# Caries experience of adults attending private and public dental clinics in Australia

David S. Brennan, MPH, PhD<sup>1</sup>; Loc Giang Do, MScDent, PhD<sup>1</sup>; Gary D. Slade, DDPH, PhD<sup>2</sup>

1 Australian Research Centre for Population Oral Health, School of Dentistry, The University of Adelaide, Adelaide, South Australia 2 The Department of Dental Ecology, UNC School of Dentistry, Chapel Hill, North Carolina, United States

#### Keywords

dental caries; inequality; SES; site of visit.

#### Correspondence

Assoc. Prof. David S. Brennan, Australian Research Centre for Population Oral Health, School of Dentistry, The University of Adelaide, Adelaide, South Australia. Tel.: (+61) 8 8303 4046; Fax: (+61) 8 8303 3070; e-mail: david.brennan@adelaide.edu.au. D.S. Brennan and L.G. Do are with the Australian Research Centre for Population Oral Health, School of Dentistry, The University of Adelaide, Adelaide, South Australia. G.D. Slade is with the Department of Dental Ecology, UNC School of Dentistry, Chapel Hill, North Carolina, United States

Received: 11/23/2009; accepted 8/9/2010.

doi: 10.1111/j.1752-7325.2010.00199.x

## Abstract

**Objectives:** In Australia, the majority of dental patients attend the private sector, while those with means tested eligibility for government assistance may attend the public sector. The aims of this study were to compare dental caries among persons who last visited private and public clinics, controlling for age, sex, reason for visit, and income.

**Methods:** Data were collected in 2004-06, using a three-stage, stratified clustered sample of Australians aged 15+ years, involving a computer-assisted telephone interview (CATI), oral examination, and mailed questionnaire.

**Results:** A total of 14,123 adults responded to the CATI (49 percent response) of whom 5,505 (44 percent of those interviewed) had an oral epidemiological examination. Multivariate regression analysis controlling for age, sex, reason for visit, and income showed (P < 0.05) that persons attending public clinics had higher levels of decayed ( $\beta = 0.33$ ) and missing teeth ( $\beta = 0.83$ ), but lower levels of filled teeth ( $\beta = -1.09$ ) compared with the reference category of private clinics.

**Conclusions:** Persons who attend for dental care in the public sector have worse oral health than adults who visit private dental clinics, in addition to an independent effect of socioeconomic disadvantage.

# Introduction

In Australia, the dental care system comprises a combination of private and public sectors. The majority of Australian adults attending for dental care visit in the private sector (83.1 percent) (1), where they usually pay on a fee-for-service basis either directly out-of-pocket or indirectly through private insurance. Public-funded dental care for Australian adults is restricted primarily to people having a pensioner concession card or health care card. Both cards are issued according to a means test administered by Centrelink, an agency of the Australian Government's Family Assistance Office. People with a card, and their dependents, are eligible for public sector dental care in most states and territories.

Previous studies have found adults eligible for publicfunded dental care to be at particular disadvantage, typically having to spend time on long waiting lists before receiving treatment or obtaining only limited emergency care in the short term (2). There has been a reported deterioration in oral health status among public dental patients (3,4). However, such previous reports have been based on data collected from public patients at the time they obtain dental care in the public sector. While it is possible to compare those public patient-based reports with findings from populationbased oral health surveys, such comparisons by necessity compare patients with population estimates from persons who may or may not have recently been dental patients. It may be expected that patients tend to visit due to needs related to their oral health status. Hence, it is preferable to compare public patients with other patients who have visited in the private sector. The 2004-06 National Survey of Adult Oral Health (NSAOH) studied a representative sample of Australian adults, including those eligible for public-funded dental care (5). The survey therefore provided the opportunity to compare the oral health of persons on the basis of their most recent dental visit (i.e., private or public) using standardised dental examiners through a national population-based oral health survey.

Age and sex are key demographic indicators and are expected to be related to oral health status and place of last visit. Caries tends to be related to both age and sex, such as decayed teeth tending to be higher among younger age groups (4), and missing teeth higher for females compared with males (6). Public sector patients include age pensioners, and tend to be older than private sector patients and to comprise a higher percentage of females. Reason for visit and income are expected to be related to both oral health and place of visit. Emergency care tends to be associated with worse oral health such as more decayed teeth and missing teeth, and fewer filled teeth (4), and public sector care has been reported to be more oriented to emergency care with higher extraction rates and related tooth loss (7). Lower income is expected to be related to worse oral health (8), and due to means tested eligibility for health care cards to be associated with a higher proportion of public sector visiting. Hence, the aims of this paper were to compare dental caries among adults who last visited private and public clinics, controlling for age, sex, reason for visit and income.

# Methods

## Sampling and data collection

The 2004-06 NSAOH involved a three-stage, stratified clustered sampling design to select a sample of Australians aged 15+ years from households with listed telephone numbers in an electronic white pages (EWP) database (5). Fifteen strata were selected from this sampling frame with population proportional to size selection. The strata comprised metropolitan and non-metropolitan areas of seven states/territories and the single stratum of the Australian Capital Territory. Postcode comprised the primary sampling unit, with household being the secondary sampling unit. Postcodes represented the geographic clustering in the design and were selected with probability proportional to size, where size was defined as the number of households listed in the EWP database in each postcode. The second stage of sampling selected a systematic sample of households listed in the EWP database for each sampled postcode. Thirty households per metropolitan stratum and 40 households per non-metropolitan stratum were selected, after elimination of nonresidential phone numbers identified during initial contact by telephone interviewers. The sample was approached to participate in a computer-assisted telephone interview (CATI) where the final stage of sampling entailed the random selection of one person aged 15 years or more per household, followed by an oral epidemiological examination and a mailed questionnaire.

Approximately, 10 days prior to dialing each sampled telephone number, a primary approach letter explaining the purpose of the survey was mailed to the address that accompanied each sampled telephone number. On each occasion when interviewers dialed a sampled telephone number, a record was made on the computer system. In the CATI, interviewers read questions from a computer screen and recorded answers directly onto the computer. The interview comprised 79 questions, with skip sequences built into the CATI computer system so that questions flowed without intervention from the interviewers. Each sampled telephone number was called up to six times at varying times of day and evening, and on different days of the week. Where there was no answer after six calls, the number was abandoned and recorded as a "noncontact." When a sampled person was identified up to six additional calls were made in an attempt to contact them. If the target person did not speak English an attempt was made to conduct a proxy interview with a resident of the household who spoke English, and in some instances interviews were conducted in foreign languages. People who reported having some or all of their own natural teeth were invited to attend an examination, after which they were sent a mailed selfcomplete questionnaire.

The examination was conducted under standardized clinical conditions by one of 30 trained and calibrated dentists. Two light sources were used throughout: an intraoral batteryoperated mirror light and standard dental clinical halogen light. No radiographs were taken. All teeth present were assessed and categorized using visual criteria (no sharp explorer was used). Presence of cavitated carious lesions, restorations because of decay and teeth missing because of decay were recorded. The examination protocol can be viewed at http://www.arcpoh.adelaide.edu.au/project/distribution/ nsaoh\_pdf%20files/NSAOH\_ExamProtocol\_v8.pdf.

#### Variables measured

In the first stage of data collection respondents supplied information during a CATI on variables such as self-reported health status, use of dental services, demographics, and socioeconomic status. The explanatory variables consisted of site of last visit, sex, reason for last visit, income, and age. People who had reported ever having made a dental visit were asked "Where did you make your last dental visit?" The response categories of "private general dental practice," "specialist practice," and "dental clinics associated with health insurance funds" were classified as "private practice." The remainder were classified as "public practice," except for "school dental service," and "dental technician" which were excluded from the analysis. Under schemes operating in some states/ territories it is possible that public-funded care be provided to eligible card holders through private dentists. Such cases would be classified as private sector visits.

Caries experience was the dependent variable in this analysis. Decayed, missing, and filled teeth (DMFT) reflects cumulative lifetime experience of disease and treatment. Tooth level rather than surface level scores were used as the effect sizes by site of last visit among adults were expected to be sufficiently large, and allocating surfaces to missing teeth is problematic (9). In persons aged 45 years or more, all missing teeth were counted as missing due to pathology, while in younger persons teeth were only counted as missing if the examiner judged that caries or periodontal disease was the likely reason for extraction.

The research was approved by the Human Research Ethics Committee of the University of Adelaide.

## Analysis

The analysis was restricted to dentate persons aged 15 years or older, who had made a dental visit within the last 2 years so that comparison of site of last visit by adults would reflect relatively recent contact with either dental sector. Data were weighted by state/territory, metropolitan/non-metropolitan location, age, and sex. To account for design effects associated with the complex sample design, data were analyzed using survey procedures that adjusted for strata and primary sampling units (10). For all analyses, SAS-callable SUDAAN software was used to adjust the complex sampling design for sampling error. Initially, distributions of the explanatory variables of site of last visit, sex, reason for last visit, and income were tabulated, and associations between site of last visit and sex, reason for last visit, and income were determined using chi-square statistics. Unadjusted bivariate associations of this set of explanatory variables were then tabulated for the caries experience variables (D, M, F, and DMFT). Adjusted beta coefficients were then determined from multivariate ordinary least squares regression models of caries experience. In the bivariate analysis and multivariate models site of last visit was restricted to private and public clinics as this was the contrast of central interest to the aims, and due to relatively small cell sizes available for other sites of last visit (i.e., school, technician, other). Note that it was not

feasible to analyze waiting time data as waiting time was only collected for persons who attended public clinics at their last visit, so that those attending private clinics would be excluded as missing from such analyses.

# Results

## **Response and distributions**

In the NSAOH, a total of 14,123 adults responded to the CATI (49 percent response rate, with 16 interviews conducted in foreign languages) and 5,505 were examined (44 percent of interviewed people who were invited to the examination). The majority of persons attended at a private clinic at the last visit (90.2 percent). Of those eligible to attend for public care, the majority made their last visit at a private clinic (66.3 percent). Distributions of the other explanatory variables are presented in Table 1. There were similar percentages of females compared with males, and checkup compared with problem visits. The highest percentage of persons was observed for the \$40-<60,000 income group. Age, reason for visit, and income were all associated with place of last visit with private visits associated with higher percentages of 35 to 54-year-olds, checkup visits, and incomes of \$40,000-<60,000 and \$60,000 or more.

#### Representativeness

Analysis of response patterns and comparisons with census data revealed that participants differed from nonparticipants in some characteristics that influence oral health (11), such as higher percentages who were employed (64.5 percent) compared with the census (55.9 percent). When NSAOH

Table 1	Distribution	of Explanatory	/ Variables by	Place of the	Last Dental Visit (%	)
---------	--------------	----------------	----------------	--------------	----------------------	---

	Private n (col %; row %)	Public n (col %; row %)	All, n (col %)
Sex			
Male	1,821 (49.7; 89.1)	248 (48.9; 10.9)	2,069 (49.6)
Female	2,824 (50.3; 88.8)	392 (51.1; 11.2)	3,216 (50.4)
Reason for last visit*			
Problem	2,744 (40.4; 94.6)	159 (72.5; 5.4)	2,903 (44.0)
Checkup	1,889 (59.6; 81.7)	479 (27.5; 18.3)	2,368 (56.0)
Income* (\$)			
<20,000	650 (10.5; 63.4)	359 (48.9; 36.6)	1,009 (14.7)
20,000-<40,000	1,018 (19.4; 81.9)	169 (34.8; 18.1)	1,187 (21.1)
40,000-<60,000	1,582 (37.7; 96.4)	61 (11.4; 3.6)	1,643 (34.8)
60,000+	1,112 (32.4; 98.1)	18 (5.0; 1.8)	1,130 (29.4)
Age* (years)			
15-34	870 (33.8; 88.2)	124 (36.2; 11.7)	994 (34.1)
35-54	1,943 (40.0; 91.2)	193 (30.8; 8.8)	2,136 (38.9)
55-74	1,591 (21.2; 88.0)	253 (23.1; 12.0)	1,844 (21.4)
75+	241 (5.0; 80.2)	70 (9.9; 19.8)	311 (5.6)

\* Chi-square: *P* < 0.001.

estimates of oral health were adjusted to reflect census distributions of employment, language spoken at home, and level of schooling, there were generally small changes suggesting that bias was of a small magnitude. The survey probably underestimated some aspects of oral disease and overestimated the frequency of favorable dental attendance, although the degree of variation was found to be 3 percent or less for most oral health indicators. The observed levels of examiner agreement for most oral health indicators (11) were equivalent to benchmarks reported for national oral health surveys conducted elsewhere.

## **Unadjusted associations**

Persons who last visited a public clinic had more decayed and missing teeth, but fewer filled teeth, on average, compared with those who last visited a private clinic (Table 2). Males had more decayed teeth, but fewer filled teeth than females. Persons who had last visited for a problem had more decayed teeth and missing teeth and a higher DMFT, but fewer filled teeth than persons who had visited for a checkup. Differences by income included more decayed and missing teeth and a higher DMFT among the lowest income groups compared with income groups of \$40-60,000 and \$60,000 or more. Differences between age groups included more decayed teeth among those aged 15-34 and 35-54 years compared with older persons, numbers of missing teeth were lowest among 15- to 34-year-olds and increased across successively older age groups, while filled teeth were lowest among 15- to 34-year-olds and highest among 55- to 74-year-olds. DMFT

showed a similar age gradient to that observed for missing teeth, being lowest among 15- to 34-year-olds and highest among those aged 75 years or older.

#### **Multivariate models**

Multivariate analyses showed that persons attending public clinics had more decayed and missing teeth, but fewer filled teeth compared with the reference category of private clinics (Table 3). Males had more decayed teeth, but fewer filled teeth and DMFT compared with females. Problem-oriented visits were associated with more decayed and missing teeth and DMFT, but fewer filled teeth compared with checkup visits. There was an income gradient in decayed teeth with lower income associated with more decay. Missing teeth were higher among persons in the two lowest income groups compared with the reference of \$60,000 or more. There were fewer filled teeth in the lowest income group compared with the highest, and DMFT was highest in the lowest income group compared with the reference of \$60,000 or more.

## Discussion

The main finding of this study was that persons attending public clinics had higher levels of decayed and missing teeth, but lower levels of filled teeth compared with those persons attending private clinics. The disparity in oral health by place of last visit remained after controlling for age, sex, reason for visit, and income, all of which had significant independent effects with the exception of sex and numbers of missing

Table 2 Oral Health Status by Explanatory Variables: Mean (95% confidence interval)

	Decayed teeth	Missing teeth	Filled teeth	DMFT
Place of last visit				
Public clinic	1.3 (1.0-1.6)	7.0 (6.3-7.9)	6.2 (5.5-6.9)	14.6 (13.4-15.8)
Private clinic	0.5 (0.5-0.6)	4.5 (4.2-4.7)	8.3 (7.9-8.6)	13.2 (12.8-13.7)
Sex				
Male	0.7 (0.6-0.8)	4.5 (4.1-4.8)	7.2 (6.8-7.7)	12.4 (11.8-13.1)
Female	0.5 (0.4-0.6)	4.6 (4.3-5.0)	8.1 (7.8-8.5)	13.3 (12.7-13.9)
Reason for last visit				
Problem	1.0 (0.9-1.1)	5.5 (5.1-5.9)	7.2 (6.8-7.6)	13.7 (13.1-14.3)
Checkup	0.3 (0.2-0.4)	3.8 (3.6-4.1)	8.2 (7.7-8.6)	12.3 (11.7-12.9)
Income (\$)				
<20,000	0.9 (0.7-1.1)	9.9 (9.2-10.7)	7.9 (7.4-8.4)	18.8 (17.9-19.6)
20,000-<40,000	0.7 (0.5-0.8)	6.2 (5.6-6.7)	8.4 (7.9-9.0)	15.2 (14.4-16.1)
40,000-<60,000	0.6 (0.5-0.69)	3.4 (3.2-3.7)	7.9 (7.5-8.4)	12.0 (11.3-12.6)
60,000+	0.4 (0.3-0.54)	2.8 (2.5-3.2)	7.9 (7.3-8.5)	11.2 (10.4-12.0)
Age (years)				
15-34	0.7 (0.6-0.8)	0.8 (0.6-0.9)	3.1 (2.8-3.5)	4.6 (4.1-5.0)
35-54	0.6 (0.5-0.8)	3.9 (3.6-4.2)	9.8 (9.5-10.2)	14.4 (13.9-14.8)
55-74	0.4 (0.4-0.5)	10.2 (9.7-10.7)	11.7 (11.2-12.1)	22.3 (22.0-22.6)
75+	0.4 (0.3-0.6)	14.1 (13.1-15.1)	9.8 (8.8-10.8)	24.3 (23.6-25.0)
All	0.6 (0.5-0.7)	4.6 (4.3-4.8)	7.7 (7.4-8.0)	12.9 (12.4-13.3)

DMFT, decayed, missing, and filled teeth.

Journal of Public Health Dentistry 71 (2011) 32–37 © 2010 American Association of Public Health Dentistry

Table 3 Multivariate Regression Models: Adjusted Beta (standard error)

	Decayed teeth	Missing teeth	Filled teeth	DMFT
Place of last visit				
Public clinic	*0.33 (0.17)	*0.83 (0.36)	**-1.09 (0.38)	-0.06 (0.47)
Private clinic (Ref.)	-	-	-	-
Sex				
Male	*0.18 (0.07)	-0.04 (0.18)	**-0.79 (0.22)	*-0.66 (0.27)
Female (Ref.)	-	-	-	-
Reason for last visit				
Problem	**0.62 (0.07)	**1.42 (0.18)	**-0.84 (0.25)	**1.20 (0.28)
Checkup (Ref.)	-	-	-	-
Income (\$)				
<20,000	**0.48 (0.16)	**2.31 (0.36)	**-1.93 (0.39)	*0.86 (0.40)
20,000-<40,000	*0.23 (0.10)	**0.79 (0.30)	-0.47 (0.33)	0.55 (0.40)
40,000-<60,000	*0.17 (0.08)	0.08 (0.20)	-0.15 (0.28)	0.10 (0.37)
60,000+ (Ref.)	-	-	-	-
Age (years)				
15-34	**0.52 (0.14)	**-12.15 (0.55)	**-6.98 (0.55)	**-18.61 (0.49)
35-54	**0.39 (0.12)	**-9.19 (0.55)	-0.57 (0.54)	**-9.37 (0.46)
55-74	0.09 (0.10)	**-3.59 (0.57)	**1.78 (0.53)	**-1.72 (0.41)
75+ (Ref.)	-	-	-	-
R-squared:	8%	30%	46%	56%

\**P* < 0.05; \*\**P* < 0.01.

DMFT, decayed, missing, and filled teeth.

teeth. These findings add to the evidence from previous studies to show that not only are public dental patients worse off in terms of their oral health compared with oral health estimates for the Australian population (12), but in a comparison of persons who had visited in the last 2 years those who received public dental care had worse caries experience than those who received private care.

#### Site of visit: dental system and visit factors

The impact of system factors on oral health was reflected in those last attending for public dental care having more decayed teeth and missing teeth, but fewer filled teeth. The pattern of more decay and fewer fillings suggests access issues that impinge on the management of dental caries. These are consistent with patterns of use of public dental services that typically involve long waiting times for treatment (2). The higher numbers of missing teeth among public dental patients is consistent with the reported profile of dental services that is characterized by high rates of tooth extraction related to an emphasis on emergency rather than general dental care (7,13,14). Observed patterns of tooth loss by social class have been linked not only to cultural factors such as attitudes but also to the delivery system itself (15). However, variation in oral health by payment method has been largely attributable to socio-demographic factors and regularity of dental attendance rather than method of payment itself (16). A study of public dental service utilization in South Australia concluded that unless structural barriers to dental care are addressed, patients will engage in dental visiting behaviors that place them at risk of worse oral health outcomes, and this pattern of behavior could be perpetuated indefinitely (17).

A problem-oriented visit pattern was associated with more decayed teeth and fewer filled teeth, which could reflect different management of disease through less frequent and recent visits. However, even if the higher overall DMFT may conflate aspects of both disease and treatment the higher number of missing teeth suggests poorer oral health outcomes due to problem-based attendance. Regular dental attendance has been shown to have a positive impact on oral health (18), while irregular, problem-oriented visiting has been related to poorer oral health such as fewer teeth (19).

## Socioeconomic status and demographic factors

The effects of income on caries experience showed clear adverse consequences for oral health, with lower income associated with more decayed teeth and missing teeth as well as overall DMFT, and fewer filled teeth. This is consistent with previous reports which have found that increasing levels of socioeconomic disadvantage have been related to worse oral health and decreased utilization of services (20). The majority of card holders made their last dental visit at private clinics even though they were eligible for public dental care. A study restricted to health card holders only reported that where differences were observed by place of last dental visit, the differences consistently involved disadvantage in terms of either oral health status or service patterns for those who visited the public sector compared with the private sector (21). However, the majority of comparisons involved estimates with overlapping confidence intervals which may be indicative of a general level of disadvantage common to card holders regardless of the place of their last dental visit. While not the central focus of the study, differences in caries experience were observed by age and sex. As expected, younger adults had more decayed teeth, while older adults had more missing teeth. Numbers of filled teeth tended to increase across older age groups, except for the oldest age group. Overall DMFT accumulated across successively older age groups. Males had more decayed teeth, but fewer filled teeth suggesting a visit-related effect. Males also had lower overall DMFT, but as the index represents both disease and treatment decisions (e.g., interventions based on false positive diagnoses) this is difficult to interpret.

# Conclusions

Persons who attend for dental care in the public sector have worse oral health than adults who visit private dental clinics, in addition to an independent effect of socioeconomic disadvantage.

# Acknowledgments

Data collection for the National Survey of Adult Oral Health was supported by NHMRC, Australian Government Department of Health and Ageing, AIHW, Colgate Oral Care, Australian Dental Association, US Centers for Disease Control and Prevention, and Australian state/territory health departments. Also supported by NHMRC (CDA 627037).

#### References

- Spencer AJ, Harford J. Dental care. Chapter 6. In: Slade GD, Spencer AJ, Roberts-Thomson KF, editors. *Australia's dental* generations. The National Survey of Adult Oral Health 2004-06. Canberra: Australian Institute of Health and Welfare; 2007. pp. 143-72.
- Australian Health Ministers' Advisory Council. Oral health of Australians. National planning for oral health improvement. Adelaide: SA Department of Human Services; 2001.
- 3. Brennan DS, Spencer AJ, Slade GD. Caries experience among public-funded dental patients in Australia, 1995-96: type of care and geographic location. *Aust Dent J.* 2000;**45**:37-45.
- Brennan DS, Spencer AJ. Changes in caries experience among public dental patients between 1995/96 and 2001/02. *Aust N Z J Public Health*. 2004;28:542-8.
- 5. Slade GD, Spencer AJ, Roberts-Thomson KF. Australia's dental generations. The National Survey of Adult Oral Health

*2004-06*. Canberra: Australian Institute of Health and Welfare; 2007.

- 6. Brennan DS, Spencer AJ, Roberts-Thomson KF. Caries experience among 45-54-year-olds in Adelaide, South Australia. *Aust Dent J.* 2007;**52**:122-7.
- Brennan DS, Spencer AJ, Slade GD. Service provision among adult public dental service patients: baseline data from the Commonwealth Dental Health Program. *Aust N Z J Public Health.* 1997;21:40-4.
- Sanders AE, Spencer AJ. Social inequality in perceived oral health among adults in Australia. *Aust N Z J Public Health*. 2004;**28**:159-66.
- 9. Broadbent J, Thomson WM. For debate: problems with the DMF index pertinent to dental caries data analysis. *Community Dent Oral Epidemiol.* 2005;**33**:400-9.
- SAS Institute Inc. SAS/STAT user's guide. Version 6. 4th ed. Cary, NC: SAS Institute Inc.; 1990.
- 11. Mejia G, Slade GD, Spencer AJ. Participation in the Survey. Chapter 3. In: Slade GD, Spencer AJ, Roberts-Thomson KF, editors. *Australia's dental generations. The National Survey of Adult Oral Health 2004-06*. Canberra: Australian Institute of Health and Welfare; 2007.
- 12. Brennan DS. *Oral health of adults in the public dental sector*. Canberra: Australian Institute of Health and Welfare; 2008.
- Brennan DS, Spencer AJ. Evaluation of service provision patterns during a public-funded dental program. *Aust N Z J Public Health*. 1999;23:140-6.
- Brennan DS, Luzzi L, Roberts-Thomson KF. Dental service patterns among private and public adult patients in Australia. BMC Health Serv Res. 2008;8:1.
- Davis P. Tooth loss, the culture of dentistry and the delivery of dental care in New Zealand. *Community Health Stud.* 1981; V:98-105.
- McGrath C, Bedi R. Dental services and perceived oral health: are patients better off going private? *J Dent.* 2003;**31**: 217-21.
- Luzzi L. Public dental service utilisation in South Australia. PhD thesis. The University of Adelaide, Australian Research Centre for Population Oral Health, School of Dentistry; 2005.
- Richards W, Ameen J. The impact of attendance patterns on oral health in a general dental practice. *Br Dent J.* 2002;**193**: 697-702.
- Treasure E, Kelly M, Nuttall N, Nunn J, Bradnock G, White D. Factors associated with oral health: a multivariate analysis of results from the 1998 Adult Dental Health Survey. *Br Dent J.* 2001;190:60-8.
- Wamala S, Merlo J, Bostrom G. Inequity in access to dental care services explains current socioeconomic disparities in oral health: the Swedish National Surveys of Public Health. 2004-2005. *J Epidemiol Community Health*. 2006;60: 1027-33.
- Brennan DS. Oral health of health card holders attending for dental care in the private and public sectors. Canberra: Australian Institute of Health and Welfare; 2009.

Copyright of Journal of Public Health Dentistry is the property of Wiley-Blackwell and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.