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Oral health of Aboriginal and Torres Strait Islander children

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Abbreviations

ABC	Aboriginal Birth Cohort
ABS	Australian Bureau of Statistics
AGDHA	Australian Government Department of Health and Ageing
AIHW	Australian Institute of Health and Welfare
ARCPOH	Australian Research Centre for Population Oral Health
CDHS	Child Dental Health Survey
CHINS	Community Housing and Infrastructure Needs Survey
CPI	Community Periodontal Index
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
ERP	estimated resident population
f	deciduous filled teeth
F	permanent filled teeth
m	deciduous teeth missing due to caries
M	permanent teeth missing due to caries
NACCHO	National Aboriginal Community Controlled Health Organisation
NACOH	National Advisory Committee on Oral Health
NHC	Nganampa Health Council
NSW	New South Wales
NT	Northern Territory
OECD	Organisation for Economic Co-operation and Development
ppm	parts per million (in reference to fluoride levels in water)
RRMA	Rural, Remote and Metropolitan Areas
SA	South Australia
SCATSIH	Standing Committee of Aboriginal and Torres Strait Islander Health
SDS	School Dental Service
SES	Socio-Economic Status
se	standard error
SEIFA	Socio-Economic Indices for Areas
SOKS	Save Our Kids Smiles (program)
SRDC	Strategic Research Development Committee

Symbols

n.a.	not available
%	percentage

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Summary

This publication provides a summary of Aboriginal and Torres Strait Islander child oral health using information collected from three data sources: the Child Dental Health Survey, the Aboriginal and Torres Strait Islander Children and Receipt of Hospital Dental Care Investigation and the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities. The main points of interest are as follows:

- A higher percentage of Aboriginal and Torres Strait Islander children had experienced dental caries than other Australian children at all ages between 4 and 14 years.
- Throughout the states and territories observed, Aboriginal and Torres Strait Islander children had consistently higher levels of dental caries (decay) in the deciduous and permanent dentition than their non-Aboriginal and Torres Strait Islander counterparts.
- Aboriginal and Torres Strait Islander children most affected were those in socially disadvantaged groups and those living in rural/remote areas.
- Trends in Aboriginal and Torres Strait Islander child caries prevalence indicate that dental caries levels are rising, particularly in the deciduous dentition.
- Aboriginal and Torres Strait Islander children aged <5 years had almost one and a half times the rate of hospitalisation for dental care as other Australian children.
- The rate of Aboriginal and Torres Strait Islander children receiving hospital dental care increased with increasing geographic remoteness.
- Less than 5% of remote Aboriginal and Torres Strait Islander pre-school children brush their teeth on a regular basis.
- Many young remote Aboriginal and Torres Strait Islander children experienced extensive destruction of their deciduous teeth.

1 Introduction

This chapter outlines the purpose and structure of this publication, *Oral health of Aboriginal and Torres Strait Islander children*.

1.1 Purpose

The purpose of this publication is to provide a summary of Aboriginal and Torres Strait Islander Australian child oral health. To achieve this, three data sources were analysed: the Child Dental Health Survey, the Aboriginal and Torres Strait Islander Children and Receipt of Hospital Dental Care Investigation, and the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities. The first study entailed analysis of data routinely collected for the Child Dental Health Survey (CDHS), a survey of the oral health status of school children enrolled in the School Dental Service (SDS) in each state and territory of Australia. Specific emphasis was on the differences between Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander child dental caries experience. The second investigation involved examination of hospital dental procedure data obtained from the Australian Institute of Health and Welfare (AIHW) National Hospital Morbidity Database, 2002–2003. Data were collected from public and private hospitals across all states and territories, and analysis compared the difference in hospital dental care received by Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children. The final study involved the aggregation of Aboriginal and Torres Strait Islander child oral health data obtained from remote communities in three states and territories, and comparison with those of national Australian and Aboriginal and Torres Strait Islander child populations respectively.

1.2 Structure

The publication is divided into five main chapters: Introduction, Background, Methods, Results and Discussion.

The background chapter (Chapter 2) describes a conceptual framework of Aboriginal and Torres Strait Islander child oral health, determinants of Aboriginal and Torres Strait Islander child oral health, general background characteristics of Aboriginal and Torres Strait Islander children and an overview of Aboriginal and Torres Strait Islander child oral health.

Chapter 3 outlines the methods used in the three investigations, with background information provided where appropriate.

Results of the studies are provided in Chapter 4. The general format is for univariate characteristics to be described followed by bivariate analysis. The latter is generally in the form of oral disease experience of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children in association with sociodemographic factors. Dental caries trends are described in the Child Dental Health Survey. In the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities, remote Aboriginal and Torres Strait Islander children's oral

disease experience is compared with national child oral disease levels and state/territory Aboriginal and Torres Strait Islander child oral health status respectively. A summary of findings for each data source is presented at the end of the chapter.

Chapter 5 presents comparisons with international data on Indigenous children from New Zealand, Canada and the United States of America.

Chapter 6 presents a discussion of findings from each data source, followed by a general discussion in line with principles of the conceptual framework outlined in the background chapter. Concluding remarks end the chapter.

2 Background

This chapter provides a conceptual framework for Aboriginal and Torres Strait Islander child oral health, explains the relevant child oral health determinants, provides general background characteristics of Aboriginal and Torres Strait Islander children, and concludes with an overview of Indigenous child oral health.

2.1 A conceptual framework for Aboriginal and Torres Strait Islander child oral health

Although at a microbiological level the causes of oral diseases have long been recognised (e.g. dental caries arising when bacteria, substrate, host and time are present in favourable amounts: Mitchell & Mitchell 1991), the concept of oral health being a product of environmental, cultural and social factors is relatively recent (Aleksejuniene et al. 2002; Gilbert et al. 2003; Hallett & O'Rourke 2003; Petersen 2003; Ylostalo et al. 2003). Such factors may be roughly grouped into 'determinants', 'interventions' and 'resources/systems' and are displayed in a conceptual framework presented in Figure 1. Aboriginal and Torres Strait Islander child oral health can thus be seen to reflect the performance of both the general and dental health systems, the Aboriginal and Torres Strait Islander child population and Australian society as a whole.

2.2 Oral health determinants of Aboriginal and Torres Strait Islander children

Oral health determinants are factors that influence the level of oral health in an individual (or population). Determinants that increase the risk of oral ill-health are called 'risk factors', while those that benefit oral health are known as 'protective factors' (ABS & AIHW 2005). Determinants help to both explain trends in oral health and predict why some groups have better or worse oral health than others.

Working from left to right in the 'determinants' section of the conceptual framework (Figure 1), general background factors are seen to determine the nature and degree of socioeconomic characteristics of Aboriginal and Torres Strait Islander children and their caregivers, and these characteristics may influence oral health behaviours such as dietary and self-care habits. These in turn may influence biomedical factors such as oral microflora and immune status, which may have oral health effects through other causal pathways. At all stages along the path the determinants interact with an individual's make-up, which is influenced by life-course factors, genetics, intergenerational factors and ageing. Factors within a box also interact and are highly related to each other. Although the general direction is shown in Figure 1, the reverse may also occur; for example, an individual's oral health may also affect their psychological well-being and general health.

2.3 General background of Aboriginal and Torres Strait Islander children

This section provides background information on Aboriginal and Torres Strait Islander children's culture, history, demography, living conditions and general health.

Culture

In Australia Indigenous people are those who identify as being of Aboriginal, Torres Strait Islander, or both Aboriginal and Torres Strait Islander origin. They live in a wide range of locations, speak many different languages and belong to hundreds of distinct descent groups. While this publication focuses on Indigenous children as a group, it is important to acknowledge this diversity. Culture alone does not influence oral health status, but it plays an important role when combined with other background factors and oral health determinants.

History

Prior to European settlement in 1788, Indigenous people lived for an estimated 50,000 years in all areas of the continent. In the three decades following colonisation, Indigenous numbers were reduced by 90% (Diamond 1997), largely due to introduced diseases. From the late 1830s remnants of Indigenous groups were moved onto reserves and missions, the majority of which were remotely located. During the 1900s separation was an official Government policy (separation was mainly of children who were of mixed Indigenous/non-Indigenous parents), and today many Indigenous people are unfamiliar with their origins (NHC 2001). This has resulted in disempowerment, poverty, depression and despair for many Indigenous people, large numbers of whom are dependent on the welfare system (Altman 2003).

The past half-century has been a period of immense change for Indigenous people living in remote communities in particular. As a group they were protected against some of the major effects of European settlement occurring in other regions because of their isolation. However, in the last 50 years they have had increasing contact with Government officials, missionaries, miners, farmers, tourists, and a money economy (Altman 2003). New systems of travel, communication and technology have been forced upon them, as have mandatory systems of employment, education, health and welfare services. Consistent with the problems faced by Indigenous groups in metropolitan centres, remote Indigenous people struggle to retain aspects of their own culture including language, values, relationships, beliefs and rituals (Edwards 1992). Addictions to introduced products such as alcohol, petrol and cigarettes have also contributed to the rapid unravelling of a delicate society that was able to survive for countless years on what today's standards describe as 'next to nothing' (Thomson 2003).

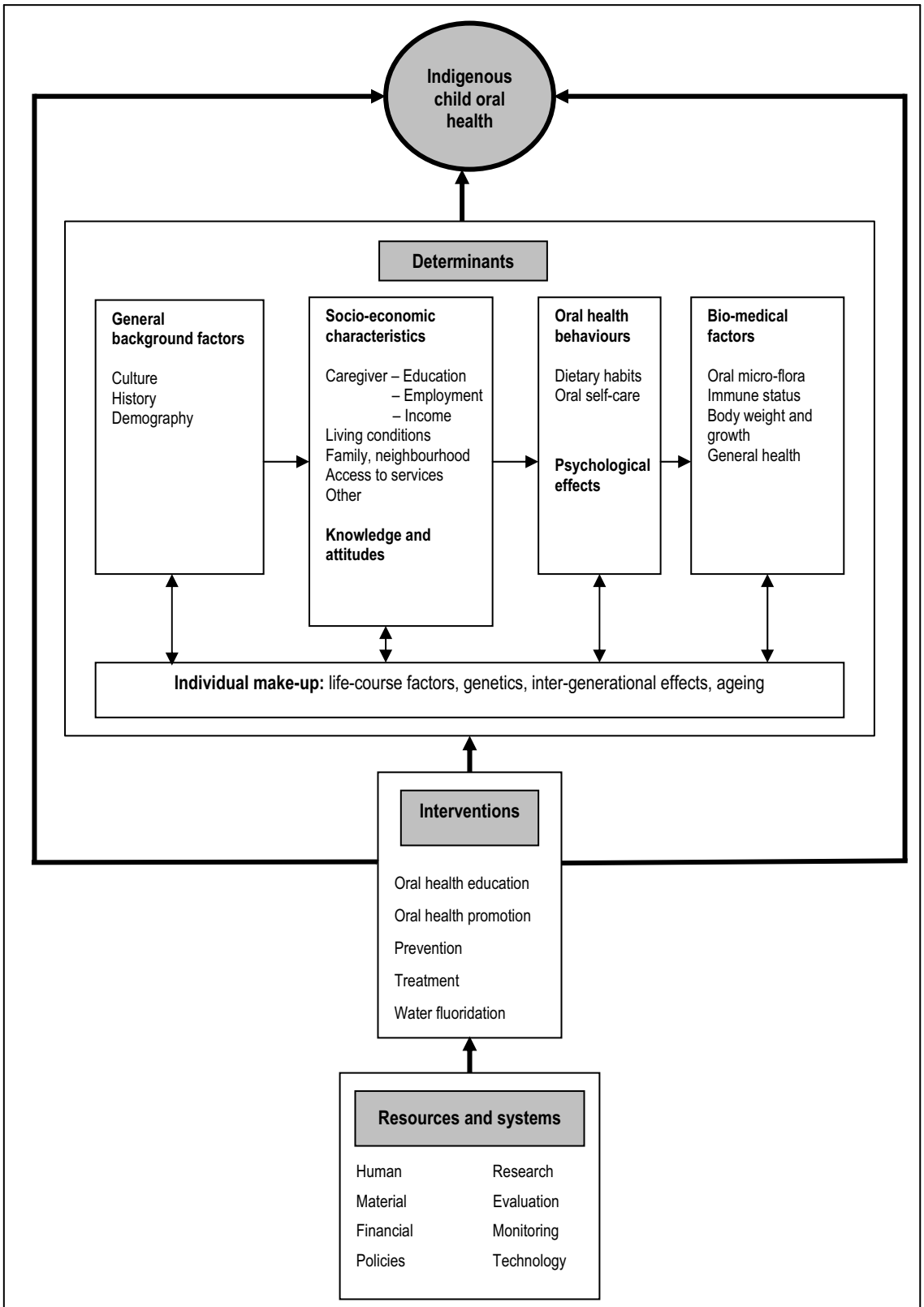


Figure 1: Conceptual framework for Indigenous child oral health (modified from AIHW 2004)

Demography

Aboriginal and Torres Strait Islander children (aged 0–19 years) represent 4.4% of the total child population (AIHW & ABS 2005). When this age group is analysed further, Aboriginal and Torres Strait Islander children are seen to represent 4.9%, 4.8%, 4.4% and 3.6% respectively of children aged 0–4 years, 5–9 years, 10–14 years and 15–19 years (AIHW & ABS 2005). One in four Indigenous children live in regions described as remote or very remote, compared with 2% of the non-Indigenous child population (AIHW & ABS 2005). As shown in Figure 2, over half the Indigenous child population in 2001 lived in New South Wales or Queensland, with a further 14% residing in Western Australia and 13% in the Northern Territory.

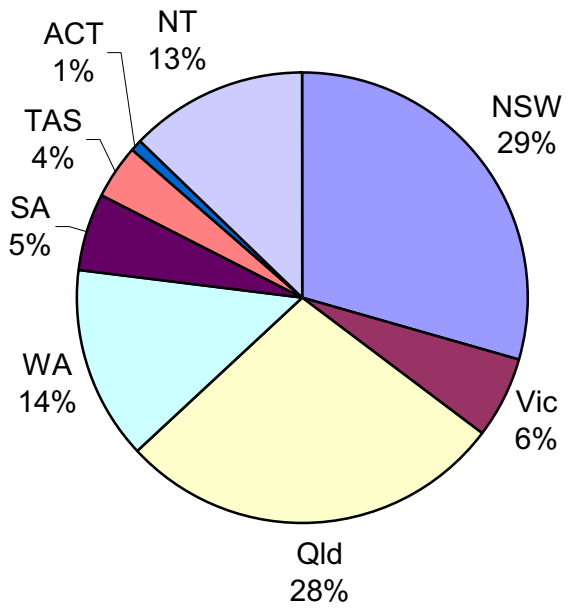


Figure 2: Geographic distribution of Indigenous children (ABS 2006)

Living conditions

In contrast with their non-Aboriginal and Torres Strait Islander counterparts, a large proportion of Aboriginal and Torres Strait Islander children live in housing conditions that do not satisfy the basic Australian standard requirement of shelter, safe drinking water and adequate sewerage provisions (AIHW forthcoming). Fifteen per cent of Indigenous households are overcrowded (need at least one extra bedroom), and 19% of housing require major repairs and 10% need to be replaced (AIHW forthcoming). Because some 83% (AIHW forthcoming) of Indigenous people living in remote locations are not connected to a town water supply, regular testing and treatment of their water is necessary. In the 2006 Community Housing and Infrastructure Needs Survey (CHINS), one-fifth of remote Indigenous communities had drinking water that had not been tested in 12 months, and one-quarter had drinking water that had failed testing at least once in the previous 12 months. A high proportion of remote Indigenous communities reported problems with wastewater and sewerage systems, in particular with 'ponding' (large pools of stagnant water collecting and remaining for more than a week; usually caused by blocked drains, sewerage overflows or leakage). Ponding had occurred more than five times in 2006 for 46% of CHINS sites (AIHW forthcoming).

General health

Aboriginal and Torres Strait Islander children are at higher risk of disease, injury and mortality than other Australian children, and more likely to be hospitalised for most diseases and conditions (ABS & AIHW 2005). Between 1999 and 2003, Indigenous child mortality rates were 2.4 times those of non-Aboriginal and Torres Strait Islander children (AIHW 2006). The reasons for Aboriginal and Torres Strait Islander children having, in general, poorer health and higher mortality rates than non-Aboriginal and Torres Strait Islander children are multifaceted. Aboriginal and Torres Strait Islander children are more likely to experience greater disability and reduced quality of life due to ill health. The Indigenous population is disadvantaged across a range of socioeconomic conditions that can affect health outcomes for children such a family, income and housing. In addition, risks to health such as smoking, obesity, alcohol misuse and exposure to violence are important determinants of health among Aboriginal and Torres Strait Islander children (AIHW 2006). They are also more than twice as likely to have been born underweight than other Australian children (ABS & AIHW 2005). Low birth weight babies are more prone to ill health during childhood, and more vulnerable to some diseases, such as kidney disease, in adulthood (Kuh & Ben-Shlomo 2002).

Remoteness is also recognised as a factor affecting Aboriginal and Torres Strait Islander child general health. Physical height and weight measures of Aboriginal and Torres Strait Islander children in remote areas fall far short of average urban Aboriginal and Torres Strait Islander children measures (Dugdale et al. 1994; Hitchcock et al. 1987; Mackerras et al. 2003). Levels of anaemia and other nutrient-deficient conditions among expecting mothers are higher in remote communities than in more populated areas (Gracey et al. 1996). Many Aboriginal and Torres Strait Islander children living in remote communities do not have access to a healthy diet (ABS & AIHW 2005). In areas where healthy food is available, competing priorities for limited family incomes, lack of nutritional knowledge by caregivers and lack of culturally appropriate information on healthy food often lead to dietary choices

that are not conducive to generating or maintaining health. Poor sanitary conditions such as ponding (described above) are also prevalent in remote communities and increase the risk of vector-borne diseases such as dengue fever.

2.4 Aboriginal and Torres Strait Islander child oral health

A brief description of Aboriginal and Torres Strait Islander child oral diseases is provided in this section, followed by an overview of Aboriginal and Torres Strait Islander child oral health investigations.

Oral disease description

Background information on oral diseases is provided, followed by a description of oral microflora.

Oral diseases – background

Oral diseases belong to 'multifactorial' conditions such as cancer, cardiovascular diseases and diabetes, in which many genetic, environmental and behavioural risk factors are known to interact (Fejerskov 2004; Hujoel et al. 1994). The most common diseases of the oral cavity—dental caries (decay) and periodontal (gum) disease—are affected by diet (Hornick 2002; Petersen et al. 2004). Dental caries is regarded as a 'sugar-dependent infectious disease' (Mitchell & Mitchell 1991), while periodontal disease often reflects underlying nutritional deficiencies (Lowe et al. 2003). Both may lead to pain, tooth loss, difficulties with eating, problems with speech, infections that spread to other areas of the body and lowered self-esteem due to poor aesthetics (Low et al. 1999). The consequences of childhood oral diseases extend into adulthood, with caries and periodontitis in deciduous teeth being one of the best predictors of caries and periodontal disease in the permanent dentition (Greenwell et al. 1990; Oscarson et al. 2003; Seow et al. 1996). The impact of oral disease is also not confined to oral health, with a growing body of literature revealing that oral conditions also influence systemic health and quality of life (McGrath & Bedi 2002, 2003; Slade 2002; US Surgeon General 2000).

Oral microflora

The aetiological factors of dental caries include microorganisms, fermentable carbohydrates and a susceptible host (tooth surface). In children early colonisation with bacteria and frequent sucrose exposure creates an environment that encourages growth of microorganisms (predominantly mutans streptococci) in dental plaque (Seow 1998). Several studies indicate that children may acquire mutans streptococci at a time that coincides with the emergence of incisor teeth (about 1 year of age) (Seow 1998; Wan et al. 2003). By 15 months of age, up to 60% of children may be affected (Karn 1998). Children who are colonised with mutans streptococci at 2 years of age may be up to 3.5 times more likely to have caries than those not colonised at such an age (Kohler et al. 1988).

The principal aetiological factor in periodontal disease is plaque, which consists of a number of different microorganisms such as mutans streptococci in the early phases and more anaerobic organisms such as vibrios and spirochaetes as it ages (Mitchell & Mitchell 1991). *B. gingivalis* is associated with established periodontal disease in adults, while *Actinobacillus actinomycetemcomitans (Aa)* is recognised as the predominant microorganism in juvenile periodontitis. Periodontal disease progression is dependent upon host defence, the oral environment, organism pathogenicity and plaque maturity (Chestnutt & Gibson 1998). As outlined in the conceptual framework (Figure 1), host defence may be influenced by life-course factors, while a diet high in fermentable carbohydrates may alter the delicate microflora balance in the oral environment. Both host defence and diet may influence periodontal status.

Previous studies of Aboriginal and Torres Strait Islander child oral health

Prior to the 1980s Aboriginal and Torres Strait Islander children in Australia were recognised as having better oral health than their non-Aboriginal and Torres Strait Islander counterparts, although they were generally less well-off socioeconomically (Barrett 1953; Barrett & Williamson 1972; Kailis 1971a, 1971b). In recent times, however, Aboriginal and Torres Strait Islander children are recognised as having, on average, twice as much caries as other Australian children, with Aboriginal and Torres Strait Islander child dental caries levels in some communities being five times that of non-Aboriginal and Torres Strait Islander children (Bourke et al. 1999; Endean et al. 2004; Schamschula et al. 1980). In one remote community, more than 90% of child decayed, missing and filled tooth surfaces (dmfs) were found to be either decayed or missing surfaces, and less than 10% of tooth surfaces with experience of decay had been treated with a filling (Bourke et al. 1999).

3 Methods

This chapter outlines the methods used in the Child Dental Health Survey, the Aboriginal and Torres Strait Islander Children and Receipt of Hospital Dental Care Investigation, and the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities respectively. Background information is provided where appropriate.

3.1 Child Dental Health Survey (CDHS)

A brief overview of the Child Dental Health Survey is provided, followed by methods used to obtain data.

Background

The Child Dental Health Survey is a national survey of the oral health status of school children enrolled in the SDS in each state and territory of Australia. Data are obtained each year from routine dental examinations conducted by non-calibrated dental health professionals within the SDS. Children are enrolled from both public and private schools. In New South Wales the SDS had previously adopted a targeted state-wide screening program entitled 'Save Our Kid's Smiles' (SOKS). Whereas SOKS involves screening children every 2 years from kindergarten to Year 8, other SDSs provide dental care principally to primary-school-aged children. This care typically 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 nature of services. As a consequence there are variations in the extent of enrolment in the SDS, with some jurisdictions serving more than 80% of primary school children and others serving lower percentages.

Methods

Methods are described in terms of sampling, weighting, time frame, area-based socioeconomic status and location indices.

Sampling

Children in the CDHS were sampled by a number of strategies, using systematic sampling based on selecting children with certain birth dates. Indigenous status is obtained for all children except those from Western Australia, Tasmania and the Australian Capital Territory because of incomplete 'Indigenous status' data collected in these jurisdictions. Although Queensland and Victoria collect information on Indigenous status, the small numbers of Aboriginal and Torres Strait Islander children sampled in Victoria and the poor compliance with collection of Indigenous status in Queensland meant that these states were unable to provide reliable statistics. For these reasons, analyses of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children were confined to collections from New South Wales (NSW), South Australia (SA) and the Northern Territory (NT) only. It is important to note that there was no service provision for pre-school children for SA and the NT.

Children in this age group who presented to the SDS were those who were likely to have had a problem, and were potentially not a true representation of the total pre-school population.

Weighting

Data within SA and the NT were weighted on the basis of 'area of sampling' and 'sampling fraction' to provide a more representative estimate for that state or territory. Data within SA and the NT 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. So that estimates might more accurately reflect the child population of each respective state and territory in the year that data were captured, all data were weighted using the child estimated resident population (ERP) estimates of the appropriate year provided by the Australian Bureau of Statistics. The weighted estimates are thus representative of the ERP of the three states and territories.

Time frame

Indices of caries experience were calculated from data collected over a 12-month period. Data from NSW were obtained from 2000, while data from SA and the NT were obtained from 2003 and 2002 respectively. Where children received more than one examination during this period, the information derived from examinations other than the first has been excluded.

Dental indices

Deciduous caries (decay) experience is recorded as the number of deciduous (baby or first) teeth that are decayed (d), missing because of dental caries (m) or filled because of dental caries (f), and is based on the coding scheme of Palmer et al. (1984). These are referred to as dmft.

Permanent caries experience is recorded as the number of permanent teeth that are decayed (D), missing because of dental caries (M) or filled because of dental caries (F), and is based on the World Health Organization protocol (WHO 1997). These are referred to as DMFT. An alternative measure to dmft or DMFT is dmfs or DMFS where the units counted are tooth surfaces rather than teeth.

The indices dmft and DMFT are clinical indicators of caries experience. Prevalence of dental caries is measured as the percentage of a population who have a dmft or DMFT score greater then 1. The reverse of this is also used where the percentage of persons without caries experience is recorded as dmft=0 or DMFT=0.

The mean dmft/DMFT is a second commonly used measure. If the mean DMFT for a population is 2, it indicates that for every 100 people there are 200 teeth with experience of dental caries.

The third measure utilizing dmft/DMFT scores is d/dmft or D/DMFT which measures the proportion of dental caries experience which is untreated and presents as decay.

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. Fissure sealants are a proven preventive measure for caries in the grooves and fissures of molar teeth.

Socioeconomic indices

The Socio-Economic Indices For Areas (SEIFA; ABS 2001) were used to determine socioeconomic relationships with oral disease experience. The indices were developed by the Australian Bureau of Statistics (ABS), and use data derived from the 2001 Census of Population and Housing. The indices use a range of measures to rank areas based on their relative social and economic well-being. For the purposes of this publication, the SEIFA Index of Disadvantage (category 2) was used. This index takes into account variables relating to income, educational attainment, unemployment and dwellings without motor vehicles. In particular it focuses on low-income earners, relatively lower educational attainment and high unemployment. In the figures, '1' denotes the most disadvantaged area and '5' denotes the least disadvantaged area.

Location indices

The Rural, Remote and Metropolitan Areas (RRMA) classification was used to determine dental caries experience associations with location. The classification is based on statistical local areas (SLA) and allocates each SLA in Australia to a category based primarily on population numbers and an index of remoteness. The classification was defined in 1994 by the then Commonwealth Departments of Primary Industry and Energy, and Human Services and Health, and is based on 1991 Census data.

The classifications defined in RRMA are presented in Table 1. For the purposes of this work, the 'rural' and 'remote' zones were combined to make up 'rural'.

Table 1: Structure of the Rural, Remote and Metropolitan Area (RRMA) classifications

Zone	Classification	Category
Metropolitan	1	Capital cities
	2	Other metropolitan centres (urban centre population >100,000)
Rural	3	Large rural centres with population 25,000–99,000
	4	Small rural centres with population 10,000–24,999
	5	Other rural areas with population <10,000
Remote	6	Remote centres with population >5,000
	7	Other remote areas with population <5,000

3.2 Aboriginal and Torres Strait Islander Children and Receipt of Hospital Dental Care Investigation

In this section background information on child hospital dental care is provided, followed by methods of how data for the study were obtained.

Background

There has been limited investigation of hospital dental care received by Aboriginal and Torres Strait Islander children at a national level in Australia. Tennant et al. (2000) reported that, in Western Australia, dental caries resulted in the fifth and sixth highest number of episodes of hospitalisation in pre-school- and primary-school-aged children respectively. Abnormal tooth eruption resulted in the highest number of episodes of hospitalisation in high-school-aged children, of which non-Aboriginal and Torres Strait Islander children were more than twice as likely to enter hospital than Aboriginal and Torres Strait Islander children. The authors noted that the rate of hospitalisation for Aboriginal and Torres Strait Islander children was more likely to reflect population and service delivery differences (particularly in regional and remote Western Australia) rather than a diminished burden of disease for such groups.

Methods

Methods for this study are described in terms of data collection, ICD-10-AM codes and location indices.

Data collection

To obtain an overview of hospital dental care received under a general anaesthetic by Aboriginal and Torres Strait Islander children in four jurisdictions, data on dental procedures received by children admitted to public and private hospitals in Queensland, Western Australia, South Australia and the Northern Territory were accessed from the AIHW National Hospital Morbidity Database for 2002–2003 (AIHW 2004). Only four jurisdictions were included due to the incomplete enumeration of 'Indigenous status' data in other states or territories (AIHW 2005). Data was collected by hospital-employed dentists and recorded in standardised ICD-10-AM codes (patient record codes used throughout Australian hospitals). Estimated resident population (ERP) counts of all sociodemographic stratification combinations (age by sex by Indigenous status by location) for 2002–2003 were also provided by AIHW.

ICD-10-AM codes

There were just over 80 ICD-10-AM dental procedure codes that, for purposes of the study, were grouped into 'extraction', 'pulpal care', 'restorative care' or 'other'. Sociodemographic information was also collected, and included patients' age, sex, Indigenous status and residential location. Age group was divided into four categories; less than 5 years, 5–9 years, 10–14 years and 15–19 years.

Location indices

As with the CDHS, the RRMA classification was used to determine oral health status associations with location. For the purposes of this section, the 'rural' and 'remote' zones were combined to make up 'rural'.

3.3 Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities

Background information on Aboriginal and Torres Strait Islander child oral health in remote communities is described in this section, followed by methods of how data for the study were obtained.

Background

The Indigenous proportion of the total population rises with increasing geographic remoteness, with 45% of the Indigenous child population residing in remote or very remote areas (ABS & AIHW 2005). Although anecdotal evidence suggests that remote Aboriginal and Torres Strait Islander children experience worse oral health than their urban counterparts (Australian Government Department of Health and Ageing 2003; NHC 2001), scientific evidence is limited. Endean et al. (2004) reported that children in the remote Anangu Pitjantjatjara lands (SA) had dental caries prevalence more than twice that of the Australian child average in the deciduous dentition. Over 90% of the child sample had gingivitis and over two-fifths (41.3%) had severe gingivitis. Tooth brushing at school was reported by 49% of children and 10% reported brushing at home. A comparison of caries experience between 1987 and 2000 in Anangu children is presented in Table 2. Dental caries experience in the primary and permanent dentition had increased across all age groups in the time period observed.

Table 2: Comparison of caries experience between 1987 and 2000 in Anangu children

Age (years)	Mean dmft 1987	Mean dmft 2000	Mean DMFT 1987	Mean DMFT 2000
0–4	1.44	1.61	n.a.	n.a.
5–9	2.00	2.85	0.11	0.27
10–14	0.40	0.81	0.85	1.03

Source: Endean et al. 2004.

Methods

Under a memorandum of understanding between the Far West Area Health Service (NSW), the remote Indigenous communities of Nganampa lands (SA), various remote communities around Alice Springs (NT) and the Australian Research Centre for Population Oral Health (ARCPOH), Aboriginal and Torres Strait Islander child oral health data were collected from remote Indigenous communities in all jurisdictions in the 2000–2003 period. Data were collected by dental health professionals providing services to these communities. (Due to issues of confidentiality, specific location details were unable to be included in the analysis.)

Data were gathered in terms of sociodemographic information (age, sex, Indigenous status), self-care habits (tooth brushing at home and school), dental caries experience, gingivitis and caries risk status, and fluorosis and hypoplasia levels.

Gingivitis was classified according to the Gingival Index of Loe and Silness (1963).

Risk status was defined as the likelihood of developing further disease in the foreseeable future, in the opinion of the examining dentist.

Hypoplasia (a malformation of dental enamel) was classified according to written criteria as mild, moderate or severe. Dental fluorosis (an enamel defect caused by excessive intake of fluoride during enamel formation) was classified according to Dean's criteria (1934) collapsed into four categories: normal, mild, moderate or severe.

4 Results

In this chapter findings of the Child Dental Health Survey, the Aboriginal and Torres Strait Islander Children and Receipt of Hospital Dental Care Investigation, and the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities are presented.

4.1 Child Dental Health Survey

Results of the Child Dental Health Survey are presented in terms of distribution and numbers of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children; and their caries experience, gingival oral health, treatment need, socioeconomic associations, location and dental caries trends. Counts of children from NSW, SA and the NT have been merged in this section; for state/territory-specific analyses, refer to Appendix A.

Number of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children

Data from a total of 341,195 children were included in the analyses: 11,017 (3.2%) Aboriginal and Torres Strait Islander and 330,178 (96.8%) non-Aboriginal and Torres Strait Islander. The numbers of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children by age are presented in Table 3. The highest proportion of Aboriginal and Torres Strait Islander children was observed in the 3-year-old category (6.8%).

Table 3: Number of Indigenous and non-Indigenous children by age

Age	Indigenous n (%)	Non-Indigenous n (%)	Total n
2	34 (4.1)	786 (95.9)	820
3	192 (6.8)	2,650 (93.2)	2,842
4	539 (5.5)	9,261 (94.5)	9,800
5	1,308 (2.6)	49,752 (97.4)	51,060
6	924 (3.7)	23,786 (96.3)	24,710
7	1,411 (2.9)	48,057 (97.1)	49,468
8	1,106 (4.4)	24,010 (95.6)	25,116
9	1,379 (3.0)	44,807 (97.0)	46,186
10	1,056 (4.5)	22,499 (95.5)	23,555
11	1,298 (3.2)	39,388 (96.8)	40,686
12	752 (3.8)	18,904 (96.2)	19,656
13	506 (1.8)	27,197 (98.2)	27,703
14	238 (2.4)	9,864 (97.6)	10,102
15	115 (2.9)	3,838 (97.1)	3,953
16	87 (2.9)	2,945 (97.1)	3,032
17	55 (2.2)	2,432 (97.8)	2,487

Dental caries experience of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children

Percentage of children with experience of dental caries

The proportion of children with clinical caries experience in the deciduous dentition (dmft>0) increased from age 5 years (31.9%) to 8 years where 44.4% of children had a dmft>0 and then decreased to age 10 years as deciduous teeth were exfoliated.

At each year of age a higher percentage of Aboriginal and Torres Strait Islander children had clinical caries experience in the deciduous dentition than non-Aboriginal and Torres Strait Islander children. At age 6 years nearly double the percentage of Aboriginal and Torres Strait Islander children had clinical deciduous caries experience (72.0%) than non-Aboriginal and Torres Strait Islander children (37.7%).

Table 4: Percentage of 4–10-year-old children with dmft>0 by Indigenous status

Age	Indigenous n (%)	Non-Indigenous n (%)	Total n (%)
4	359 (66.6)	2,952 (31.9)	3,311 (33.8)
5	826 (63.1)	15,478 (31.1)	16,304 (31.9)
6	665 (72.0)	8,979 (37.7)	9,644 (39.0)
7	886 (62.8)	18,850 (39.2)	19,736 (39.9)
8	746 (67.5)	10,400 (43.3)	11,146 (44.4)
9	801 (58.1)	17,835 (39.8)	18,636 (40.3)
10	547 (51.8)	8,077 (35.9)	8,624 (36.6)

The proportion of children with caries experience in the permanent dentition increased with increasing age. In the permanent dentition the differences in the proportion with clinical caries experience between Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was less marked than in the deciduous dentition. However, at each age level a higher percentage of Aboriginal and Torres Strait Islander children had caries experience than non-Aboriginal and Torres Strait Islander children.

Table 5: Percentage of 6–17-year-olds with DMFT>0 by Indigenous status

Age	Indigenous n (%)	Non-Indigenous n (%)	Total n (%)
6	78 (8.4)	751 (3.2)	829 (3.4)
7	202 (14.3)	4,651 (9.7)	4,853 (9.8)
8	269 (24.3)	3,302 (13.8)	3,571 (14.2)
9	401 (29.1)	7,526 (16.8)	7,927 (17.2)
10	400 (37.9)	4,721 (21.0)	5,121 (21.7)
11	480 (37.0)	9,669 (24.5)	10,149 (24.9)
12	336 (44.7)	5,523 (29.2)	5,859 (29.8)
13	230 (45.5)	8,422 (31.0)	8,652 (31.2)
14	141 (59.2)	3,808 (38.6)	3,949 (39.1)
15	71 (61.7)	2,236 (58.3)	2,307 (58.4)
16	58 (66.7)	1,744 (59.2)	1,802 (59.4)
17	40 (72.7)	1,487 (61.1)	1,527 (61.4)

Mean deciduous caries experience

The mean number of decayed deciduous teeth for 4–10-year-olds is presented in Table 6. Across all ages the mean number of decayed teeth in Aboriginal and Torres Strait Islander children was far greater than for non-Aboriginal and Torres Strait Islander children. Four-year-old Aboriginal and Torres Strait Islander children had the highest levels of decay in the deciduous dentition, and this was 3.2 times that of non-Aboriginal and Torres Strait Islander 4-year-old children.

Table 6: Mean number of decayed deciduous teeth for 4–10-year-olds

Age	Indigenous mean (se)	Non-Indigenous mean (se)
4	2.77 (0.14)	0.87 (0.02)
5	2.49 (0.09)	0.72 (0.01)
6	2.38 (0.10)	0.72 (0.01)
7	1.77 (0.07)	0.64 (0.01)
8	1.65 (0.07)	0.60 (0.01)
9	1.10 (0.05)	0.47 (0.01)
10	0.82 (0.05)	0.36 (0.01)

The mean number of missing deciduous teeth due to decay for 4–10-year-olds is presented in Table 7. Across all ages the mean number of missing teeth in Aboriginal and Torres Strait Islander children was far greater than for non-Aboriginal and Torres Strait Islander children. Five-year-old Aboriginal and Torres Strait Islander children had the highest numbers of missing deciduous teeth, and this was 5.2 times that of their 5-year-old non-Aboriginal and Torres Strait Islander counterparts.

Table 7: Mean number of missing deciduous teeth for 4–10-year-olds

Age	Indigenous mean (se)	Non-Indigenous mean (se)
4	0.16 (0.04)	0.05 (0.01)
5	0.27 (0.04)	0.05 (0.00)
6	0.19 (0.03)	0.07 (0.00)
7	0.11 (0.02)	0.06 (0.00)
8	0.12 (0.02)	0.07 (0.00)
9	0.10 (0.02)	0.05 (0.00)
10	0.07 (0.01)	0.03 (0.00)

The mean number of filled deciduous teeth for 4–10-year-olds is presented in Table 8. Across all ages the mean number of filled teeth in Aboriginal and Torres Strait Islander children was considerably greater than for non-Aboriginal and Torres Strait Islander children. Aboriginal and Torres Strait Islander children aged 8 years had the highest number of filled teeth.

Table 8: Mean number of filled deciduous teeth for 4–10-year-olds

Age	Indigenous mean (se)	Non-Indigenous mean (se)
4	0.35 (0.06)	0.22 (0.01)
5	0.44 (0.04)	0.22 (0.00)
6	0.86 (0.06)	0.50 (0.01)
7	0.75 (0.04)	0.54 (0.01)
8	0.95 (0.05)	0.72 (0.01)
9	0.77 (0.04)	0.62 (0.01)
10	0.62 (0.04)	0.58 (0.01)

The mean number of decayed, missing and filled deciduous teeth (dmft) for 4–10-year-olds is presented in Table 9. Across all ages the mean dmft in Aboriginal and Torres Strait Islander children was greater than for non-Aboriginal and Torres Strait Islander children, with the difference being greatest in the younger age groups. In general, mean dmft scores were highest for Aboriginal and Torres Strait Islander children at about age 6 years, compared with an age of about 8 years for non-Aboriginal and Torres Strait Islander children. The highest mean dmft levels were observed among 6-year-old Aboriginal and Torres Strait Islander children, and this was 2.4 times the mean dmft of 6-year-old non-Aboriginal and Torres Strait Islander children.

Table 9: Mean number of decayed, missing and filled deciduous teeth for 4–10-year-olds

Age	Indigenous mean (se)	Non-Indigenous mean (se)
4	3.41 (0.16)	1.33 (0.03)
5	3.66 (0.12)	1.31 (0.01)
6	3.68 (0.12)	1.54 (0.02)
7	2.94 (0.09)	1.54 (0.01)
8	2.91 (0.09)	1.60 (0.02)
9	2.17 (0.07)	1.34 (0.01)
10	1.60 (0.07)	1.09 (0.01)

Mean permanent caries experience

The mean number of decayed permanent teeth for 6–15-year-olds is presented in Table 10. Across all ages the mean number of decayed teeth in Aboriginal and Torres Strait Islander children was far greater than for non-Aboriginal and Torres Strait Islander children. Fifteen-year-old Aboriginal and Torres Strait Islander children had the highest levels of decay, and this was 2.7 times the level of decay among similarly aged non-Aboriginal and Torres Strait Islander children.

Table 10: Mean number of decayed permanent teeth for 6–15-year-olds

Age	Indigenous mean (se)	Non-Indigenous mean (se)
6	0.12 (0.02)	0.04 (0.00)
7	0.21 (0.02)	0.12 (0.00)
8	0.35 (0.03)	0.15 (0.00)
9	0.38 (0.02)	0.16 (0.00)
10	0.56 (0.04)	0.18 (0.00)
11	0.53 (0.03)	0.22 (0.00)
12	0.70 (0.05)	0.28 (0.01)
13	0.90 (0.08)	0.32 (0.01)
14	1.04 (0.12)	0.43 (0.01)
15	1.54 (0.23)	0.58 (0.02)

The mean number of filled permanent teeth for 6–15-year-olds is presented in Table 11. Across all ages, except age 15 years, Aboriginal and Torres Strait Islander children had a greater mean number of filled teeth than non-Aboriginal and Torres Strait Islander children. The greatest relative difference in the number of filled teeth between Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children occurred in the 6-year-old age group, with Aboriginal and Torres Strait Islander children having twice the filled component of their non-Aboriginal and Torres Strait Islander counterparts. The mean number of missing permanent teeth for 6–15-year-olds is not presented as numbers were negligible.

Table 11: Mean number of filled permanent teeth for 6–15-year-olds by state/territory

Age	Indigenous mean (se)	Non-Indigenous mean (se)
6	0.02 (0.01)	0.01 (0.00)
7	0.04 (0.01)	0.03 (0.00)
8	0.09 (0.01)	0.08 (0.00)
9	0.15 (0.01)	0.13 (0.00)
10	0.25 (0.02)	0.20 (0.00)
11	0.28 (0.02)	0.24 (0.00)
12	0.42 (0.03)	0.34 (0.01)
13	0.42 (0.05)	0.38 (0.01)
14	0.71 (0.09)	0.56 (0.01)
15	0.96 (0.15)	1.12 (0.03)

The mean number of decayed, missing and filled permanent teeth (DMFT) for 6–15-year-olds is presented in Table 12. Across all ages, the mean DMFT of Aboriginal and Torres Strait Islander children was greater than for non-Aboriginal and Torres Strait Islander children. Fifteen-year-old Aboriginal and Torres Strait Islander children had the highest mean DMFT, and this was 1.5 times the mean DMFT of their 15-year-old non-Aboriginal and Torres Strait Islander counterparts.

Table 12: Mean number of decayed, missing and filled permanent teeth for 6–15-year-olds

Age	Indigenous mean (se)	Non-Indigenous mean (se)
6	0.16 (0.02)	0.06 (0.00)
7	0.31 (0.02)	0.22 (0.00)
8	0.51 (0.03)	0.29 (0.01)
9	0.64 (0.03)	0.38 (0.00)
10	0.94 (0.05)	0.46 (0.01)
11	0.96 (0.05)	0.59 (0.01)
12	1.25 (0.07)	0.75 (0.01)
13	1.62 (0.12)	0.90 (0.01)
14	2.09 (0.19)	1.18 (0.02)
15	2.65 (0.29)	1.80 (0.04)

Mean fissure sealed permanent teeth

The mean number of fissure sealed permanent teeth for 6–15 year-olds is presented in Table 13. Across all ages, except ages 14 and 15 years, Aboriginal and Torres Strait Islander children had a higher mean number of fissure sealants than their non-Aboriginal and Torres Strait Islander counterparts. The highest mean number of fissure sealants was observed among non-Aboriginal and Torres Strait Islander 15-year-olds.

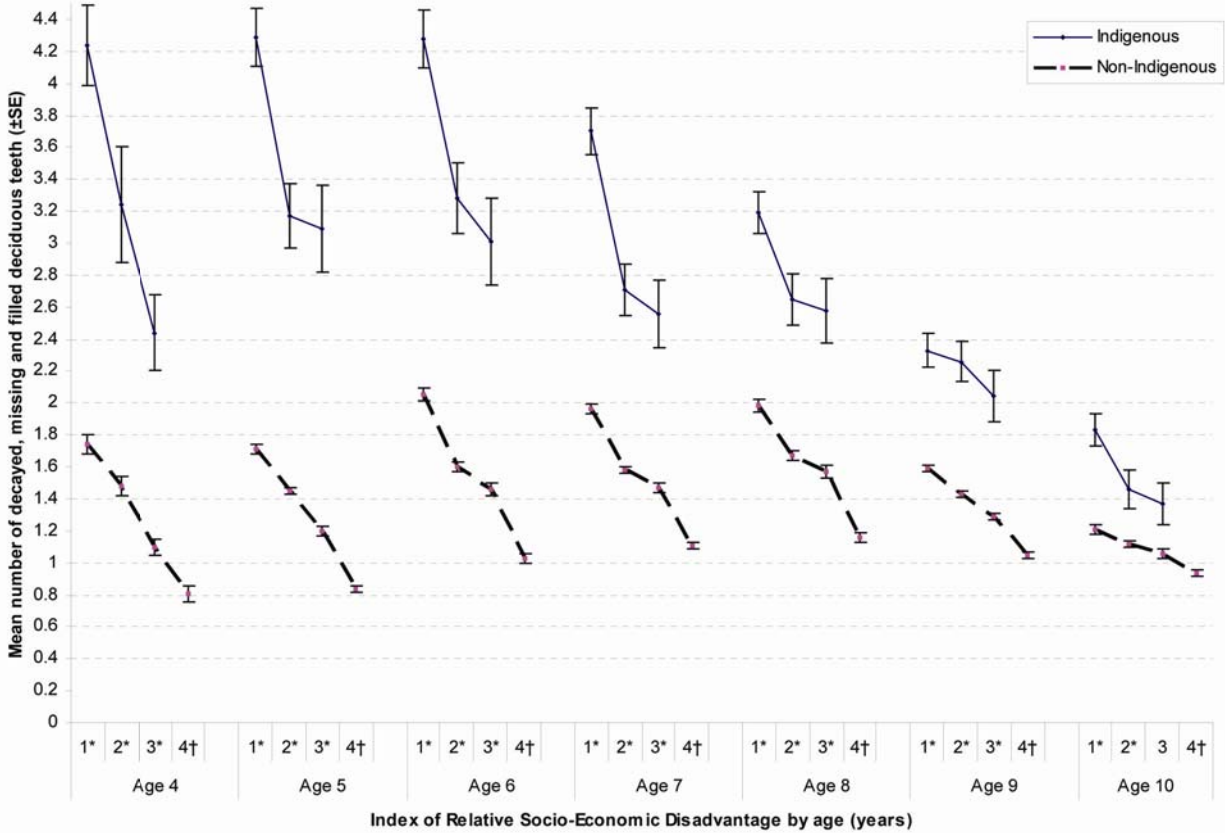
Table 13: Mean number of fissure sealed permanent teeth for 6–15-year-olds

Age	Indigenous mean (se)	Non-Indigenous mean (se)
6	0.06 (0.01)	0.03 (0.00)
7	0.22 (0.02)	0.16 (0.00)
8	0.48 (0.04)	0.34 (0.01)
9	0.70 (0.04)	0.54 (0.01)
10	0.74 (0.04)	0.63 (0.01)
11	0.84 (0.04)	0.69 (0.01)
12	1.02 (0.07)	0.74 (0.01)
13	0.93 (0.09)	0.68 (0.01)
14	0.90 (0.11)	0.94 (0.02)
15	1.33 (0.20)	1.49 (0.03)

Socioeconomic differences in the dental caries experience of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children

Deciduous teeth

The mean dmft of 4–10-year-old Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children by the SEIFA Index of Relative Disadvantage is presented in Figure 3. The numbers of Aboriginal and Torres Strait Islander children in the least disadvantaged category across each age group were too small to allow for robust statistical analysis, and were thus excluded. Aboriginal and Torres Strait Islander children across all age groups had higher mean dmft than non-Aboriginal and Torres Strait Islander children, and Aboriginal and Torres Strait Islander children in the most disadvantaged category had higher mean dmft than Aboriginal and Torres Strait Islander children who were less disadvantaged. Aboriginal and Torres Strait Islander children aged 4–6 years from disadvantaged areas had the highest mean dmft scores, and this was around 2.5 times the mean dmft of 4–6-year-old non-Aboriginal and Torres Strait Islander children from disadvantaged areas. The mean dmft difference among Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children decreased with increasing age, although across all age groups the mean dmft of Aboriginal and Torres Strait Islander children from the most advantaged areas was more than the mean dmft of non-Aboriginal and Torres Strait Islander children from the most disadvantaged areas. The mean dmft of non-Aboriginal and Torres Strait Islander children decreased with increasing social advantage across all age groups. The highest mean dmft level of non-Aboriginal and Torres Strait Islander children was observed among 6–8-year-olds.

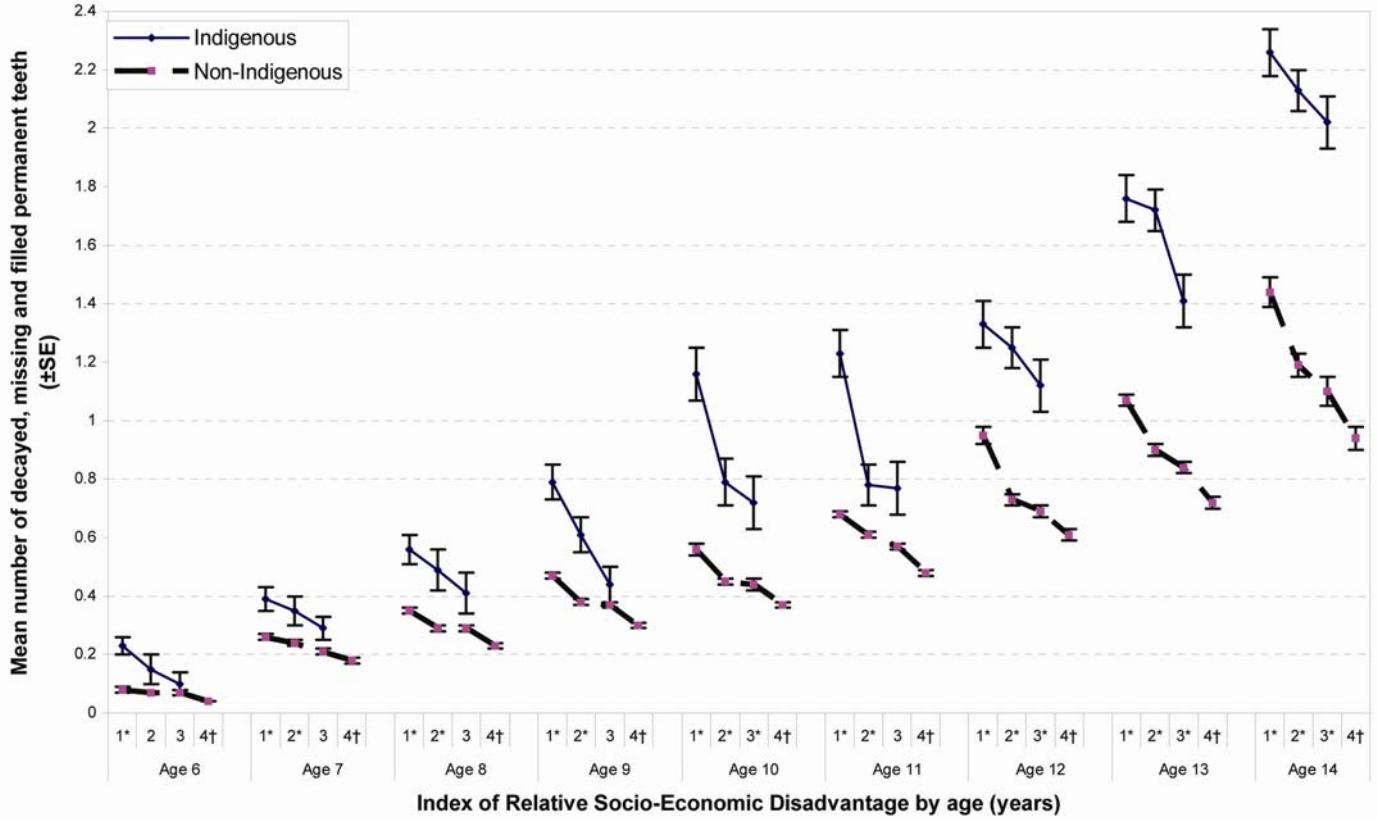


‡Where 1 = most socially disadvantaged and 4 = least socially disadvantaged
*P<0.05
†Estimates with a relative standard error >40% excluded

Figure 3: Mean dmft of 4–10-year-old children by SEIFA Index of Relative Socio-Economic Disadvantage‡

Permanent teeth

The mean DMFT of 6–14-year-old Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children by the SEIFA Index of Relative Disadvantage is presented in Figure 4. Due to small sample sizes, Aboriginal and Torres Strait Islander children in the least disadvantaged category were not included in the analyses. Across all age groups, Aboriginal and Torres Strait Islander children had higher mean DMFT than non-Aboriginal and Torres Strait Islander children and this difference increased with increasing age. Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children in the most disadvantaged SES category had higher mean DMFT than their counterparts in more advantaged categories across all age groups. The highest mean DMFT was observed among Aboriginal and Torres Strait Islander 14-year-olds in the most disadvantaged category and this was 1.6 times the mean DMFT of similarly disadvantaged non-Aboriginal and Torres Strait Islander 14-year-olds. The greatest relative mean DMFT difference among the most disadvantaged Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was observed among 10-year-olds (10-year-old Aboriginal and Torres Strait Islander children from the most disadvantaged areas had 2.1 times the mean DMFT of their non-Aboriginal and Torres Strait Islander counterparts). Across all age groups, except 9 years, Aboriginal and Torres Strait Islander children in the least disadvantaged categories had higher mean DMFT than the most disadvantaged non-Aboriginal and Torres Strait Islander children.



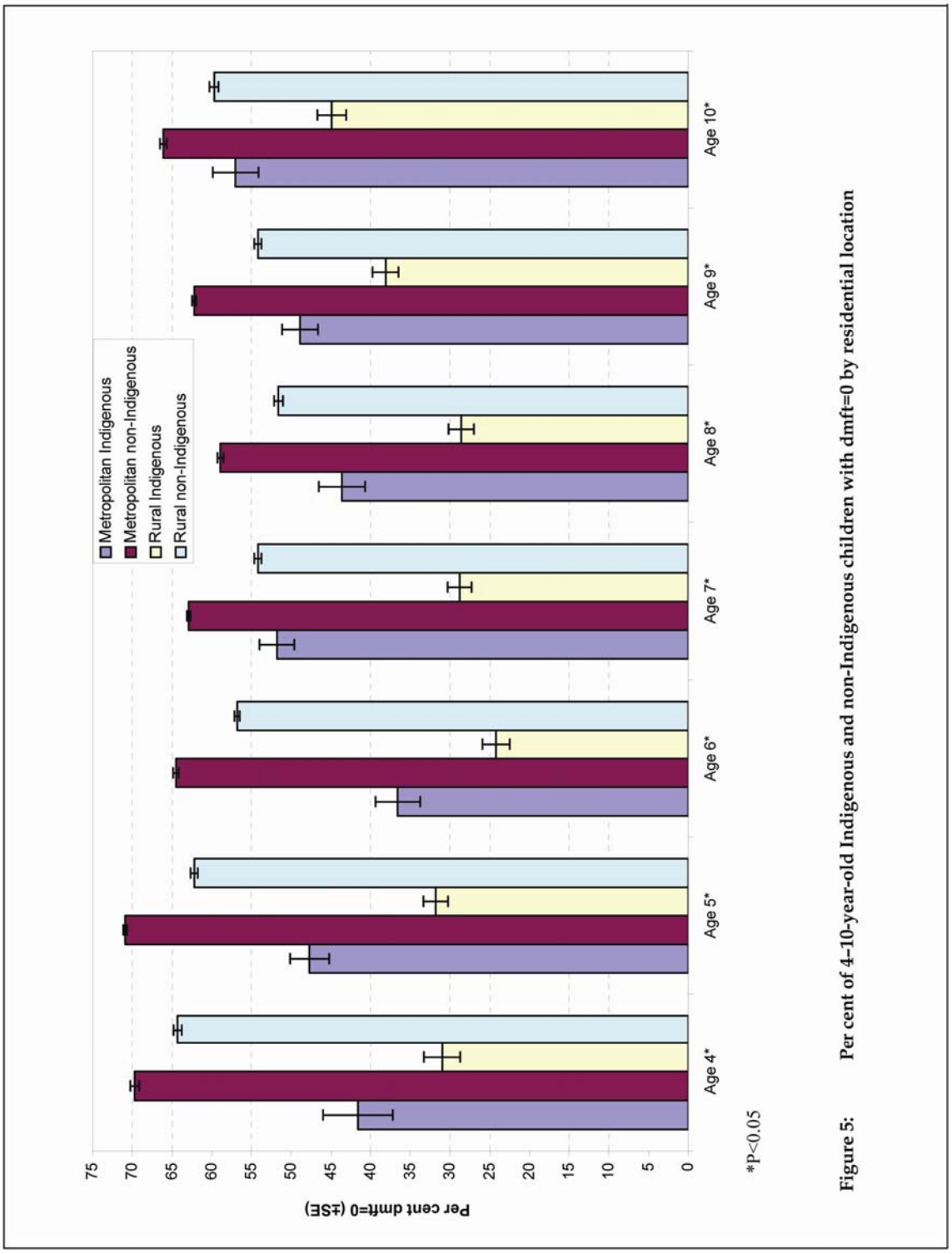
‡Where 1 = most socially disadvantaged and 4 = least socially disadvantaged
*P<0.05
†Estimates with a relative standard error >40% excluded

Figure 4: Mean DMFT of 6–14-year-old children by SEIFA Index of Relative Socio-Economic Disadvantage‡

Regional differences in the dental caries experience of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children

Deciduous teeth: dmft = 0

The percentage of 4–10-year-old children with no clinical caries experience (dmft=0) by residential location is presented in Figure 5. Across all age groups a higher proportion of metropolitan non-Aboriginal and Torres Strait Islander children had no evidence of dental caries experience in the deciduous dentition, followed by rural non-Aboriginal and Torres Strait Islander children, metropolitan Aboriginal and Torres Strait Islander children and rural Aboriginal and Torres Strait Islander children respectively. Metropolitan non-Aboriginal and Torres Strait Islander children aged 5 years had the highest percentage with no clinical caries experience, and this was 1.5 times that of similarly aged metropolitan Aboriginal and Torres Strait Islander children. The greatest difference in percentage of children with dmft=0 between rural Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was observed among 6-year-olds, with rural non-Aboriginal and Torres Strait Islander children in this age group having 2.3 times that of their rural Aboriginal and Torres Strait Islander counterparts.



*P<0.05

Figure 5: Per cent of 4–10-year-old Indigenous and non-Indigenous children with dmft=0 by residential location

Deciduous teeth: mean dmft

The mean dmft of 4–10-year-old Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children by residential location is presented in Figure 6. In all age groups rural Aboriginal and Torres Strait Islander children had the highest mean dmft levels, followed by metropolitan Aboriginal and Torres Strait Islander children, rural non-Aboriginal and Torres Strait Islander children and metropolitan non-Aboriginal and Torres Strait Islander children. Rural Aboriginal and Torres Strait Islander children aged 5–6 years had the highest mean dmft levels, and these were 2.5 and 2.3 times those of similarly aged rural non-Aboriginal and Torres Strait Islander children respectively. The greatest relative mean dmft difference between rural Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was observed among 4-year-olds, with 4-year-old rural Aboriginal and Torres Strait Islander children having 2.6 times the mean dmft of rural non-Aboriginal and Torres Strait Islander 4-year-olds. The mean dmft generally decreased with increasing age across Indigenous groups, with the trend being most marked among rural Aboriginal and Torres Strait Islander children.

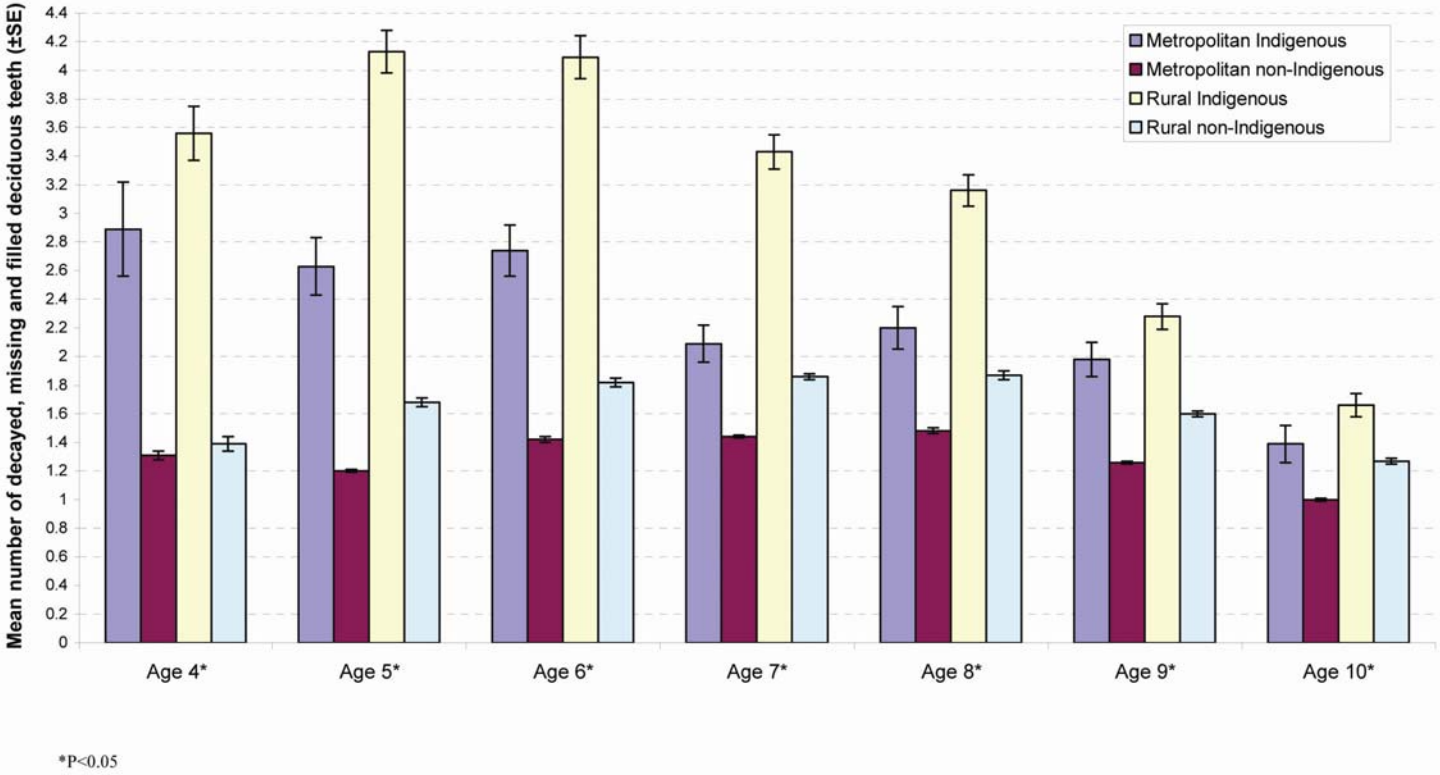
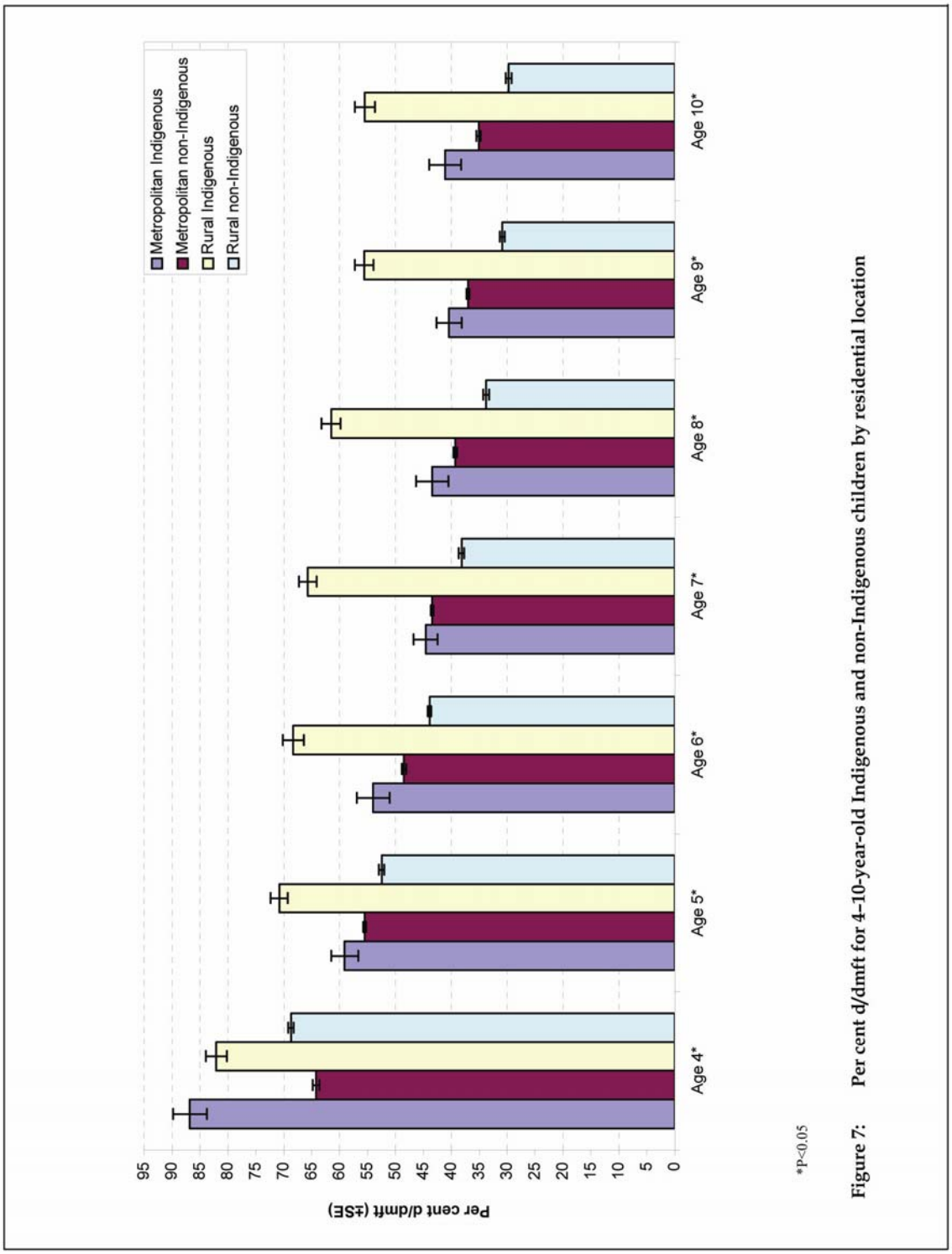


Figure 6: Mean dmft of 4–10-year-old Indigenous and non-Indigenous children by residential location

Deciduous teeth: per cent d/dmft

Aboriginal and Torres Strait Islander children had higher levels of untreated decay as a percentage of total caries experience than non-Aboriginal and Torres Strait Islander children across all age groups, with the difference between rural Aboriginal and Torres Strait Islander and rural non-Aboriginal and Torres Strait Islander children becoming more marked with increasing age (Figure 7). Across all age groups, with the exception of 4-year-olds, rural Aboriginal and Torres Strait Islander children had markedly higher per cent d/dmft than their metropolitan and non-Aboriginal and Torres Strait Islander counterparts. The highest per cent d/dmft in rural Aboriginal and Torres Strait Islander children was observed among 4-year-olds, and this was 1.2 times that of rural non-Aboriginal and Torres Strait Islander 4-year-olds. The greatest difference in per cent d/dmft between rural Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was observed among 10-year-olds, with rural Aboriginal and Torres Strait Islander children having 1.9 times the per cent d/dmft of rural non-Aboriginal and Torres Strait Islander children. The per cent d/dmft decreased with increasing age for all children.



*P<0.05

Figure 7: Per cent d/dmft for 4–10-year-old Indigenous and non-Indigenous children by residential location

Permanent teeth: DMFT = 0

Across all age groups the proportion of children with no evidence of dental caries experience in the permanent dentition was highest among metropolitan and rural non-Indigenous groups, followed by metropolitan Aboriginal and Torres Strait Islander children and rural Aboriginal and Torres Strait Islander children respectively (Figure 8). The highest proportion of children who were caries free in the permanent dentition were metropolitan and rural living non-Aboriginal and Torres Strait Islander children aged 6 years. The greatest per cent DMFT=0 difference between rural Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was observed among 14-year-olds, with rural non-Aboriginal and Torres Strait Islander children having 1.5 times the per cent DMFT=0 of rural Aboriginal and Torres Strait Islander children in this age group. The per cent DMFT=0 generally decreased with increasing age across Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander groups, with the trend being most marked among rural and metropolitan Aboriginal and Torres Strait Islander children.

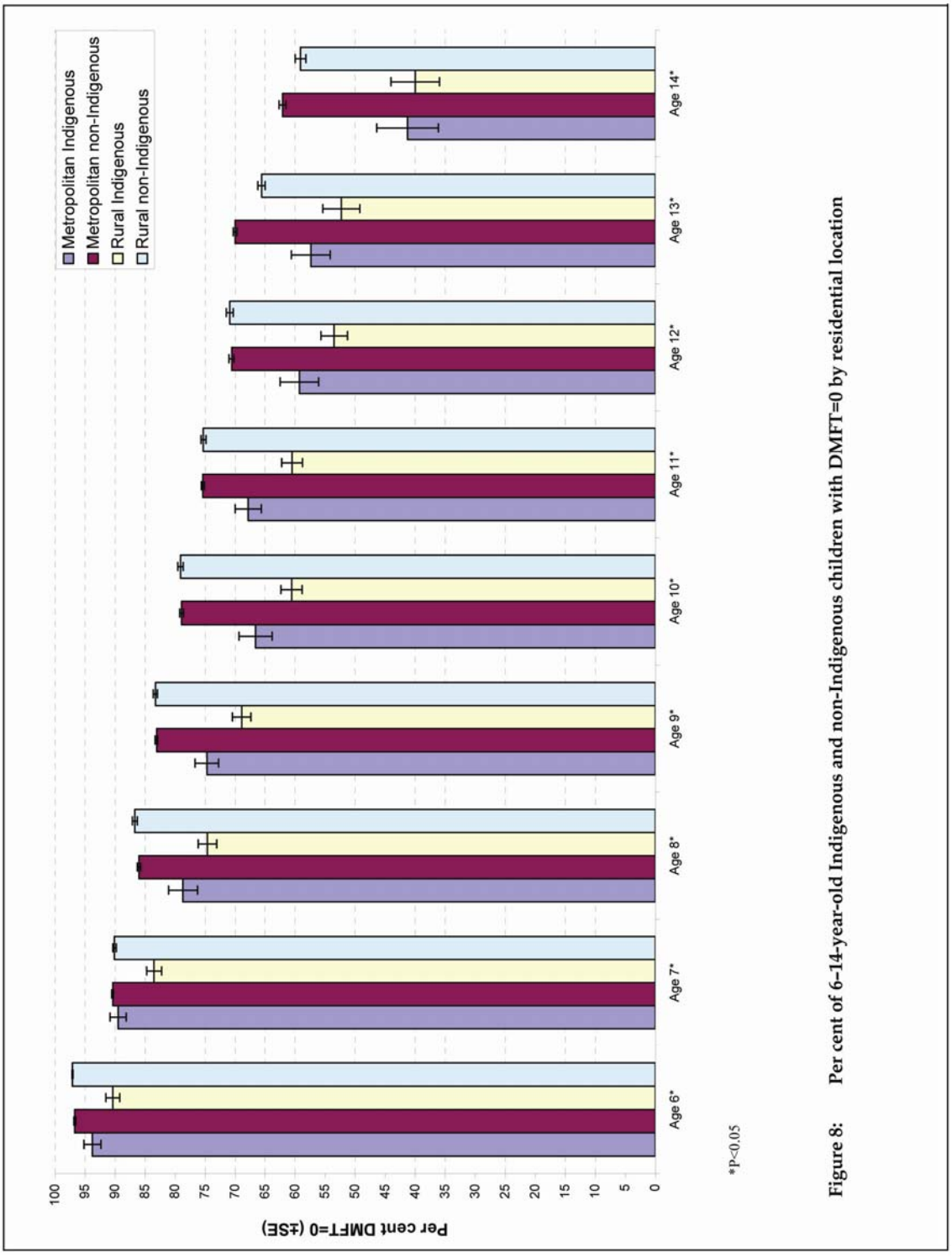
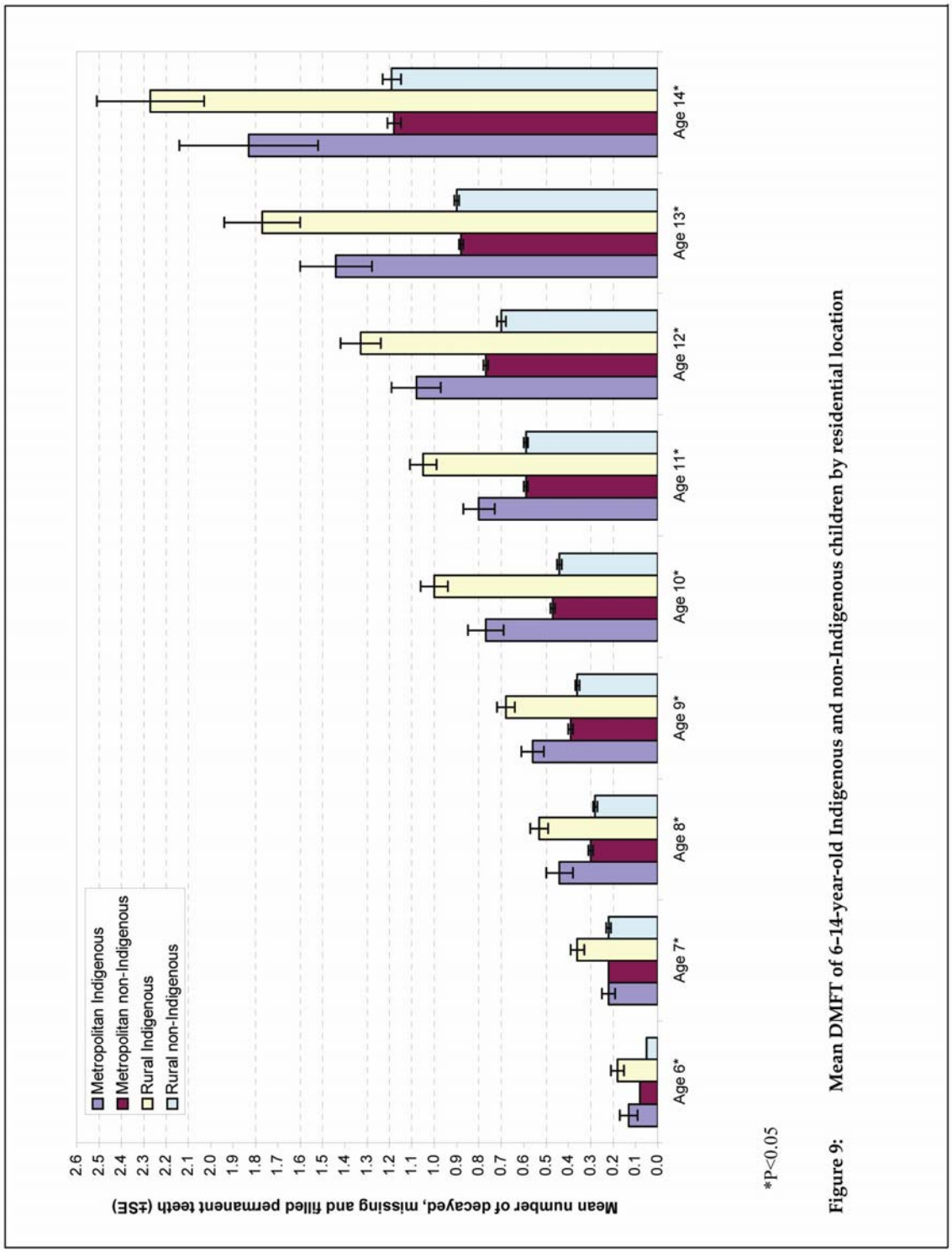


Figure 8: Per cent of 6–14-year-old Indigenous and non-Indigenous children with DMFT=0 by residential location

Permanent teeth: mean DMFT

The mean DMFT of 6–14-year-old Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children by residential location is presented in Figure 9. Aboriginal and Torres Strait Islander children had higher mean DMFT than non-Aboriginal and Torres Strait Islander children across all age groups except 7-year-old metropolitan children, with the difference becoming more marked with increasing age. Across all age groups rural Aboriginal and Torres Strait Islander children had greater mean DMFT than their metropolitan counterparts but rural and metropolitan non-Indigenous mean DMFT levels were relatively similar. The highest mean DMFT was observed among rural Aboriginal and Torres Strait Islander 14-year-olds, and this was 1.9 times that of rural non-Aboriginal and Torres Strait Islander 14-year-olds. The greatest relative mean DMFT difference between rural Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was observed among 6-year-olds, with 6-year-old rural Aboriginal and Torres Strait Islander children having 3.6 times the mean DMFT of rural non-Aboriginal and Torres Strait Islander 6-year-olds. The mean DMFT increased with increasing age for all children, with the steepest gradient occurring among rural Aboriginal and Torres Strait Islander children.

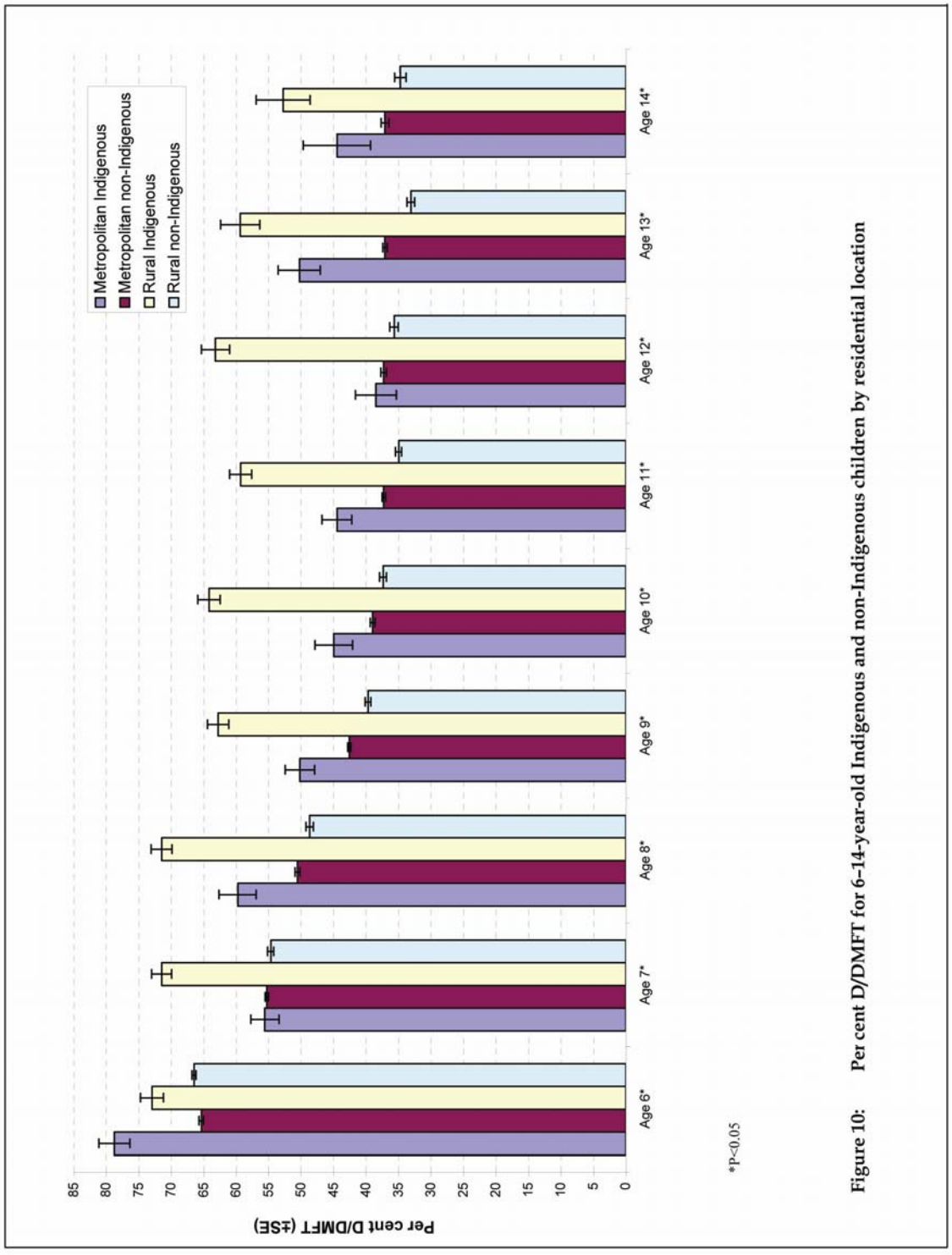


*P<0.05

Figure 9: Mean DMFT of 6–14-year-old Indigenous and non-Indigenous children by residential location

Permanent teeth: per cent D/DMFT

Aboriginal and Torres Strait Islander children across all ages except 7 and 12-year-olds had higher levels of untreated decay in the permanent dentition as expressed by per cent D/DMFT than non-Aboriginal and Torres Strait Islander children (Figure 10). Across all age groups, with the exception of 6-year-olds, rural Aboriginal and Torres Strait Islander children had higher per cent D/DMFT than their metropolitan counterparts. There were no significant differences between metropolitan and rural non-Indigenous per cent D/DMFT levels across all ages, except age 13 years (metropolitan non-Aboriginal and Torres Strait Islander children had slightly higher per cent D/DMFT levels than their rural counterparts). The highest proportion of unmet treatment need in the permanent dentition among rural Aboriginal and Torres Strait Islander children was observed among 6-year-olds. The greatest difference in per cent D/DMFT between rural Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was observed among 12- and 13-year-olds, with rural Aboriginal and Torres Strait Islander children in these age groups having 1.8 times the per cent D/DMFT of their similarly aged rural non-Aboriginal and Torres Strait Islander counterparts.



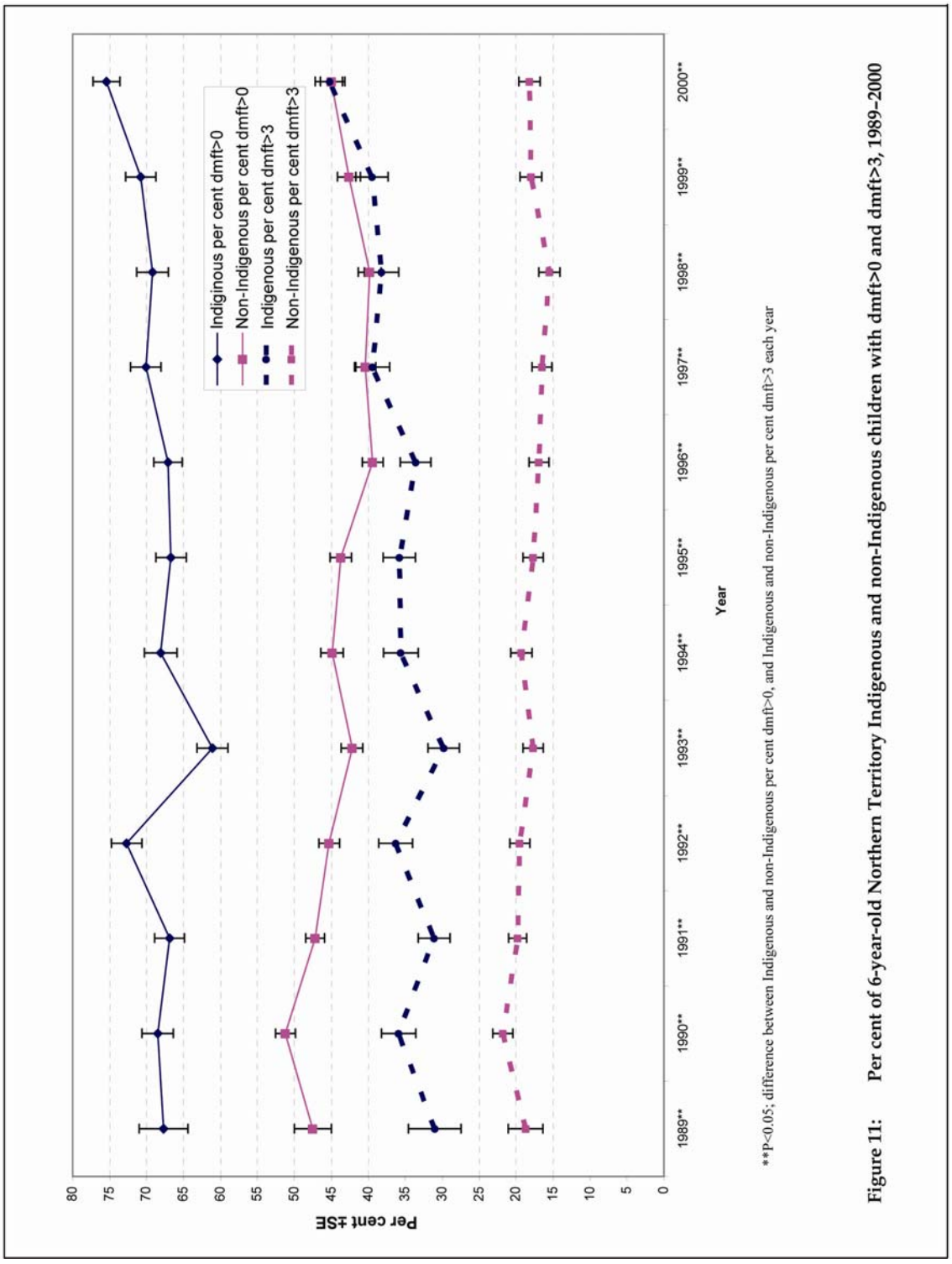
*P<0.05

Figure 10: Per cent D/DMFT for 6–14-year-old Indigenous and non-Indigenous children by residential location

Dental caries trends among Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children in the Northern Territory

Deciduous teeth: dmft>0 and dmft>3

The percentage of 6-year-old children with caries experience and with more than 3 teeth with caries experience for Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children in the NT from 1989–2000 are presented in Figure 11. Across all years the proportion of children with evidence of dental caries experience was greater among Aboriginal and Torres Strait Islander than non-Aboriginal and Torres Strait Islander children, with the differences increasing from 1994. From 1997–2000 the percentage of Aboriginal and Torres Strait Islander children with dmft>3 was more than double that of non-Aboriginal and Torres Strait Islander children. The greatest difference was observed in 2000, with the proportion of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children with dmft>0 being 75.4% and 45.0% respectively, and the proportion of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children with dmft>3 being 45.0% and 18.2% respectively. The proportion of Aboriginal and Torres Strait Islander children with deciduous caries experience increased between 1989 and 2000 (67.7% to 75.4%). The proportion of non-Aboriginal and Torres Strait Islander children with experience of dental caries decreased from 1989 to 2000 (47.5% to 45.0%), with a peak in 1990 (51.9%). The proportion of Aboriginal and Torres Strait Islander children with dmft>3 increased between 1989 and 2000 (32.3% to 45.0%), while in the same period the proportion of non-Aboriginal and Torres Strait Islander children with dmft>3 decreased (19.1% to 18.7%). The prevalence of dental caries in the deciduous dentition (both dmft>0 and dmft>3) of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children has been increasing since 1998.

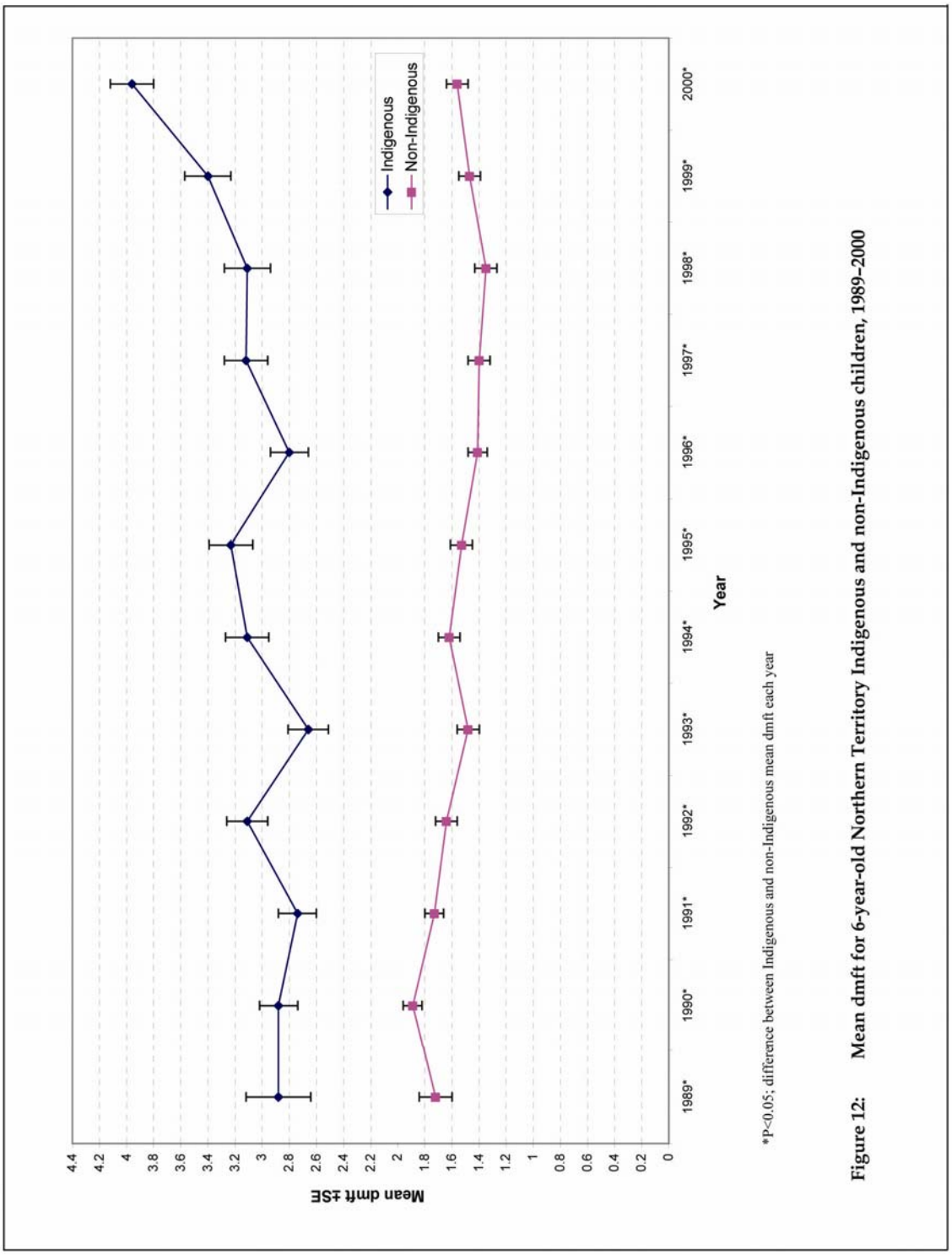


**P<0.05; difference between Indigenous and non-Indigenous per cent dmft>0, and Indigenous and non-Indigenous per cent dmft>3 each year

Figure 11: Per cent of 6-year-old Northern Territory Indigenous and non-Indigenous children with dmft>0 and dmft>3, 1989–2000

Deciduous teeth: mean dmft

Across all years the mean dmft of Aboriginal and Torres Strait Islander children was higher than that of non-Aboriginal and Torres Strait Islander children, with Aboriginal and Torres Strait Islander children having more than double the mean dmft of their non-Aboriginal and Torres Strait Islander counterparts across the period 1994–2000 (Figure 12). The mean dmft of Aboriginal and Torres Strait Islander children increased from 2.88 in 1989 to 3.96 in 2000, although slight decreases occurred from 1992 to 1993 and from 1995 to 1996. There has been an increase in mean dmft for Aboriginal and Torres Strait Islander children since 1998. The mean dmft of non-Aboriginal and Torres Strait Islander children was at its highest peak in 1990 (1.89) and lowest in 1998 (1.35). The mean dmft of non-Aboriginal and Torres Strait Islander children has been increasing since 1998 although not to the extent observed for Aboriginal and Torres Strait Islander children. The difference in mean dmft between Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was least in 1990 and greatest in 2000, and has been increasing since 1996.

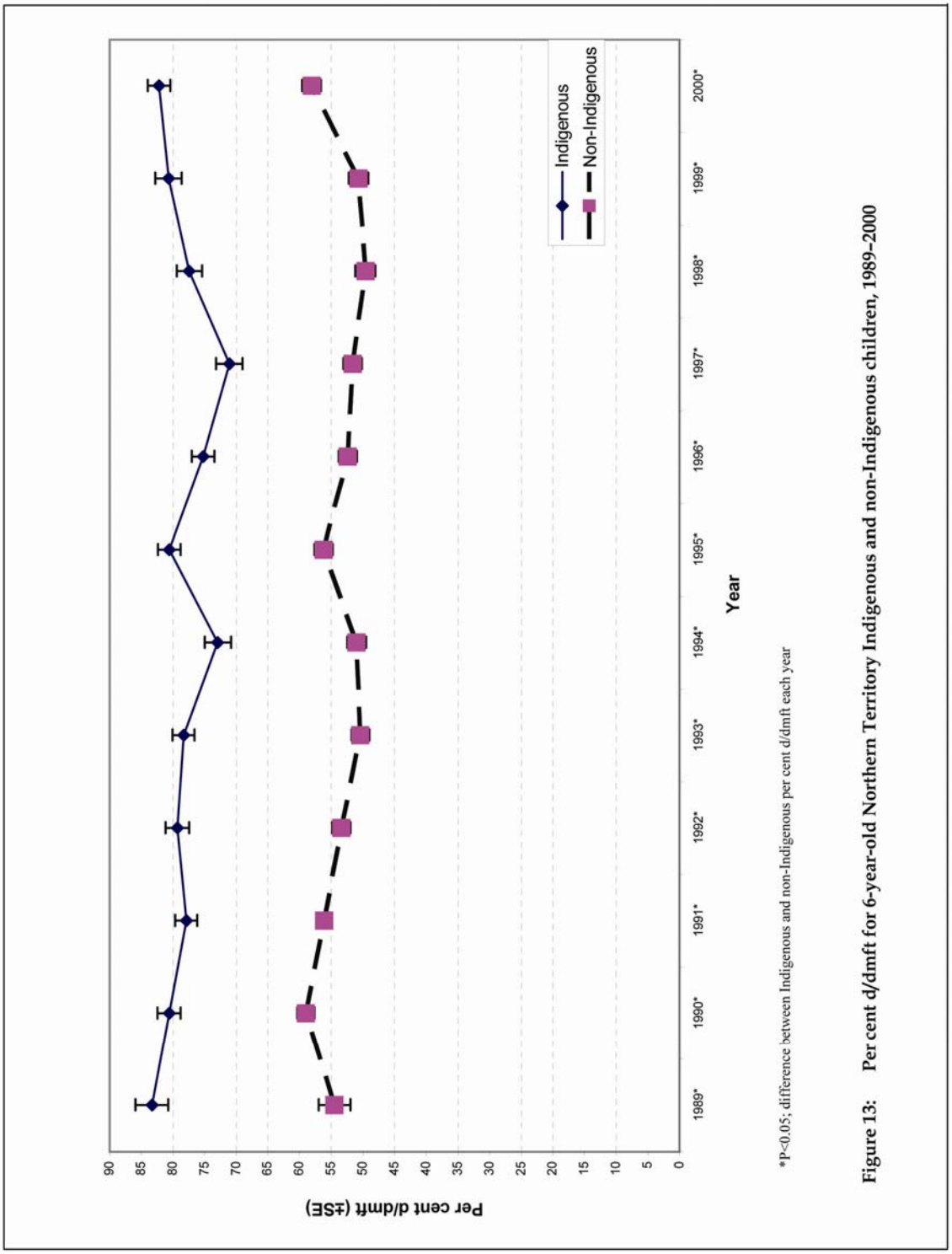


*P<0.05; difference between Indigenous and non-Indigenous mean dmft each year

Figure 12: Mean dmft for 6-year-old Northern Territory Indigenous and non-Indigenous children, 1989–2000

Deciduous teeth: d/dmft

Across all years the per cent d/dmft was higher for Aboriginal and Torres Strait Islander than non-Aboriginal and Torres Strait Islander children. The per cent d/dmft for Aboriginal and Torres Strait Islander children never dropped below 71% (1997) and never rose above 59% (1990) for non-Aboriginal and Torres Strait Islander children (Figure 13). There was no significant difference in per cent d/dmft for Aboriginal and Torres Strait Islander children between 1989 and 2000, although fluctuations did occur in the intervening years. The proportion of the decayed component in overall dmft has been increasing among Aboriginal and Torres Strait Islander children since 1997. The per cent d/dmft increased among non-Aboriginal and Torres Strait Islander children between 1989 and 2000, with the sharpest increase occurring from 1999 to 2000. The difference in per cent d/dmft between Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was least in 1990 and greatest in 1999.

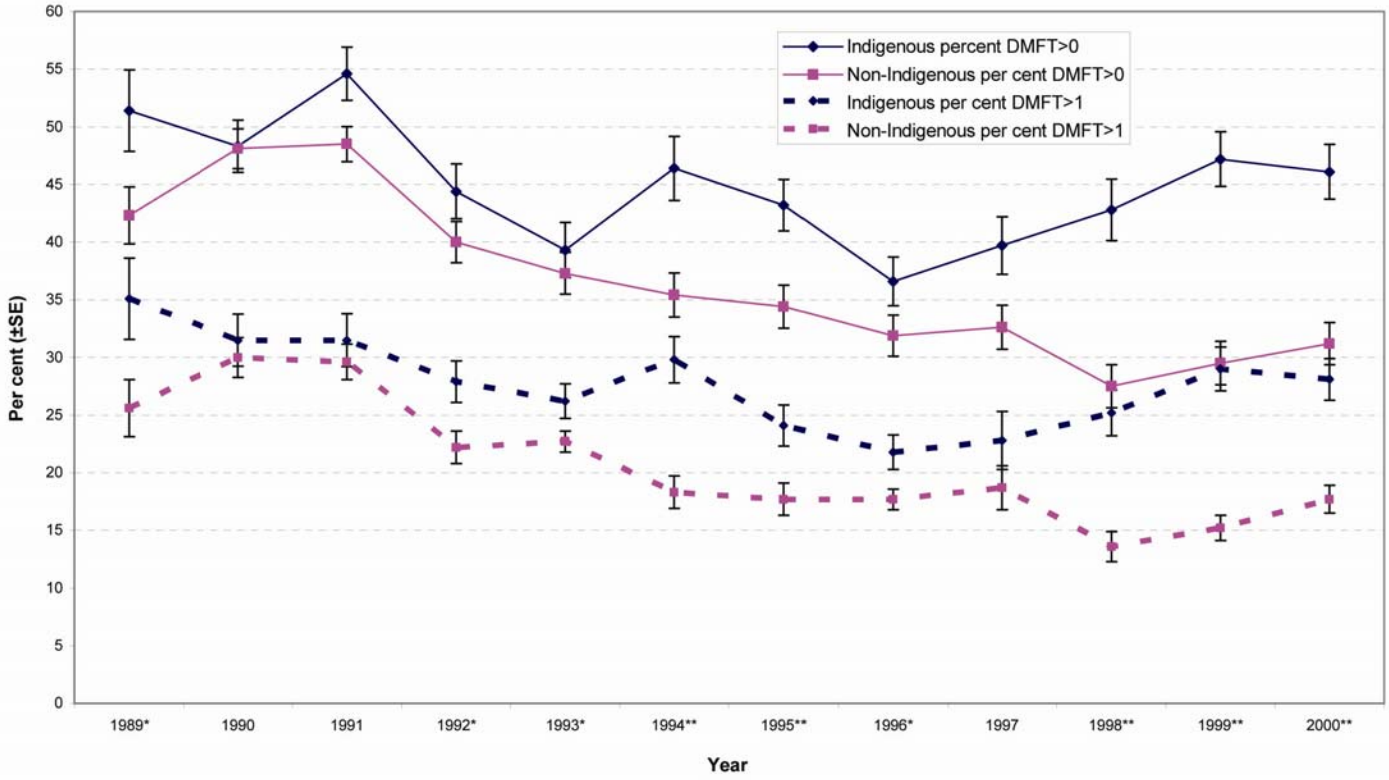


*P<0.05; difference between Indigenous and non-Indigenous per cent d/dmft each year

Figure 13: Per cent d/dmft for 6-year-old Northern Territory Indigenous and non-Indigenous children, 1989–2000

Permanent teeth: DMFT>0 and DMFT>1

Across all years except 1990 the proportion of children with evidence of dental caries experience in the permanent dentition was greater among Aboriginal and Torres Strait Islander than non-Aboriginal and Torres Strait Islander children (Figure 14). The greatest difference was observed in 1999, with the proportion of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children with DMFT>0 being 47.2% and 29.5% respectively, and the proportion of Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children with DMFT>1 being 29.6% and 15.1% respectively. The proportion of Aboriginal and Torres Strait Islander children with caries experience in the permanent dentition decreased between 1989 and 2000 (52.1% to 46.9%), as did the proportion of non-Aboriginal and Torres Strait Islander children with caries experience (43.1% to 32.2%). The proportion of both Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children with DMFT>1 decreased between 1989 and 2000 (35.0% to 27.5% for Aboriginal and Torres Strait Islander children and 25.2% to 17.8% for non-Aboriginal and Torres Strait Islander children). Since 1998 the trends in the proportion of children with DMFT>0 and DMFT>1 has been increasing for both Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children.

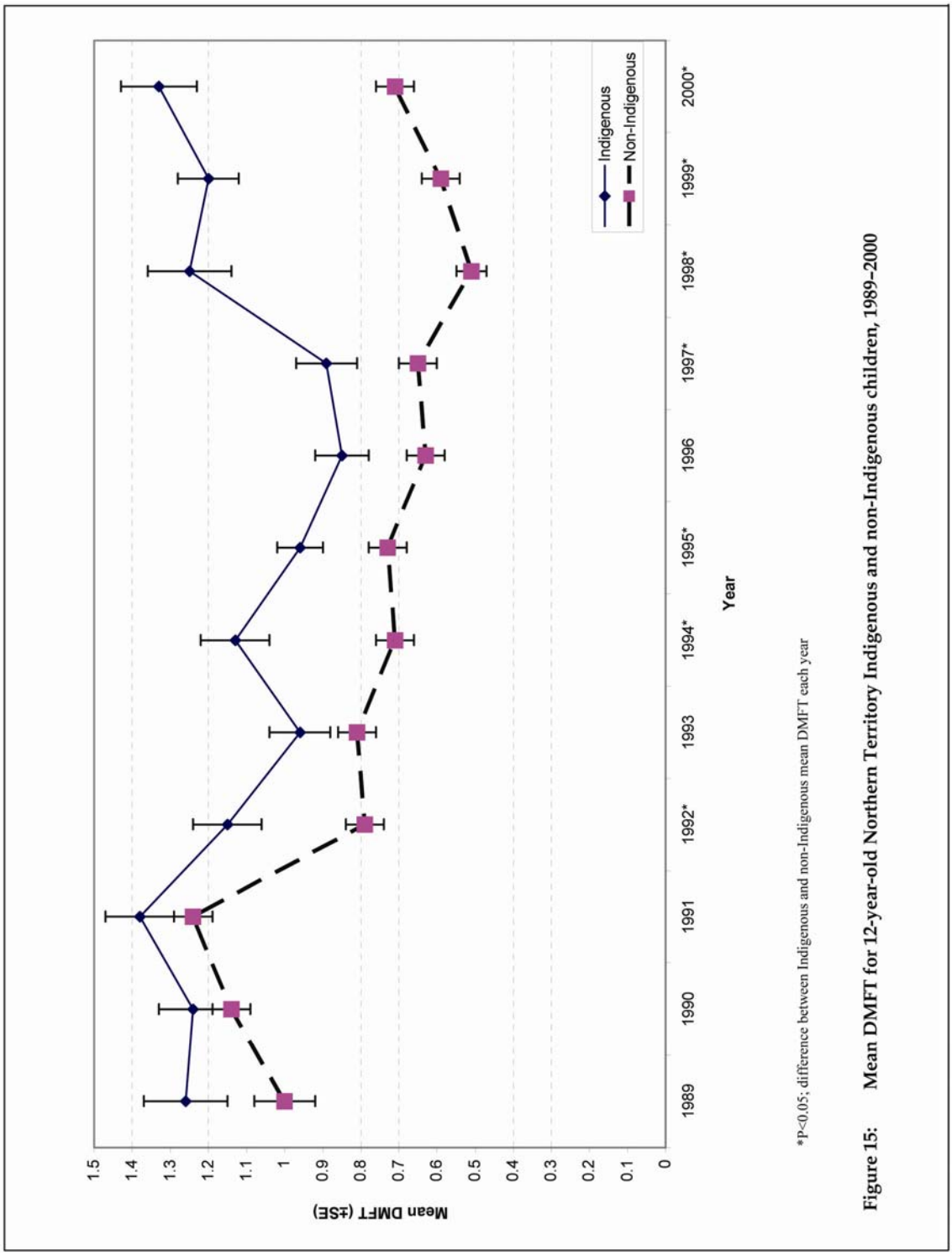


* P<0.05; difference between Indigenous and non-Indigenous per cent DMFT>1 each year
**P<0.05; difference between Indigenous and non-Indigenous per cent DMFT>0, and Indigenous and non-Indigenous per cent DMFT>1 each year

Figure 14: Per cent of 12-year-old Northern Territory Indigenous and non-Indigenous children with DMFT>0 and DMFT>1, 1989–2000

Permanent teeth: mean DMFT

The mean DMFT of Aboriginal and Torres Strait Islander children was higher across all years than for non-Aboriginal and Torres Strait Islander children, with the difference in mean DMFT between Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children being least in 1990 and largest in 1998 (Figure 15). In 1998 and 1999 the mean DMFT of Aboriginal and Torres Strait Islander children was over twice that of non-Aboriginal and Torres Strait Islander children. The mean DMFT of Aboriginal and Torres Strait Islander children in 1989 and 2000 were not significantly different although fluctuations occurred in the interim years; the lowest mean DMFT score was observed in 1996 (0.85) and the highest in 1991 (1.38). The mean DMFT of non-Aboriginal and Torres Strait Islander children decreased overall from 1989 to 2000, with the highest point occurring in 1991 (1.24) and the lowest point in 1998 (0.51). Since 1998 the mean DMFT for non-Aboriginal and Torres Strait Islander children has been increasing although it is still less than the values observed in 1989–91.

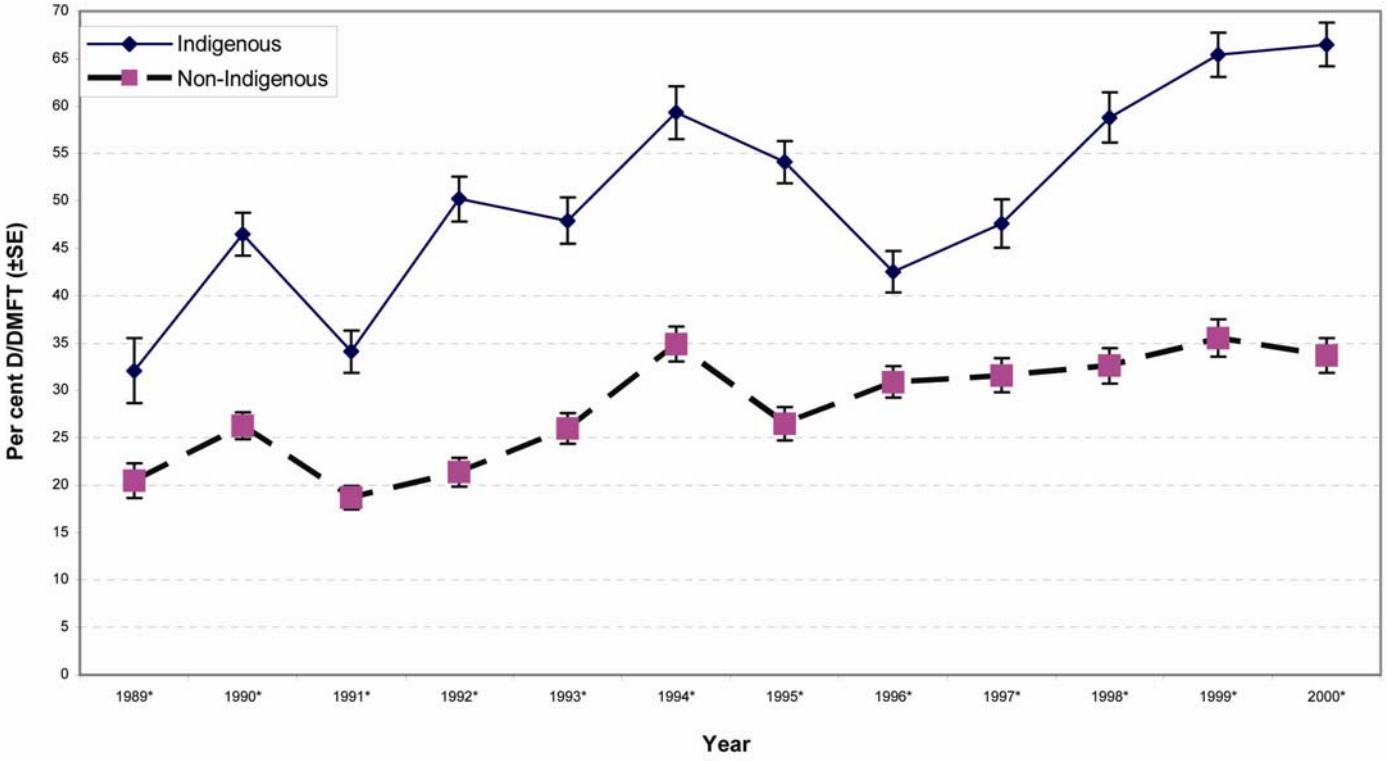


*P<0.05; difference between Indigenous and non-Indigenous mean DMFT each year

Figure 15: Mean DMFT for 12-year-old Northern Territory Indigenous and non-Indigenous children, 1989–2000

Permanent teeth: D/DMFT

Across all years the per cent D/DMFT was higher for Aboriginal and Torres Strait Islander children than for non-Aboriginal and Torres Strait Islander children, with the relative difference being most marked in 1992 (50.2% compared to 21.4% respectively; Figure 16). The difference was least marked in 1996. The lowest per cent D/DMFT for Aboriginal and Torres Strait Islander children was noted in 1989 (32.1%) and the highest in 2000 (66.5%). For non-Aboriginal and Torres Strait Islander children, the proportion of permanent decay in overall DMFT was highest in 1999 (35.5%) and lowest in 1991 (18.7%). The per cent D/DMFT was lower in 1989 than 2000 for both Indigenous and non-Indigenous groups. The proportion of the decayed component of the DMFT index for Aboriginal and Torres Strait Islander children has been increasing since 1996, but there has been little change in per cent D/DMFT among non-Aboriginal and Torres Strait Islander children since 1995.



*P<0.05; difference between Indigenous and non-Indigenous per cent D/DMFT each year

Figure 16: Per cent D/DMFT for 12-year-old Northern Territory Indigenous and non-Indigenous children, 1989–2000

4.2 Aboriginal and Torres Strait Islander Children and Receipt of Hospital Dental Care Investigation

Results are presented in terms of hospital population numbers, sociodemographic characteristics, and differences in Indigenous and other Australian hospital dental procedures (extraction, pulpal treatment, restoration or other) in relation to age group, sex and location. Findings are presented as proportions within the hospital sample, and as rate per 100,000 total population. Rate ratio is the Indigenous rate divided by the other Australian rate.

Hospital numbers

Hospital dental procedure data were obtained from 1,297 hospitals and included 24,874 children. All children had received care under a general anaesthetic.

Sociodemographic characteristics

Sociodemographic characteristics of children who received hospital dental care are presented in Table 14. The rate of males was 1.0 times the rate of females. The age group with the highest hospital rate was 5–9 years, and this was 1.5 times the rate of those aged 10–14 years. The rate of other Australian children was 1.1 times the rate of Aboriginal and Torres Strait Islander children. The highest rate of hospital dental care in terms of location was for those living in rural areas.

Table 14: Sociodemographic characteristics of children who received dental care in hospital

	Hospital population (%)	Rate per 100,000
Sex		
Male	12,599 (50.7)	616.3
Female	12,275 (49.3)	631.8
Age group		
<5 years	8,569 (34.4)	668.2
5–9 years	9,710 (39.0)	718.4
10–14 years	6,595 (26.5)	487.4
Indigenous status		
Indigenous	1,062 (4.3)	594.3
Other Australian	23,812 (95.7)	662.4
Location		
Metropolitan	14,843 (59.7)	588.3
Rural	10,030 (40.4)	759.7

Indigenous status and sex

Gender characteristics of Aboriginal and Torres Strait Islander and other Australian children who received hospital dental care are presented in Table 15. Hospital dental care rates were slightly higher for Indigenous than other Australian males, but the rate was slightly lower for Indigenous than other Australian females. For Aboriginal and Torres Strait Islander children hospital dental procedure rates were higher among males. Rates among other Australian children were higher among females, although the difference was less marked.

Table 15: Children who received hospital dental care by Indigenous status and sex

	Indigenous		Other Australian		
	Hospital population (%)	Rate per 100,000	Hospital population (%)	Rate per 100,000	Rate ratio (ref=other)
Male	589 (55.5)	641.8	12,010 (50.4)	587.5	**1.1**
Female	473 (44.5)	544.2	11,802 (49.6)	607.5	**0.9**

Indigenous status and age group

Age-group characteristics of Aboriginal and Torres Strait Islander and other Australian children who received hospital dental care are presented in Table 16. Aboriginal and Torres Strait Islander children aged <5 years had almost one and a half times the hospital dental procedure rate of similarly aged other Australian children. For all other age groups hospital dental procedure rates were lower for Aboriginal and Torres Strait Islander than other Australian children, with the difference decreasing with increasing age group. Among Aboriginal and Torres Strait Islander children, rates for hospital dental care decreased markedly with increasing age group, with Aboriginal and Torres Strait Islander children aged <5 years having over five times the hospital dental care rate of their 10–14-year-old counterparts. Differences in hospital dental care rates were not as pronounced among other Australian children, with 5–9-year-old children having the highest rate.

Table 16: Children who received hospital dental care by Indigenous status and age group

	Indigenous		Other Australian		
	Hospital population (%)	Rate per 100,000	Hospital population (%)	Rate per 100,000	Rate ratio (ref=other)
Age group					
<5 years	546 (51.4)	906.9	8,023 (33.7)	656.5	1.4
5–9 years	414 (39.0)	667.4	9,296 (39.0)	720.8	0.9
10–14 years	102 (9.6)	180.7	6,493 (27.3)	500.8	0.4

Indigenous status and location

Location characteristics of Aboriginal and Torres Strait Islander and other Australian children who received hospital dental care are presented in Table 17. Hospital dental rates for Aboriginal and Torres Strait Islander and other Australian children were the same in metropolitan areas and slightly higher among Aboriginal and Torres Strait Islander children in rural locations. Hospital dental rates increased with rising geographic remoteness for both Aboriginal and Torres Strait Islander and other Australian children, with rural rates being 1.4 times that of metropolitan rates for both Aboriginal and Torres Strait Islander and other Australian children.

Table 17: Children who received hospital dental care by Indigenous status and location

	Indigenous hospital dental care	Rate per 100,000	Other Australian hospital dental care	Rate per 100,000	Rate ratio (ref=other)
Location					
Metropolitan	287 (27.0)	426.0	14,556 (61.1)	434.3	1.0
Rural	775 (73.0)	591.7	9,255 (38.9)	587.1	1.0

Hospital dental care, sex and Indigenous status

Hospital dental procedure rates by sex and Indigenous status are presented in Table 18. Rates for extractions and restorations were higher for Indigenous males than other Australian males, while rates for pulpal and other treatment were lower. Similarly, Indigenous females had higher rates of extractions and restorative care than other Australian females, but lower rates of pulpal and restorative care. In comparison with Indigenous males, Indigenous females had lower rates for all dental procedures.

Table 18: Hospital dental procedure rates by sex and Indigenous status

	Male (rate per 100,000)			Female (rate per 100,000)		
	Indigenous	Other Australian	Rate ratio (ref=other)	Indigenous	Other Australian	Rate ratio (ref=other)
Extraction	601.5	450.5	**1.3**	520.0	470.5	**1.1**
Pulpal	59.9	88.2	**0.7**	52.9	83.0	**0.6**
Restoration	396.7	310.9	**1.3**	317.5	291.3	**1.1**
Other	91.5	129.9	**0.7**	58.7	117.3	**0.5**

Hospital dental care, age group and Indigenous status

Hospital dental procedure rates by age group and Indigenous status are presented in Table 19. Extraction rates for Aboriginal and Torres Strait Islander children aged <5 years were over double the rate of their counterparts among other Australians. With increasing age group the difference decreased, with Aboriginal and Torres Strait Islander and other Australian children aged 5–9 years having similar rates of extraction. However, other Australian 10–14-year-old children had almost three times the extraction rate on their Aboriginal and Torres Strait Islander counterparts. Across all age groups the rate of Aboriginal and Torres Strait Islander children who received pulpal or 'other' treatments was consistently lower than for other Australian children. Rates for restorations were higher among Aboriginal and Torres Strait Islander than other Australian children for the <5 years age group, and approximately equal for other age groups. For Aboriginal and Torres Strait Islander children extraction, pulpal treatment, restoration and other treatment rates were highest among children aged <5 years, and decreased markedly as age group increased. The same was true for other Australian children with the exception of extraction rates, with those in the 10–14 years age group having slightly higher rates than those in other age groups.

Table 19: Hospital dental procedure rates by age group and Indigenous status

	<5 years (rate per 100,000)			5–9 years (rate per 100,000)			10–14 years (rate per 100,000)		
	Indigenous	Other Aust.	Rate ratio (ref=other)	Indigenous	Other Aust.	Rate ratio (ref=other)	Indigenous	Other Aust.	Rate ratio (ref=other)
Extraction	865.4	409.3	**2.1**	628.7	556.1	**1.1**	164.7	476.4	**0.3**
Pulpal	99.7	142.8	**0.7**	62.9	120.7	**0.5**	5.3	8.9	**0.6**
Restoration	579.7	447.3	**1.3**	409.5	438.7	**0.9**	65.5	68.8	**1.0**
Other	129.6	208.8	**0.6**	85.4	173.6	**0.5**	7.1	11.0	**0.6**

Hospital dental care, location and Indigenous status

Hospital dental procedure rates by location and Indigenous status are presented in Table 20. Extraction rates among Aboriginal and Torres Strait Islander children were higher than for other Australian children in all areas, particularly rural locations (Aboriginal and Torres Strait Islander children in rural locations had 1.3 times the extraction rate of other Australian rural-living children). Across all locations rates for pulpal treatment and other care were lower for Aboriginal and Torres Strait Islander than for other Australian children. For restorative care, rates were similar in metropolitan areas for Aboriginal and Torres Strait Islander and other Australian children but were higher in rural locations for Aboriginal and Torres Strait Islander children. For both Aboriginal and Torres Strait Islander and other Australian children rates for all hospital dental procedures rose with increasing geographic remoteness, except for 'other care', which was highest among Aboriginal and Torres Strait Islander children living in a major city.

Table 20: Hospital dental procedure rates by location and Indigenous status

	Metropolitan (rate per 100,000)			Rural (rate per 100,000)		
	Indigenous	Other Australian	Rate ratio (ref=other)	Indigenous	Other Australian	Rate ratio (ref=other)
Extraction	498.6	445.6	**1.1**	738.4	567.5	**1.3**
Pulpal	58.3	100.6	**0.6**	79.2	105.8	**0.7**
Restoration	280.3	289.3	**1.0**	499.8	419.5	**1.2**
Other	122.3	150.3	**0.8**	76.6	148.9	**0.5**

4.3 Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities

Results are described in terms of sociodemographic, dental self-care characteristics and oral disease experience (caries experience, gingival oral health, hypoplasia and fluorosis). Comparisons are made with national child oral disease levels and state/territory Aboriginal and Torres Strait Islander child oral health status.

Sociodemographic and dental care characteristics

There were a total of 831 children in the sample, whose ages ranged from 2 to 16 years. All children were Aboriginal and Torres Strait Islander. Sociodemographic and dental care characteristics are presented in Table 21. The sample was equally distributed by sex. Almost half the children were aged 5–9 years, and nearly 44% were in the 10–14 years age group. Less than one-fifth brushed their teeth at school or at home.

Table 21: Sociodemographic and dental self-care characteristics of remote Indigenous children

	n (%)
Sex	
Male	418 (50.7)
Female	406 (49.3)
Age group	
<5 years	52 (6.4)
5–9 years	381 (46.9)
10–14 years	355 (43.7)
15–16 years	24 (3.0)
Brush teeth at school	**146 (17.6)**
Brush teeth at home	**164 (19.7)**
Don't brush teeth at school or home	**536 (78.2)**

Oral health status of remote Aboriginal and Torres Strait Islander children is presented in Table 22. Almost one-third were classified as 'high caries risk' and just over one-fifth were in the 'moderate' gingivitis risk group. Approximately one-quarter had 'moderate' hypoplasia on permanent teeth and nearly one-quarter had 'mild' fluorosis on permanent teeth. The mean dmfs was 4.03 while the mean DMFS was 1.06.

Table 22: Oral health status of remote Indigenous children

	n (%)
Caries risk status	
Low	366 (44.0)
Moderate	193 (23.2)
High	265 (31.9)
Gingivitis risk status	
Low	541 (65.1)
Moderate	171 (20.6)
High	56 (6.7)
Hypoplasia on permanent teeth	
None	92 (25.4)
Mild	127 (35.1)
Moderate	88 (24.3)
Severe	55 (15.2)
Fluorosis on permanent teeth	
None	120 (58.3)
Mild	50 (24.3)
Moderate	33 (16.0)
Severe	3 (1.5)
	Mean (sd)
dmfs	**4.03 (6.89)**
DMFS	**1.06 (2.47)**

Oral health status and tooth brushing behaviour by age group of remote Aboriginal and Torres Strait Islander children are presented in Table 23. Younger Aboriginal and Torres Strait Islander children had higher mean dmfs than those in older age groups (due to natural loss of deciduous teeth), while the opposite was true for mean DMFS (older children had higher levels than their younger counterparts). Less than 5% of children aged <5 years brushed their teeth at home, compared to almost one-quarter of those aged 10–14 years. Children aged 5–9 years had the greatest proportion at high caries risk, while those aged 15–16 years had the greatest percentage at high gingivitis risk. The prevalence of hypoplasia and fluorosis on permanent teeth was higher among children in the older age groups.

Table 23: Oral health status and tooth brushing behaviour by age group of remote Indigenous children

	Age group			
	<5 years	**5–9 years**	**10–14 years**	**15–16 years**
Mean dmfs (sd)[(a)]	3.69 (7.04)	6.27 (8.38)	1.99 (4.19)	0.08 (0.41)
Mean DMFS (sd)[(a)]	0.00 (0.00)	0.55 (1.37)	1.62 (3.16)	3.67 (4.07)
	n (%)	**n (%)**	**n (%)**	**n (%)**
Brush teeth at school	11 (21.2)	78 (20.5)	52 (14.6)	5 (20.8)
Brush teeth at home[(b)]	2 (3.8)	79 (20.7)	80 (22.5)	3 (12.5)
Caries risk status[(c)]				
Low	28 (53.8)	130 (34.1)	192 (54.1)	10 (41.7)
Moderate	5 (9.6)	98 (25.7)	76 (21.4)	8 (33.3)
High	19 (36.5)	150 (39.4)	84 (23.7)	6 (25.0)
Gingivitis risk status[(c)]				
Low	38 (73.1)	290 (76.1)	198 (55.8)	8 (33.3)
Moderate	3 (5.8)	56 (14.7)	97 (27.3)	10 (41.7)
High	0 (0.0)	10 (2.6)	39 (11.0)	6 (25.00)
Hypoplasia on permanent teeth[(b)]				
None	3 (100.0)	49 (26.1)	31 (20.0)	3 (42.9)
Mild	0 (0.0)	72 (38.3)	54 (34.8)	1 (14.3)
Moderate	0 (0.0)	45 (23.9)	42 (27.1)	1 (14.3)
Severe	0 (0.0)	22 (11.7)	28 (18.1)	2 (28.6)
Fluorosis on permanent teeth				
None	3 (100.0)	55 (61.8)	55 (54.5)	0 (0.0)
Mild	0 (0.0)	21 (23.6)	26 (25.7)	2 (40.0)
Moderate	0 (0.0)	11 (12.4)	19 (18.8)	3 (60.0)
Severe	0 (0.0)	2 (2.2)	1 (1.0)	0 (0.0)

(a) ANOVA P<0.001
(b) chi-square P<0.05
(c) chi-square P<0.001.

Remote Aboriginal and Torres Strait Islander child oral health and national child dental caries levels

The comparison of the remote Aboriginal and Torres Strait Islander child caries experience with that of SA, the NT and the total Australian child populations for 2000 is shown in Table 24. The dental caries experience in primary was greater for remote Aboriginal and Torres Strait Islander children, while the proportion of children with caries was greater for children living in remote Indigenous communities in both deciduous and permanent dentitions.

Table 24: Comparison of remote Indigenous child caries experience with that of SA, the NT and total Australian child populations

Population	Mean dmft (5–6 years)	% dmft>0	Mean DMFT (12 years old)	% DMFT>0
Remote Indigenous	2.94	69.0	0.92	43.6
SA	1.46	58.5	0.60	31.4
NT	2.26	47.6	0.97	37.5
Australia	1.56	59.1	0.84	35.1

Remote Aboriginal and Torres Strait Islander child oral health and state/territory Aboriginal and Torres Strait Islander child oral health status

Six-year-old children in the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities had higher mean dmft levels than their NSW counterparts in the Child Dental Health Survey, but lower levels than the NT and SA Aboriginal and Torres Strait Islander children (Table 25). Average DMFT levels for 12-year-old Aboriginal and Torres Strait Islander children were highest among those in the NT and lowest among those in NSW. A higher percentage of 6-year-old Aboriginal and Torres Strait Islander children in remote communities had caries experience in the deciduous dentition than children in the NSW and SA, while a higher percentage of 12-year-old Aboriginal and Torres Strait Islander children in remote locations had caries experience in the permanent dentition compared to their NSW and SA counterparts.

Table 25: Remote and state/territory caries experience of Indigenous children

Population	Mean dmft (6 years old)	% dmft>0	Mean DMFT (12 years old)	% DMFT>0
Remote Indigenous	2.94	69.0	0.92	43.6
NSW Indigenous	2.09	55.0	0.87	35.9
SA Indigenous	3.64	49.3	1.28	37.0
NT Indigenous	3.96	67.8	1.33	46.1

4.4 Study summaries

Key findings of the three investigations are summarised below.

Child Dental Health Survey

- A higher percentage of Aboriginal and Torres Strait Islander children had experienced dental caries than non-Aboriginal and Torres Strait Islander children at all ages between 4 and 15 years.
- The mean dmft of 6-year-old Aboriginal and Torres Strait Islander children was 2.4 times the mean dmft of their 6-year-old non-Aboriginal and Torres Strait Islander counterparts (3.7 compared with 1.5 respectively).
- The mean DMFT of 12-year-old Aboriginal and Torres Strait Islander children was 1.7 times the mean DMFT of their 12-year-old non-Aboriginal and Torres Strait Islander counterparts (1.3 compared with 1.8 respectively).
- Socially disadvantaged Aboriginal and Torres Strait Islander children experienced higher mean dmft and DMFT levels than non-Aboriginal and Torres Strait Islander children in the same socially disadvantaged categories. Aboriginal and Torres Strait Islander children aged 4–6 years had 2.5 times the mean dmft of their non-Aboriginal and Torres Strait Islander counterparts in the same disadvantage category, while Aboriginal and Torres Strait Islander children aged 10 years had 2.1 times the mean DMFT of their non-Aboriginal and Torres Strait Islander counterparts in the same disadvantage category.
- Irrespective of metropolitan or rural location, mean dmft and DMFT levels were higher among Aboriginal and Torres Strait Islander than non-Aboriginal and Torres Strait Islander children. Aboriginal and Torres Strait Islander children in rural locations had higher mean dmft and DMFT levels than Aboriginal and Torres Strait Islander urban children.
- Mean dmft, DMFT and untreated decay levels for 6- and 12-year-old Aboriginal and Torres Strait Islander children in the NT appear to be increasing at a higher rate than for their non-Aboriginal and Torres Strait Islander counterparts. Aboriginal and Torres Strait Islander children had the highest levels of dental decay in the permanent dentition in 2000, and this was twice the level noted for non-Aboriginal and Torres Strait Islander children.
- The proportion of caries-free Aboriginal and Torres Strait Islander children in the NT is declining.

Aboriginal and Torres Strait Islander Children and Receipt of Hospital Dental Care Investigation

- Aboriginal and Torres Strait Islander children aged <5 years had almost one and a half times the rate of receiving hospital dental care as non-Aboriginal and Torres Strait Islander children.
- Hospital dental procedure rates consistently increased for all children, particularly Aboriginal and Torres Strait Islander children, with increasing geographic remoteness.
- The rate ratio of extractions for <5-year-old Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander children was 2.1. In the 10–14 years age group the rate ratio was 0.3.
- Aboriginal and Torres Strait Islander children aged <5 years received lower rates of pulpal treatment (rate ratio 0.7) or other care (rate ratio 0.6), but higher rates of restorations (rate ratio 1.3), than their non-Aboriginal and Torres Strait Islander counterparts.
- Extraction rates for rural-living Aboriginal and Torres Strait Islander children were 1.3 times that of their rural-living non-Aboriginal and Torres Strait Islander counterparts.

Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities

- Less than one-fifth of children brushed their teeth at home (19.7%) or school (17.6%). Among pre-schoolers less than 5% brushed their teeth regularly.
- Gingivitis was evident in 60% of remote Aboriginal and Torres Strait Islander children.
- Approximately one-third of remote Aboriginal and Torres Strait Islander children were caries-free in the deciduous dentition, while one-half were caries-free in the permanent dentition.
- Almost one-third of children were classified as 'high' caries risk.
- Caries risk status was highest for those aged 5–9 years.
- Three-quarters of remote Aboriginal and Torres Strait Islander children experienced some form of hypoplasia on the permanent dentition.
- Over two-fifths of remote Aboriginal and Torres Strait Islander children had fluorosis to some degree on their permanent dentition.
- Mean dmft for remote Aboriginal and Torres Strait Islander 6-year-olds was 2.9 (compared to 2.1, 3.6 and 4.0 for Aboriginal and Torres Strait Islander children in NSW, SA and the NT respectively) and mean DMFT for 12-year-olds was 0.9 (compared to 0.9, 1.3 and 1.3 for Aboriginal and Torres Strait Islander children in NSW, SA and the NT respectively).

5 International comparisons

In this section the oral health of Māori children in New Zealand, First Nation children in Canada and Native American children in the United States of America are described. This is followed by international comparisons of children in other Organisation for Economic Co-operation and Development (OECD) countries.

5.1 Indigenous child oral health in New Zealand

There is no national survey data that describe the oral health status of Māori children in New Zealand. However, regional studies suggest that Māori children experience higher levels of oral disease than non-Māori children (Thomson 1993), and that this disparity is widening (Lee & Dennison 2004; Thomson et al. 2002). In a survey of 3,283 5-year-olds in one region the proportion of Māori children identified as having dental caries severe enough to warrant treatment under a general anaesthetic was over twice that of non-Māori children (Thomson 1993). Another report found that 66% of children receiving dental care under a general anaesthetic in one region were Indigenous, and that demand for this form of care was increasing (Broughton 2000; Thomson 1994).

The New Zealand Health Strategy identifies oral health as a 1 of 13 population health objectives, with a specific aim being to reduce oral health inequalities that affect Māori children (Mauri Ora Associates 2005). The New Zealand Government and Ministry of Health aim to meet this objective through acknowledgement of the unique relationship between Māori and the Crown under the Treaty of Waitangi, and enforcement of collaborative oral health promotion and disease prevention initiatives by all Māori and non-Māori health sectors.

5.2 Indigenous child oral health in Canada

Although oral health is improving among Canadian children in the general population, the same cannot be said for Indigenous Canadian children. A comparison of two national oral health surveys of Indigenous Canadian children conducted in 1990–91 and 1996–97 respectively showed that deft (decayed, extracted, filled deciduous teeth) scores for 6-year-old children had increased from 8.2 to 8.7, while mean DMFT scores had increased from 0.7 to 0.8. This was in contrast to the overall Canadian child population in these age groups, where a decrease in dental caries experience was noted (Peressini et al. 2004a). Other regional reports of Indigenous Canadian child oral health show similar trends (Harrison & Davis 1993; Harrison & White 1997; Klooz 1988).

Health Canada and the Canadian Government recognise oral health as an emerging health concern among Indigenous Canadian children, and have identified determinants of poor oral health identical to those observed for Australian Indigenous children (Health Canada 2004). Bids to improve Canadian Indigenous child oral health involve addressing life-course factors that contribute to such states and boosting Indigenous numbers in the dental workforce. The latter has been achieved to some extent by establishment of the Saskatchewan Indian Federated College (First Nations University of Canada 2003), which is a model of education and professional training for Indigenous Canadian people. The college is funded by Health Canada and has an

advisory board solely of Indigenous people. Graduates of the college's dental therapy course are able to provide basic restorative and preventive services to Indigenous people in remote communities. Over half the dental therapy intake are Indigenous.

5.3 Indigenous child oral health in the United States of America

In the Report of Oral Health in the United States of America the Surgeon General noted that 'members of Indigenous groups experience a disproportionate level of oral health problems, particularly children' (United States Surgeon General 2000). There are numerous studies that support this statement. Jones et al. (1992) found that among Head Start children (disadvantaged children involved in a government program to address health concerns) in Alaska, Indigenous children had substantially higher mean dmft and DMFT scores than non-Indigenous children. Of such children, those in remote areas were more dentally disadvantaged. In discussing child oral health disparities and access to care, Edelstein (2002) reported that Native American children experienced the greatest amount of oral disease, the most extensive disease and the most frequent use of dental services for pain relief; and had the highest rates of dental insurance coverage (primarily through Medicaid). However, such children had the fewest overall dental visits. The disparities were found to continue into adolescence and young adulthood. It was also noted that Indigenous children were the fastest growing population among children, implying that if the correlation between these groups and oral diseases continued, caries rates were likely to escalate and the stress on publicly financed dental care likely to increase.

Findings from the 1991 Indian Health Service Patient Oral Health Status and Treatment Needs Survey revealed that Native American children experienced a much higher prevalence of dental caries in their primary and permanent dentitions than the general US child population (Niendorff & Jones 2000). Grim et al. (1994) reported that of 1,667 public school students dentally examined in Oklahoma, Native American children had over double the dmfs and DMFS scores of their non-Native American counterparts. The mean dmfs for 5–6-year-olds was 10.4 for Native American children and 5.1 for non-Native American children, while the mean DMFS for 15–17-year-olds was 10.1 for Native American children and 6.0 for non-Native American children. A review of several large-scale oral health epidemiologic surveys found that Native American children had greater caries experience than non-Native American children, with risk factors including rural residence, minimal exposure to fluoride, and coming from less educated or poorer families (Caplan & Weintraub 1993).

The United States of America Government is addressing the oral health disparities observed among Native American child groups primarily through the 'Healthy People 2010' initiative. The strategy has 28 focus areas including oral health. In terms of Native American child oral health, the oral health strategy aims to increase both the level of population-based preventive programs organised by the Indian Health Service (IHS) and the public and private capacity to provide needed care (Centre for Disease Control and Prevention et al. 2004). It is acknowledged that the present IHS dental service infrastructure is compromised and that for changes to be seen at a grassroots level, the number of American Indian dental professionals with public health training needs to increase. This is already happening to some extent, with an agreement being made for

Indigenous Alaskans to train as dental therapists in New Zealand and to work with remote Indigenous groups in Alaska upon graduation. The first trainees from this scheme have recently graduated (University of Otago 2004).

5.4 International child oral health

State/territory and remote Indigenous 12-year-old mean DMFT scores from these studies were compared with those of children in other OECD countries (WHO Oral Health Country/Area Profile Program; World Health Organisation 2004) and are presented in Table 26. Information was only presented for countries that had national data collected from 1998. While the overall Australian 12-year-old mean DMFT score was the equal lowest reported (together with children from The Hague, Netherlands), the rank decreased when only Indigenous children from various states and territories were observed. New South Wales Indigenous children were ranked 2nd equal in terms of low mean DMFT scores, with children from the United Kingdom, Denmark and Switzerland having similar scores. Northern Territory Indigenous children were ranked 4th equal, while SA and remote Indigenous children were ranked 6th equal and 7th respectively. Due to differences in sampling and examination techniques, these findings should be interpreted with caution.

Table 26: Mean DMFT scores for state/territory and remote Australian Indigenous children and children from other OECD countries

Rank	Country	Year	12-year-old mean DMFT	Rank
1	Netherlands[(a)]	2002	0.8	Equal 1st
1	**Australia**	**2000**	**0.8**	**"**
3	United Kingdom[(b)]	2000–2001	0.9	Equal 2nd
3	Denmark	2003	0.9	"
3	Switzerland	2000	0.9	"
3	**NSW Indigenous**	**2000**	**0.9**	**"**
7	Austria	2002	1	3rd
8	Ireland (fluoridated)	2002	1.1	Equal 4th
8	Sweden	2002	1.1	"
8	Belgium	2001	1.1	"
8	Spain	2000	1.1	"
8	**NT Indigenous**	**2002**	**1.1**	**"**
13	Finland	2000	1.2	Equal 5th
13	Germany	2000	1.2	"
15	Ireland (non-fluoridated)	2002	1.3	Equal 6th
15	United States of America	1992–94	1.3	"
15	**SA Indigenous**	**2003**	**1.3**	**"**
18	**Remote Indigenous**	**2002**	**1.4**	**7th**
19	Norway	2000	1.5	Equal 8th
19	Portugal	1999	1.5	"
21	Global	2004	1.6	9th
22	France	1998	1.9	10th
23	Greece[(c)]	2000	2.2	11th
24	Japan	1999	2.4	12th
25	Czech Republic	2002	2.5	13th
26	Poland	2000	3.8	14th
27	Slovakia	1998	4.3	15th

(a) The Hague only
(b) England and Wales only
(c) Attica only

6 Discussion

This chapter provides a brief discussion of each investigation's findings, followed by a general discussion. International comparisons are made and recommendations suggested. The chapter ends with final conclusions.

6.1 Child Dental Health Survey

The Child Dental Health Survey findings show that throughout the states and territories observed, Aboriginal and Torres Strait Islander children had consistently higher dental caries experience in the deciduous and permanent dentition than their non-Aboriginal and Torres Strait Islander counterparts. These differences were most marked when social disadvantage and rural location were taken into consideration. The social disadvantage findings are not unique to Aboriginal and Torres Strait Islander children – in the general Australian population, children who are socially disadvantaged have greater levels of oral disease than those less disadvantaged (Alcaino et al. 2000; Hallet & O'Rourke 2003; Soo & Morgan 1995). This is also apparent in other countries (Marthaler 2004; Poulton et al. 2002). The rural location findings reflect those of Endean et al. (2004), who also found that Aboriginal and Torres Strait Islander children living in a non-urban area had higher caries levels than the average Australian child. Overseas investigations generally report that non-Aboriginal and Torres Strait Islander children living in rural locations have the same as, or better, oral health than their urban-living counterparts (Jamieson & Thomson 2003; Mossey et al. 2003). However, among Indigenous populations in Canada and the United States of America, rural-living children have been consistently found to have poorer oral health than those living in urban areas (Jones et al. 1992; Peressini et al. 2004).

Trends in child caries prevalence indicate that while dental caries levels among non-Aboriginal and Torres Strait Islander children have stabilised or are slightly increasing (Armfield et al. 2003), those for Aboriginal and Torres Strait Islander children are rising (particularly in the deciduous dentition). This is supported by trends of non-Aboriginal and Torres Strait Islander children in other developed countries; for example, Truin et al. (2005) found that caries experience in 6-year-old children in The Hague (The Netherlands) had remained static over a 6-year period, while that of 12-year-old children, particularly those in low socioeconomic status groups, had improved markedly. Trends in New Zealand, Canada and the United States of America show that oral health for Aboriginal and Torres Strait Islander children is generally deteriorating (Jones 2000; Thomson et al. 2003; Peressini et al. 2004b).

6.2 Aboriginal and Torres Strait Islander Children and Receipt of Hospital Dental Care Investigation

Aboriginal and Torres Strait Islander children under 5 years of age had higher rates of hospitalisation for dental procedures than non-Aboriginal and Torres Strait Islander children. Pre-school Aboriginal and Torres Strait Islander children who received hospital dental care were more than twice as likely to have received an extraction as

opposed to other dental care than their non-Aboriginal and Torres Strait Islander counterparts. The rate of Aboriginal and Torres Strait Islander children receiving hospital dental care (and extractions) increased with geographic remoteness.

Young children are usually referred for dental care in a hospital setting because they have high oral disease levels, are medically compromised, or do not cooperate in the dental chair (Sheller et al. 2003). Deciduous teeth are extracted when they are deemed to have too much decay, when multiple teeth are affected or when time constraints preclude more comprehensive care (the time to extract a deciduous tooth being far less than the time taken to restore it: Tochel et al. 2004; Vinckier et al. 2001). The findings suggest that young Aboriginal and Torres Strait Islander children experienced more advanced stages of dental decay, or had more teeth that were affected, than their non-Aboriginal and Torres Strait Islander counterparts. The increased rate for hospital dental care with increasing geographic remoteness reflects the limited dental service provision in these areas. The rate of extractions also increased with increasing remoteness, suggesting either that more children who lived in remote locations had teeth that were deemed unsalvageable or that, should restorative care prove unsuccessful, the delay before another dental/general anaesthetic appointment could be made would be unreasonable. It is important to note that more Aboriginal and Torres Strait Islander children may have been scheduled to receive hospital dental care in the study, but did not present because of physical/cultural barriers, or difficulties in general anaesthetic procedure compliance (e.g. fasting before the procedure, or the need for a caregiver to stay in the hospital overnight with the child) (pers. comm. Dr Bruce Simmons, General Manager, Central Australian Oral Health Services).

6.3 Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities

Findings from the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities revealed that remote Aboriginal and Torres Strait Islander children, on the whole, were more dentally disadvantaged than the average Australian child, experienced higher mean dmft and DMFT levels than the average Aboriginal and Torres Strait Islander child in the states and territories observed in the Child Dental Health Survey, and had poor oral self-care behaviours.

Dental service provision to Aboriginal and Torres Strait Islander children, particularly in remote communities, is problematic (Australian Government Department of Health and Ageing 2003). One report found that only 50% of Aboriginal and Torres Strait Islander children in remote NT communities had regular access to the SDS (Harford et al. 2003). Although the SDS attempts to visit each community annually, resources are limited and not all children are enrolled (the SDS of each state and territory requires children to be enrolled by caregivers before any dental care can be undertaken). Furthermore, only 40% of the Aboriginal and Torres Strait Islander child population in remote communities attend school at any given time (ABS 2002), so that children who are enrolled in the SDS may not be seen even when a dental therapist is in the community. The cultural aspects of dental service provision are also often overlooked by mainstream oral health systems, with the result that Aboriginal and Torres Strait Islander children may be reluctant to attend even when dental services are available (Simmons & May 1999).

Poor links between different parts of the health system (e.g. primary health care services and dental providers) also make dental service provision to Aboriginal and Torres Strait Islander children in remote locations difficult (Australian Government Department of Health and Ageing 2003). Traditionally, medical and dental professions have been independent in their training (Spencer 2001). Consequently, when health personnel in remote communities are presented with medical conditions that arise from dental problems (e.g. facial swelling, trismus, eating difficulty), treatment options are limited to prescriptions for analgesics, anti-inflammatories and antibiotics, and recommendations to seek professional dental care. One attempt to deal with this has been the training of remote Indigenous health workers in aspects of oral health to enable them to implement long-term preventive strategies at a local level (Pacza et al. 2001). A second proposal has been the employment of oral health professionals within Indigenous-controlled health services, e.g. the Pika Wiya Health Service Inc. in Port Augusta (SA). Anecdotal evidence suggests that these services are heavily used when available, demonstrating that Indigenous people in remote communities will use oral health services when provided in a culturally appropriate manner. Partnerships between mainstream services and Indigenous communities that focus on the principles of cultural safety, community development and primary health care have also achieved high participation rates and appear to have met most basic dental treatment needs (Simmons & May 1999).

6.4 General discussion

In this section findings from the investigations are broadly discussed in terms of the Aboriginal and Torres Strait Islander child oral health conceptual framework provided in Chapter 2 (see Figure 1).

Aboriginal and Torres Strait Islander child oral health determinants

Determinants for Aboriginal and Torres Strait Islander child oral health are discussed in terms of diet, oral self-care, general health and life-course factors.

Diet

There has been a marked increase in the range, availability and consumption of cariogenic food and beverage products among Indigenous people in recent times, particularly in remote communities and among children (Endean et al. 2004; Martin-Iverson et al. 2000). Traditionally, Indigenous diets consisted of kangaroo, wallaby, possum, echidna, snake, lizard, parrot and emu meat; berries and wild vegetables; and unprocessed grains (NHC 2001). Loss of traditional lands and nomadic lifestyles following European contact, however, led to generations of Indigenous people becoming dependent on 'rations' such as white flour and sugar, tea, rice, and tinned or dried meat, and more recently, upon convenience foods (many of which are high in fat and refined carbohydrates). Marketing strategies of the carbonic drink industry have also meant that cariogenic beverages are now readily accessible in the remotest of communities, and are often the drink of choice when little else is available (Lovel 2004). Those exposed to cariogenic food and beverage products at a young age are at increased risk of developing dental caries (Pascoe & Seow 1994). None of the

studies in this publication specifically investigated dietary intake, so it is not possible to quantify the role diet may have played in the oral disease levels observed.

Oral self-care practices

As shown by the findings of the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities, less than one-fifth of the child sample brushed their teeth at home or at school, with the figure dropping to <5% for those aged 5 years or less (who correspondingly had the highest dmfs levels). Erratic or non-existent caregiver oral self-care practices may have played a role in this observation. Children learn most oral self-care behaviours by repeatedly witnessing the habits of those who share the same household, and caregivers who brush their teeth regularly are more likely to instil sound dental care habits in their children than those with inconsistent oral self-care behaviours (Evans et al. 1982; Mattila 2001). In the Indigenous context there may be numerous factors that preclude regular oral health care practices, such as lack of clean storage areas to keep toothbrushes and toothpaste, lack of clean water, and frequent mobility between lodgings. Such explanations have been provided for Native American children in remote communities in the United States of America, who also experience high levels of oral disease (Atchison et al. 1997). It is also important to note that, unlike other cultures throughout the world, some traditional Indigenous groups in Australia did not adopt oral self-care practices (NHC 2001; Wall 1984), e.g. the use of twigs for tooth cleaning in Papua New Guinea, and the use of ash and salt for gum cleaning by First Nation people in Canada (Dickson 1983).

Contemporary oral self-care practices include regular brushing and flossing of one's teeth and using a range of other dental cleaning aids such as fluoride mouth-rinses, toothpicks, interdental cleaners and disclosing solutions. Self-care practices are understood to play an important role in oral health maintenance, predominantly by reducing food build-up on and between teeth, minimising plaque levels at the gum level and raising the fluoride content in saliva (if fluoride-containing toothpastes are used) (Ekstrand & Oliveby 1999; Sbaraglia et al. 2002).

General health

The rapid change in dietary intake among Aboriginal and Torres Strait Islander children, together with a more sedentary lifestyle, has led to an increase in general health conditions such as diabetes and obesity (Braun et al. 1996; Gracey 2000). This is particularly evident in remote communities (Endean et al. 2004; Irvine et al., 2003). Diabetes plays a marked role in child periodontal diseases, particularly early-onset prepubertal periodontitis (Aren et al. 2003; Iughetti et al. 1999; Oh et al. 2002). While local treatment in combination with systemic antibiotics may be beneficial for this condition, the prevalence of premature loss of teeth in diabetic children with early-onset prepubertal periodontitis is high (Meyle & Gonzales 2001). Nutritional deficiencies such as scurvy (Vitamin C deficiency) are additional risk factors for child periodontal diseases (Bsoul & Terezhalmy 2004; Salama et al. 2004), as is smoking (Bergstrom 2004; Kamma et al. 2004; Molloy et al. 2004). The prevalence of smoking among Aboriginal and Torres Strait Islander children is high (Kirov et al. 2003; Lowe et al. 2004) and may occur in children as young as 7 years of age (Dunne et al. 2000).

General health conditions were not assessed in these investigations, so it was not possible to explore the role that general health factors may have had on the oral health of children involved in the studies. Further research in this area is planned (see Appendix B).

Life-course events

Accumulation of different events in children's lives may influence oral health outcomes (Kuh & Ben-Shlomo 2002). These include premature birth, low birth weight, congenital conditions, poor childhood nutrition and inadequate childhood general health. Children who experience some or all of these events have an increased risk of developing enamel hypoplasia (weakened tooth structure) (Pascoe & Seow 1994; Seow 1997). If enamel in teeth is weakened, susceptibility to dental decay in the primary and permanent dentition increases. Enamel hypoplasia has a higher prevalence among Aboriginal and Torres Strait Islander than non-Aboriginal and Torres Strait Islander children in some populations (Seow 1997; Seow et al. 1996; Seow et al. 1999). The findings in this publication show that Aboriginal and Torres Strait Islander children in remote locations also have a high prevalence of enamel hypoplasia (in the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities 74.6% of children were found to have enamel hypoplasia to some degree).

Those who have poor systemic health at a young age may be more likely to experience rapidly progressive periodontitis in later life (Tonetti & Mombelli 1999). While no measures of periodontal disease were made in these investigations, high levels of gingivitis were noted among Aboriginal and Torres Strait Islander children in both the Child Dental Health Survey and the Study of Aboriginal and Torres Strait Islander Child Oral Health in Remote Communities.

An assessment of the effect of life-course factors on Aboriginal and Torres Strait Islander oral health is one of the aims of an investigation to commence in the NT in 2006 (see Appendix B).

Aboriginal and Torres Strait Islander child oral health interventions

Interventions for Aboriginal and Torres Strait Islander child oral health are discussed in terms of oral health education and fluoride exposure.

Oral health education

Oral health education initiatives specifically designed for Aboriginal and Torres Strait Islander children have been developed, but are still few in number. Those that do exist have not usually been designed or implemented by Indigenous persons and, although appearing robust theoretically, have often not been as effective in their execution as hoped (e.g. tooth-brushing initiatives in schools). An exception is an initiative recently developed by Queensland Health, in which oral health education tools (principally flip-charts) were designed in conjunction with community consultation to be used by health care workers in remote communities (pers. comm. Helen Clifford, Oral Health Educator, Queensland Health). The success of the model has been attributed to two

factors: Indigenous people being involved in the construction of the tools, and a primary health care approach being used. Population-based oral health education programs (e.g. televised advertising of oral health self-care products) have also traditionally targeted non-Indigenous groups. Most Indigenous households in Australia have at least one television (ABS 2006) and anecdotal evidence suggests that these are left running continuously in some remote community households (pers. comm. Mary Anne Anu, Manager, Santa Teresa Health Centre). Although not measured in these investigations, culturally non-specific oral health education interventions may have played some role in the Indigenous–non-Indigenous dental health disparities observed.

Fluoride exposure

The efficacy of fluoride in the prevention of dental caries is incontrovertible (Chestnutt & Gibson 1998; Mitchell & Mitchell 1991; Singh & Spencer 2004; Stookey et al. 2004). Studies show that caries prevalence is lower in areas where fluoride is naturally present in the water supply (Petersen & Lennon 2004) or where fluoride has been added (particularly in high-risk populations: Naylor & Murray 1998; Tagliaferro et al. 2004). Fluoride supplements in the form of tablets, drops, salt and milk have been shown to be effective in caries prevention (Birkeland et al. 2000; Marino et al. 2004; Meyer-Lueckel et al. 2002), while fluoride-containing toothpastes and topical gels have had a marked impact internationally on the reduction of caries levels (Hausen 2004; Marinho et al. 2004; Twetman et al. 2003). Although our investigations did not examine fluoride exposure and Aboriginal and Torres Strait Islander child oral health per se, research in this area is currently being undertaken elsewhere (see Appendix B).

Aboriginal and Torres Strait Islander child oral health resources and systems

Resources and systems for Aboriginal and Torres Strait Islander child oral health are discussed in terms of health services expenditure. (Current Aboriginal and Torres Strait Islander child oral health research initiatives and policies are provided in Appendices B and C respectively.)

Health service expenditure

In 2001–2002 the overall expenditure on health services per capita (including dental health services) provided to Indigenous people in Australia was 22% higher than the expenditure delivered to non-Indigenous persons. The ratio of per capita expenditure on Indigenous and non-Indigenous persons varied considerably by type of service. For example, Indigenous people were found to use community health centres and acute care services of the public hospital system more than Medicare or the Pharmaceutical Benefits Scheme (ABS & AIHW 2005). In 2002–2003 Aboriginal and Torres Strait Islander children were more likely to be seen in the public health sector than privately, and to present with more acute conditions than the average Australian child (AIHW 2004).

Aboriginal and Torres Strait Islander child dental service costs are estimated to be $120 million each year (ABS & AIHW 2005). The proportion of these funds that are absorbed

by hospital dental procedures costs, including those for treatment received under general anaesthetic, are unknown. Costs for dental care received under general anaesthesia may be up to 20 times the cost of care received under routine conditions (Milnes et al. 1993). Findings from these investigations suggest that there is limited dental service provision available to Aboriginal and Torres Strait Islander children in the areas where it is most required (e.g. remote communities). While the overall health service expenditure per capita is higher for Indigenous than non-Indigenous people, these findings suggest that further funding is still required. Financial packages that attract dental personnel to work in Indigenous communities (particularly remote communities) may be beneficial, together with greater funding for Indigenous oral health promotion and education schemes, and for Aboriginal and Torres Strait Islander child oral health research, monitoring and surveillance exercises.

6.5 Recommendations

Recommendations are suggested in terms of culturally appropriate oral health promotion and education initiatives, improved dental service provision (including workforce training), increased access to fluoride (in its various forms), more Aboriginal and Torres Strait Islander child oral health research initiatives, and addressing of Indigenous determinants that have a negative effect on general and oral health. These recommendations reflect and reinforce those that arose from the national workshop on Aboriginal and Torres Strait Islander oral health (see Appendix C).

Oral health promotion and education

There is a paucity of effective oral health promotion and education tools that specifically target Indigenous groups (with the exception perhaps of those implemented by Queensland Health). It may therefore be beneficial for Indigenous health promotion groups, together with dental policy planners, the Australian Government, broadcasters and companies that manufacture dental self-care products, to take a more pro-active stance in developing Indigenous-specific oral health promotional messages. If Indigenous people were to view members of their own culture in television advertisements that promote sound dental health behaviours, the incentive to adopt similar behaviours is likely to be greater than if witnessing advertisements where good oral health is associated with being non-Indigenous. Indigenous television (e.g. Yapa TV) would be an ideal forum to pilot such advertisements.

Initiatives that encourage enrolment of Aboriginal and Torres Strait Islander children in the SDS may be more effective if Indigenous people are involved in SDS promotion, if there are more Indigenous dental personnel within the SDS, or if the Service is seen to recognise and embrace Indigenous customs. Such strategies include inviting caregivers or other support people to be present when an Aboriginal and Torres Strait Islander child attends for dental care, welcoming and communicating with each child/support group in the manner to which they are accustomed, and allowing support people to partake in dental assisting. Ensuring that dental personnel have enough time for thorough, relaxed oral health discourse with Aboriginal and Torres Strait Islander children and their support group may also be helpful.

Oral health education initiatives may be more effective if the emphasis is shifted from school-based models to a primary health care approach (e.g. oral health advice provided by health workers in well-person checks, during nutrition education seminars and when communicating with young mothers groups). Holding regular dental education sessions for Indigenous caregivers in familiar, non-threatening environments (e.g. outdoors) in a bid to reinforce oral health awareness in Indigenous homes may be a more effective strategy for reducing the high oral disease levels observed among Aboriginal and Torres Strait Islander children. If Indigenous caregivers were consistently informed of the benefits of sound oral health practices, and if this information was relayed by an Indigenous person the audience could relate to, behaviour changes might occur that have a positive effect on the oral health of Aboriginal and Torres Strait Islander children.

Water

Opportunities for oral health personnel to work with other primary health care workers in encouraging and facilitating good nutrition policies should be taken enthusiastically. The encouragement of the drinking of water and facilitating the availability of cool, palatable drinking water in remote communities may be important strategies for the improvement of oral health as well as general health. Oral health practitioners should support nutritionists in advocating for this measure.

General/oral health services and training

Training more Indigenous people as dental health professionals should be encouraged, perhaps by introducing incentive schemes whereby fees are waived and entrance criteria to dental training institutions are altered. Greater emphasis on Indigenous culture and customs in the training of dental health professionals, with placements in Indigenous communities being a mandatory part of qualifying, may also help to change the attitudes of such professionals towards service provision to Indigenous people. Because of difficulties in recruiting dental health professionals in remote locations, the role of remote area health workers could be expanded to include basic dental care. Incorporating basic components of oral health care into all medical training may also enable those who choose to work in remote communities to have greater awareness of the causes of, and solutions to, dental health problems.

In the long term it may be beneficial to include dental health training as part of the curriculum at Indigenous health training institutions.

Water fluoridation

Water fluoridation is an equitable and cost-effective means of reducing dental decay levels in Indigenous communities with low levels of fluoride in their reticulated water supplies (pers. comm. Professor Ross Bailie, Division of Environmental Health and Health Services Research, Menzies School of Health Research). Water fluoridation is advantageous in that it accommodates the whole population without changes to lifestyle. People with limited oral health knowledge, those who are too poor to pay for dental treatment/oral self-care products, or those who live too far away to access dental services regularly all benefit. Reports have demonstrated that fluoridation of water supplies is cost-effective in small communities with high caries rates

(Wright et al. 2001), supporting its introduction into remote Indigenous communities. It should be noted, however, that in areas where fluoride levels in reticulated water systems are too high, the prevalence of enamel fluorosis may increase. Details of a trial water fluoridation scheme in remote NT communities are provided in Appendix B.

Aboriginal and Torres Strait Islander child oral health research

Continued research into Aboriginal and Torres Strait Islander child oral health is important for a number of reasons. It allows trends to be followed and factors suggested as being causal to oral health conditions to be scrutinised. It enables Aboriginal and Torres Strait Islander child oral health needs to be determined, which in turn allows service providers to allocate dental resources more equitably and appropriately. Research can be closely linked with evaluation and monitoring of oral health promotion strategies and interventions, while findings from well-designed investigations are crucial in raising the profile of Aboriginal and Torres Strait Islander child oral health at a policy-making level.

Aboriginal and Torres Strait Islander child oral health determinants

As stated previously, Aboriginal and Torres Strait Islander child oral health is dependent on a complex interaction of social, cultural, environmental and personal factors (AIHW 2004). Most of these factors lie outside the direct responsibility of the oral health sector—they are 'up-stream' of the specific preventive and clinical interventions implemented by dental health professionals. If long-term, sustainable changes to Aboriginal and Torres Strait Islander children's oral health are to occur, addressing such factors is crucial. Continued infrastructure changes that support Indigenous oral health policy and program development are a step in the right direction (Thomson 2003).

6.6 Final conclusions

The findings from these studies suggest that while many non-Aboriginal and Torres Strait Islander children may now reach adulthood free of oral disease, the same cannot be said for Aboriginal and Torres Strait Islander children. Many Aboriginal and Torres Strait Islander children experience extensive destruction of their deciduous teeth, a condition now rarely seen in the rest of Australia. With limited access to dental services, low fluoride content in many communities' drinking water, limited culture-specific oral health education and promotion strategies, a dental profession that (largely) does not embrace Indigenous philosophies, negligible oral health training in health professional courses, and increasing availability of cariogenic food and beverage products, the oral health needs of Aboriginal and Torres Strait Islander children throughout Australia are likely to increase. It would seem that raising the profile of Aboriginal and Torres Strait Islander child oral health at a government level is necessary before oral health initiatives that are targeted towards, and implemented by, Indigenous people may be effectively endorsed. It is hoped that with more understanding of Aboriginal and Torres Strait Islander child oral health patterns and the factors that contribute to them, a stronger 'voice' may be given to the oral health concerns of those whose needs have not always been made a priority.

Appendix A: Child Dental Health Survey findings by state/territory

A1 Distribution of Indigenous and non-Indigenous children

The distribution of Indigenous and non-Indigenous children by state/territory is presented in Table A1. Over one-third (36.7%) of children in the NT were Indigenous, in comparison with less than 3% of children in NSW and SA.

Table A1: Distribution of Indigenous and non-Indigenous children by state/territory

	New South Wales		South Australia		Northern Territory	
	n	%	*n*	%	*n*	%
Indigenous	4,383	1.8	1,942	2.5	4,306	36.7
Non-Indigenous	244,561	98.2	77,209	97.5	7,423	63.3

A2 Numbers of Indigenous and non-Indigenous children

The numbers of Indigenous and non-Indigenous children by age and state/territory are presented in Table A2. There were 56, 31 and 2 times the numbers of 6-year-old non-Indigenous than Indigenous children in NSW, SA and the NT respectively, and 60, 35 and 1.7 times the numbers of 12-year-olds in the same states/territories respectively.

Table A2: Numbers of Indigenous and non-Indigenous children by age and state/territory

	New South Wales		South Australia		Northern Territory	
Age	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
2	0	0	20	757	13	24
3	2	47	71	2,427	111	140
4	62	3,839	112	4,461	322	822
5	659	42,467	173	6,318	431	849
6	298	16,544	200	6,261	370	845
7	738	40,451	159	6,682	448	787
8	371	16,340	179	6,780	506	771
9	681	37,125	156	6,769	474	811
10	348	14,997	174	6,622	499	775
11	625	32,169	170	6,372	458	763
12	206	12,258	169	5,997	369	629
13	290	22,201	95	4,838	123	161
14	98	5,880	91	3,972	53	17
15	5	243	82	3,584	37	18
16	0	0	48	2,939	53	6
17	0	0	43	2,430	15	2

A3 Dental caries experience of Indigenous and non-Indigenous children

Deciduous teeth

The mean number of decayed deciduous teeth for 4–10-year-olds by state/territory is presented in Table A3. Across all states/territories the decayed component in Indigenous children was far greater than for non-Indigenous children. Four-year-old children had the highest levels of decay in NSW and SA compared to other age groups, while in the NT, 5-year-olds had the highest levels of decay. Among 6-year-olds Indigenous children in contrast to non-Indigenous children had 109.2% more decayed deciduous teeth in NSW, 136.0% more in SA and 264.7% more in the NT.

Table A3: Mean number of decayed deciduous teeth for 4–10-year-olds by state/territory

	New South Wales		South Australia		Northern Territory	
Age	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
4	1.90 (0.38)	0.79 (0.03)	2.48 (0.30)	0.96 (0.03)	3.07 (0.18)	0.82 (0.06)
5	1.64 (0.10)	0.69 (0.01)	2.11 (0.24)	0.89 (0.02)	3.62 (0.17)	0.92 (0.06)
6	1.36 (0.12)	0.65 (0.01)	2.10 (0.18)	0.89 (0.02)	3.10 (0.17)	0.85 (0.05)
7	1.05 (0.07)	0.62 (0.01)	1.54 (0.15)	0.78 (0.02)	2.90 (0.14)	0.73 (0.05)
8	0.98 (0.09)	0.56 (0.01)	1.22 (0.12)	0.67 (0.01)	2.19 (0.11)	0.67 (0.04)
9	0.74 (0.05)	0.45 (0.01)	1.27 (0.15)	0.60 (0.01)	1.54 (0.09)	0.54 (0.03)
10	0.43 (0.06)	0.32 (0.01)	0.58 (0.08)	0.44 (0.01)	1.17 (0.07)	0.38 (0.03)

The mean number of missing deciduous teeth for 4–10-year-olds by state/territory is presented in Table A4. Across all states/territories the missing component in Indigenous children was far greater than for non-Indigenous children except for 8- and 9-year-olds in the NT. For all jurisdictions percentage differences between Indigenous and non-Indigenous 6-year-old children were in the range 200–220%. Five-year-old Indigenous children across all states/territories had the highest levels of missing deciduous teeth due to decay compared to other age groups.

Table A4: Mean number of missing deciduous teeth for 4–10-year-olds by state/territory

	New South Wales		South Australia		Northern Territory	
Age	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
4	0.16 (0.10)	0.04 (0.01)	0.33 (0.12)	0.06 (0.01)	0.11 (0.04)	0.05 (0.01)
5	0.33 (0.06)	0.04 (0.00)	0.35 (0.08)	0.09 (0.01)	0.15 (0.04)	0.05 (0.01)
6	0.16 (0.04)	0.05 (0.00)	0.31 (0.08)	0.10 (0.01)	0.15 (0.04)	0.05 (0.02)
7	0.12 (0.03)	0.06 (0.00)	0.21 (0.07)	0.08 (0.01)	0.08 (0.02)	0.06 (0.01)
8	0.13 (0.03)	0.06 (0.00)	0.24 (0.08)	0.08 (0.01)	0.07 (0.02	0.09 (0.02)
9	0.10 (0.02)	0.04 (0.00)	0.07 (0.02)	0.06 (0.00)	0.09 (0.02)	0.09 (0.01)
10	0.05 (0.02)	0.03 (0.00)	0.05 (0.03)	0.03 (0.00)	0.08 (0.02)	0.05 (0.01)

The mean number of filled deciduous teeth for 4–10-year-olds by state/territory is presented in Table A5. Across both NSW and SA, the filled component in Indigenous children was considerably greater than for non-Indigenous children.

Table A5: Mean number of filled deciduous teeth for 4–10-year-olds by state/territory

	New South Wales		South Australia		Northern Territory	
Age	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
4	0.35 (0.13)	0.14 (0.00)	0.58 (0.17)	0.30 (0.02)	0.28 (0.06)	0.22 (0.03)
5	0.31 (0.04)	0.17 (0.01)	1.17 (0.17)	0.51 (0.02)	0.37 (0.05)	0.51 (0.04)
6	0.57 (0.08)	0.32 (0.01)	1.54 (0.16)	0.94 (0.02)	0.74 (0.07)	0.82 (0.05)
7	0.57 (0.05)	0.43 (0.01)	1.45 (0.17)	1.16 (0.02)	0.78 (0.07)	0.99 (0.06)
8	0.68 (0.08)	0.49 (0.01)	1.82 (0.15)	1.24 (0.02)	0.85 (0.07)	1.15 (0.06)
9	0.51 (0.04)	0.48 (0.01)	1.68 (0.17)	1.29 (0.02)	0.84 (0.07)	1.10 (0.06)
10	0.49 (0.06)	0.40 (0.01)	1.29 (0.13)	0.95 (0.02)	0.49 (0.05)	0.76 (0.05)

The mean number of decayed, missing and filled deciduous teeth (dmft) for 4–10-year-olds by state/territory is presented in Table A6. Across all states/territories the mean dmft in Indigenous children was far greater than for non-Indigenous children, with the difference being greatest in the younger age groups. Four-year-old Indigenous children in NSW had the highest mean dmft levels in that state, while in SA 6-year-old Indigenous children had the highest mean dmft levels. In the NT, 5-year-old Indigenous children had the highest levels of mean dmft. In general, mean dmft scores were highest for Indigenous children at about age 5 years, compared with an age of about 7 years for non-Indigenous children.

Table A6: Mean number of decayed, missing and filled deciduous teeth for 4–10-year-olds by state/territory

	New South Wales		South Australia		Northern Territory	
Age	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
4	2.42 (0.61)	0.98 (0.05)	3.39 (0.36)	1.32 (0.04)	3.44 (0.19)	1.06 (0.07)
5	2.27 (0.18)	0.90 (0.01)	3.64 (0.31)	1.49 (0.03)	4.09 (0.18)	1.40 (0.08)
6	2.09 (0.21)	1.02 (0.02)	3.95 (0.25)	1.93 (0.04)	3.94 (0.18)	1.66 (0.09)
7	1.74 (0.12)	1.11 (0.01)	3.20 (0.24)	2.03 (0.03)	3.70 (0.15)	1.72 (0.08)
8	1.79 (0.16)	1.11 (0.02)	3.27 (0.21)	2.00 (0.03)	3.02 (0.13)	1.84 (0.08)
9	1.35 (0.10)	0.98 (0.01)	3.02 (0.21)	1.95 (0.03)	2.39 (0.12)	1.71 (0.07)
10	0.97 (0.11)	0.75 (0.01)	1.92 (0.17)	1.92 (0.03)	1.69 (0.09)	1.13 (0.06)

Permanent teeth

The mean number of decayed permanent teeth for 6–15-year-olds by state/territory is presented in Table A7. Across all states/territories, the decayed component in Indigenous children was far greater than for non-Indigenous children. Fourteen-year-old Indigenous children had the highest levels of decay in NSW, while in SA and the NT the highest levels of decay occurred for 15-year-old and 13-year-old Indigenous children respectively.

Table A7: Mean number of decayed permanent teeth for 6–15-year-olds by state/territory

	New South Wales		South Australia		Northern Territory	
Age	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
6	0.09 (0.02)	0.03 (0.00)	0.14 (0.04)	0.06 (0.00)	0.12 (0.02)	0.06 (0.01)
7	0.17 (0.02)	0.12 (0.00)	0.30 (0.06)	0.17 (0.01)	0.25 (0.03)	0.12 (0.01)
8	0.29 (0.04)	0.13 (0.00)	0.39 (0.06)	0.18 (0.01)	0.40 (0.04)	0.12 (0.02)
9	0.29 (0.03)	0.15 (0.00)	0.53 (0.09)	0.19 (0.01)	0.45 (0.04)	0.14 (0.02)
10	0.37 (0.06)	0.16 (0.00)	0.51 (0.08)	0.21 (0.01)	0.69 (0.05)	0.17 (0.02)
11	0.36 (0.04)	0.21 (0.00)	0.55 (0.08)	0.24 (0.01)	0.72 (0.06)	0.21 (0.02)
12	0.54 (0.090	0.26 (0.01)	0.59 (0.08)	0.31 (0.01)	0.78 (0.08)	0.25 (0.03)
13	0.66 (0.08)	0.31 (0.01)	1.00 (0.17)	0.41 (0.01)	1.45 (0.24)	0.25 (0.05)
14	0.82 (0.16)	0.38 (0.01)	1.24 (0.21)	0.50 (0.02)	1.24 (0.28)	0.74 (0.29)
15	n.a.	n.a.	1.59 (0.28)	0.54 (0.02)	1.31 (0.43)	0.48 (0.27)

The mean number of filled permanent teeth for 6–15-year-olds by state/territory is presented in Table A8. Within NSW and SA the filled component in Indigenous children aged 9+ years was greater than for non-Indigenous children. However, in the NT non-Indigenous children aged 9+ years had a higher filled component than similarly aged Indigenous children. Fourteen-year-old Indigenous children had the highest levels of filled teeth in NSW and the NT, while in SA 15-year-old Indigenous children had the highest filled component.

The mean number of missing permanent teeth for 6–15-year-olds by state/territory is not presented as numbers were negligible and no clear patterns emerged.

Table A8: Mean number of filled permanent teeth for 6–15-year-olds by state/territory

	New South Wales		South Australia		Northern Territory	
Age	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
6	0.01 (0.01)	0.01 (0.00)	0.03 (0.02)	0.01 (0.00)	0.01 (0.01)	0.01 (0.00)
7	0.03 (0.01)	0.03 (0.00)	0.06 (0.03)	0.06 (0.00)	0.04 (0.01)	0.04 (0.01)
8	0.06 (0.02)	0.06 (0.00)	0.13 (0.03)	0.14 (0.01)	0.08 (0.01)	0.08 (0.01)
9	0.11 (0.02)	0.10 (0.00)	0.33 (0.06)	0.27 (0.01)	0.15 (0.02)	0.18 (0.02)
10	0.22 (0.04)	0.13 (0.00)	0.47 (0.07)	0.35 (0.01)	0.19 (0.03)	0.21 (0.02)
11	0.25 (0.03)	0.20 (0.00)	0.55 (0.07)	0.43 (0.01)	0.21 (0.03)	0.29 (0.03)
12	0.33 (0.06)	0.27 (0.01)	0.67 (0.09)	0.48 (0.01)	0.32 (0.04)	0.39 (0.04)
13	0.34 (0.05)	0.32 (0.01)	0.78 (0.13)	0.66 (0.02)	0.36 (0.10)	0.41 (0.08)
14	0.45 (0.10)	0.39 (0.01)	1.12 (0.18)	0.81 (0.02)	0.43 (0.16)	0.77 (0.39)
15	n.a.	n.a.	1.18 (0.18)	1.14 (0.03)	0.11 (0.13)	0.39 (0.28)

The mean number of decayed, missing and filled permanent teeth (DMFT) for 6–15-year-olds by state/territory is presented in Table A9. Mean DMFT in Indigenous children was greater than for non-Indigenous children. Fourteen-year-old Indigenous children had the highest mean DMFT in NSW and the NT, while in SA, 15-year-old children had the highest mean DMFT. Among 12-year-olds the mean DMFT was approximately 60% higher for Indigenous than for non-Indigenous children for all jurisdictions.

Table A9: Mean number of decayed, missing and filled permanent teeth for 6–15-year-olds by state/territory

	New South Wales		South Australia		Northern Territory	
Age	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
6	0.11 (0.04)	0.04 (0.00)	0.17 (0.04)	0.07 (0.00)	0.13 (0.03)	0.07 (0.00)
7	0.21 (0.04)	0.15 (0.00)	0.36 (0.07)	0.22 (0.01)	0.29 (0.03)	0.16 (0.02)
8	0.36 (0.08)	0.20 (0.00)	0.53 (0.07)	0.32 (0.01)	0.49 (0.04)	0.20 (0.01)
9	0.42 (0.05)	0.26 (0.01)	0.87 (0.10)	0.47 (0.01)	0.61 (0.05)	0.32 (0.03)
10	0.61 (0.11)	0.30 (0.01)	1.09 (0.11)	0.57 (0.01)	0.93 (0.06)	0.40 (0.03)
11	0.63 (0.07)	0.43 (0.01)	1.11 (0.12)	0.68 (0.02)	0.99 (0.07)	0.52 (0.04)
12	0.87 (0.16)	0.54 (0.01)	1.28 (0.13)	0.80 (0.02)	1.13 (0.10)	0.71 (0.05)
13	1.03 (0.15)	0.65 (0.01)	1.83 (0.23)	1.09 (0.02)	1.87 (0.27)	0.78 (0.10)
14	1.37 (0.33)	0.81 (0.03)	2.43 (0.29)	1.34 (0.03)	1.87 (0.34)	1.51 (0.48)
15	n.a.	n.a.	2.79 (0.34)	1.73 (0.04)	1.60 (0.49)	0.86 (0.50)

The mean number of fissure sealed permanent teeth for 6-15 year-olds is presented in Table A10. In most age groups Indigenous children had higher levels of fissure sealants than their non-Indigenous counterparts in NSW and SA. In the NT, however, non-Indigenous children had higher levels of fissure sealants than Indigenous children in most age groups. In NSW and the NT, 13-year-old Indigenous children had higher levels of fissure sealants than other age groups, while in SA 15-year-old children had the highest levels of fissure sealants.

Table A10: Mean number of fissure sealed permanent teeth for 6–15-year-olds by state/territory

	New South Wales		South Australia		Northern Territory	
Age	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
6	0.06 (0.03)	0.03 (0.00)	0.03 (0.02)	0.02 (0.00)	0.05 (0.02)	0.08 (0.02)
7	0.17 (0.03)	0.16 (0.00)	0.11 (0.05)	0.13 (0.01)	0.27 (0.04)	0.35 (0.04)
8	0.37 (0.06)	0.33 (0.00)	0.26 (0.06)	0.32 (0.01)	0.47 (0.06)	0.70 (0.01)
9	0.50 (0.05)	0.53 (0.05)	0.58 (0.09)	0.51 (0.01)	0.79 (0.07)	0.97 (0.01)
10	0.60 (0.08)	0.59 (0.01)	0.72 (0.10)	0.63 (0.06)	0.69 (0.07)	1.14 (0.01)
11	0.68 (0.06)	0.65 (0.01)	0.81 (0.10)	0.78 (0.01)	0.76 (0.08)	1.32 (0.06)
12	0.65 (0.10)	0.62 (0.01)	1.01 (0.12)	0.92 (0.02)	0.89 (0.11)	1.34 (0.07)
13	0.73 (0.11)	0.58 (0.02)	1.16 (0.17)	1.12 (0.02)	0.91 (0.21)	1.87 (0.23)
14	0.54 (0.14)	0.64 (0.02)	1.05 (0.15)	1.40 (0.03)	1.06 (0.33)	0.00 (0.00)
15	n.a.	n.a.	1.67 (0.26)	1.57 (0.03)	0.28 (0.20)	0.14 (0.12)

A4 Gingival health of Indigenous and non-Indigenous children

Gingival health was assessed by measuring bleeding levels, plaque levels and presence of calculus. The Community Periodontal Index (CPI) was also used.

Gingival bleeding

The bleeding levels for 4–14-year-olds in NSW are presented in Figure A1. There was a markedly higher percentage of Indigenous 12-14-year-old children with bleeding than non-Indigenous children. Prior to these ages the percentages of either Indigenous or non-Indigenous children with gingival bleeding is low.

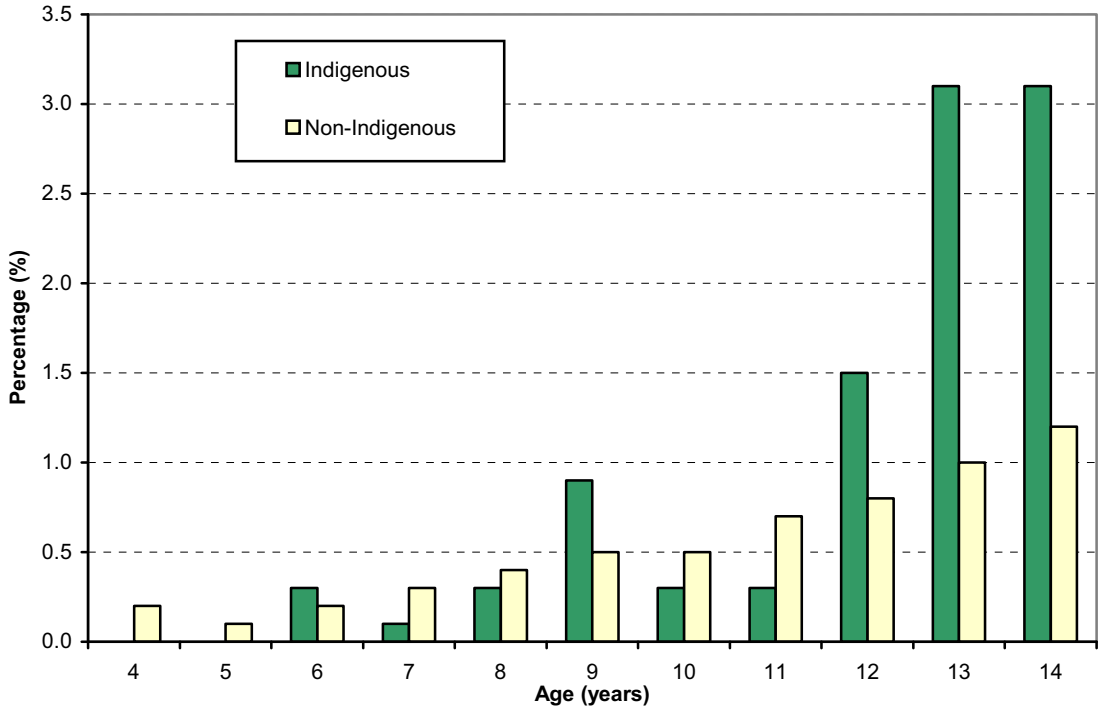


Figure A1: Gingival bleeding for 4–14-year-old children from New South Wales by Indigenous status

Plaque levels

The plaque levels for 4–14-year-olds in NSW are presented in Figure A2. There were markedly more Indigenous 13- and 14-year old children with plaque than non-Indigenous children of the same age. Again, among the younger age groups the percentages of children with plaque, whether Indigenous or non-Indigenous, were relatively low.

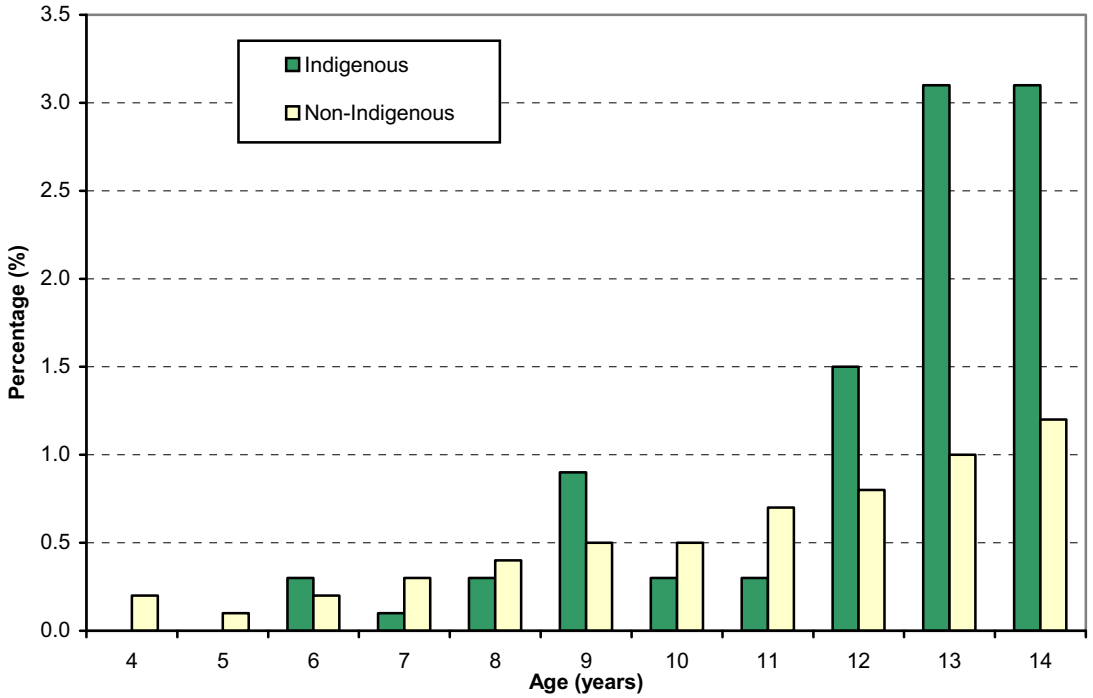


Figure A2: Plaque for 4–14-year-old children from New South Wales by Indigenous status

Gingival health

The gingival health of 6–15-year-olds in SA is presented in Figure A3. Across all age groups the bleeding component was greater for Indigenous children than non-Indigenous children. Differences in prevalence of bleeding between Indigenous and non-Indigenous children ranged from 11.4% for 13-year-olds to 285.9% for 5-year-olds. Overall, the bleeding component was highest in the 12-year-old age group. While bleeding (upon probing) was higher for Indigenous children, the opposite was the case in relation to calculus (calcified plaque, also known as tartar). For all but the youngest age group a higher percentage of non-Indigenous children had calculus than did Indigenous children.

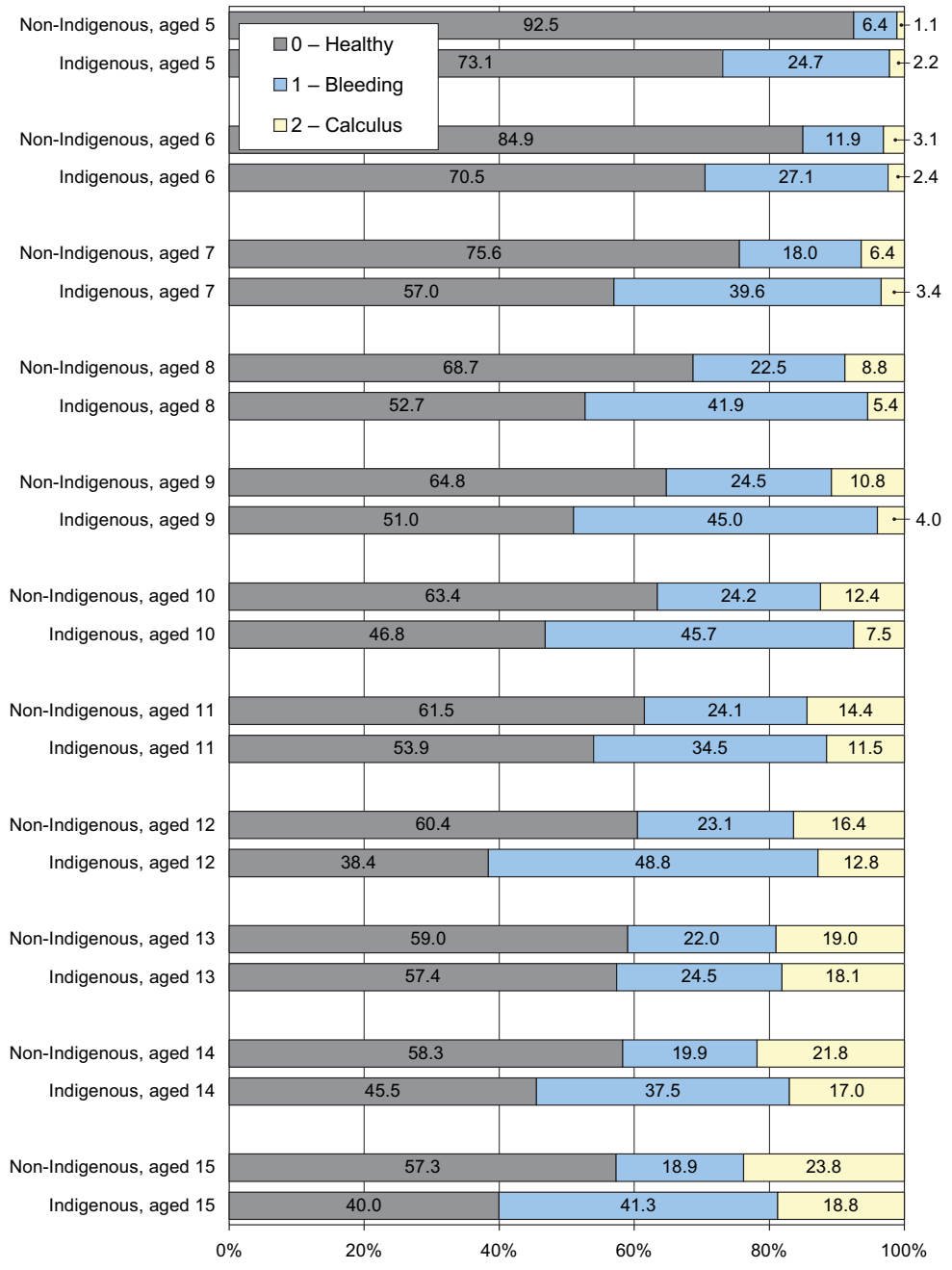


Figure A3: Gingival health of 6–15-year-old South Australian children by Indigenous status

A5 Treatment needs of Indigenous and non-Indigenous children

Treatment needs were divided into several categories that correspond to treatment program codes within the New South Wales SOKS program. Children in need of immediate care are deemed to be needing care within 24–48 hours. They comprise children who are in pain at the time of the assessment, have a dental condition likely to cause pain within the foreseeable future, have a carious lesion in permanent anterior teeth or have an oral infection.

Children who require treatment which is not urgent include those who require prevention and treatment of caries in permanent teeth. The category also includes:

- those who have deciduous teeth that are over-retained, non-mobile and with the permanent successor either erupted or able to be detected at assessment;
- children who have need of material or chemical stabilisation of caries in their deciduous dentition;
- children with poor oral hygiene deemed to require the clinical removal of calculus and/or clinical intervention to remedy poor oral hygiene practice or gingival conditions; and
- children requiring only an X-ray.

A third category includes children who have no disease or abnormalities present and therefore require no treatment.

The treatment needs for 4–14-year-olds in NSW are presented in Figure A4.

Across all age groups more Indigenous children required immediate care than their non-Indigenous counterparts, with between 3.6% and 5.9% of non-Indigenous children deemed to be requiring immediate treatment compared to between 7.3% and 12.2% of Indigenous children.

Indigenous children were more likely to be categorised as requiring non-urgent treatment than non-Indigenous children. Between 26.7% (5-year-olds) and 43.0% (9-year-olds) of non-Indigenous children were deemed to require prevention and/or treatment, compared to between 33.8% (4-year-olds) and 49.0% (8-year-olds) of Indigenous children. The largest relative difference was 9.9% among 6-year-olds with 32.3% of non-Indigenous children needing non-urgent care compared with 42.2% of Indigenous children.

More non-Indigenous children in every age group required no treatment than did Indigenous children. The differences in these percentages ranged from 4.8% for 10-year-olds to 18.8% for 5-year-olds. Disparities between Indigenous and non-Indigenous children were greatest for the youngest and the oldest children.

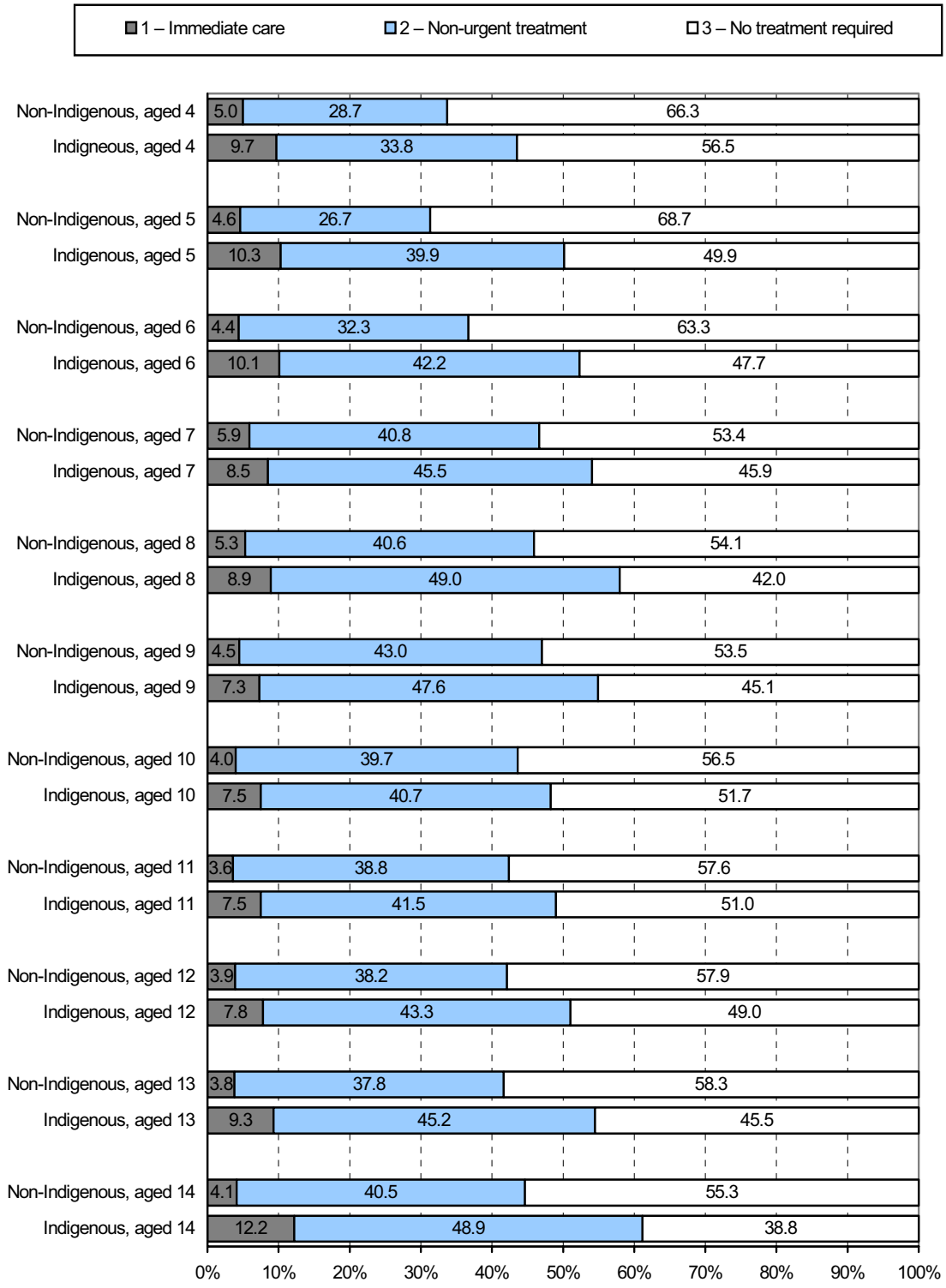


Figure A4: Treatment needs for 4–14-year-old children in New South Wales by Indigenous status

A6 Socioeconomic differences in the dental caries experience of Indigenous and non-Indigenous children

South Australia: mean dmft

The mean dmft for 4–10-year-old SA children by the SEIFA Index of Relative Socio-Economic Disadvantage is presented in Figure A5. Across most age groups and disadvantage categories, Indigenous children had up to twice the mean dmft score of their non-Indigenous counterparts, with Indigenous children aged 6 years experiencing the highest mean dmft levels. For the 4 to 7 years age groups the highest mean dmft levels for Indigenous children were seen for the second most disadvantaged groups, while for ages 8 and 10 years Indigenous children in the middle category of disadvantage had the highest mean dmft scores. Among Indigenous children aged 9 years those in the second to least disadvantaged group experienced the highest mean dmft levels. The mean dmft difference for Indigenous children in the 4 to 7 years age groups were marked, with those most socioeconomically disadvantaged having up to four times the dental caries experience of those least socioeconomically disadvantaged.

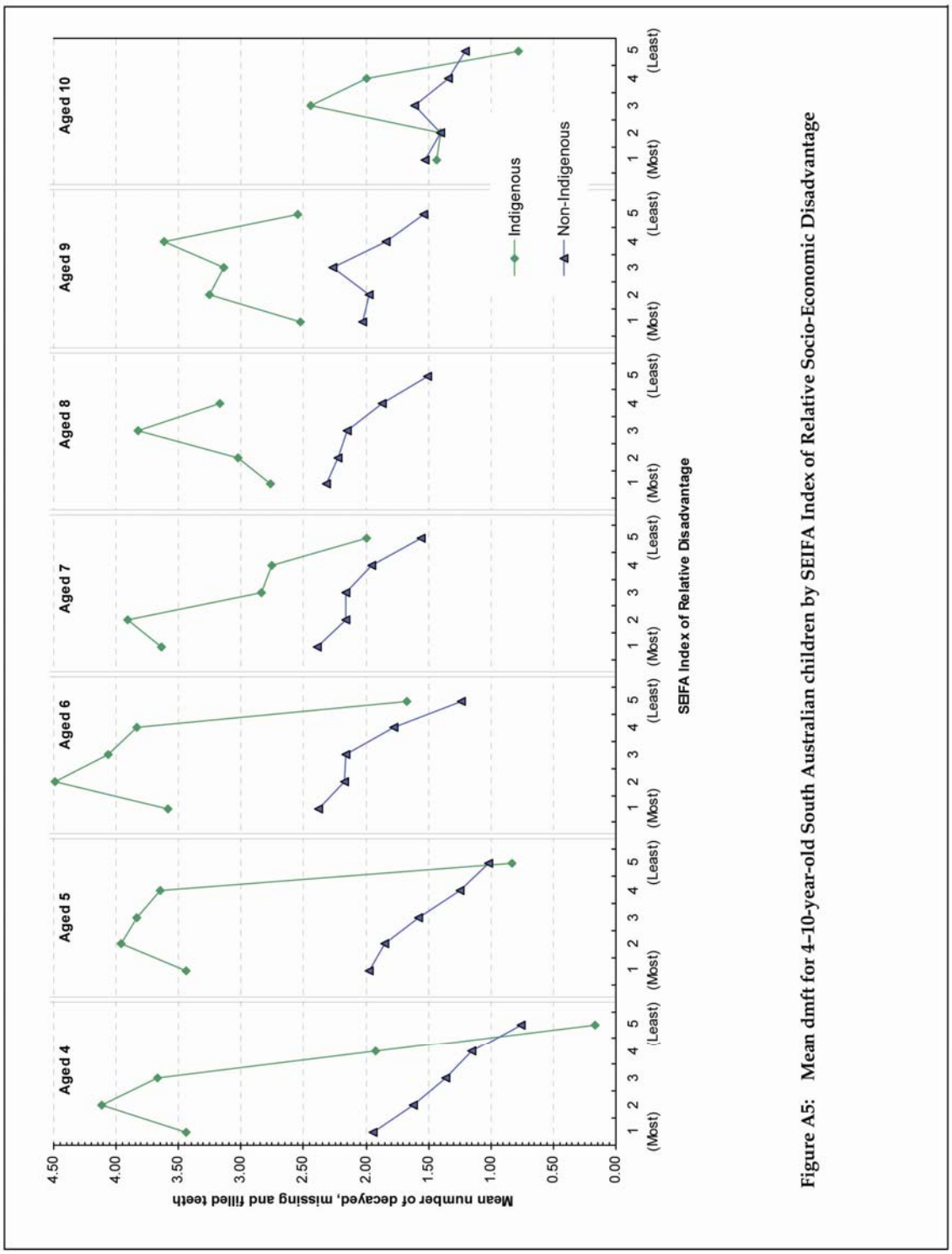


Figure A5: Mean dmft for 4–10-year-old South Australian children by SEIFA Index of Relative Socio-Economic Disadvantage

South Australia: mean DMFT

The mean DMFT for 6–14-year-old SA children by the SEIFA Index of Relative Socio-Economic Disadvantage is shown in Figure A6. Indigenous children had higher mean DMFT scores than non-Indigenous children across almost all SEIFA categories and age groups, with mean DMFT levels for both Indigenous and non-Indigenous children increasing with increasing age. Across all Indigenous age groups (except ages 6, 12 and 13 years), the most socioeconomically disadvantaged had the highest mean DMFT scores. The highest mean DMFT levels for 6-year-old Indigenous children were for those in the middle disadvantage category, while the highest mean DMFT levels among Indigenous 12-year-olds were noted for those in the fourth most disadvantaged category. Among 13-year-old Indigenous children the highest mean DMFT levels were experienced by those in the second most disadvantaged category, and these were approximately double that of their non-Indigenous counterparts in the same category of disadvantage. Mean DMFT levels for both Indigenous and non-Indigenous children generally decreased with increasing socioeconomic advantage, although this was not the case for Indigenous 12-year-old children. The difference in mean DMFT between disadvantage categories was more marked among Indigenous than non-Indigenous children, for example, the difference in mean DMFT for 11-year-old Indigenous children fell from 1.75 to 0.60 from most to least disadvantaged categories, while for non-Indigenous 11-year-old children a decrease from 0.85 to 0.60 was noted across the same categories.

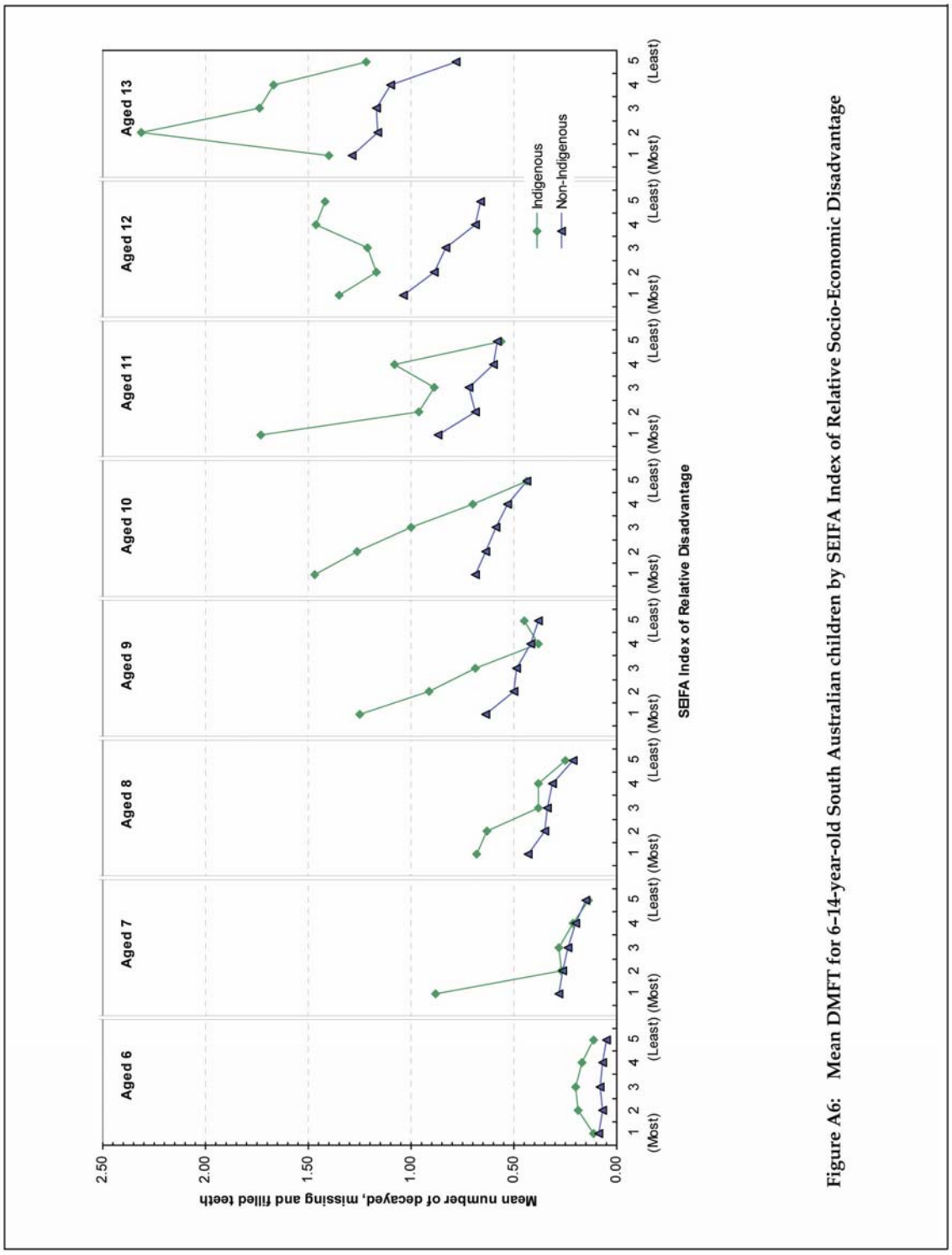


Figure A6: Mean DMFT for 6–14-year-old South Australian children by SEIFA Index of Relative Socio-Economic Disadvantage

Northern Territory: mean dmft

The mean dmft for 4–10-year-old NT children by the SEIFA Index of Relative Socio-Economic Disadvantage is presented in Figure A7. Note that for Indigenous children no cases fell into the least disadvantaged categories. Across all age groups and disadvantage categories Indigenous children had higher mean dmft scores than their non-Indigenous counterparts. Indigenous children aged 5 years had the highest mean dmft score, and this was almost six times the mean dmft of their non-Indigenous counterparts in the same disadvantage category. Among Indigenous children aged 4–8 years mean dmft levels fell steeply with increasing socioeconomic advantage. This was less marked with Indigenous children aged 9–10 years but a decrease was still observed. Similarly, the difference in mean dmft between Indigenous and non-Indigenous children was greater in the 4 to 8 years age groups but was reduced considerably in the 9 to 10 years age groups.

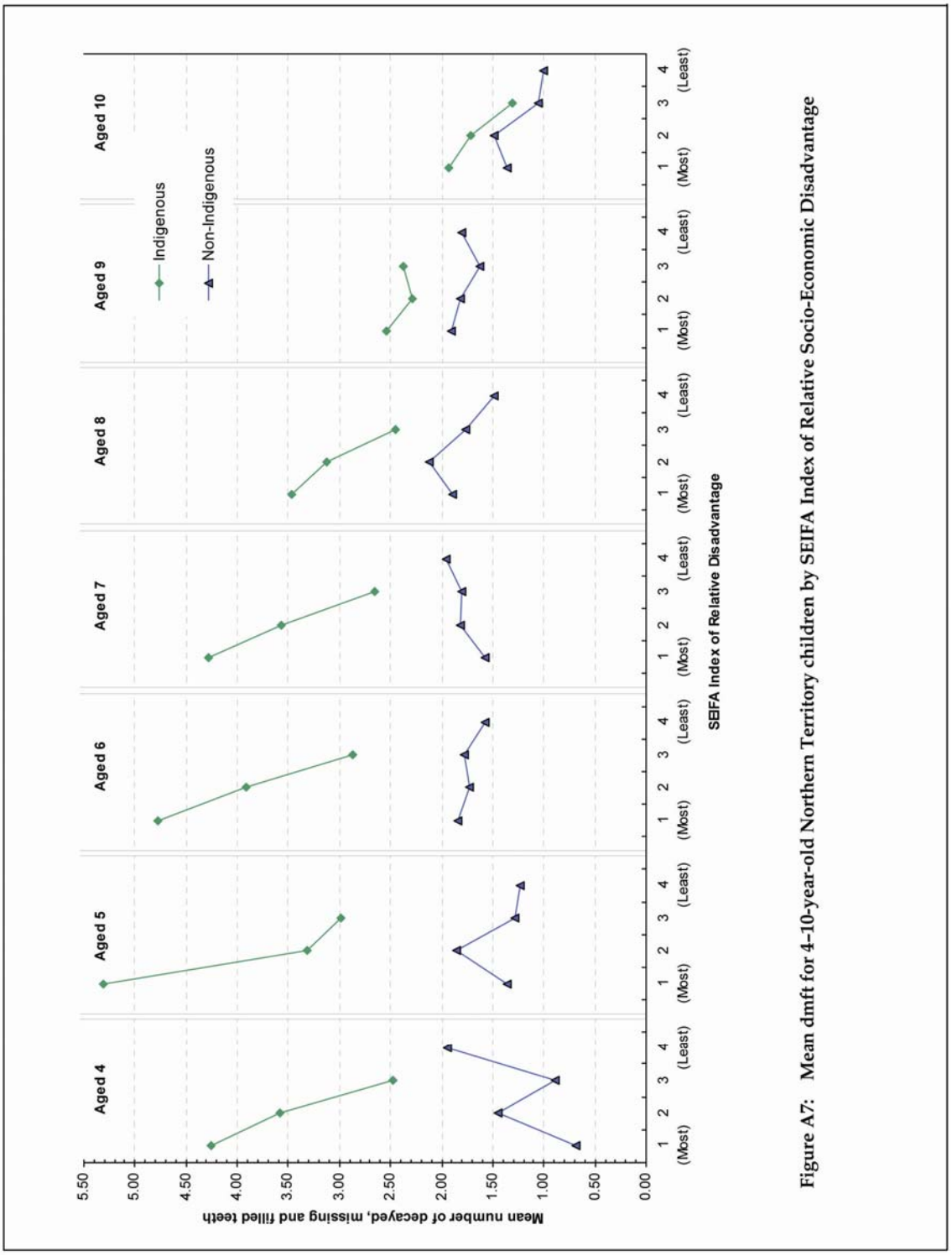


Figure A7: Mean dmft for 4–10-year-old Northern Territory children by SEIFA Index of Relative Socio-Economic Disadvantage

Northern Territory: mean DMFT

The mean DMFT for 6–13-year-old NT children by the SEIFA Index of Relative Socio-Economic Disadvantage is presented in Figure A8. There were no Indigenous children in the least disadvantaged category. Indigenous children had higher mean DMFT levels than non-Indigenous children across all age groups and disadvantage categories, with the difference being four-fold in some situations (e.g. 10-year-old children in the most disadvantaged category). Thirteen-year old Indigenous children experienced the highest mean DMFT levels, and this was over twice the mean DMFT observed for their non-Indigenous counterparts in the same disadvantage group. While mean DMFT increased with increasing age across both sample groups, the trend was more pronounced among Indigenous children. For example, the mean DMFT of Indigenous 6-year-olds and 13-year-olds in the most disadvantaged category were 0.15 and 1.95 respectively, while for similarly aged and disadvantaged non-Indigenous children mean DMFT levels of 0.0 and 0.85 respectively were observed. Across all Indigenous age groups (except age 6 years), children who were most disadvantaged had higher mean DMFT levels than those who were least disadvantaged. Across all age groups, the difference in mean DMFT between Indigenous and non-Indigenous children was widest in the most disadvantaged groups.

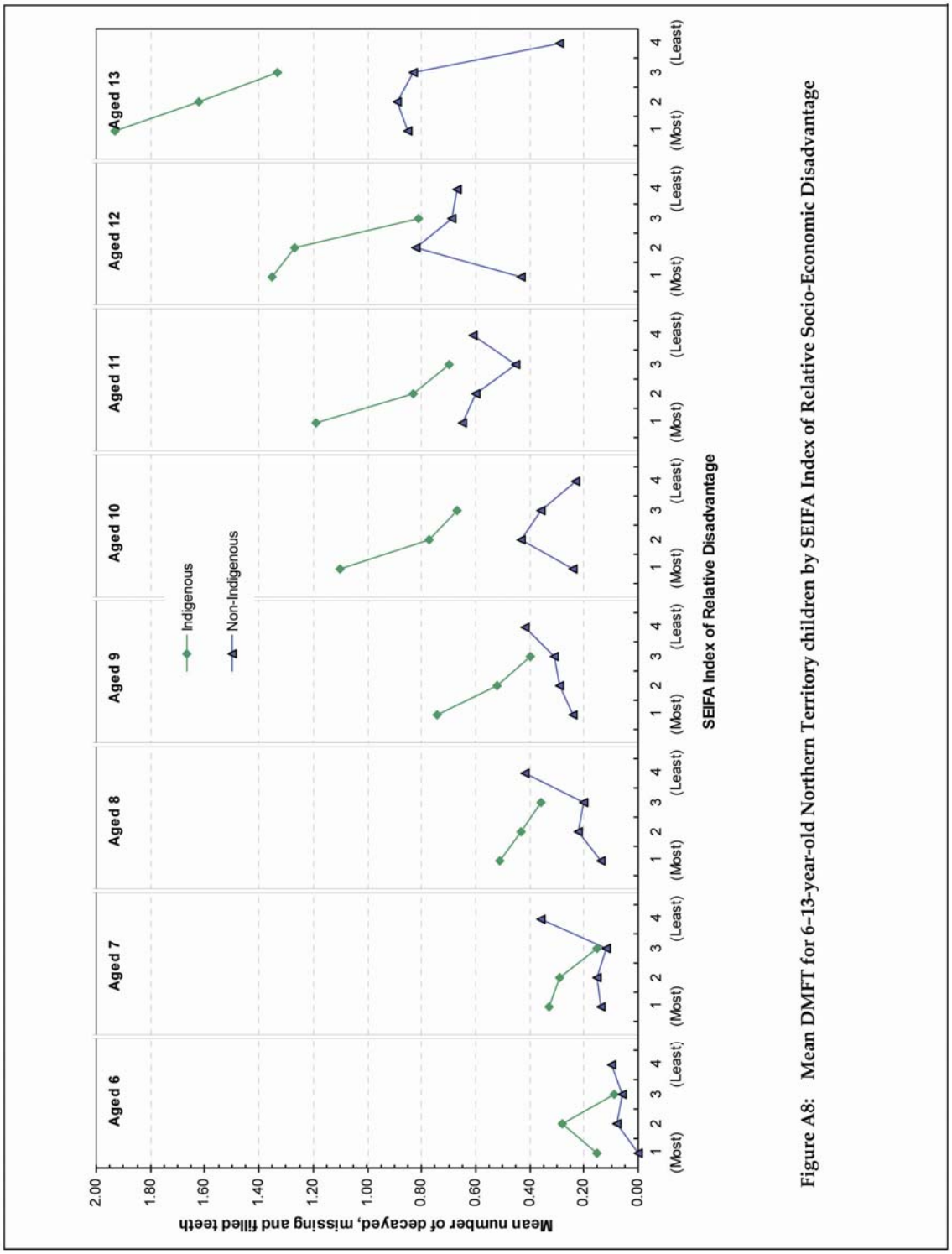


Figure A8: Mean DMFT for 6–13-year-old Northern Territory children by SEIFA Index of Relative Socio-Economic Disadvantage

A7 Regional differences in the dental caries experience of Indigenous and non-Indigenous children

New South Wales: mean dmft

The mean dmft for 4–10-year-old NSW children by residential location is presented in Figure A9. Across all age groups, Indigenous children living in metropolitan areas had higher dental caries experience than their non-Indigenous metropolitan-living counterparts. The greatest mean dmft difference among metropolitan-living children was noted among 4-year-olds, with Indigenous children having over twice the mean dmft of non-Indigenous children. Similarly, Indigenous children living in rural areas had higher mean dmft levels than their non-Indigenous rural-living counterparts, with the greatest difference in mean dmft being observed among 5-year-old children. Across all age groups rural Indigenous children had higher mean dmft than their metropolitan counterparts, with the greatest difference again being noted among 5-year-olds (rural Indigenous children had 1.6 times the mean dmft of metropolitan Indigenous children). The highest mean dmft levels were noted for rural-living 5-year-old Indigenous children. For Indigenous children living in metropolitan areas 4-year-olds experienced the highest mean dmft levels.

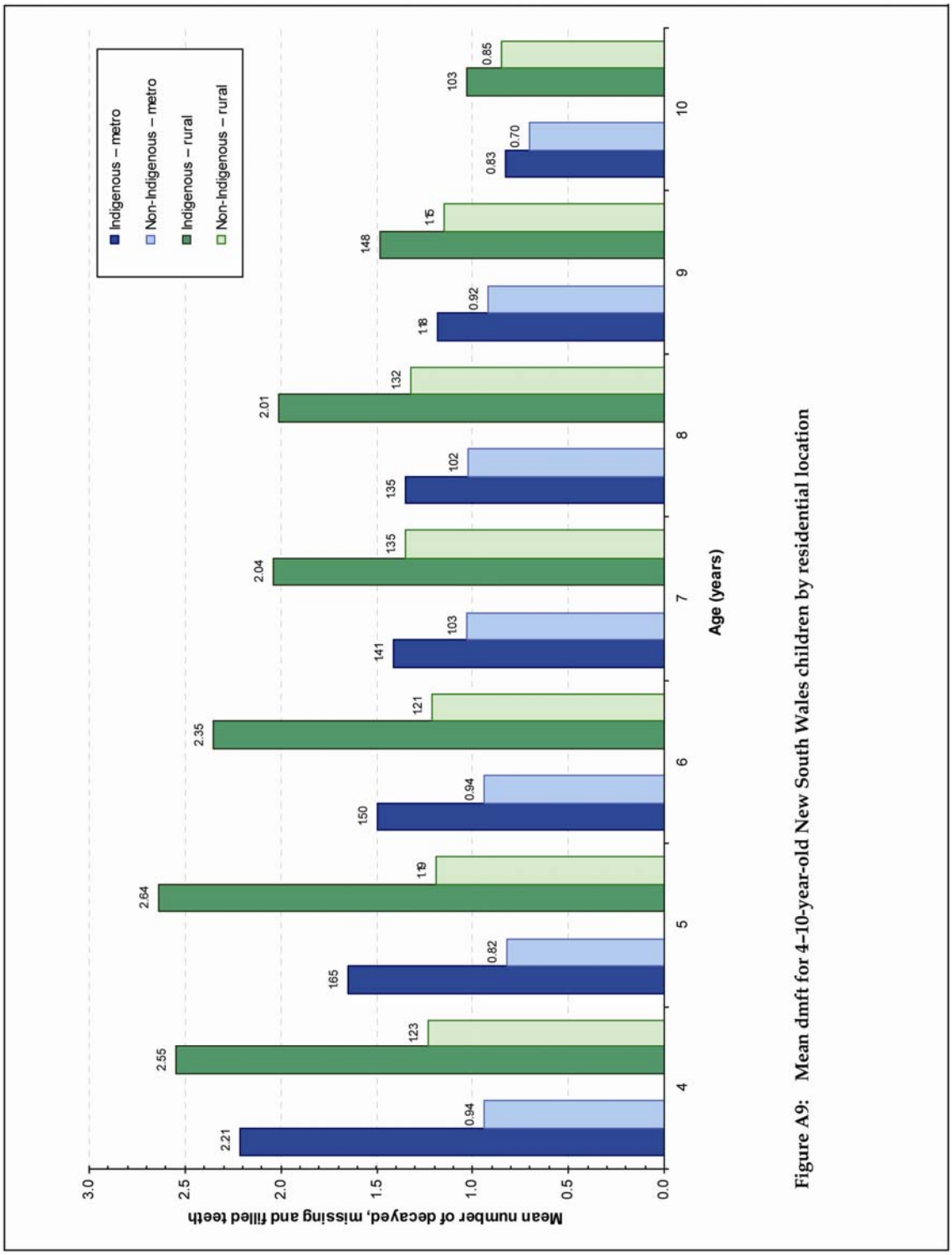


Figure A9: Mean dmft for 4–10-year-old New South Wales children by residential location

New South Wales: mean DMFT

The mean DMFT for 6–14-year-old NSW children by residential location is presented in Figure A10. Indigenous children living in metropolitan areas had higher mean DMFT than their non-Indigenous metropolitan-living counterparts across all age groups except 7-year-olds, with the greatest difference in mean DMFT being noted among 14-year-olds (Indigenous metropolitan 14-year-olds having 1.7 times the mean DMFT of their non-Indigenous counterparts). Across all age groups rural Indigenous children had higher mean DMFT than their non-Indigenous rural counterparts, with the greatest relative difference in mean DMFT being among 6-year-olds (Indigenous rural 6-year-olds having 4.7 times the mean DMFT of their non-Indigenous counterparts). Rural Indigenous children had higher mean DMFT than their urban Indigenous counterparts across all age groups except ages 12 and 14 years. The greatest differences in mean DMFT between Indigenous metropolitan and rural groups was noted for 10-year-olds, with rural Indigenous children having 1.5 times the mean DMFT of metropolitan Indigenous children in the same age group. The highest mean DMFT levels were noted for 14-year old Indigenous children living in metropolitan areas. For Indigenous children living in rural areas the highest mean DMFT levels were also experienced by 14-year olds.

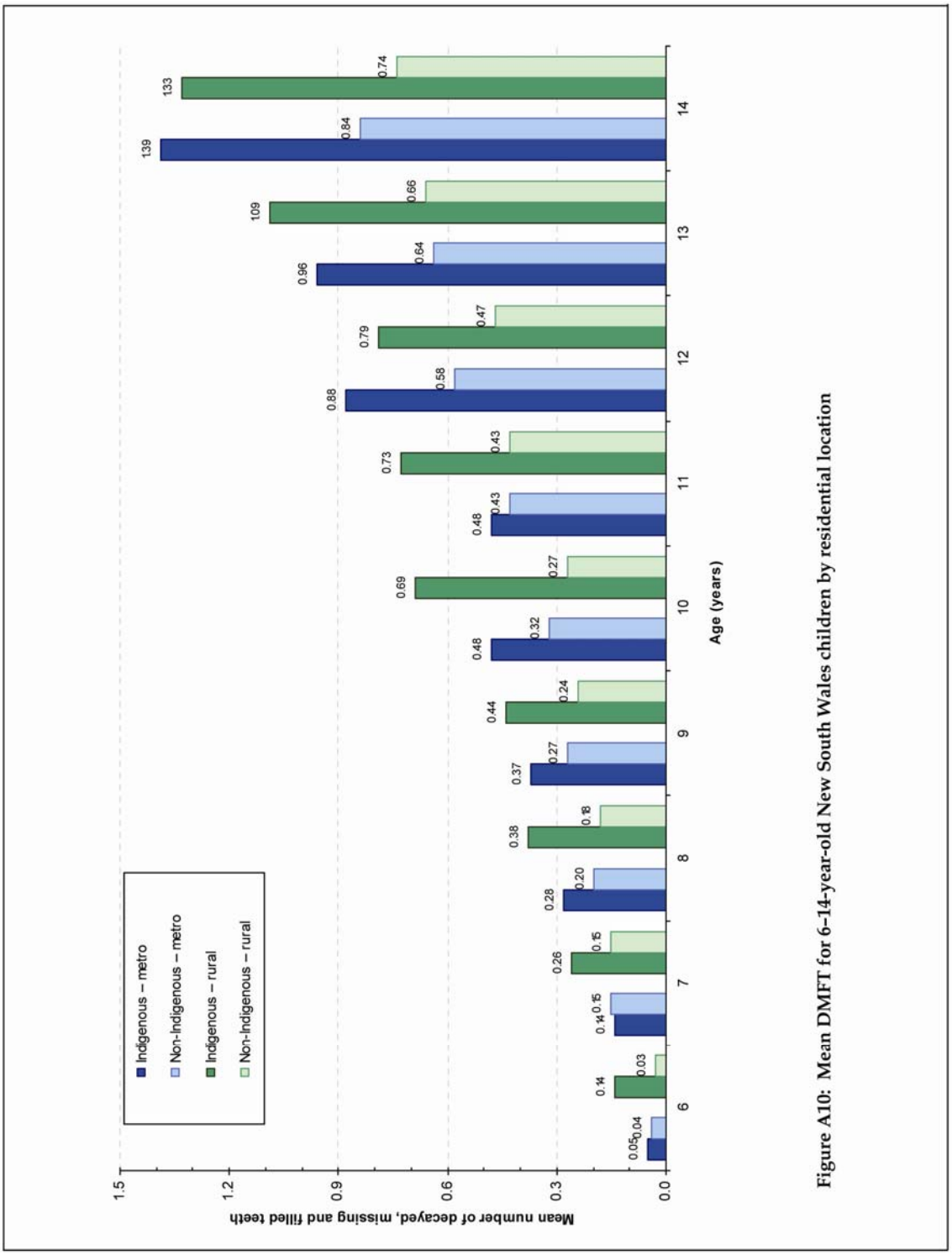


Figure A10: Mean DMFT for 6–14-year-old New South Wales children by residential location

South Australia: mean dmft

The mean dmft for 4–10-year-old SA children by residential location is presented in Figure A11. Indigenous children living in metropolitan areas had higher dental caries experience than their non-Indigenous metropolitan-living counterparts, with the greatest difference in mean dmft occurring for 5-year-old children (5-year-old metropolitan-living Indigenous children had over twice the mean dmft of non-Indigenous metropolitan-living 5-year-olds). Similarly, Indigenous children living in rural areas had higher dental caries experience than their non-Indigenous rural-living counterparts, with the greatest difference in mean dmft occurring among 4-year-olds (rural Indigenous 4-year-olds having nearly two and a half times the mean dmft of their non-Indigenous rural-living counterparts). Indigenous children living in rural areas had higher mean dmft levels than their metropolitan Indigenous counterparts, with the greatest relative difference being noted among 8-year olds (8-year-old rural Indigenous mean dmft was 3.86, compared with 2.73 in metropolitan-living 8-year-old Indigenous children). The highest mean dmft levels were noted for 6-year-old Indigenous children living in rural areas. For Indigenous children living in metropolitan areas 6-year-olds also experienced the highest mean dmft levels.

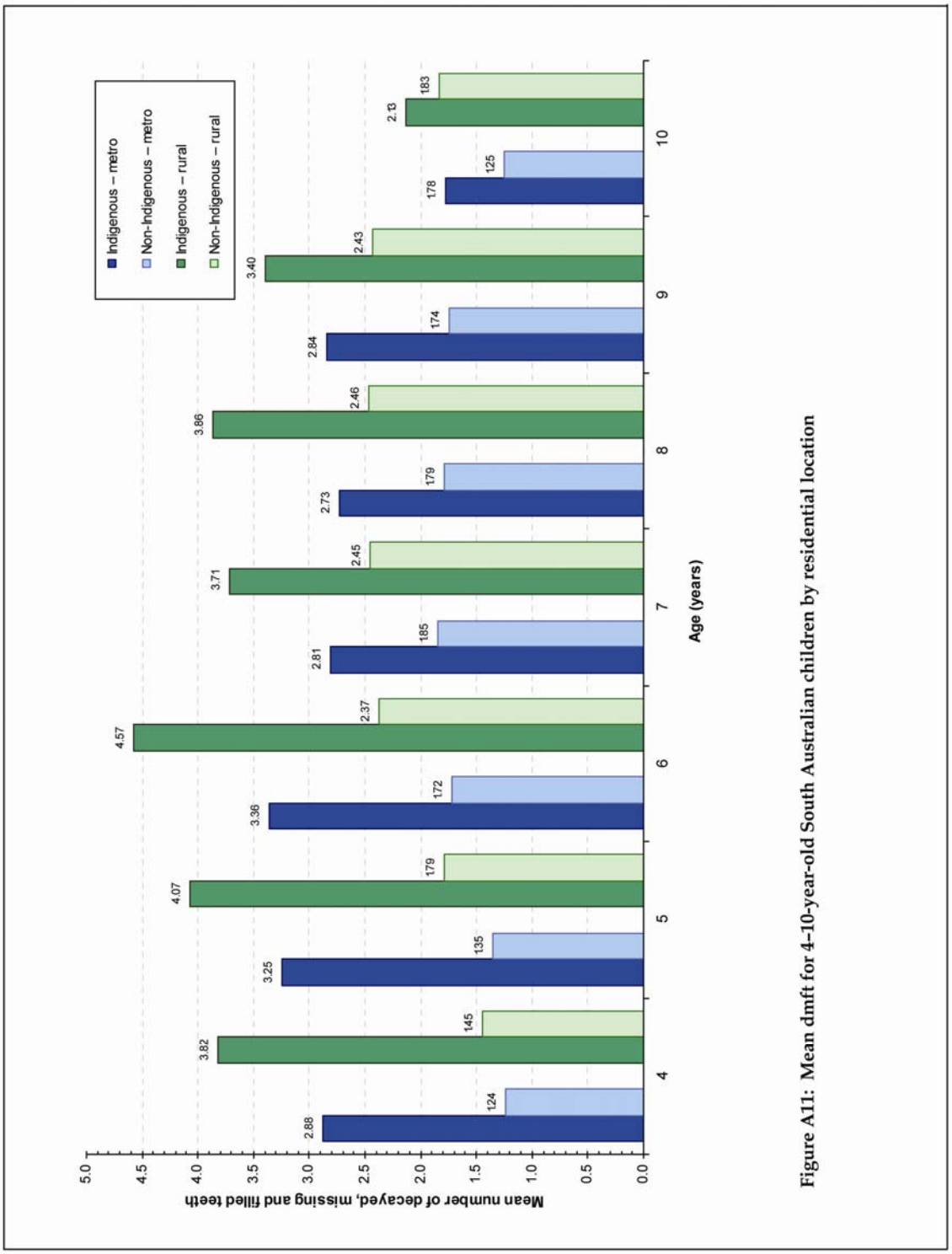


Figure A11: Mean dmft for 4–10-year-old South Australian children by residential location

South Australia: mean DMFT

The mean DMFT for 6–15-year-old SA children by residential location is presented in Figure A12. Across all age groups Indigenous children living in metropolitan areas had higher mean DMFT levels than their non-Indigenous metropolitan-living counterparts, with 15-year-old Indigenous children having the highest mean DMFT score (2.33). The greatest Indigenous/non-Indigenous metropolitan-living difference in mean DMFT was 0.71, and this was noted among both 13- and 15-year-olds. Similarly, Indigenous children living in rural areas had higher dental caries experience than their non-Indigenous rural-living counterparts, with 14-year-old Indigenous children having the highest mean DMFT score (3.32). Across all age groups (except 11-year-olds), rural Indigenous children had higher mean DMFT scores than metropolitan Indigenous children, with the greatest difference in mean DMFT occurring for 14-year-olds (1.51).

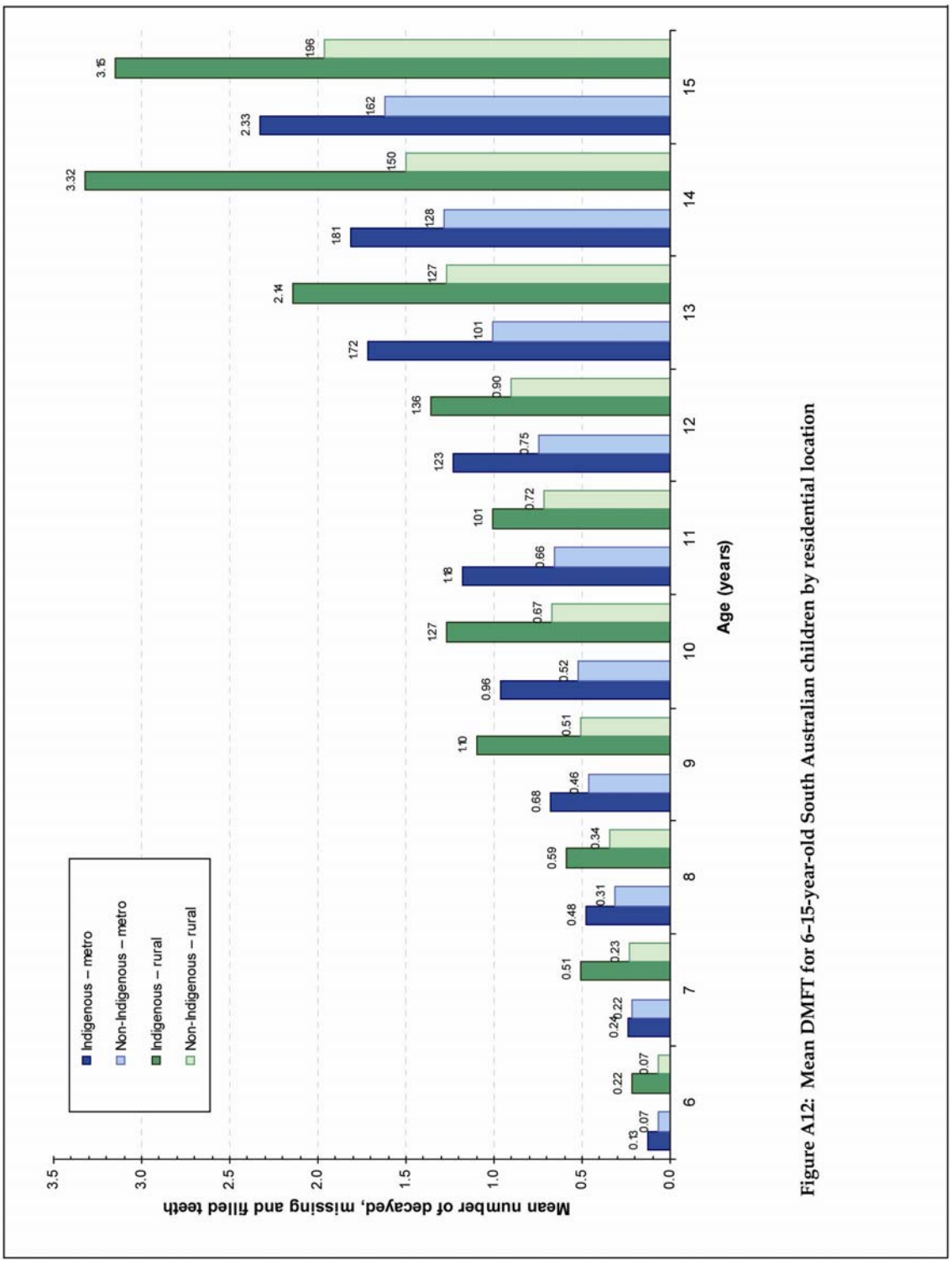


Figure A12: Mean DMFT for 6–15-year-old South Australian children by residential location

Northern Territory: mean dmft

The mean dmft for 4–10-year-old NT children by residential area is presented in Figure A13. Indigenous children living in metropolitan areas had higher mean dmft levels than their non-Indigenous metropolitan-living counterparts, with the greatest difference in mean dmft (1.42) occurring among 4-year-olds. Among metropolitan-living Indigenous children 9-year-olds had the highest mean dmft score (2.82). In rural locations Indigenous children had higher dental caries experience than their non-Indigenous rural-living counterparts, with 5-year-old rural Indigenous children having over three times the mean dmft score of their non-Indigenous counterparts. Rural-living Indigenous children had higher mean dmft levels than metropolitan-living Indigenous children, apart from those aged 9 years. The largest difference in mean dmft between rural and metropolitan Indigenous children was noted among 5-year-olds, with rural Indigenous 5-year-olds having 1.94 times the mean dmft of their metropolitan counterparts.

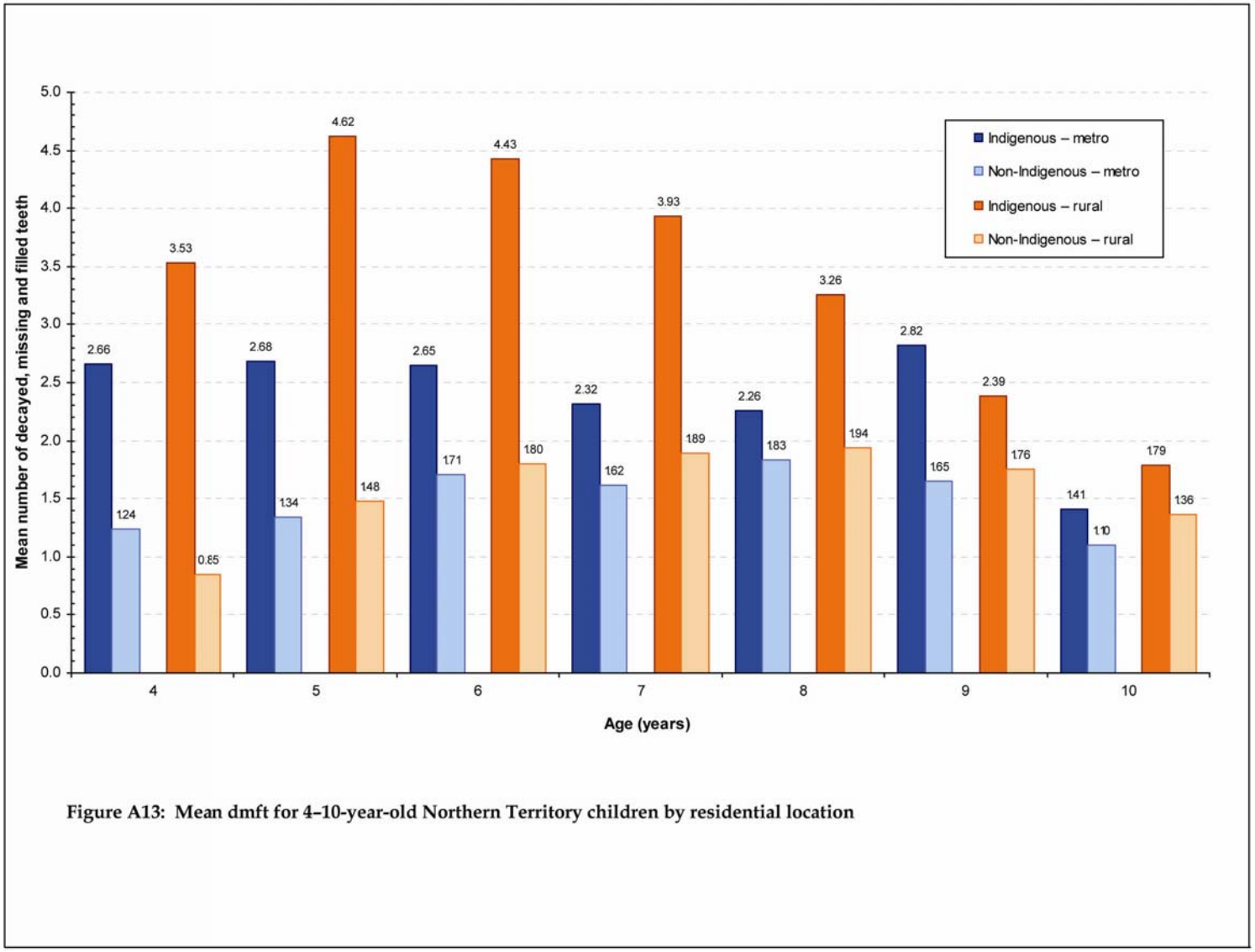


Figure A13: Mean dmft for 4–10-year-old Northern Territory children by residential location

Northern Territory: mean DMFT

The mean DMFT for 6–13-year-old NT children by residential location is presented in Figure A14. Across all age groups except 12-year-olds metropolitan-living Indigenous children had higher mean DMFT scores than their non-Indigenous metropolitan-living counterparts, with Indigenous children aged 13 years having the highest mean DMFT score (1.50). The greatest difference in mean DMFT among metropolitan-living children also occurred among 13-year-olds (13-year-old metropolitan-living Indigenous children had 2.83 times the mean DMFT of 13-year-old metropolitan-living non-Indigenous children). In rural areas, Indigenous children across all age groups had higher mean DMFT scores than their non-Indigenous rural-living counterparts. The highest mean DMFT score (1.85) for rural-living children was observed among Indigenous 13-year-olds. The difference in mean DMFT between rural-living Indigenous and non-Indigenous children increased with increasing age group, with the most marked difference (0.87) noted among those aged 13 years. Indigenous children living in rural areas had higher mean DMFT levels than their metropolitan counterparts across all age groups except 6-year-olds. This relative difference was most marked in 12-year-old children, with 12-year-old rural-living Indigenous children having over twice the mean DMFT of their metropolitan-living counterparts.

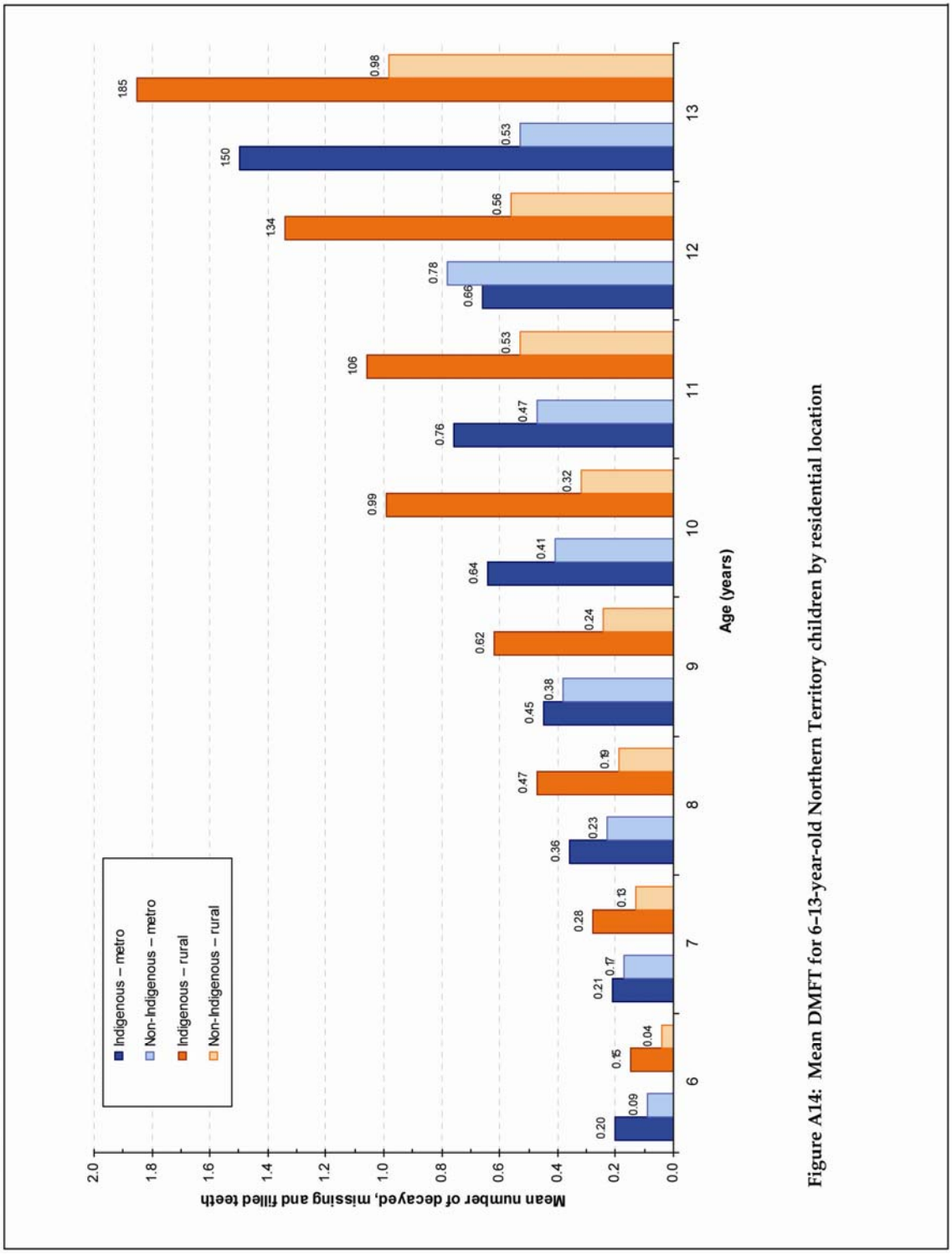


Figure A14: Mean DMFT for 6–13-year-old Northern Territory children by residential location

Appendix B: Indigenous oral health research initiatives

Investigation of the oral health of Indigenous people, particularly those living in remote communities, is at the crossroads of three national research priorities (http://www.nhmrc.gov.au/research/spdres.htm). This appendix outlines a number of Indigenous oral health research initiatives taking place, or about to take place, throughout the nation. A large proportion of these initiatives focus on remote Indigenous oral health.

National

The design and implementation of a National Aboriginal Oral Health Survey was discussed at the national workshop on Indigenous oral health, and recommended to the National Advisory Committee on Oral Health (NACOH) (Australian Government Department of Health and Ageing 2003).

New South Wales

A project has been funded in NSW to investigate the molecular epidemiology of dental infection in Indigenous communities. It is known that destructive periodontal diseases are affected by modifying factors including systemic diseases such as diabetes, socioeconomic conditions and lack of effective control of microbial accumulation at the gingival margin. The hypothesis is that a limited number of pathogenic bacterial strains, defined by quantitative molecular probe analysis, persist in or reinfect individuals. Thus, a high disease burden is maintained in the presence of adverse modifying factors that prevail in isolated, disadvantaged Indigenous communities.

South Australia

In Port Augusta an oral health research initiative has been developed that involves monitoring and evaluating oral health programs for Indigenous children. It is hoped that outcomes of the study will guide the planning and implementation of programs for other age groups and for remote communities serviced by the Pika Wiya Health Service (a Government funded health service run by Indigenous people). The project group will also investigate the appropriateness of the developed strategies for implementation in other Indigenous communities.

Northern Territory

The goal of the 'STLK' (Strong Teeth for Little Kids in remote Aboriginal children) project is to develop, implement and evaluate the effectiveness of a community-oriented, primary health care intervention to prevent dental decay among pre-school children in Indigenous communities. Around 20 NT Indigenous communities will be involved in the project, in which pre-schoolers in half the communities only receive dental services currently offered to school-aged children, and pre-schoolers in the other communities receive an additional comprehensive primary health care intervention. The hypothesis is that children's net caries experience

(both treated and untreated decay) will be lower in communities that receive the comprehensive primary health care intervention compared with those that only receive the extended school dental services.

The 'Strong Teeth' study currently being conducted in the NT aims to determine the requirements, feasibility and cost-effectiveness of fluoridating water supplies in remote Indigenous communities. The project has two objectives: to identify Indigenous communities likely to benefit most from water fluoridation, and to examine the feasibility and impact of introducing a small-scale fluoridation plant into at least one community. The first objective was achieved by mapping natural levels of fluoride in the water supply of 22 Indigenous communities across the NT, and selecting six communities with low natural fluoride levels (<0.6 ppm). The second objective is currently being met, with fluoridation plants being installed in two of the communities. Maintenance and cost requirements of the plants are being monitored, and oral health data of children in all six communities are being collected 6-monthly. Oral health comparisons will be made after 3 years of the fluoride plants being installed.

A further oral health investigation proposed for the NT is the addition of a dental component to the already-established Aboriginal Birth Cohort (ABC). The ABC is a life-course investigation of a sample of Indigenous children born in the NT between 1987 and 1990. Two waves of the study have already occurred. The goal of the dental component is to assess variations in dental caries and periodontal disease in accordance with the life-course approach, following the methodology of the National Adult Oral Health Survey (which will run concurrently with Wave 3 of the ABC project). Specific aims include: describing the prevalence and severity of dental caries and periodontal disease; assessing variations in oral disease experience among participants who were low-weight, pre-term babies and those who were normal birth weight; estimating variations in periodontal disease experience among participants who had poor systemic general health during childhood or in young adulthood; and analysing dental caries experience among participants by a range of social and behavioural risk/protective factors.

The 'Testing a community-based model of oral health promotion in a remote community' project involves development and trialling of an oral health promotion package for remote Indigenous groups based on community consultation, including development of an audiovisual health promotion package in local language. The project is based in Santa Teresa (100 km west of Alice Springs) in the NT. The specific aims are to survey the oral health status and treatment needs of all children in Santa Teresa aged 2–6 years, present the survey data findings to the community, work with the community to develop strategies and resources to address the identified oral health problems, implement a culturally-appropriate and community-owned oral health promotion model, and evaluate the implemented strategies and early childhood caries outcomes over a 3-year period.

Appendix C: Indigenous child oral health policies

The National Aboriginal Health Strategy in 1989 acknowledged that the extreme poverty and unhealthy diet experienced by remote Indigenous children no doubt contributed to the increase in dental caries observed in such children over the past 20 years, and identified oral health as a priority for Indigenous communities. Around the same time the National Aboriginal Community Controlled Health Organisation (NACCHO 1989) recommended that oral health be incorporated into Indigenous primary health care services. Their objective was to raise awareness of Indigenous oral health at a policy-making level, so that dental services could be more culturally appropriate and owned/organised by Indigenous communities. The long-term goal was to give Indigenous communities ownership of oral health initiatives, to be key players in the conceptualisation, development and realisation of such initiatives, and thus be empowered through the premises of the Ottawa Charter for Health Promotion (1986).

Indigenous oral health workshop

Under the auspices of the Health Council and the Standing Committee of Aboriginal and Torres Strait Islander Health (SCATSIH), a national workshop on Indigenous oral health was held in 2002. It was seen as an opportunity for health professionals, community representatives, service providers and policy makers to discuss Indigenous oral health issues; specifically to address access to services, workforce needs, health promotion, data and information, and integration of oral health within health systems and services. Key points that arose from the workshop included:

- generation of funding for comprehensive oral health programs through Indigenous community controlled health services;
- an increase in water fluoridation in Indigenous communities;
- encouragement of community ownership of dental programs;
- incorporation of cultural awareness as a mandatory part of all oral health professional training;
- integration of oral health into medical and other health training;
- expansion of dental therapists' roles to meet demand;
- adoption of incentives to attract oral health professionals to rural and remote areas;
- increase in training and support for the Indigenous oral health workforce;
- accreditation of university courses for Indigenous health workers;
- development of oral health promotion resources and location in a national clearing house;
- encouragement of partnerships with other health care providers (oral health checks being a part of general health checks);
- establishment of regular and standardised collection of oral health data;
- linkage of oral health data to general health data;

- consolidation and evaluation of existing data sets;
- formal assessment of prevention and promotion activities; and
- collection of oral health data from Indigenous controlled health services in a manner consistent with national standards.

A plan of action emerged from the workshop and included the following five general objectives:

- Provide culturally appropriate oral health services to all Indigenous people.
- Increase the workforce available to improve oral health outcomes for Indigenous people.
- Increase oral health promotion activity with the aim of improving health outcomes for Indigenous people.
- Improve the collection, quality and dissemination of oral health information about Indigenous people.
- Foster integration of oral health within health systems and services, particularly with respect to primary health care and Indigenous people.

A report from the workshop was referred to the National Advisory Committee on Oral Health (NACOH), which included it in the National Oral Health Plan.

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List of tables

List of figures