

Article

Factors Associated with Edentulism among Adult Users of Public Oral Health Services in Victoria, Australia

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External Editor: Claude Jaquiéry

Received: 2 July 2014; in revised form: 23 September 2014 / Accepted: 1 October 2014 /

Published: 5 November 2014

Abstract: This study examined edentulism (total absence of natural dentition) trends among adults' users of public oral health care in Victoria, Australia and factors associated with these trends. The sample comprised 13,578 dental clients of public oral health care services, collected between July 2008 and June 2009, from which data were complete. The group of edentulous clients represented 6.8% of all clients. Older participants were more likely to be edentulous (OR = 3.95; 95% CI 3.53–4.43). By language spoken at home, those who spoke English were more likely to be edentulous than those who spoke other languages (OR = 1.29; 95% CI 1.02–1.63). Aboriginal clients were more likely to be edentulous than non-Aboriginal clients (OR = 2.21; 95% CI 1.15–4.27). By region of residence, clients living in rural locations were more likely to be edentulous than those living in urban regions (OR = 1.53; 95% CI 1.32–1.78). The full model explained 16.8% of the variance in being edentulous. Findings in edentulism were lower than what was reported by the National Survey of Adult Oral Health. However, despite this trend, significant variations existed across urban and rural locations. Innovative public health programs and services are essential to prevent inequalities in oral health diseases and conditions for rural populations.

Keywords: oral health; dental health services; health services access; oral epidemiology; Australia

1. Introduction

Tooth mortality is one of the most important statistics in studies of oral health status. Tooth loss and the absence of natural dentition (edentulism), are not the direct result of the ageing process, but the effect of local factors acting throughout life [1]. In fact, today, more than ever before, older adults are keeping their natural teeth. Tooth loss can affect people of all ages. Oral diseases can be prevented and treated. However, untreated dental disease may negatively affect the entire body, and will ultimately end up in tooth loss. Thus, tooth loss could be considered as a crude estimate of the oral health status in a community [2,3]. The negative impact of edentulism has been widely described as having many disadvantages [4]. Moreover, recent research reported number of teeth as an independent predictor of mortality among elderly populations [3–6]. The number of remaining natural teeth/number missing teeth has been commonly used as an oral health outcome to assess socioeconomic inequalities among adult populations [7–9]. Oral health has improved in Australian adults over the last decades, with significant reduction in edentulism [10]. Access to dental care influences tooth retention, therefore tooth loss could be considered as a crude estimate of lack of availability of methods of conserving teeth or lack of access to dental care [11].

In Australia there is wide recognition of the existence of socioeconomic and geographical inequalities in oral health and their determinants [12–15]. Nonetheless, the magnitude of inequalities in oral health in the state of Victoria, in particular for those using the public system have been less explored. Against this backdrop, as an initial step to provide this knowledge, this study reports on the prevalence and factors associated with edentulism across the Victorian public sector with emphasis on rural regions. This information will offer Victorian oral health care providers with an initial profile of the distribution of inequalities among the adult eligible population using the public dental services, and a better understanding of the effectiveness of the different strategies used to address inequalities in oral health.

2. Methods

The study conducted a secondary analysis of data collected from July 2008 to June 2009 for the eligible adult clients (18 years or older) who attended public oral health services throughout Victoria that had implemented the dental status (DMF) index data base, which was being rolled out across the State at the time of this study. Data came from 67 clinics (out of 84 across the state), which were grouped into the nine Victorian Health Regions. Ethic approvals were obtained from Dental Health Services Victoria (DHSV) and the University of Melbourne Human Research Ethic Committees.

Clients of public dental services, as part of the admission procedure complete a form, which includes clients' sociodemographic characteristics. De-identified data were provided by DHSV, including:

- a) Sociodemographic: age, gender, aboriginality, type of health care card. Age was measured at the time of the examination and also regrouped into four groups: 18 to 24; 25 to 44; 45 to 64; and

65 and older. Type of card was coded as: “Pensioner Concession Card”, “Health Card”, and “Non-card Holder”;

- b) Immigration: country of birth, coded as “Australia” and “Other” and language spoken at home coded as “English”, and “Other than English”;
- c) Region: Classified according to the location of the agency where the client received dental care, into nine Regions. The regions were recoded into “Rural” (Barwon, Grampians, Loddon, Hume and Gippsland) and “Metropolitan” Melbourne (Western, Eastern, Southern and Northern).

Clinical data considered in this analysis included routine information collected for each participant on the number of missing teeth. This information allowed for the assessment of the absence of natural dentition (edentulism). Edentulism was assessed as a dichotomous variable (Yes/No).

Clinical data were derived from dental examinations conducted by uncalibrated oral health professionals working in community dental clinics across the State of Victoria. The use of general practitioners to collect epidemiological data has been investigated previously as a possible alternative to conventional surveys of adult dental health [16,17]. The results suggest that data collected from public health records are not decisively inferior to those obtained from examinations by trained and calibrated examiners.

2.1. Analysis

The analysis provides descriptive information on the sample’s demographic characteristics and edentulism. Data were analyzed to statistically compare results between edentulism and various sociodemographic variables. Chi-squared analysis was used for nominal or ordinal variables, while continuous variables were compared using one-way variance (ANOVA). To better understand the relationship between the combination of sociodemographic variables and edentulism, a stepwise logistic regression analysis (LRA) was performed. Data manipulation and analyses were conducted using SPSS PC (Version 20.0).

3. Results

The study population comprised a sample of 13,578 Victorian adults who used public dental services between July 2008 and June 2009 in clinics that had implemented the dental status (DMF) data base and for whom DMF was fully recorded at the time this study was fully implemented. The distribution of clients by rural and Melbourne metropolitan locations was similar (49.2% vs. 50.8%, respectively). However, by region the proportions were higher in the Northern region of Melbourne (21.8%), Hume (16.0%), Barwon (14.1%), Eastern region of Melbourne (14.0%), and Gippsland (11.1%). Other Regions (e.g., Loddon, Southern region of Melbourne and Western region of Melbourne) had less than 10% of the sample’s population, with the Grampians Region having only 1.8% of the total number of adult patients in the sample. The majority (66.8%) held a pensioner concession card, and 26.5% held a health care card. Another 6.7% were non concession card holders.

On average, the sample was 52.8 years of age (s.d. 19.2) and the majority of users were female (59.0%) with no differences by sex in any age group. Few adults clients included in this study (1.2%; n = 166) reported indigenous heritage. Of the total sample 66.8% were born in Australia and 33.2%

overseas. Public dental clients nominated 122 different countries of birth, including Australia. After Australia, most commonly reported countries included Italy, Greece, UK, Vietnam and China. By Region, while about half (49.1%) of the urban clients were born in Australia, clients from agencies located in rural areas have a larger proportion of Australia-born clients (85.0%).

According to language spoken at home, 86.6% reported English. Nonetheless, public dental clients nominated 82 different languages spoken at home, including English. Most frequently reported languages other than English spoken at home were: Italian (15.0%); Greek (13.2%); Chinese (12.3%); Arabic (12.3%); Vietnamese (8.8%); and Turkish (4.8%). By region, while 76.4% of those living in urban areas spoke English at home, this proportion was higher in rural regions (97.1%).

3.1. Dental Status and Edentulism

The group of edentulous patients represented 6.8% of all adult (18 years and older) clients. There were higher percentages of edentulous clients among those aged 65 years and older (15.3%) compared to those aged 18 to 24 years (0.3%), those aged 25 to 44 years (1.0%), and those aged 45 to 64 years (5.2%) ($p < 0.0001$).

Prevalence of edentulism was lower among those who spoke a language other than English at home (5.3% vs. 7.0%). A significantly larger proportion of pensioners (9.2%) were edentulous compared to health care card holders (2.1%) ($p < 0.0001$). Overall, by Region, agencies located in rural areas have a larger proportion of edentulous compared to urban agencies (8.0% vs. 5.6%). Specifically, the Grampians (14.1%), Loddon (11.1%) or Hume (8.4%) had a larger proportion of edentulism among their clients. On the other hand, 5.0% and 5.4% and of the Gippsland and Southern Region's clients were edentulous. By gender, males tended to have a higher proportion of edentulism than females (males: 7.8% vs. females: 6.0%; $p < 0.0001$). Table 1 presents the distribution of edentulous adults by selected sociodemographic variables. No differences in prevalence of edentulism were noted by country of birth (Australia 7.1% vs. Other 6.2%), or aboriginality (Aboriginals: 6.6% vs. non-Aboriginals: 6.8%).

To better explore the probability of being edentulous, a logistic regression analysis was performed using age, gender, language spoken at home, Aboriginality, and Region of residence as predictors. The final model included four statistically significant variables [$\chi^2(7) = 78.97$; $p < 0.0001$]. These four variables demonstrated to be significant predictors for being edentulous. By age, as age increases, participants were more likely to be edentulous (OR = 3.95; 95% CI 3.53 to 4.43). By language spoken at home, those who spoke English were more likely to be edentulous than those who spoke languages other than English at home (OR = 1.29; 95% CI 1.02 to 1.63). Aboriginal clients were twice as likely to be edentulous than non-Aboriginal clients (OR = 2.21; 95% CI 1.15 to 4.27). Additionally, by region of residence, using Melbourne Metropolitan Regions as the reference category, clients living in rural Regions, after controlling for the other variables in the model, were more likely to be edentulous (OR = 1.53; 95% CI 1.32 to 1.78) than those living in metropolitan Regions (See Table 2). The variance for being edentulous, using the full model, was 16.8% (Nagelkerke $r^2 = 0.168$).

Table 1. Proportion of edentulous adults clients of public dental health services in Victoria by sociodemographic variables.

	% ^a	Edentulous (%)
Age Group		

18 to 24 years	9.6	0.3
25 to 44 years	28.8	1.0
45 to 64 years	29.3	5.2
65 years or over	32.3	15.3
Health Card Type		

Health Care Card	26.5	2.1
Non-Card	6.7	1.0
Pensioner	66.8	9.2
Region		

<i>Urban</i>		
Northern	21.8	4.0
Eastern	14.0	6.7
Southern	8.3	5.4
Western	6.7	7.7
<i>Rural</i>		
Hume	16.0	8.4
Barwon	14.1	7.5
Gippsland	11.1	5.0
Loddon	6.2	11.1
Grampians	1.8	14.1
Language Category^b		
		**
English	86.6	7.1
Non-English	13.4	5.3
Country of Birth		
Australia	66.8	7.0
Other	33.2	6.2
Gender^c		

Male	41.0	7.8
Female	59.0	6.0
Aboriginality		
Aboriginal	1.2	6.6
Non-Aboriginal	98.8	6.8

Notes: ^a n = 13,578; ** = p < 0.01; *** = p < 0.0001; ^b 9 cases with missing values; ^c 13 cases with missing values.

Table 2. Regression coefficient, odds ratios and 95% confidence interval for odds ratios for the factors predicting being edentulous among adult clients of public dental health services in Victoria.

	β Coefficient	Odds Ratio	95% Confidence Interval
<i>Age</i>	1.37	3.95	3.53–4.43
<i>Language spoken at home</i>			
Other than English			1
English	0.25	1.29	1.02–1.63
<i>Aboriginality</i>			
Non-Aboriginal			1
Aboriginal	0.79	2.21	1.15–4.27
<i>Region</i>			
Urban			1
Rural	0.25	1.53	1.32–1.78
Constant	-10.37		

4. Discussion

Data show that, out of 13,578 Victorian adults in the sample, 6.8% were fully edentulous. Overall, findings in edentulism were consistent with what Brennan reported for public patients in Australia [18], but were lower than what was reported in Victoria by the National Survey of Adult Oral Health 2004/2006 [10]. Difference with the National Survey might be attributed to the fact that the use of dental health services tends to decrease after retirement [19,20].

Brennan, Spencer and Szuster [21] showed that dental care received by metropolitan patients was preventive and maintenance in nature, as opposed to rural patients, who were more likely to receive fillings, extractions and dentures. Findings from the present study indicate that adults living in rural and non-metropolitan areas were more likely to be edentulous, which support the notion of varying patterns of oral health inequalities by place of residence (i.e., metropolitan vs. regional). Results from the logistic regression indicate that these results persisted after controlling for other sociodemographic variables. English spoken at home increased the odds to be edentulous, as did being Aboriginal. Nonetheless, we have to keep in mind that public patients are at a socioeconomic disadvantage and tended to have worse oral health than those who are able to regularly visit a private dentist [22]. Whatever is the case operating among public patients, access to oral health services is critical. This is important because, inequalities in oral health mirror those of general health [23] and persist throughout the lifespan into old age [24].

While this information is useful, it only provides initial information at a state level. Findings only reflect the sociodemographic and clinical characteristics of those who used public dental services with a completed dental health status data record at the time of the study. According to the National Survey of Adult Oral Health, the majority of those eligible for public dental services (63%) [10], attend a private dental clinic. Additionally, users were health card holders, and as such at an economic or social disadvantage. Nonetheless, while our data may have limitations, we believe that due to the size of our

sample and the breadth of data collection, our study represents a substantial sample of users of dental public health services.

Geographical, as well as, socioeconomic inequalities in oral health are still a major public health issue. Poor oral health, as measured by level of oral disease and edentulism, in particular in old ages, is not only a risk factor for malnutrition, but critical to people's appropriate physical, emotional and social functioning. Specific strategies are still necessary to redress this situation and reduce disparities in oral health, particularly among those in rural, and social and material deprivation. In view of the health, social, and psychological consequences of oral diseases and the role of oral health services' potential for improving the population's quality of life, service provision targeting of vulnerable patients in rural and urban locations need to be coordinated to ensure equity in access to oral health services.

Acknowledgments

This research was supported by funding from Dental Health Services Victoria (DHSV) Research & Innovation Grants.

Conflicts of Interest

Hanny Calache and Martin Whelan are employees of Dental Health Services Victoria (DHSV).

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