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Caries experience among publicly-funded dental patients in Australia,1995-96: Type of care and geographic location

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Abstract

Health card holders are a financially disadvantaged group and are the target population eligible for publicly-funded dental care. While their health status is generally worse compared with other Australians, there is also considerable variation among card holders. The aims of this study were to describe the oral health status of publicly-funded dental patients by type of care, geographic location and age, and to compare trends over time against other Australian studies. Patients were sampled randomly, based on date of birth, by State/Territory dental services in 1995-96. Dentists recorded oral health measures at the initial visit of a course of care using written instructions, but there was no formal calibration. The 6109 patients sampled were weighted in proportion to the numbers of publicly-funded dental patients for each State/Territory. Multiple linear regression analysis indicated that caries experience measured by the DMFT index increased across older age groups ($p<0.05$). For rural compared with urban patients, mean numbers of decayed and filled teeth tended to be higher. For emergency compared with non-emergency care, mean numbers of decayed and missing teeth were higher, and filled teeth lower. The findings of this monitoring survey document high levels of previous disease and treatment and indicate variation between subgroups of users of publicly-funded dental care. This included an uneven geographic distribution of oral health and disease, and variation in unmet treatment needs by type of course of care. Temporal comparisons indicate publicly-funded patients have experienced the population trend towards lower levels of tooth loss over time but have higher levels of untreated decayed teeth compared with the general population.

Key words: Caries, DMFT, public patients.

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Introduction

Australia has an extensive record of the oral health status of children but there has been less emphasis on adults.[1] Surveys of self-reported measures of edentulism have demonstrated decreasing levels of complete tooth loss among Australian adults.[2,3] However, there have been few studies documenting oral measures such as caries experience and periodontal conditions among adults. The only national level data are from the National Oral Health Survey of Australia conducted in 1987-88.[4] Other surveys of adult oral health have been restricted to limited geographic regions within Australia. For example, there have been surveys reported from Brisbane,[5] Melbourne,[6] and Adelaide.[7]

There also has been a paucity of information specific to the groups who are considered to be most at risk of the consequences of oral disease. Some special groups have been studied, for example nursing home residents,[8] and older adults.[9-11] However, data specific to health card holders have been limited. Health card holders are the target group eligible for publicly-funded dental care. Holders of health cards include groups such as aged pensioners and the unemployed. Oral health data were collected on publicly-funded dental patients during 1992-93 from locations in New South Wales, Victoria, and South Australia. Findings included higher levels of decayed teeth for emergency compared with non-emergency patients, particularly among those aged 15-24 years, while periodontal pocketing of 6 mm or more was highest among emergency patients aged 65 years or older.[12] Card holders represent a low income group within the Australian population and are the target group eligible for publicly-funded dental care. Inequalities in oral health and access to dental services were identified as major issues in public health in Australia by the National Health Strategy.[13] Oral health goals and targets for Australia include reducing the proportion of persons with

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untreated dental caries and reducing the prevalence of missing teeth and edentulism, with persons from low socio-economic groups being a priority within the population.[14]

The main aim of this study was to describe the oral health status of publicly-funded dental patients by type of care, geographic location and age. Another aim was to compare trends in oral health status over time against other Australian studies. These analyses update and extend the ability to generalize the findings on publicly-funded dental patients from 1992-93 by using data based on a larger sample size from a wider range of locations across Australia.

Methods

Collection procedures

Data were collected from a random sample of adult patients at the beginning of a publicly-funded course of care. The target population consisted of adult card holders attending for publicly-funded dental care in all States/Territories of Australia during the 1995-96 period. Data were collected on oral health status, patient characteristics, visit details, and services provided. Patients attending for multiple courses of care throughout the survey period were analysed as separate courses of care.

The mode of data collection varied between States/Territories but was based on a recording system developed and tested in three States in 1992-93.[15] In all States/Territories, except New South Wales, optical mark read (OMR) scan forms were used to record measures of oral health status. The remaining data on patient characteristics, visit details, and service provision were either recorded on the same double-sided OMR form as the oral health data, or recorded on data files derived from computer-based management information systems (MIS) which were linked to oral health data recorded on single-sided OMR forms. In New South Wales, only the United Dental Hospital of Sydney participated in the survey, using a manual forms system designed to be compatible with the data items collected on the OMR forms.

Sampling

Sampling was based on date of birth. In all five mainland States, a yield of approximately 3570 patients was determined to obtain 119 persons in each of six age groups, in order to provide prevalence estimates with a relative standard error of 40 per cent or less within five subgroups of an age group for key outcome measures as low as 5 per cent prevalence (for example, emergency patients receiving preventive services). Smaller yields were proposed for Tasmania and the two Territories in order to reduce the survey workload at clinics where patient flows were less, but this limited the ability to make precise age-specific estimates by another level of disaggregation in these States/Territories.[16]

Weighting

The data were weighted using the State/Territory-specific estimated number of adult persons who made their last visit to either a public dental clinic or to a publicly-funded private practice within the last 12 months, using information from the 1996 National Dental Telephone Interview Survey.[17] This was performed to weight the national sample yields in proportion to the number of publicly-funded visits for each State/Territory. Hence, national estimates reported here aim to be representative of health card holders seeking dental care through publicly-funded programs. While weighting of data adjusts the sample yield in proportion to the numbers of patients in each State/Territory, the data for New South Wales do not represent the geographic distribution of patients across this State, as all patients were sampled from the State capital, Sydney.

Measurement approach

The measurement approach adopted was consistent with a monitoring survey rather than an epidemiological survey. As such there was no attempt at calibration of dentists and no assessment of reliability of the measures. The approach was developed as a form of low-cost methodology. Such methods have been used elsewhere to develop dental public health databases through the use of a large number of examiners as an alternative to conventional epidemiological surveys.[18] The approach consisted of supplying those responsible for publicly-funded dental services in all States/Territories with copies of written instructions regarding the use of OMR examination forms and guidelines on coding and clinical definitions. These guidelines had been developed in conjunction with a Steering Committee which had representatives from State/Territory dental services and the Commonwealth Department of Health and Family Services. The States/Territories distributed these instructions to dentists involved in the provision of clinical care to publicly-funded dental patients in their respective States/Territories. These dentists recorded the oral health status at the beginning of a course of care for sampled patients during the survey period.

Instructions for coding caries experience were based on the US National Institute of Dental Research (NIDR) scoring system for coronal and root caries.[19] The examination form made provision to either code the tooth status for each permanent tooth in an arch or else to record the entire arch as edentulous. If an arch was not edentulous, then a mandatory single tooth status score was required for

Table 1. Number of examined patients by State/Territory

	NSW	Vic	Qld	SA	WA	Tas	ACT	NT	All
Mode of data collection	Manual	MIS and OMR*	OMR†	MIS and OMR‡	MIS and OMR‡	OMR†	MIS and OMR‡	OMR†	
Target yield	3570	3570	3570	3570	3570	714	714	714	19 992
Number of patients examined	874	1847	2628	1505	1193	359	58	269	8733
Number of matched examined patients	874	1040	2628	753	160	359	26	269	6109
Percentage matched	100.0	56.3	100.0	50.0	13.4	100.0	44.8	100.0	70.0

MIS = Management Information System (computer).
*Double-sided and single-sided optical mark read (OMR) scan forms.
†Double-sided optical mark read (OMR) scan forms only.

all crowns, including third molars, and an optional single tooth status score could be recorded for roots, depending on their status. The status of crowns were recorded as one of: decayed, recurrent caries, filled (and otherwise sound), filled (unsatisfactory – for reasons other than caries), extracted (due to caries or periodontal reasons), missing/other, sound, or unerupted. The categories of extracted, missing/other, sound, or unerupted were mutually exclusive, while there were precedence rules determining the other codes. Decayed status had precedence over recurrent caries, filled, and filled (unsatisfactory). Recurrent caries status had precedence over filled, and filled (unsatisfactory). Filled (unsatisfactory) had precedence over filled. The status of roots could be recorded as either decayed, recurrent caries, filled, or filled (unsatisfactory), or left blank if none of these conditions was present. The findings presented here are restricted to coronal caries experience. Dentists were instructed to evaluate oral health status using visual and tactile information alone, in conjunction with the definitions supplied. When a single carious lesion affected the crown and root, then caries experience was recorded for both the crown and root if the lesion affected both crown and root equally; if more than half of the lesion was apical to the cemento-enamel junction (CEJ) then the site was defined as the root; if less than half of the lesion was apical to the CEJ then the site was defined as the crown.

Analysis

The dependent variables in the analysis consisted of caries experience in the permanent dentition as measured by the DMFT index and components. These were calculated for each examined patient as: D = the sum of decayed and recurrent caries tooth status codes, M = the sum of extracted (due to caries or periodontal conditions) plus the number of teeth in an edentulous arch if appropriate, and F = the sum of filled and filled (unsatisfactory) tooth status codes. The analysis of caries experience was restricted to examinations which had two or less invalid tooth status codes out of the 32 teeth scored. An invalid tooth status code could arise either through the tooth status being left blank or multiple marks being recorded for a tooth. Overall 83.7 per cent of examinations of dentate persons had no invalid codes, 7.7 per cent had one invalid code,and 2.3 per cent had two invalid codes. The remaining 6.3 per cent which had three or more invalid codes were excluded from the analysis.

Independent variables used in the analysis consisted of age of patient, type of course of care, and geographic location. Type of course of care was defined as emergency if relief of pain was the reason for which the care was initiated; other types such as general scheduled care and screening visits were classified as non-emergency. Geographic location was classified as urban or rural, based on the residential postcode of the patient.[20] The analysis proceeds from a description of sample yields by State/Territory, to an examination of the distribution of sociodemographic and visit details in the sample, and then to an analysis of bivariate and multivariate associations of caries experience by age, type of care and location, using analysis of variance with $p<0.05$ as the significance level.[21]

Results

Sample yields by State/Territory

Table 1 shows that a total of 6109 patients were available for analysis. The sample yields varied between States/Territories from 26 in the Australian Capital Territory up to 2628 in Queensland. In total, this represents 30.6 per cent of the desired sample yield. This undersampling limits the level of precision possible when disaggregating age-specific estimates by States/Territories. However, the total yield provides acceptable precision when aggregated at the national level. Note that although the sample yield for Australian Capital Territory was small (0.4 per cent of the total yield), patients from this Territory comprised only 1.3 per cent of public

Table 2. Sociodemographic and visit characteristics by matched and unmatched sample components for States/Territories using single-sided OMR forms, and for matched cases from all States/Territories

	Vic, SA, WA and ACT		All States/ Territories
	Matched* %	Unmatched† %	Matched‡ %
Age of patient			
15-24 years	10.2	11.2	10.7
25-34 years	15.0	17.7	16.7
35-44 years	17.8	17.2	16.9
45-54 years	12.6	12.4	12.8
55-64 years	17.1	16.1	17.0
65+ years	27.4	25.5	25.9
Dentate status			
Dentate	86.4	95.6§	92.2
Edentulous	13.6	4.4	7.8
Type of care			
Emergency	54.8	53.4	57.5
Non-emergency	45.2	46.7	42.5
Geographic location			
Urban	80.4	84.9	84.0
Rural	19.6	15.1	16.0

*Single-sided OMR forms matched with computer MIS (n=1979).
†Computer MIS records not matched with single-sided OMR forms; this also includes patients who were in scope but not sampled and examined for the survey (n=30 970).
‡Single-sided OMR forms matched with computer MIS, double-sided OMR forms and manual forms (n=6109).
§Dentate status not available from all State/Territory MISs (n=18 570

patients when weighted, and comparisons of analyses which excluded these patients revealed that this had little effect on the estimates or patterns of associations, hence these patients were retained in further analyses. As well as undersampling, there was some loss of data through lack of matching between single-sided OMR forms and computer MIS files, with a total matching of 70 per cent across all States/Territories.

For the States which used single-sided OMR forms in conjunction with computer MISs, a comparison of matched and unmatched data was performed to assess the extent of bias likely to occur from lack of matching and undersampling. The results are presented in Table 2. Note that the unmatched data include the patients who had examinations recorded on single-sided OMR forms which were not matched with computer MIS records (presented in Table 1), plus the computer MIS records for patients with birth dates which were in scope but were not sampled and examined for this survey. Some differences were evident when comparing matched with unmatched data by age (for example, 27.4 per cent compared with 25.5 per cent aged 65 years or more), dentate status (13.6 per cent compared with 4.4 per cent edentulous), and geographic location (80.4 per cent compared with 84.9 per cent urban). This suggests a tendency to include more elderly and edentulous patients. This may reflect that less effort is required by dentists to record edentulous status on the charting system used. The distribution by geographic location was similar to the distribution for all States/Territories combined, while the differences by dentate status were reduced when compared with all States/Territories.

Sociodemographic and visit characteristics by State/Territory

Table 3 shows the distribution of sociodemographic and visit characteristics by State/Territory. For all States/Territories the highest percentage of patients was in the 65+ years age group (25.9 per cent); this pattern was observed in New South Wales, Victoria, Queensland and South Australia. Younger age distributions were observed for Western Australia, Tasmania and Northern Territory where the highest percentage of patients was in the 25-34 years age group. The small number of cases in the Australian

Table 3. Sociodemographic and visit details by State/Territory

	NSW %	Vic %	Qld %	SA %	WA %	Tas %	ACT %	NT %	All %
Age of patient									
15-24 years	8.1	12.3	13.0	6.5	9.9	14.9	19.2	21.2	10.7
25-34 years	17.5	15.6	15.1	12.8	20.8	27.8	19.2	35.9	16.7
35-44 years	15.7	18.1	15.7	16.8	20.1	20.1	19.2	21.2	16.9
45-54 years	13.4	14.7	11.4	9.5	12.6	12.0	19.2	12.0	12.8
55-64 years	19.4	18.0	15.2	16.9	14.5	11.5	3.9	6.2	17.0
65+ years	25.9	21.4	29.7	37.6	18.9	13.8	19.2	3.5	25.9
Dentate status									
Dentate	96.6	92.9	87.1	80.9	98.8	98.3	100.0	97.8	92.2
Edentulous	3.4	7.1	12.9	19.1	1.3	1.7	0.0	2.2	7.8
Type of care									
Emergency	68.4	67.8	47.6	38.8	45.6	32.3	50.0	44.6	57.5
Non-emergency	31.6	32.2	52.4	61.2	54.4	67.7	50.0	55.4	42.5
Geographic location									
Urban	99.9	82.0	72.9	78.7	74.8	52.8	100.0	18.4	84.0
Rural	0.1	18.0	27.1	21.3	25.2	47.2	0.0	81.6	16.0

Table 4. Mean DMFT and components: age of patient, type of course of care and geographic location

	Age (years)											
	15-24		25-34		35-44		45-54		55-64		65+	
	Mean	(SE)	Mean	(SE)	Mean	(SE)	Mean	(SE)	Mean	(SE)	Mean	(SE)
Decayed teeth												
Emergency	3.1	(0.2)	3.3	(0.2)	2.3	(0.1)	1.7	(0.1)	1.2	(0.1)	1.2	(0.1)
Non-emergency	2.3	(0.2)	2.7	(0.2)	2.2	(0.1)	1.5	(0.1)	1.5	(0.1)	0.8	(0.1)
Urban	2.7	(0.2)	3.0	(0.1)	2.2	(0.1)	1.6	(0.1)	1.3	(0.1)	1.1	(0.1)
Rural	3.2	(0.3)	3.4	(0.2)	2.3	(0.2)	2.3	(0.3)	1.5	(0.2)	0.8	(0.1)
All	2.8	(0.1)	3.1	(0.1)	2.3	(0.1)	1.6	(0.1)	1.4	(0.1)	1.1	(0.1)
Missing teeth												
Emergency	0.7	(0.1)	1.8	(0.1)	4.0	(0.2)	6.0	(0.3)	7.7	(0.4)	10.6	(0.4)
Non-emergency	0.5	(0.1)	2.0	(0.2)	3.2	(0.2)	4.8	(0.4)	8.7	(0.4)	8.8	(0.4)
Urban	0.7	(0.1)	1.9	(0.1)	3.6	(0.2)	5.6	(0.3)	8.5	(0.3)	9.9	(0.3)
Rural	0.4	(0.1)	1.9	(0.2)	4.0	(0.4)	5.4	(0.6)	7.0	(0.6)	9.5	(0.7)
All	0.6	(0.1)	1.9	(0.1)	3.7	(0.2)	5.5	(0.3)	8.3	(0.3)	9.8	(0.3)
Filled teeth												
Emergency	3.3	(0.2)	5.6	(0.2)	6.9	(0.3)	7.8	(0.3)	7.2	(0.3)	6.1	(0.2)
Non-emergency	3.8	(0.3)	6.5	(0.2)	8.2	(0.3)	9.2	(0.4)	6.6	(0.3)	7.1	(0.2)
Urban	3.4	(0.2)	5.7	(0.2)	7.2	(0.2)	8.3	(0.3)	6.9	(0.2)	6.6	(0.2)
Rural	3.8	(0.3)	7.0	(0.3)	8.9	(0.4)	8.6	(0.5)	6.3	(0.4)	6.5	(0.4)
All	3.5	(0.1)	5.9	(0.2)	7.5	(0.2)	8.3	(0.2)	6.8	(0.2)	6.5	(0.2)
DMFT												
Emergency	7.1	(0.3)	10.7	(0.3)	13.3	(0.3)	15.5	(0.4)	16.1	(0.4)	17.9	(0.4)
Non-emergency	6.6	(0.3)	11.1	(0.3)	13.6	(0.3)	15.6	(0.4)	16.7	(0.4)	16.8	(0.3)
Urban	6.8	(0.3)	10.5	(0.3)	13.0	(0.3)	15.4	(0.3)	16.7	(0.3)	17.5	(0.3)
Rural	7.4	(0.4)	12.3	(0.4)	15.2	(0.5)	16.3	(0.6)	14.8	(0.6)	16.8	(0.7)
All	6.9	(0.2)	10.9	(0.2)	13.4	(0.2)	15.5	(0.3)	16.5	(0.3)	17.4	(0.2)

Capital Territory makes the age distribution difficult to interpret. The percentage of dentate patients was 92.2 per cent overall, ranging from 80.9 per cent in South Australia, 87.1 per cent in Queensland and over 92 per cent in the remaining States/Territories. The percentage of emergency courses of care was 57.5 per cent overall, ranging from 32.2 per cent in Tasmania, 38.8 per cent in South Australia and over 44 per cent among the remaining States/Territories. The percentage of care at urban locations ranged from 18.4 per cent in the Northern Territory, 52.8 per cent in Tasmania and was over 72 per cent among the remaining States/Territories. The high percentage of urban locations for New South Wales reflects the fact that all data were from the United Dental Hospital of Sydney.

Caries experience by age, type of care, and location

Caries experience is presented in Table 4 by age of patient, type of course of care and geographic location. Overall, DMFT varied by age, increasing across successively older age groups. The components of D, M, and F also varied by age. Decayed teeth were higher among younger patients, aged 15-24 and 25-34 years, and declined across older age groups. Missing teeth increased across successively older age groups. Filled teeth increased across older age groups up to a peak in the 45-54 years age group, and then declined across older age groups.

DMFT did not vary greatly by type of care. Mean decayed teeth were higher among emergency compared with non-emergency patients, particularly for patients aged 15-24 and 25-34 years. Missing teeth were higher among emergency patients compared with non-emergency patients in the age groups 15-24, 35-44 and 45-54 years, but lower in the age groups 25-34, 55-64, and 65+ years. Filled teeth were lower for emergency compared with non-emergency care for all age groups except 55-64 year olds.

DMFT was higher for patients in rural locations in age groups 15-24 to 45-54 years, but was lower in the age groups 55-64 and 65+ years. Decayed teeth were higher in rural locations among all patient age groups less than 65 years. Mean numbers of missing teeth were slightly lower for rural patients in the age groups 15-24 and 45-54 years and older. Filled teeth were higher in rural locations for patients aged 15-24 to 45-54 years.

Multivariate associations

Having analysed the data in a descriptive manner, the patterns of caries experience by age, type of care and location, the four dependent variables of DMFT, D, M, and F were examined through linear regression models which included the three independent variables of age, type of care, and location as indicator variables with reference categories of 65+ years, non-emergency care and rural locations. These models are summarized in Table 5. DMFT, D, M, and F all varied significantly by age of patient.

Table 5. Summary table of linear regression models for DMFT and components by age of patient, type of course of care and geographic location

	Decayed teeth			Missing teeth			Filled teeth			DMFT		
	Estimate	SE	p	Estimate	SE	p	Estimate	SE	p	Estimate	SE	p
Age of patient												
15-24 years	1.7	0.1	<0.01	-9.3	0.3	<0.01	-3.0	0.3	<0.01	-10.6	0.4	<0.01
25-34 years	1.9	0.1	<0.01	-8.0	0.3	<0.01	-0.6	0.2	<0.01	-6.7	0.3	<0.01
35-44 years	1.2	0.1	<0.01	-6.2	0.3	<0.01	0.9	0.2	<0.01	-4.1	0.3	<0.01
45-54 years	0.6	0.1	<0.01	-4.4	0.3	<0.01	1.8	0.3	<0.01	-2.0	0.4	<0.01
55-64 years	0.3	0.1	<0.05	-1.6	0.3	<0.01	0.3	0.2	0.25	-1.0	0.3	<0.01
65+ years	ref	-	-	ref	-	-	ref	-	-	ref	-	-
Type of care												
Emergency	0.4	0.1	<0.01	0.9	0.2	<0.01	-0.9	0.2	<0.01	0.4	0.2	0.08
Non-emergency	ref	-	-	ref	-	-	ref	-	-	ref	-	-
Geographic location												
Urban	-0.3	0.1	<0.01	0.1	0.3	0.84	-0.4	0.2	<0.05	-0.7	0.3	<0.05
Rural	ref	-	-	ref	-	-	ref	-	-	ref	-	-
P for model		0.0001			0.0001			0.0001			0.0001	
Adjusted R-squared		0.07			0.22			0.06			0.18	

SE = standard error.

D, M and F also varied significantly by type of care, with emergency patients having lower F, but having higher mean D and M teeth. D, F and DMF teeth were significantly higher in rural compared with urban locations.

Comparisons over time

Table 6 presents age-specific comparisons of caries experience over time, contrasting 1995-96 with 1987-88 and 1992-93.[4,12] Note that the component 'IT' for teeth indicated for extraction was recorded in 1987-88 but not in 1992-93 and 1995-96. However, this category contributed only a small component to the total DMFT score and hence does not greatly influence the comparison. Trends towards improved oral health status over time are evident in the comparison between 1987-88 and 1995-96, with age-specific DMFT being lower in the present study compared with the National Oral Health Survey of Australia (NOHSA) 1987-88 for age groups 25-29 years and older. Much of this difference is attributable to lower levels of missing teeth, consistent with population trends towards lower levels of edentulism. However, despite the trends over time towards better oral health, the levels of DMFT were higher for younger persons, aged 15-19 and 20-24, compared with NOHSA 1987-88. This was mainly due to higher levels of D teeth (for example, 2.0 compared with 1.1 for 15-19 year olds, and 3.3 compared with 1.6 for 20-24 year olds). Even among persons aged 25-29 years and older, who had lower DMFT, the mean number of D teeth was higher in each age group.

The 1992-93 study showed similar trends to NOHSA 1987-88, with DMFT being lower for each age group in the present study, indicating a trend towards improved oral health over time within the pool of health card holders attending for care. Missing teeth were lower in each age group, while D teeth were lower in younger patients (aged 15-24 and 25-44 years). To illustrate these trends over time, for persons aged 65 years or more M teeth were 17.4 in 1987-88, 16.8 in 1992-93, and 9.8 in 1995-96. For publicly-funded patients aged 15-24 years the level of D teeth was lower in 1995-96 (2.8) compared with 1992-93 (3.2) but remained high compared with the general population in 1987-88 (1.1 for 15-19 year olds and 1.6 for 20-24 year olds).

Discussion

This study reports the results of a national survey of the oral health of patients receiving publicly-funded dental care during the period 1995-96. These results need to be interpreted in view of the fact that this was a monitoring survey rather than an epidemiological survey. As such there was no attempt at calibration of dentists and no measurement of reliability of the measures. The use of general practitioners to collect epidemiological data has been investigated previously in the UK as a possible alternative to conventional surveys of adult dental health.[22] They found that mean numbers of filled teeth, sound teeth and the proportion of patients with 21 or more teeth were all similar to those found in the 1988 UK national survey of oral health, and concluded that the collection of data by general practitioners was feasible, and had construct and internal validity. However, they caution that the findings on a convenience sample of regularly attending adults could not replace traditional adult dental health surveys.

When comparing the results presented here with those of other studies it must be considered that this study was a survey of patients attending for

Table 6. Age-specific comparisons of mean DMFT and components: 1987-88 with 1995-96, and 1992-93 with 1995-96

Age group	Year of survey	DT	IT	MT	FT	DMFT
15-19 years	1987-88*	1.1	0.0	0.3	2.9	4.3
	1995-96	2.0	-	0.4	2.7	5.1
20-24 years	1987-88	1.6	0.0	0.6	5.3	7.6
	1995-96	3.3	-	0.8	3.9	8.0
25-29 years	1987-88	1.8	0.1	1.8	8.0	11.7
	1995-96	3.4	-	1.5	5.2	10.2
30-34 years	1987-88	1.5	0.1	3.1	10.0	14.7
	1995-96	2.7	-	2.2	6.6	11.6
35-44 years	1987-88	1.2	0.1	6.1	9.9	17.3
	1995-96	2.3	-	3.7	7.5	13.4
45-54 years	1987-88	1.0	0.1	10.4	7.6	19.2
	1995-96	1.6	-	5.5	8.3	15.5
55-64 years	1987-88	0.8	0.1	13.6	5.4	19.9
	1995-96	1.4	-	8.3	6.8	16.5
65+ years	1987-88	0.6	0.1	17.4	3.0	21.0
	1995-96	1.1	-	9.8	6.5	17.4
15-24 years	1992-93†	3.2	-	2.4	3.7	9.2
	1995-96	2.8	-	0.6	3.5	6.9
25-44 years	1992-93	3.0	-	5.9	8.1	17.0
	1995-96	2.7	-	2.8	6.7	12.2
45-64 years	1992-93	1.3	-	13.3	7.8	22.4
	1995-96	1.5	-	7.0	7.5	16.0
65+ years	1992-93	0.9	-	16.8	6.4	24.1
	1995-96	1.1	-	9.8	6.5	17.4

*1987-88: National Oral Health Survey of Australia.[4]
†1992-93:Adult Dental Programs Survey.[12]

publicly-funded dental care. The study population consists of health card holders, which represent a low income group. Therefore, the findings are not intended to be representative of the entire Australian population. It is expected that this group would have different levels of disease and it is likely they would have more untreated disease. Another consideration is that these findings are not only restricted to health card holders, but also to those health card holders who are eligible for care and have obtained such care.

Another limitation to consider is the level of under-sampling which occurred. While this placed limits on the level of precision possible when disaggregating age-specific estimates, the data reported here were only disaggregated by two other factors, type of care and geographic location each having only two levels (emergency versus non-emergency, and urban versus rural), providing acceptable levels of precision. The loss of some data through lack of matching represents a possible source of bias, but this was assessed through a comparison of matched examination cases with unmatched and unsampled MIS computer data records, which provided a quantitative assessment of potential bias. While older and edentulous patients tended to be over-represented in matched examination cases compared with the unmatched computer records, the analysis was restricted to dentate patients and estimates were stratified by age, geographic location and type of course of care. The scope of data collection could be improved through the inclusion of a greater range of geographic locations in New South Wales. While the collection of data across the other States/Territories ensured adequate numbers of patients from rural locations, the results may not reflect the conditions in rural New South Wales.

Two Australian studies provided relevant comparisons. The first being the National Oral Health Survey of Australia (NOHSA) 1987-88 which provides data on oral health status, based on 14 430 examined persons aged five years or more from seven of the eight States/Territories, which can be compared with the present study.[4] However, NOHSA is a survey of the general population, rather than patients attending for publicly-funded dental care. Hence, some differences are expected due to the different study populations. The comparison between 1987-88 and 1995-96 will also be influenced by a trend in the population towards improved oral health. For example, there has been a dramatic decline in the percentage of edentulous adults,[2,3] and the caries experience among children has declined since the 1970s.[1]

The other relevant comparative study is from the Research Database on Dental Care for Adults in Australia which included a survey of the oral health of publicly-funded dental patients in 1992-93.[12] The 1992-93 survey was performed at selected sites in New South Wales, Victoria and South Australia. It is possible that some of the decline in M teeth observed between 1992-93 and 1995-96 may represent an instrument effect, reflecting different coding and recording procedures for teeth missing due to caries or periodontal disease, or missing due to other reasons.

For example, the M component may be lower in 1995-96 if a greater number of missing teeth was recorded as missing due to reasons other than caries or periodontal disease, and hence not included in the DMFT score. On the other hand, a steady decline in missing teeth due to a cohort progression effect over time would be consistent with the observed decline in edentulism among adults reported from other studies.[2,3] The higher level of D teeth observed for publicly-funded patients in both 1992-93 and 1995-96 compared with the general population in 1987-88 is also in contrast to that observed among patients of school dental services. For example, among 15 year old school dental service patients in 1993 mean DMFT was 2.61, with 0.93 D teeth.[23] This suggests that at least among young adult health card holders the underlying population trend toward reduced levels of disease has not been sufficient to contain their disease levels and need for treatment. The inability of publicly-funded care for children to permanently influence their understanding of the benefits of prevention and treatment has been observed before in considering systems of dental coverage for adults.[24]

Multivariate analysis of caries experience in the present study indicated that the DMFT index increased across older age groups, and was lower among patients in urban locations. D and F teeth varied by age, geographic location, and by type of care, while M teeth varied by age and type of care. Rural patients had higher mean D and F, while emergency patients had higher D and M, but lower F teeth. The findings document high levels of previous disease and treatment and indicate variation between subgroups of users of publicly-funded dental care. This included an uneven geographic distribution of oral health and disease and variation in unmet treatment needs by type of course of care. Problems associated with emergency dental care have been recognized as an area of concern for publicly-funded dental care, being associated with less favourable treatment outcomes such as extraction of teeth.[12,13] Policy responses to address this are needed to build the numbers of eligible patients on maintenance care programmes and draw additional eligible patients into public care, while managing acceptable waiting times for treatment.[25]

Health card holders face financial barriers to oral health care. However, the removal of financial barriers alone may not be sufficient to achieve equity in care when other factors such as geographic remoteness remain.[26] Less favourable patterns of service provision have been observed among publicly-funded dental patients in non-urban locations.[27] The pattern for age of patient by location observed in this study showed higher levels of age-specific caries experience as measured by DMFT for patients aged 15-24 through to 45-54 years. Similar patterns of higher caries experience among younger patients in rural locations occurred for the components of DMFT. For patients in rural locations, mean D teeth were particularly higher for patients aged 15-24 and 25-34 years, the age groups where D peaked for both rural and urban patients. Mean F teeth were higher for rural patients aged 15-24 to 35-44 years but lower for patients aged 55-64 and 65 years or more. These patterns suggest worse caries experience for patients at rural locations among younger patients. Inconsistencies in these trends among older patients may be attributable to differences in edentulism. At rural locations there were higher percentages of edentulous patients for age groups 25-34 years and older. For rural compared with urban patients the per cent edentulous was 11.0 per cent compared with 3.5 per cent for 45-54 year olds, 16.1 per cent compared with 8.4 per cent for 55-64 year olds, and 24.6 per cent compared with 18.8 per cent for 65+ year olds. Other potential explanations for the inconsistency in trends by location among older patients could include differential migration of patients between urban and rural locations by age of patient. However, the combined effects of edentulism and caries experience reinforces the view that oral health status was worse among patients in rural compared with urban locations.

The findings of this study indicate that some of the improvements in oral health seen for levels of edentulism among adults and caries experience among children appear to be operating for caries experience among adults. For example, as cohorts of children and adolescents with lower caries experience than previously observed progress into older age groups over time, then improved oral health status may be expected compared with these adult age groups in the past. While there are some limitations to the present study such as the scope of sites covered in some States, the study extends the coverage of previous surveys of oral health status of publicly-funded patients. The results reinforce the view that patients in rural locations tend to have worse oral health than urban patients and that emergency care is associated with higher levels of presenting untreated disease. Although the study populations differ between this study and NOHSA 1987-88 the results indicate higher levels of untreated disease for publicly-funded patients compared with the general population. The temporal comparisons and cross-sectional associations documented here may provide impetus for further development of this monitoring survey approach to assemble an ongoing series of surveys which may form a database to augment the processes of planning and policy debate in the field of dental public health.

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