmft score of any State or Territory to having the lowest dmft score. Queensland, the Northern Territory and Victoria, who recorded the highest dmft scores among the States and Territories, recorded their lowest dmft scores in 1997, 1993 and 1996, respectively, before each of these jurisdictions experienced an increase in dmft scores towards the end of the 1990s. After declining from 1.85 teeth in 1990 to 1.58 teeth in 1994, average dmft in Victoria increased 23.4% to 1.95 teeth in 1999. Queensland demonstrated declines in average dmft through to 1997, decreasing 22.8% from 2.32 teeth on average in 1990 to 1.79 teeth in 1997. However, the last two years of the 1990s saw a dramatic increase in mean dmft in this State, with a return to levels of decayed, missing and filled teeth similar to those at the beginning of the 1990s.

Among States and Territories with comparatively low dmft scores, South Australia shows the greatest decline in mean dmft, reducing 45.5% from 1.76 teeth in 1990 to 0.96 teeth in 1994. Low caries States and Territories experienced their lowest dmft scores in the mid 1990s, Tasmania in 1993, and the Australian Capital Territory and Western Australia in 1996. Again, caries experience for these jurisdictions was increasing at the end of the 1990s. In Tasmania, mean dmft increased 28.2% from 1.24 teeth in 1993 to 1.59 teeth in 1999. The trend in the Australian Capital Territory is harder to interpret due to a relatively higher recorded disease incidence in 1995. Nonetheless, in 1999 the mean dmft of 1.17 was 23.2% higher than in 1996 (mean = 0.95). In Western Australia, dmft reached its lowest levels in the mid 1990s before increasing 19.7%, from 1.22 teeth in 1996 to 1.46 teeth in 1999.

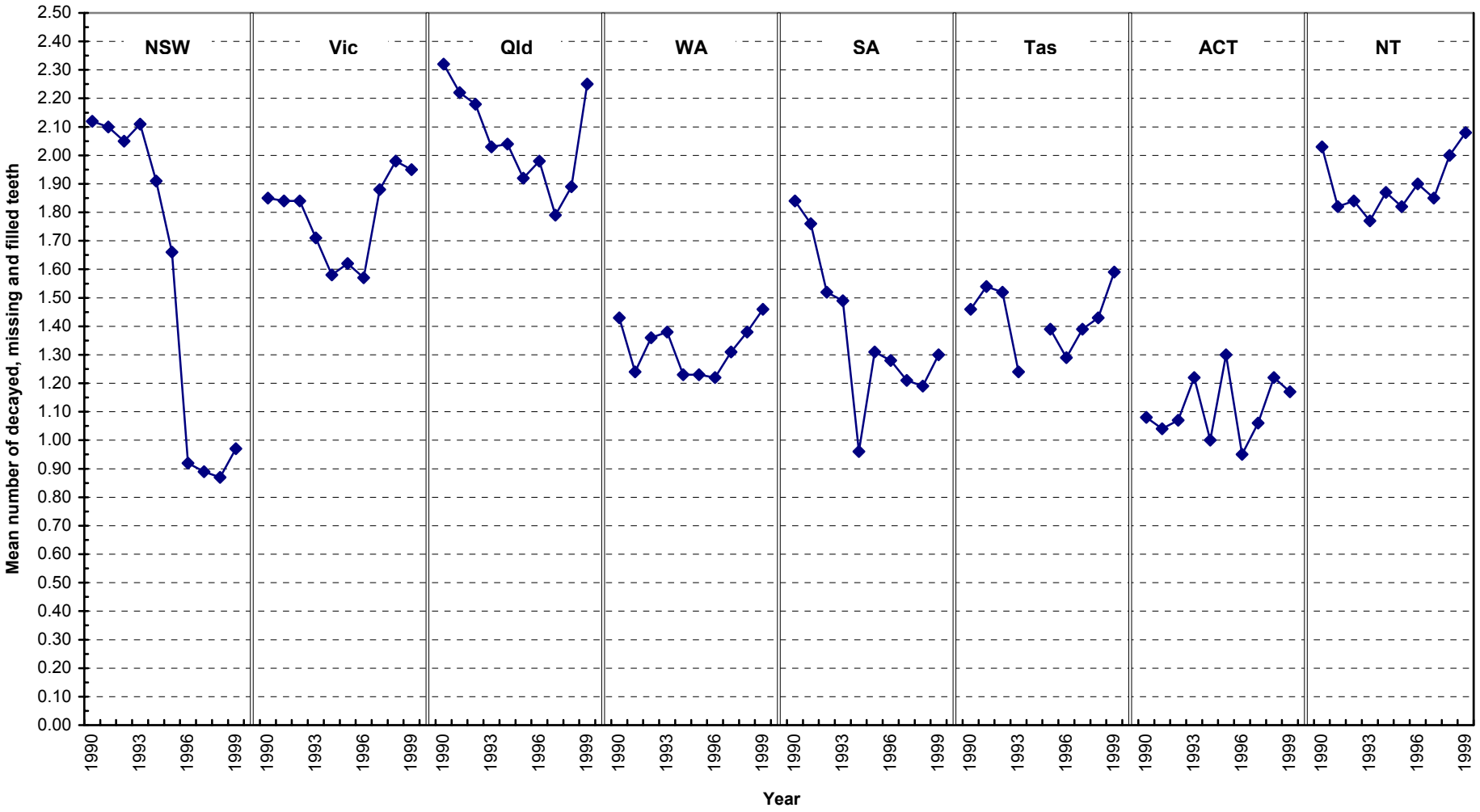


Figure 23: Mean decayed, missing and filled deciduous teeth (dmft) for 5–6-year-old children by State and Territory from 1990 to 1999

Figure 24 shows the average Australian dmft score across the 1990s and the percentage of change in the sum of State and Territory changes accounted for by each State and Territory for each year. The decline in dmft between 1992 and 1996 is strongly associated with changes occurring in New South Wales, which accounted for 43.2%, 57.3% and 87.4% of the total variation in State and Territory scores in 1994, 1995 and 1996, respectively. It should be noted that in 1996, which saw the biggest single drop in 5–6-year-old dmft across the 1990s, the SOKS screening program was introduced in New South Wales.

Since 1996 the Australian dmft score has been predominantly driven by changes occurring in Victoria and Queensland. In 1999 Queensland accounted for 57.5% of the change in Australia's dmft score.

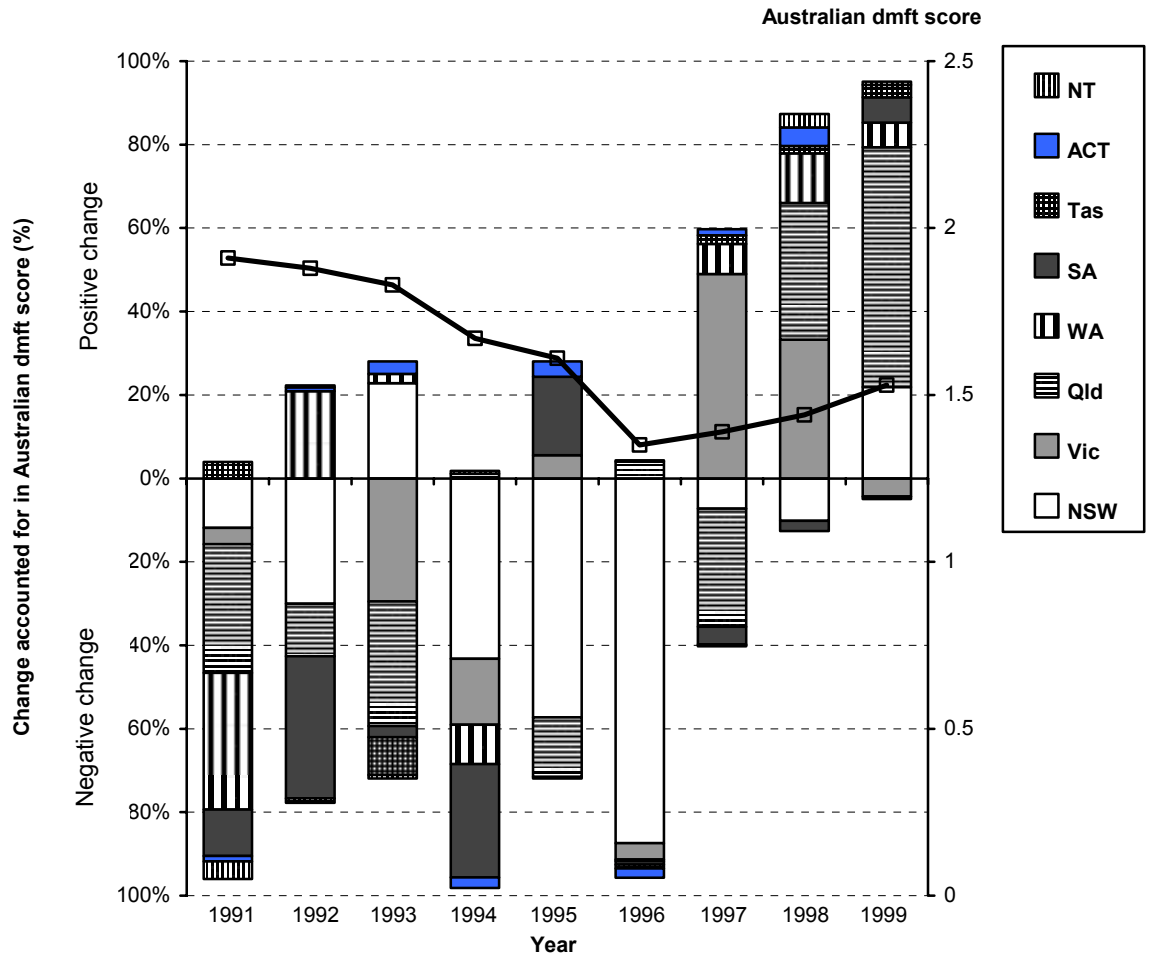


Figure 24: Percentage of total change in 5–6-year-old Australian dmft scores accounted for by each State and Territory from 1990 to 1999

Trends in permanent teeth, 1990–1999

The variability in permanent caries experience expressed as clinically detectable untreated decay is appreciably less than that shown in the deciduous dentition. For children aged between 7 and 12 years, the permanent decayed teeth score remained relatively unchanged up to 1995 before dipping in 1996 (Figure 25). Since 1996, however, the permanent decayed teeth score has increased and in 1999 clinically detectable permanent decay was not dramatically different from scores recorded in 1990. Results for 13–14-year-olds are much more variable and reflect the increased variance caused by small samples of these ages from some States and Territories. Nonetheless, the dip in decay scores for this group can again be seen in 1996, followed by an increase in clinically detectable decay at the end of the 1990s.

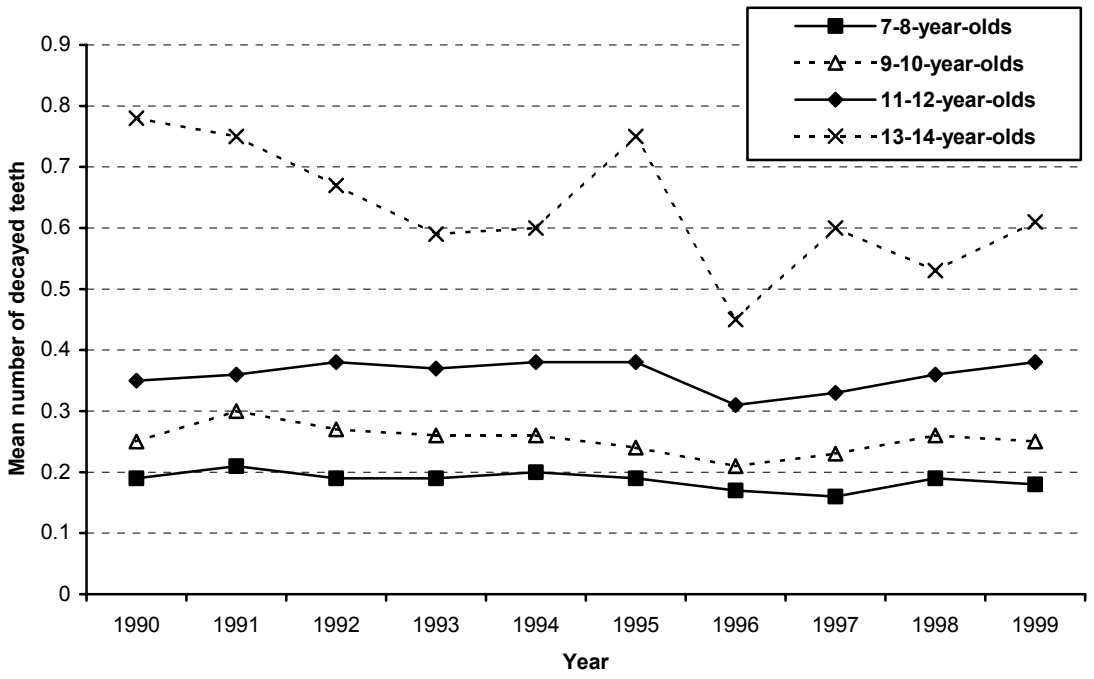


Figure 25: Mean decayed permanent teeth for 7–14-year-old children in Australia from 1990 to 1999

For all age groups, the average number of filled permanent teeth per child was lower in 1999 than in 1990 (Figure 26). A steady decline occurred for all ages up to the late 1990s. The lack of decline in filled permanent teeth between 1998 and 1999 suggests that the long period of decline in children's fillings may have come to an end at the end of the 1990s. It would be expected that there would be some lag between the increase in decayed permanent teeth shown in Figure 28 and an increase in filled permanent teeth.

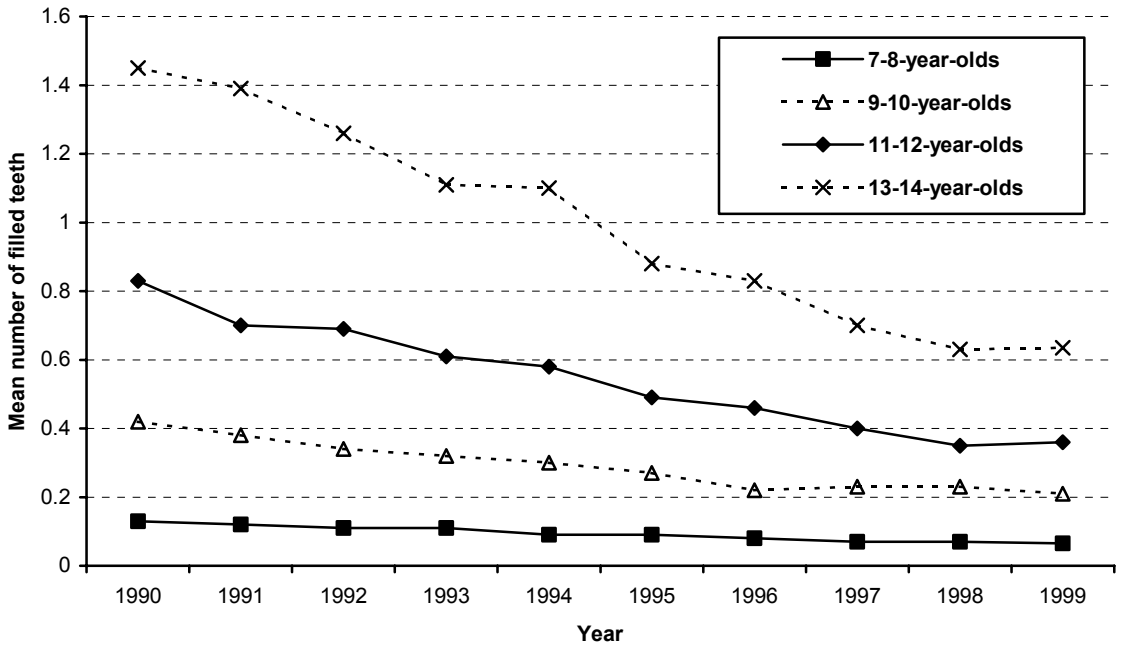


Figure 26: Mean filled permanent teeth for 7–14-year-old children in Australia from 1990 to 1999

There was a decline in permanent DMFT scores between 1990 and 1999 (Figure 27). Reductions were largest for 13–14-year-olds (43.5%, from 2.30 to 1.30 teeth) and smallest for 7–8-year-olds (24.2%, from 0.33 to 0.25 teeth). Given trends in permanent decayed and filled teeth, declines in the number of decayed, missing or filled teeth at the end of the 1990s appear to have been arrested and there are small increases for some age groups.

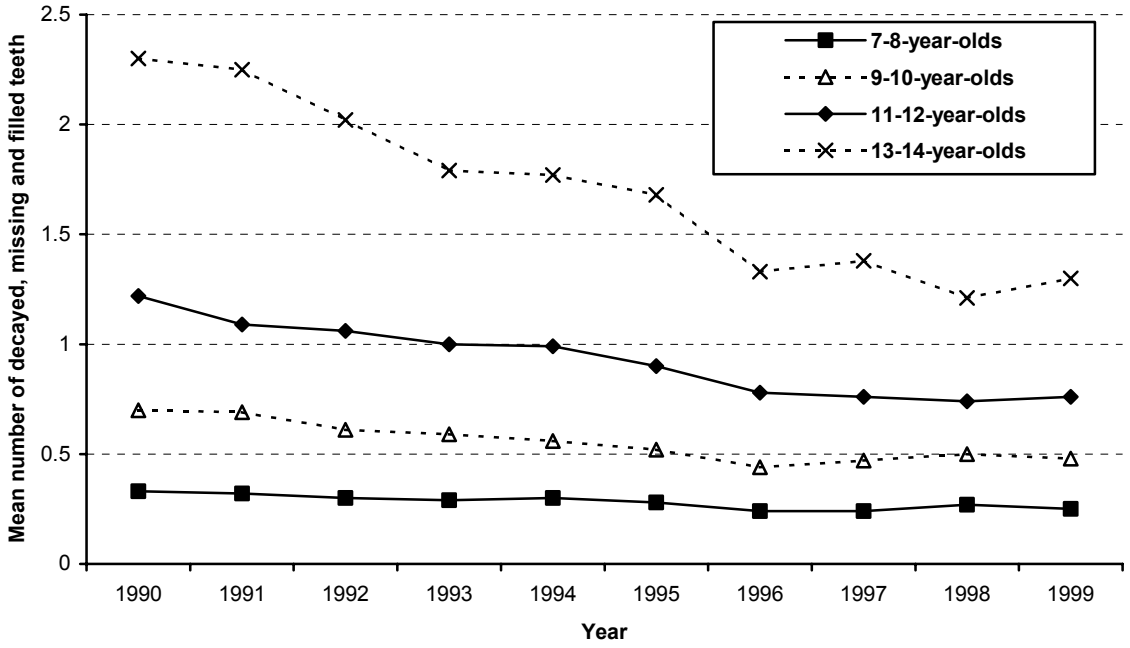


Figure 27: Mean permanent DMFT scores for 7–14-year-old children in Australia from 1990 to 1999

The percentage of DMFT scores accounted for by permanent decay increased across the 1990s for the four age groups reported on in Figure 28. This reflects decreasing past caries experience and should not be interpreted as an increase in decay scores across the 1990s. As shown in Figure 25, permanent decay scores actually declined slightly over the first several years of the 1990s.

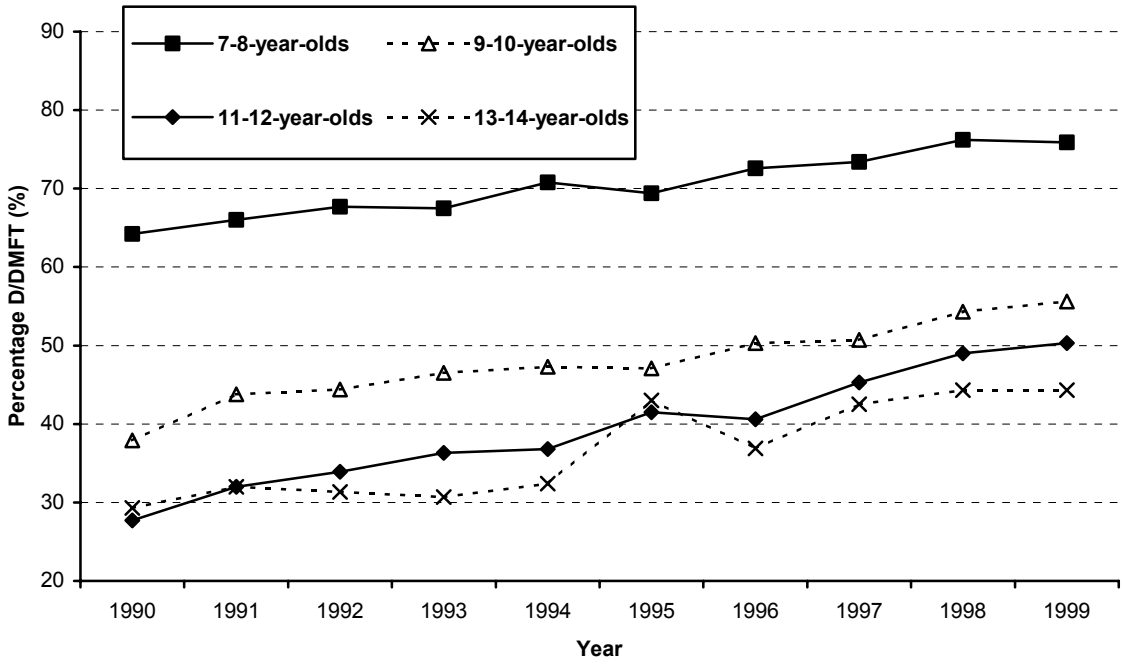


Figure 28: Percentage D/DMFT for 7–14-year-old children in Australia from 1990 to 1999

The period from 1990 to 1996 saw an increase in the percentage of children with a DMFT = 0 for all age groups, as presented in Figure 29. These children had no clinically detectable decay in their permanent dentition and no filled or missing teeth indicative of past decay in their permanent dentition. While the increase was only small in the youngest age group (from 82.0% to 86.0%), among 13–14-year-olds there was an increase of 51.3% (from 35.8% to 54.2%). From 1996 this increase was arrested and little change took place in the final three years of the 1990s.

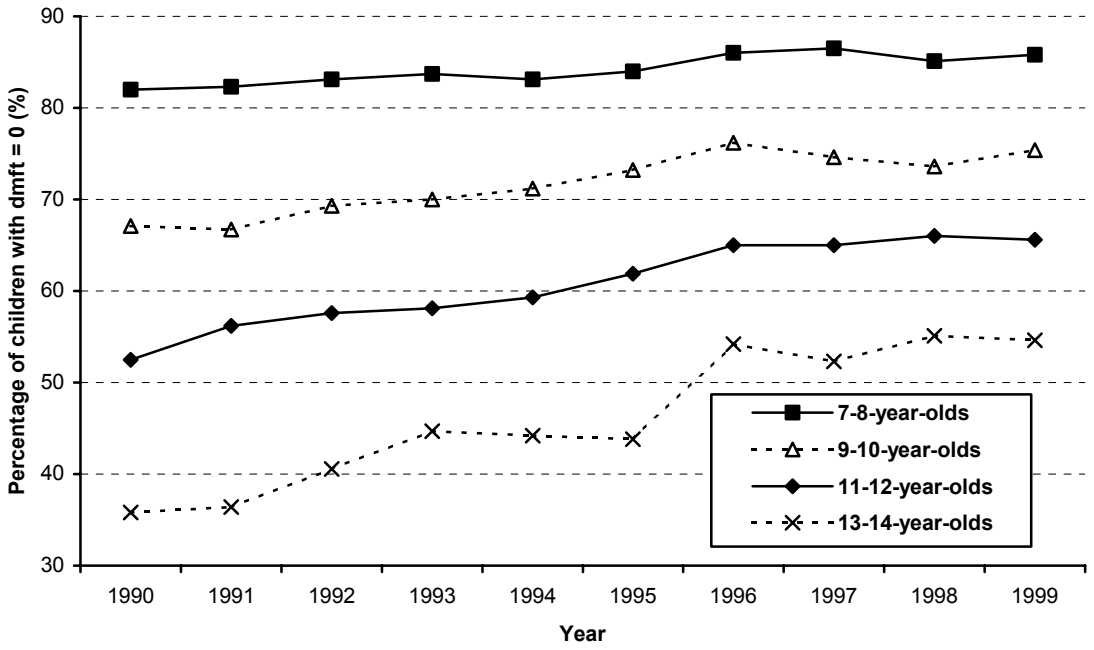


Figure 29: Percentage of 7–14-year-old children with permanent DMFT = 0 in Australia from 1990 to 1999

Fissure sealants are placed on permanent teeth as a caries preventive service. From 1990 to 1995 there was an increase in the average number of fissure sealants per child for children between the ages of 7 and 14 years (Figure 30). These represent increases of 45.5% for 7–8-year-olds, 72.9% for 9–10-year-olds, 88.0% for 11–12-year-olds and 56.9% for 13–14-year-olds. For 7–8-year-olds, this increase was followed by a sharp decrease in 1996 and then a steady increase to 1999. For 9–10-year-olds, a gradual decline in the average number of fissure sealed teeth occurred between 1995 and 1999, from 0.83 to 0.76 teeth. The number of fissure sealants plateaued between 1995 and 1999 for children aged 11–12 years, before declining slightly. For the oldest children the average number of fissure sealants, after peaking at 1.02 in 1995, was only slightly lower, at 0.98 teeth, in 1999.

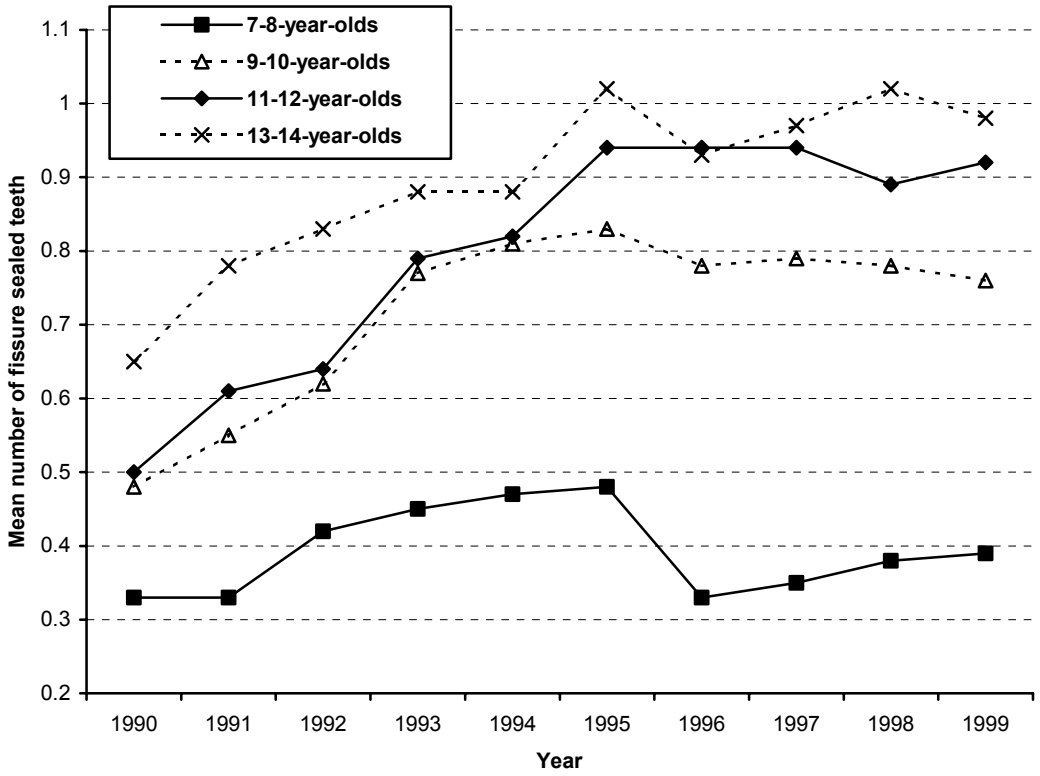


Figure 30: Mean permanent fissure sealed teeth for 7–14-year-old children in Australia from 1990 to 1999

There is considerable variability in the trends in 12-year-old decayed permanent teeth across the States and Territories (Figure 31). New South Wales shows the most dramatic change across the 1990s, having the most decay of any State or Territory up to 1994, but by 1999 having the second lowest. The principal decrease, occurring in 1996, coincides with the introduction of the SOKS program in that State. Western Australia was the only other State to have a lower decayed teeth score at the end of the 1990s (average = 0.30) than at the beginning (average = 0.28), after showing little variation across the whole period. The other States and Territories all showed increases in 12-year-old decay scores across the 1990s. Data were only available for Victoria from 1995; however, in the 4-year period to 1999, decayed teeth scores increased 20.4%, from 0.54 to 0.65 teeth. Queensland, which had the second highest decayed teeth score in 1990, steadily declined to 1994 then recorded a sharp increase at the end of the 1990s. Similarly, South Australia, Tasmania, the Australian Capital Territory and the Northern Territory all showed increased decayed permanent teeth from the mid 1990s to the end of the decade.

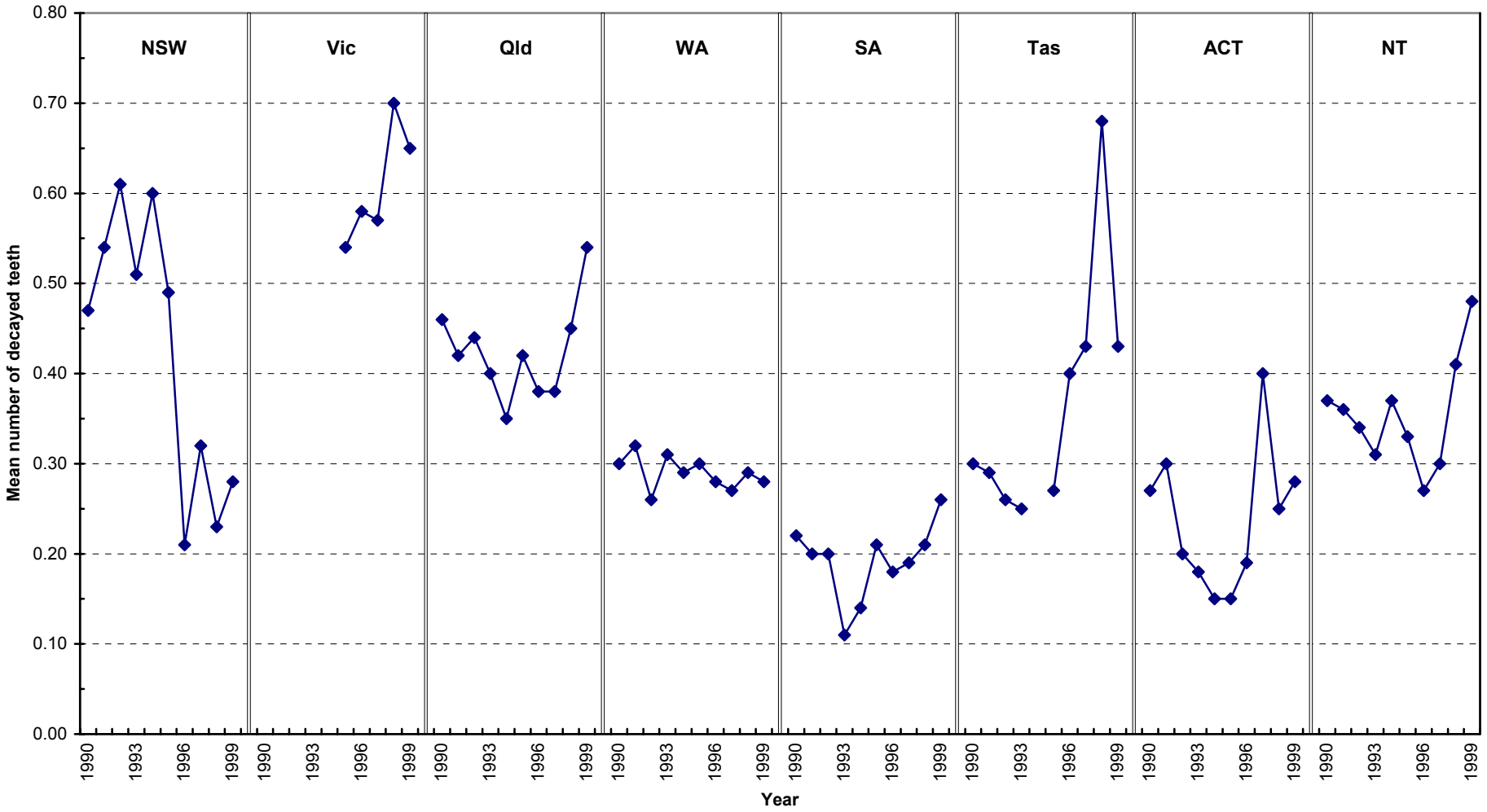


Figure 31: Mean decayed permanent teeth for 12-year-old children by State and Territory from 1990 to 1999

Despite the increased 12-year-old decayed permanent teeth score for most States and Territories across the 1990s, the national 12-year-old decayed teeth score was lower in 1999 than in 1990 (Figure 32). The principal reason for this is the influence of changes in New South Wales. Between 1990 and 1997, New South Wales accounted for between 62.5% and 80.3% of the total State and Territory variation in decay scores. The two next most populous States, Victoria and Queensland, accounted for between 40% and 50% of the total variation in decayed teeth scores in 1998 and 1999. The other States and Territories, despite often large variations from year to year, had generally little effect on changes in clinically detectable untreated decayed teeth scores due to their smaller populations.

In contrast to trends in decayed permanent teeth across the 1990s, DMFT scores declined for all but Victoria and Tasmania between 1990 and 1999 (Figure 33). However, between 1996 and 1999 all States and Territories except Western Australia and New South Wales recorded an increase in 12-year-old permanent DMFT.

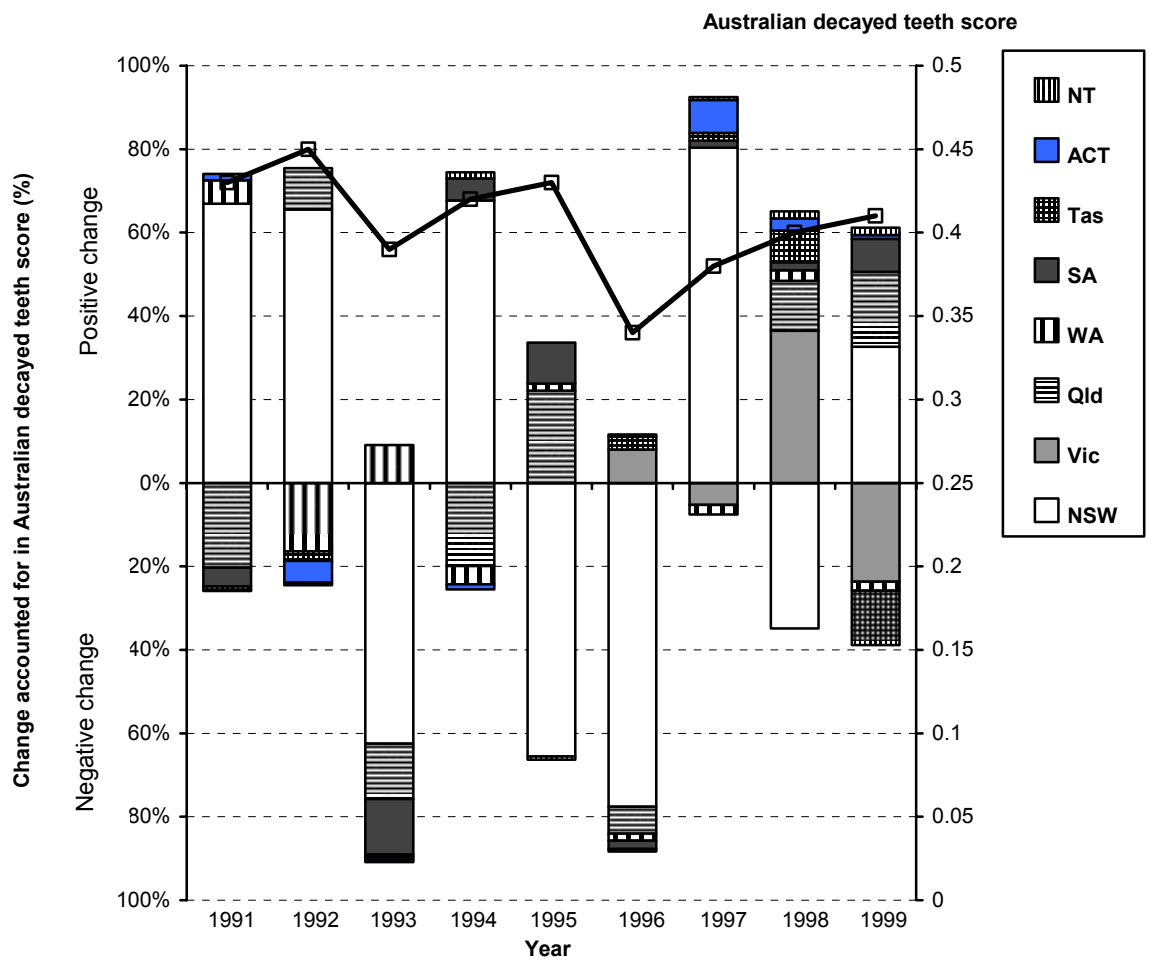


Figure 32: Percentage of total change in 12-year-old Australian permanent decayed teeth scores accounted for by each State and Territory from 1990 to 1999

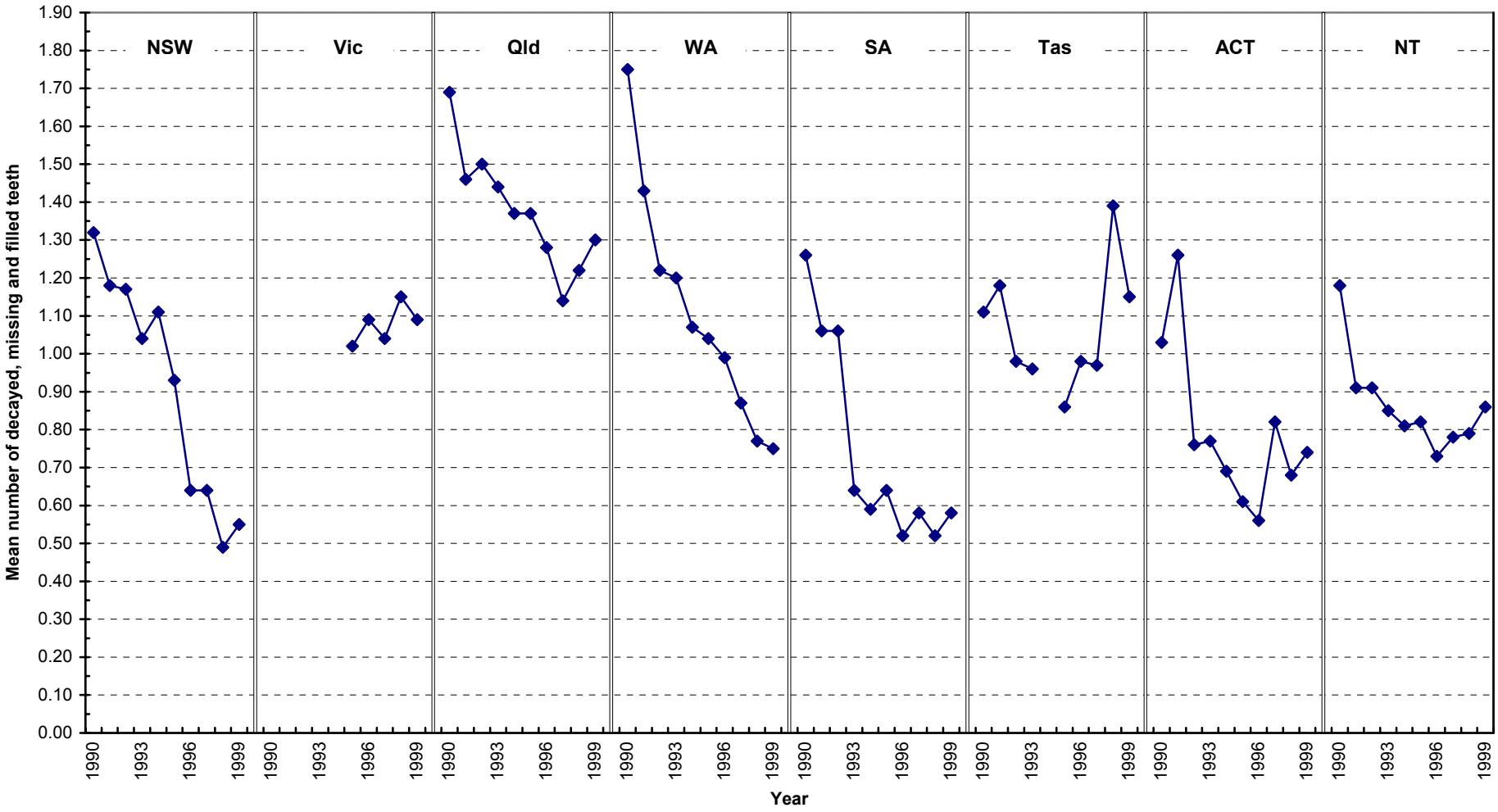


Figure 33: Mean decayed, missing and filled permanent teeth (DMFT) for 12-year-old children by State and Territory from 1990 to 1999

Figure 34 shows a consistent and steady decline in 12-year-old DMFT across the 1990s. It is noteworthy that the largest falls in recorded DMFT in 1993, 1995 and 1996 correspond to the years when New South Wales accounted for most of the change in Australian DMFT scores (48.0%, 87.7% and 64.0% in 1993, 1995 and 1996, respectively). Despite a rise in DMFT in most Australian States and Territories at the end of the 1990s, the Australian DMFT score continued to decline between 1995 and 1999. In 1997 this reduction was largely accounted for by a drop in recorded DMFT in Queensland, and in 1998 by a further decline in New South Wales.

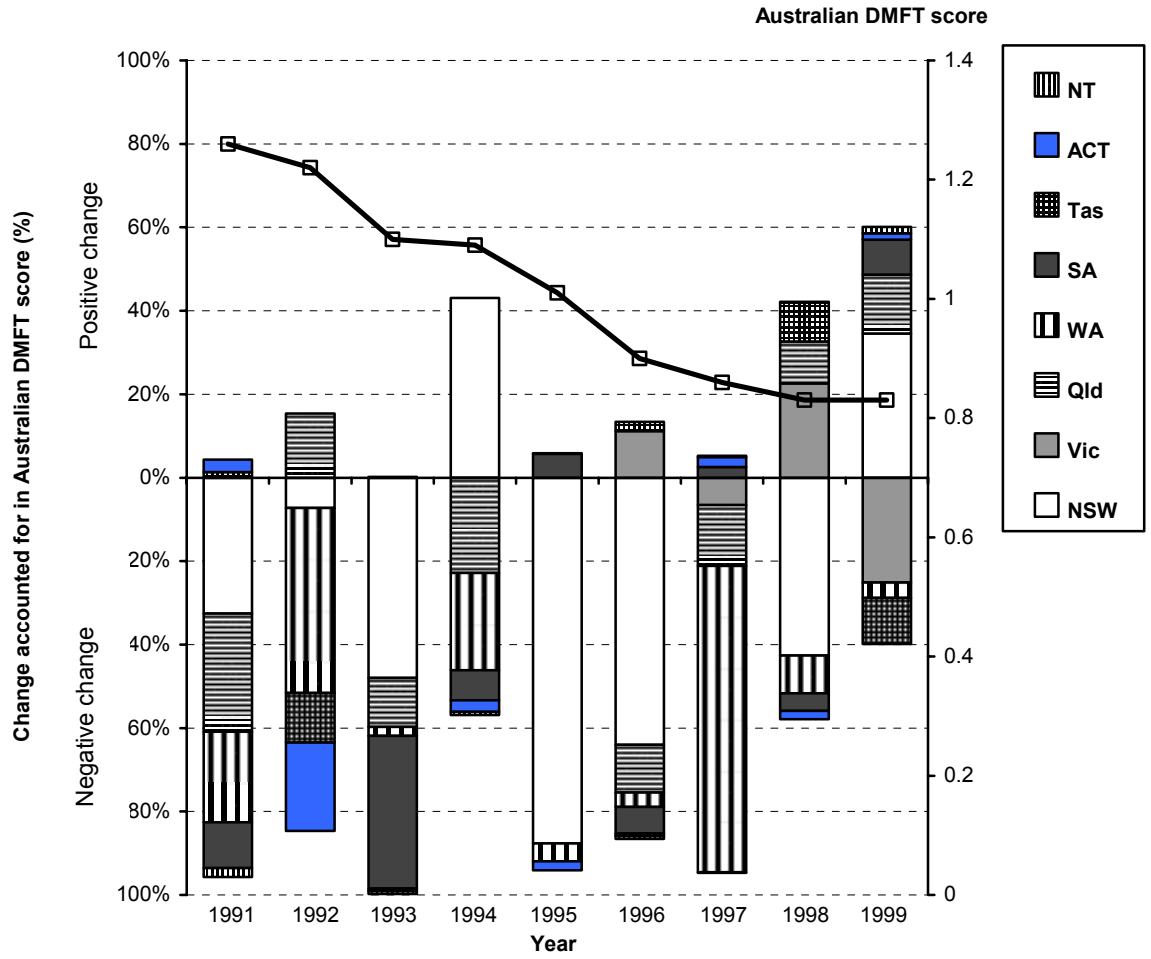


Figure 34: Percentage of total change in 12-year-old Australian permanent DMFT scores accounted for by each State and Territory from 1990 to 1999

International comparisons

Children's oral health has improved in most developed countries and many developing countries over the last quarter of a century. A comparison of 12-year-old DMFT scores from 41 countries and 18 of the 30 OECD nations is presented in Table 12. For comparative purposes, only countries with DMFT data within two years of that presented for Australia have been included. The table shows that Australia has the third lowest 12-year-old DMFT score, with only Luxembourg (DMFT = 0.7) and The Netherlands (DMFT = 0.6) having a lower score. Of those countries with available data, Australia has the second lowest percentage of 12-year-old children with caries experience. It should be noted, though, that Netherlands figures are based only on children from the capital, The Hague.

Table 12: DMFT scores and percentage with caries for 12-year-old children by country

Country	Year	DMFT	Rank	% Affected	Rank
Netherlands * [(a)]	1998	0.6	1	30.0	1
Luxembourg *	1998	0.7	2	–	–
Australia *	**1999**	**0.8**	**3**	**35.5**	**2**
Pakistan	1999	0.9	4	–	–
Sweden *	1999	0.9	4	39.0	3
Bangladesh	2000	1.0	6	46.4	5
Denmark *	1998	1.1	7	–	–
Finland *	1997	1.1	7	65.0	15
Ireland *	1997	1.1	7	52.0	8
Niger	1997	1.3	10	–	–
Cuba	1998	1.4	11	50.0	6
Fiji	1998	1.5	12	60.0	12
Norway *	1998	1.5	12	46.0	4
Belgium *	1998	1.6	14	50.0	6
Austria *	1997	1.7	15	56.0	9
Germany *	1997	1.7	15	58.2	10
Slovenia	1998	1.8	17	59.9	11
France *	1998	1.9	18	61.0	14
Malaysia	1997	1.9	18	60.9	13
Mongolia [(b)]	1997	1.9	18	75.0	20
Venezuela	1997	2.1	21	–	–
Japan *	1999	2.4	22	–	–
Mexico *	1997	2.5	23	72.3	18
Morocco	1999	2.5	23	72.0	17
Uruguay	1999	2.5	23	72.5	19
Estonia	1998	2.7	26	76.0	21
Nicaragua	1997	2.8	27	79.2	24
Portugal *	1999	3.1	28	70.0	16

continued

Table 12 (continued): DMFT scores and percentage with caries for 12-year-old children by country

Country	Year	DMFT	Rank	% Affected	Rank
Tonga	1998	3.1	28	77.5	22
Czech Republic *	1998	3.4	30	86.0	27
Croatia	1999	3.5	31	85.1	26
Panama	1997	3.6	32	77.9	23
Honduras	1997	3.7	33	83.4	25
Gabon	2000	4.0	34	–	–
Poland *	1998	4.0	34	89.0	29
Bulgaria	1998	4.2	36	90.0	30
Latvia	1998	4.2	36	–	–
Slovak Republic *	1998	4.3	37	88.0	28
Dominican Republic	1997	4.4	39	–	–
Philippines	1998	4.6	40	91.7	31
Romania	1998	7.3	41	96.0	32

* Member of the Organization for Economic Co-operation and Development (OECD).

(a) Includes only children from The Hague.

(b) Includes only children from Ulanbator City.

Sources: World Health Organization (WHO) Oral Health Country/Area Profile Programme. OECD health data 2000: a comparative analysis of 29 countries.

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Appendix A

The following tables present national and State and Territory results with adjustments for the estimated under-reporting of clinically detectable decayed teeth in New South Wales (see page 5). For children in NSW, an additional weighting of 1.56 was given for calculations of decayed deciduous teeth and 1.68 for calculations of decayed permanent teeth.

Table A1: Deciduous dentition caries experience (adjusted for NSW), 1999

Age (years)	Children	Decayed (d)		dmft		d/dmft
	n	mean	SD	mean	SD	%
4	24,314	1.39	2.91	1.67	3.27	83.5
5	31,997	1.25	2.48	1.68	2.98	76.9
6	28,709	1.09	2.21	1.64	2.83	67.4
7	33,875	0.94	1.82	1.80	2.71	54.5
8	34,509	0.82	1.58	1.91	2.68	45.5
9	34,903	0.69	1.38	1.76	2.46	41.1
10	34,241	0.51	1.15	1.36	2.14	38.0
11	33,996	0.29	0.83	0.81	1.63	36.6
12	29,020	0.17	0.66	0.42	1.19	38.4

Table A2: Permanent dentition caries experience (adjusted for NSW), 1999

Age (years)	Children	Decayed (D)		DMFT		D/DMFT
	n	mean	SD	mean	SD	%
5	31,997	0.02	0.23	0.03	0.29	78.1
6	28,709	0.09	0.46	0.10	0.50	89.3
7	33,875	0.18	0.63	0.22	0.71	82.1
8	34,509	0.23	0.73	0.33	0.88	70.0
9	34,903	0.28	0.80	0.45	1.03	60.4
10	34,241	0.30	0.85	0.56	1.17	51.3
11	33,996	0.38	0.97	0.74	1.38	50.5
12	29,020	0.48	1.20	0.89	1.64	51.0
13	34,478	0.69	1.59	1.33	2.25	47.8
14	34,686	0.67	1.71	1.41	2.32	41.7
15	17,144	0.61	1.36	1.86	2.59	33.9

Table A3: Interstate comparison – 5- to 6-year-old and 12-year-old caries experience (adjusted for NSW), 1999

State/ Territory	5–6-year-old deciduous					12-year-old permanent				
	Children	Decayed (d)		dmft		Children	Decayed (D)		DMFT	
	n	mean	SD	mean	SD	*n*	mean	SD	mean	SD
NSW	21,514	1.07	2.46	1.35	2.77	10,516	0.46	1.35	0.74	1.65
Vic	15,599	1.44	2.44	1.95	3.06	7,628	0.65	1.29	1.09	1.73
Qld	9,523	1.42	2.57	2.25	3.33	3,232	0.54	1.19	1.30	1.91
WA	6,082	0.93	1.93	1.46	2.50	3,360	0.28	0.76	0.75	1.37
SA	4,676	0.73	1.58	1.30	2.38	2,556	0.26	0.67	0.58	1.07
Tas	1,574	0.93	1.84	1.59	2.73	846	0.43	0.98	1.15	1.77
ACT	963	0.69	1.64	1.17	2.35	478	0.28	0.68	0.74	1.30
NT	776	1.42	2.47	2.08	3.11	404	0.48	1.18	0.86	1.54
Australia	**60,706**	**1.17**	**2.36**	**1.66**	**2.91**	**29,020**	**0.48**	**1.20**	**0.89**	**1.64**

Table A4: National summary of caries experience of 5- to 12-year-old children (adjusted for NSW), 1999

State/ Territory	Children in sample	dmft		DMFT	
	n	mean	SD	mean	SD
NSW	85,776	1.06	2.23	0.33	1.05
Vic	62,249	1.69	2.59	0.51	1.14
Qld	53,277	2.00	2.84	0.54	1.20
WA	25,970	1.22	2.05	0.36	0.92
SA	19,965	1.19	2.07	0.25	0.69
Tas	6,583	1.36	2.29	0.47	1.11
ACT	4,209	1.05	1.90	0.33	0.83
NT	3,220	1.50	2.45	0.37	0.97
Australia	**261,250**	**1.44**	**2.45**	**0.42**	**1.07**