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Research Article

The relationship between poor oral health and poor general health in Indigenous and non-Indigenous peoples

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Abstract

Objective: To investigate and compare the relationship between self-reported oral and general health among Indigenous and non-Indigenous Australians.

Methods: Data was obtained from two studies: study 1 was a convenience study of Indigenous Australians aged 18+ years residing in South Australia, and study 2 was a representative of Australians aged 15+ years in South Australia. Descriptive analyses were conducted to compare self-rated oral and general health-related quality of life, which was measured by calculating disutility scores with the five individual EQ-5D dimensions (EuroQol instrument: EQ-5D-5L).

Results: The sample comprised 1,011 and 2,891 Indigenous and non-Indigenous South Australian adults in study 1 and 2, respectively. A higher proportion of poor self-rated oral health and higher mean disutility score was observed among Indigenous than in non-Indigenous Australians, 33.5% vs. 9.5%, and 0.18 vs. 0.09, respectively. A higher mean disutility score was observed among Indigenous adults with poor self-rated oral health (0.25, 95% CI: 0.22-0.27) than among non-Indigenous adults with poor self-rated oral health (0.16, 95% CI: 0.14-0.18). After adjusting for social-demographic and health-related behaviors, the prevalence ratio was more than 2 times higher among Indigenous than in non-Indigenous Australians across each individual EQ-5D dimension.

Conclusion: Our findings indicate that poor self-rated oral and general health-related quality of life persists among Indigenous relative to non-Indigenous Australians. The social determinants of health are likely to be root causes. Interventions that address social, economic and political constructs are required to reduce oral and general health inequalities between Indigenous and non-Indigenous Australians.

Keywords: Indigenous Australians, EuroQol (EQ-5D-5L), Disutility score, Self-rated health

Abbreviations: CI: Confidence Intervals; COPD: Chronic Obstructive Pulmonary Disease; EQ-5D-5L: EurQoL Instrument

Introduction

It is impossible to conceive of oral health outside of general health. Evidence suggests that both the short- and long-term systemic diseases are associated with poor oral health [1], including diabetes [2], cardiovascular disease [3], renal disease [4], respiratory disease in particular for chronic obstructive pulmonary disease (COPD) [5], osteoporosis [6] and Alzheimer's disease [7]. Oral diseases in and of themselves, such as dental caries, periodontal disease and oral cancers, can cause pain and tooth loss, impact masticatory function, and subsequently impact nutritional intake [8,9]. Oral and general diseases share common risk factors, including aging, tobacco smoking, lack of physical activity and obesity [5,10].

Indigenous Australians include Australians who identify as Aboriginal and/or Torres Strait Islander Australians, and comprise 3.3% of the total Australian population [11]. Evidence suggests that Indigenous Australians score worse on both general [12] and oral health [13], compared to their non-Indigenous counterparts. Indigenous Australians have a 2.3 times higher total burden of diseases, 2.7 times higher burden of fatal diseases and a higher mortality rate, resulting in an approximately 10 years lower life expectancy than non-Indigenous Australians [12,16,17]. Indigenous Australians

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experience poorer oral health than non-Indigenous Australians, with a higher prevalence of dental caries, periodontal disease, oral mucosal disease and oral cancer [18,19].

Self-reported oral and general health are widely used to provide insight into how individuals view their oral and general health in a holistic sense, which is unique and distinct from clinical diagnoses. Self-reported oral heath typically answers the question: '*How would you rate your oral health?* Or *'How many natural teeth do you have remaining in the upper and lower jaws?'* Both questions have been validated against clinical estimates [20,21]. EurQoL (EQ-5D-5L) is a valid and reliable non-clinical standardized self-rated instrument that is widely used to estimate general health-related quality of life by assessing an individual's wellbeing (including physical and psychological state) [22,23].

Few studies compare general health using EQ-5D with respect to its individual dimensions in relation to oral health among Indigenous and non-Indigenous peoples. The aim of this study was to therefore investigate and compare the relationship between self-reported oral and general health-related quality of life among Indigenous and non-Indigenous Australians. The hypothesis was that both self-rated oral and general health-related quality of life would be poorer in Indigenous compared with non-Indigenous Australians.

Methods

Data sources

Data from two studies was used.

- Study 1 was a large convenience sample (n=1,011) of Indigenous Australian adults in South Australia aged 18+ years, conducted between February 2018 and January 2019 [24]. Just over one-third (33.6%) of participants were male. Ethics approval was obtained from the University of Adelaide Human Research Ethics Committee (H-2016-246) and the Aboriginal Health Council of South Australia (04-17-729). All participants were provided with an information sheet outlining the study objectives and signed an informed consent form.
- Study 2 was the Spring Health Omnibus Survey [25], conducted by a market research company to provide a valid and reliable estimate for South Australians aged 15+ years. Data from n=2,891 was obtained between Sept and Dec 2013. Ethics approval was granted by the University of Adelaide's Human Research Ethics Committee.

Instruments

The same global self-rated measures for oral and general health were used in the two studies.

- The global self-reported oral health item in Study 1 was: Would you rate your oral health as 'excellent, very good, good, fair, or poor', and dichotomized into 'Fair/poor' and 'Excellent/very good/good'; Study 2 used the item 'How many natural teeth do you have? remaining in the upper and lower jaw'. The response was dichotomized into 'less than 21 teeth' and '21 or more teeth'. For comparison, self-reported oral health was re-named as 'Poor' (including 'Fair/poor' and 'less than 21 teeth') versus 'Excellent/Good' (including 'Excellent/very good/good' and '21 or more teeth').
- Global self-reported general health was assessed using the EQ-5D-5L [22, 23] which is a validated tool widely used to estimate general health-related quality of life, with 5 dimensions (5D): mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension of the EQ-5D has five levels (5 L), with increasing level numbers corresponding to increasing levels of problems. Typically, a 'disutility' score is provided, which is a measure of people's health status. Higher disutility scores indicate worsening general health.

Statistical analysis

Descriptive analyses were conducted to compare the descriptive, bivariate and multivariable analytical results from the two studies, and stratified by socio-demographic characteristics: age (>50 vs. ≤50 years), sex (Male vs. Female), income (Lower: including 'Welfare support payment' OR '<$ 50, 000' vs. Higher: including 'Job' OR '≥$50, 000'), oral health (Poor vs. Excellent/good) and health-related behaviors (Current smoker vs. 'Ex-/never smoked). The mean disutility scores and prevalence of having at least one problem for each dimension of EQ-5D-5L with corresponding 95% confidence intervals (95% CI) were reported. Differences were denoted to be statistically significant when 95% CI did not overlap. Weighted data analyses were used for study 2.

Results

Participant characteristics from the two studies are presented in Table 1. Compared with non-Indigenous Australians, a higher proportion of Indigenous Australians were in the younger age group (≤50 years), female, in the lower income group and were current tobacco smokers. The proportion of poor self-rated oral health was three times higher in Indigenous than in non-Indigenous Australians.

The average disutility scores are presented in Table 2. Overall, the mean disutility score was 2 times higher in Indigenous than in non-Indigenous Australian adults. A higher mean disutility score was observed among Indigenous adults with poor self-rated oral health (0.25, 95% CI: 0.22-0.27) than among non-Indigenous adults with poor self-rated oral health (0.16, 95% CI: 0.14-0.18). When stratified by socio-demographic characteristics and health-related behaviors, the mean disutility scores were 1.5-2 times higher from every individual group/classification among Indigenous Australians compared with non-Indigenous Australians.

Overall, the prevalence of having at least one problem was higher for all dimensions among Indigenous than non-Indigenous peoples (Table 3), with the exception of the 'Mobility' dimension. The prevalence of having at least one problem was higher among those with 'excellent/good' self-rated oral health among Indigenous compared with non-indigenous Australian adults, with the exception of the 'Mobility' and 'Pain/discomfort' dimensions. There were no statistically significant differences of the prevalence of having at least one problem for most EQ-5D dimensions, with the exception of 'Anxiety/depression'.

Associations between self-rated oral health and EQ-5D after adjusting for covariates are shown in Table 4. The same findings were observed among both Indigenous and non-Indigenous Australians: poor self-rated oral health was positively associated with total disutility score and each EQ-5D dimension. However, the prevalence ratio was more than 2 times higher among Indigenous than non-Indigenous Australians across each individual EQ-5D dimension.

Table 1: Sample characteristic of Indigenous and non-Indigenous Australians

	Indigenous (Study 1)		Non-Indigenous (Study 2)	
	Number	% (95% CI)*	Number	% (95% CI)[a]
Total	1,011	100	2,891	100
Age groups (years)				
>50	283	28.0 (25.2-30.8)	1,468	43.0 (41.0-45.0)
≤50	728	72.0 (69.2-74.8)	1,423	57.0 (55.0-59.0)
Sex				
Male	340	33.6 (30.7-36.5)	1,227	48.9 (46.9-51.0)
Female	671	66.4 (63.5-69.3)	1,664	51.1 (49.0-53.1)
Income[b]				
Lower	757	76.0 (73.3-78.7)	919	32.3 (30.3-34.4)
Higher	239	24.0 (21.3-26.7)	1,312	67.7 (65.6-69.7)
Smoke status				
Current smoker	568	59.4 (56.3-62.5)	522	18.9 (17.8-20.7)
Ex-/ Never smoked	388	40.6 (35.7-45.5)	2,367	81.1 (79.3-82.6)
Self-rated oral health				
Poor	329	33.5 (30.5-36.4)	327	9.5 (8.5-10.7)
Excellent/Good	654	66.5 (63.6-69.5)	2,317	90.5 (89.3-91.5)

[a]Weighted % and 95% CI; [b]Income: 'Lower' (including 'Welfare support payment' OR '<$ 50, 000') vs 'Higher' (including 'Job' OR '≥$50, 000'); *Difference statistically significant as denoted by non-over-lapping 95% confidence intervals.

Table 2: Disutility score (EQ-5D-5L) among Indigenous and Non-Indigenous Australians

	Indigenous (Study 1)	Non-Indigenous (Study 2)
	Mean (95% CI)*	Mean (95% CI)[a]
Total	0.18 (0.17-0.19)	0.09 (0.08-0.10)
Age groups (years)		
>50	0.26 (0.22-0.29)	0.13 (0.12-0.14)
≤50	0.15 (0.14-0.17)	0.07 (0.06-0.07)
Sex		
Male	0.17 (0.15-0.19)	0.08 (0.08-0.09)
Female	0.19 (0.17-0.20)	0.10 (0.10-0.11)
Income[b]		
Lower	0.19 (0.18-0.21)	0.15 (0.14-0.17)
Higher	0.14 (0.12-0.17)	0.07 (0.06-0.07)
Smoke status		
Current smoker	0.19 (0.17-0.21)	0.12 (0.10-0.14)
Ex-/ Never smoked	0.17 (0.15-0.19)	0.09 (0.08-0.09)
Self-rated oral health		
Poor	0.25 (0.22-0.27)	0.16 (0.14-0.18)
Excellent/Good	0.15 (0.13-0.16)	0.08 (0.07-0.09)

[a]Weighted % and 95% CI; [b]Income: 'Lower' (including 'Welfare support payment' OR '<$ 50, 000') vs 'Higher' (including 'Job' OR '≥$50, 000'); *Difference statistically significant as denoted by non-over-lapping 95% confidence intervals.

Table 3: Prevalence of at least one problem for five dimensions of EQ-5D by self-rated oral health status and covariates among Indigenous and non-Indigenous Australians.

	Mobility	Self-care	Usual activities	Pain/ discomfort	Anxiety/ depression
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)*
Indigenous (study 1)					
Total	28.6 (25.8-31.4)	9.0 (7.2-10.8)	24.8 (22.1-27.5)	52.2 (49.1-55.3)	58.3 (55.2-61.3)
Age groups (years)					
>50	50.5 (44.7-56.4)	16.8 (12.4-21.2)	40.8 (35.0-46.5)	65.1 (59.6-70.7)	58.4 (52.6-64.2)
≤50	20.0 (17.1-22.9)	6.0 (4.2-7.7)	18.6 (15.7-21.4)	47.1 (43.5-50.8)	58.2 (54.6-61.8)
Sex					
Male	27.3 (22.5-32.1)	9.2 (6.1-12.3)	24.9 (20.2-29.5)	51.3 (46.0-56.7)	55.7 (50.3-61.0)
Female	29.2 (25.8-32.7)	8.9 (6.7-11.1)	24.8 (21.5-28.1)	51.6 (48.8-56.4)	59.6 (55.8-63.3)
Income [b]					
Lower	31.0 (27.7-34.3)	10.2 (8.1-12.4)	27.6 (24.4-30.8)	52.2 (48.6-55.8)	59.2 (56.0-63.4)
Higher	19.7 (14.6-24.7)	5.0 (2.2-7.8)	16.3 (11.6-21.0)	51.9 (45.5-58.2)	56.5 (50.2-62.8)
Smoke status					
Current smoker	28.3 (24.6-32.0)	9.6 (7.2-12.0)	25.7 (22.1-29.3)	52.7 (48.5-56.8)	57.8 (54.3-61.3)
Ex-/ Never smoked	28.9 (24.3-33.4)	8.3 (5.5-11.1)	23.7 (19.5-28.0)	52.5 (47.5-57.4)	54.1 (49.2-59.1)
Self-rated oral health					
Poor	42.9 (37.6-48.3)	14.7 (10.8-18.5)	35.0 (29.8-40.1)	66.8 (61.6-71.9)	71.3 (66.4-76.2)
Excellent/Good	21.2 (18.1-24.3)	6.0 (4.2-7.8)	19.4 (16.3-22.4)	45.1 (41.2-48.9)	51.8 (48.0-55.7)
Non-Indigenous (study 2)[a]					
Total	25.6 (23.9-27.4)	4.6 (3.9-5.4)	17.3 (15.9-18.8)	44.4 (42.4-46.4)	24.7 (23.0-26.4)
Age groups (years)					
>50	41.5 (38.7-44.3)	7.8 (6.5-9.3)	27.5 (25.1-30.1)	60.0 (57.1-62.7)	24.6 (22.3-27.1)
≤50	13.6 (11.8-15.7)	2.2 (1.4-3.2)	9.6 (8.1-11.5)	32.6 (30.0-35.3)	24.7 (22.3-27.2)
Sex					
Male	22.8 (20.4-25.4)	4.5 (3.5-5.9)	14.7 (12.7-17.0)	40.8 (37.8-43.9)	21.8 (19.3-24.4)
Female	28.3 (26.0-30.7)	4.6 (3.7-5.8)	19.8 (17.8-21.9)	47.8 (45.1-50.5)	27.4 (25.1-29.8)
Income[b]					
Lower	40.7 (37.2-44.2)	11.0 (8.9-13.5)	30.4 (27.3-33.8)	59.8 (56.2-63.3)	35.8 (32.4-39.3)
Higher	19.5 (17.2-21.9)	1.8 (1.1-2.7)	10.8 (9.0-12.8)	40.2 (37.3-43.1)	20.6 (18.3-23.1)
Smoke status					
Current smoker	29.3 (25.1-33.9)	5.5 (3.7-8.2)	20.0 (16.4-24.2)	48.8 (44.0-53.7)	34.1 (29.6-38.8)
Ex-/ Never smoked	24.7 (22.9-26.6)	4.4 (3.6-5.3)	16.6 (15.1-18.3)	43.3 (41.1-45.5)	22.4 (20.7-24.3)
Self-rated oral health					
Poor	49.7 (43.8-55.6)	9.7 (6.9-13.4)	32.8 (27.4-38.7)	68.5 (62.7-73.8)	28.6 (23.5-34.3)
Excellent/Good	20.9 (19.2-22.7)	3.1 (2.5-4.0)	13.9 (12.5-15.5)	40.1 (37.9-42.3)	23.7 (21.9-25.7)

[a]Weighted % and 95% CI; [b]Income: 'Lower' (including 'Welfare support payment' OR '<$50, 000') vs 'Higher' (including 'Job' OR '≥$50, 000'); *Difference statistically significant as denoted by non-over-lapping 95% confidence intervals.

Table 4: Findings from multivariable regression modelling for total disutility scores, and at least one problem for 5 dimensions among Indigenous and Non-Indigenous Australians.

	Disutility scores	Mobility	Self-care	Usual activities	Pain/ discomfort	Anxiety/ depression
	β (95%CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)
Indigenous (Study 1)						
Self-rated oral health						
Poor	0.44 (0.11-0.78)	2.53 (1.81-3.56)	2.62 (1.55-4.41)	1.87 (1.32-2.64)	2.24 (1.64-3.07)	2.41 (1.73-3.36)
Excellent/Good	ref.	ref.	ref.	ref.	ref.	ref.
Non-Indigenous (Study 2)						
Self-rated oral health						
Poor	0.04 (0.01-0.06)	1.26 (1.06-1.50)	1.29 (0.87-1.91)	1.15 (0.95-1.39)	1.16 (1.06-1.27)	1.01 (0.83-1.24)
Excellent/Good	ref.	ref.	ref.	ref.	ref.	ref.

*__Study 1__ adjusted for age, sex, geographic location, education level, income, health care card ownership, smoke status, use of e-cigarette and drugs; **Study 2** adjusted for age, sex, income, country of birth, physical activity past week, smoke status, daily alcohol consumption and chronic disease status.

Discussion

The findings support the hypothesis that both self-rated oral and general health-related quality of life would be poorer among Indigenous compared with non-Indigenous Australians. The findings demonstrate that poor self-rated oral health was associated not only with higher overall disutility scores, but across each individual dimension of EQ-5D. The findings held even after adjusting for socio-demographic factors and health-related behaviors. For both Indigenous and non-Indigenous Australians, higher disutility scores were observed among lower income and current tobacco smoker groups compared with those with higher incomes/who did not smoke.

Lower socioeconomic status, including low education attainment and income, was an important risk factor associated with both poor oral and general health. Our findings are similar to those reported by Hakeberg et al. [26] and Sabbah et al. [27], who observed that the lower income position, the poorer oral and general health among adult's population in Sweden (OR=2.1 and 6.8, respectively) and in U.S (OR=2.3 and 3.7, respectively). A higher proportion of Indigenous Australians have low household income and education levels compared with non-Indigenous Australians [28], which affects not only health literacy, but also health service utilization, resulting in lower rates of public health insurance [16], dental/general health check-ups and visiting [29]. Our tobacco association findings were consistent across the globe [30,31]. Tobacco smoking is associated with oral disease, such as dental caries [32], periodontal disease [33], and oral cancer [34], as well as general illness, including type 2 diabetes and cardiovascular disease [35], lung cancer [36], and premature death [37].

The long-lasting impacts of colonization as part of the core fabric of the social determinants of health are unique to most global Indigenous populations. Indigenous Australians suffer from the substantive burden of post-colonial consequences on almost every indicator of economic, social and health well-being [38]. Indigenous Australians residing in remote or very remote locations are especially impacted, with additional barriers including lack of access to higher education, lack of fresh food, inequitable access to primary dental and health care services, increased psychological distress, trauma, socioeconomic disadvantage, and a higher burden of chronic diseases [17,39]. These factors interact with one another to create a vicious circle, resulting in systemic and inter-generational poor oral and general health.

There are several limitations to our study. Study 1 data was derived from a large convenience sample which was not representative, and Study 2 data was not the newest data which might not represent recent oral and general health conditions among Australian adults. The same instrument was not used across both studies to assess self-rated oral health. Similarly, the covariates used in multivariable analysis were not exactly the same across both studies.

Conclusion

Our findings indicate that self-rated oral and general health-related quality of life remain poorer among Indigenous relative to non-Indigenous Australians. The social determinants of health are likely to be root causes. Interventions that address social, economic and political constructs are required to reduce oral and general health inequalities between Indigenous and non-Indigenous Australians.

Conflicts of Interest

The authors confirm that they have no competing interests.

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Author Contribution Statement

XJ and LMJ conceived and designed the study. LMJ and KK are guarantors for this article. All authors contributed to data

acquisition and interpretation, and critically reviewed and approved the manuscript.

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