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**Does optimal access to dental care counteract the oral health-related quality of life social gradient?**

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**ABSTRACT**

**Objective:** To determine if an oral health-related quality of life (OHRQoL) social gradient existed when Australian Defence Force (ADF) members have universal and optimal access to dental care.

**Methods:** A nominal roll included 4,089 individuals who were deployed to the Solomon Islands (SI) as part of operation ANODE and a comparison group of 4,092 ADF personnel frequency matched to the deployed group on sex, age group, and service type, from which 500 deployed and 500 comparison individuals were randomly selected. The dependent variables were the OHIP-14

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summary measures. Rank was used to determine socioeconomic status. The demographic variables selected were: sex and age.

Results: Response rate was 44%. Of the individual OHIP-14 items, being self-conscious, painful aching and having discomfort when eating were the most common problems. Mean OHIP-14 severity was 2.8. In bivariate analysis, there was not a significant difference in mean OHIP-14 severity ( $p=0.52$ ) or frequency of OHIP-14 impacts ( $p=0.57$ ) by military rank. There was a significant increasing OHIP-14 extent score from commissioned officer to non-commissioned officer to other ranks (0.07, 0.19, 0.40,  $p=0.03$ ).

Conclusion: Even with optimal access to dental care, there was an OHRQoL social gradient between military ranks in the ADF.

## INTRODUCTION

Studies have noted that there is a social gradient in clinical and self-reported oral health outcomes<sup>1, 2, 3, 4, 5, 6, 7, 8, 9, 10</sup>. The reasons why socioeconomic factors are associated with oral health outcomes are still open to debate. Sanders and Spencer<sup>10</sup> conjectured that socioeconomic factors do not account for observed health differences directly, but rather are marking other genetic, social and psychological phenomena that drive variation in health. Sanders and colleagues<sup>11</sup> measured relative socioeconomic status using the MacArthur Scale of Subjective Social Status and absolute socioeconomic status by equivalised household income and found that poor oral health as measured by self-reported missing teeth was not explained by personal neglect, where personal neglect was defined as lack of dental visiting or dental self-care or both.

Regular dental attendance is associated with better oral health outcomes, even after adjustment for socioeconomic status<sup>7, 11, 12, 13</sup>. Research has focussed on access to dental care in terms of the difficulties encountered and on associations with poor oral health outcomes. For example, low income adults without private insurance are more likely to have had all their teeth extracted than high-income adults with insurance<sup>23</sup>. Donaldson *et al.*<sup>4</sup> found that the association between socioeconomic status and the number of sound teeth was partially explained by regularity of dental attendance. Longitudinal studies have investigated the association between routine dental care and oral health-related quality of life (OHRQoL)<sup>12, 13, 15, 16, 17, 18, 19</sup>. Using a lifecourse study, Thomson *et al.*<sup>20</sup> showed that long-term routine dental visiting was associated with lower experience of dental caries and missing teeth, and better self-rated oral health. The longer routine attendance was maintained, the stronger the effect.

Social inequalities in health, and oral health, have been postulated to be the result of social determinants operating through relative social position, psychological distress and resilience, behaviours in the form of self-care and use of professional services<sup>6</sup>. If a social determinants model applied to the Australian Defence Force (ADF) then one would expect an OHRQoL social gradient. However, it may be attenuated by dental care<sup>21</sup>

The ADF, in maintaining its members dentally 'fit to fight', requires each member undergo a compulsory annual dental assessment and any treatment deemed necessary by the treating dental officer. This service is provided at no charge to the ADF member. Any necessary treatment whilst on leave is also free<sup>22, 23</sup>. Oral health care for ADF members is institutionalised and enforced. Those ADF members who do not attend for a dental appointment without good reason may be fined and a dental officer needs to "sign off" that an ADF member is dentally fit before he/she can be deployed, promoted or undergo further training. ADF members may have access to dental care that they may

never be able to afford outside the ADF. Complex treatment plans are reviewed by senior officers to take into account the appropriateness of the treatment, maintainability, and the cost to the services. Therefore, access to dental care for ADF members may be regarded as universal, compulsory and optimal.

The universal and optimum access to dental care may be the reason why OHRQoL is better in ADF members than in the general Australian population<sup>13</sup>. The objective of this paper was to determine whether, even with universal and optimum access to dental care, there is a social gradient in oral health across ranks in the ADF. This is important to know, because policy makers need to know if using limited government resources on improving access to dental care will counteract the oral health gradient.

## METHOD

### *Data source*

The Solomon Islands (SI) is a Melanesian nation east of Papua New Guinea. In 2003, SI was in a political and security crisis, as a result of long standing internal conflicts. The ADF deployed Operation ANODE in 2003 as part of the Regional Assistance Mission to the Solomon Islands.

The Defence Deployed Solomon Islands Health Study<sup>24</sup> (SI Health Study) aimed to determine whether the health of the veterans of Operation ANODE differed significantly from similar non-deployed ADF members. Both current and former ADF members were invited to participate. A nominal roll included 4,089 individuals who were deployed to the Solomon Islands as part of operation ANODE and a comparison group of 4,092 ADF personnel frequency matched to the deployed group on sex, age group, service (Navy, Army or Air Force) and service type (Permanent or Reserve), from which 500 deployed and 500 comparison individuals were randomly selected<sup>24</sup>. The self-report questionnaire, from which the self-report indicator of OHRQoL was obtained, was completed between March and December 2007. As there was no statistically significant difference in OHIP-14 severity between members deployed to the Solomon Islands and the comparison group of ADF members who were not deployed<sup>24</sup>, the two SI Health Study subgroups were combined for this analysis.

### *Dependent variable*

The OHIP-14 has seven content areas of functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. Each of the seven OHIP dimensions consists of two items (or questions). Each item could have one of five responses: “never”, “hardly ever”, “occasionally”, “fairly often” or “very often.”

The dependent variable was the OHIP-14 items and summary measures. The definitions for the summary OHIP-14 measures were proposed by Slade<sup>25</sup>. Frequency of OHIP-14 impacts (previously OHIP-14 Prevalence) was defined as the percentage of subjects who reported impacts “occasionally”, “fairly often”, or “very often.” Extent was summarised for each survey participant by the number of items reported “occasionally”, “fairly often”, or “very often.” This dichotomisation that included “occasionally” in the count category was chosen because it matched that used by the ADF in its report<sup>33</sup> and because OHRQoL was shown in previous studies<sup>13,24</sup> to be good in the ADF members. Severity was the sum of the ordinal responses where “never” was coded as 0, “hardly ever” as 1, “occasionally” as 2, “fairly often” as 3 and “very often” as 4. A person could have an OHIP-14 severity ranging from 0 to 56. The severity measure using all response categories attempts to

overcome limitations that may be inherent in restricting summary scores to arbitrary thresholds of impacts. A lower OHIP-14 summary score equates to better OHRQoL.

### *Socioeconomic Status*

Rank was used to determine socioeconomic status similar to the use of position in the Whitehall study of British public servants<sup>26</sup>. Rank in the armed forces is a recognised hierarchy in authority and skills in the ADF<sup>27, 28</sup>. Rank defines the ADF member's role and degree of responsibility. Officer positions are more management focused, requiring team leadership and decision-making, while other positions tend to be more trade related and team orientated. All officer positions require a minimum of Year 12 and some positions require tertiary qualifications. Rank was divided into commissioned officers, non-commissioned officers and other ranks. The highest level of education was trichotomised into having a degree, a diploma or other post-secondary education, and no post-secondary school education.

### *Demographic Covariates*

The demographic variables were selected as putative confounders on the basis of having been shown in previous studies to be associated with OHRQoL: sex<sup>29</sup> (Male/Female) and age<sup>30</sup> (18-<35, 35-<45, 45-65 years). The three age groups chosen were those usually reported by the ADF. The questionnaire date of 15 September 2007 (mid-term of the survey) was used to calculate the age for all respondents because the date when the questionnaire was completed was not given for many respondents.

### *Global Health Statement*

Participants were asked to rate their general health as either "Excellent", "Very Good", "Good", "Fair" or "Poor". Respondents who answered either "Excellent", "Very Good", "Good" were considered to have good self-perceived general health.

### *Statistical Analysis*

The participation rates, and descriptive data of the demographic variables, highest education level, global health statement, rank, for the 14 individual OHIP-14 items and the three OHIP-14 summary measures were presented. Bivariate analysis of the demographic variables, highest education level and the global health statement by rank and the OHIP-14 summary measures were also presented. Stratified analysis by rank with age and sex was undertaken for the OHIP-14 summary measures. SAS 9.3 (Research Triangle Institute, Research Triangle Park, NC) was used for the analysis. Ethics approval was received for the data collection stage of the SI Health Study from Australian Defence Human Research Ethics Committee.

## RESULTS

### *Participation rates*

Response to the SI self-report health questionnaire was obtained from 44% (n=435) of the living sample. Five were deceased and 19% of individuals could not be located and contacted in the time available. The largest proportion of those who could not be located was ex-ADF members. An overall response rate of 54% was achieved for those who could be contacted<sup>24</sup>.

### *Descriptive data*

The sample had more males than females and younger than older people (Table 1). Just under a quarter of the sample were commissioned officers, just over 40% were non-commissioned officers, and approximately one-third were other ranks. The majority of the participants were in the army

with lesser numbers from the navy and air force. Just under a quarter of the respondents had a degree while over a third had a diploma, and over a third had no post-secondary education. Over three-quarters of the respondents reported their health as being excellent, very good or good.

Of the individual OHIP-14 items, being self-conscious, painful aching and having discomfort when eating had the highest percentage of respondents who answered “very often”, “fairly often” or “occasionally” (Table 2). Frequency of OHIP-14 impacts was 7.1% and mean OHIP-14 extent was 0.23 (95%CI: 0.12,0.34). The mean OHIP-14 severity was 2.8 (95%CI: 2.2,3.4).

#### *Bivariate analysis*

The highest proportion of females was commissioned officers, followed by other ranks and then non-commissioned officers, while males had the highest proportion as non-commissioned officers (Table 3). Over half of the respondents aged less than 35 years were in the other ranks category, while non-commissioned officers made up more than half of the 35-<45 year and 45-<65 year age groups. The highest education level was significantly associated with rank, with commissioned officers having a much higher proportion of degree holders than either non-commissioned officers or other ranks. Other ranks were more likely to have reported having fair or poor health than commissioned and non-commissioned officers.

There was no significant difference in any of the OHIP-14 summary measures between the sexes, by the three age groups, or by military rank (Table 4), with the exception that there was a significant increase in OHIP-14 extent score from commissioned officer to non-commissioned officer to other ranks. There was a general health gradient with other ranks having poorer self-perceived health than commissioned and non-commissioned officers.

#### *Stratified analysis*

In males and defence force members aged less than 35 years or 45 to 60 years, there was a significant difference in OHIP-14 severity and extent scores with the scores worsening from commissioned officers to non-commissioned officers to other ranks (Table 5). In the 45-65 year age group, the frequency of impacts was higher for non-commissioned officers than the other two rank categories.

## DISCUSSION

Although, there was not a social gradient in OHRQoL between the ranks in bivariate analysis, there was an OHRQoL social gradient between military ranks in two age groups (less than 35 years or 45 to 60 years) in the stratified analysis, suggesting that improving access to dental care may not be enough to remove the OHRQoL social gradient. As the only variable that was related to OHIP-14 was the global health statement, and as a putative confounder should be statistically associated with both the main exposure (rank) and the outcome (OHIP-14 summary measures), a multivariate analysis was not necessary.

Crocombe *et al.*<sup>13</sup> found that OHRQoL was significantly better in the ADF compared to the wider Australian community and that better access to oral health care in the ADF was a contributory factor to that outcome. It may not be surprising that there still exists an OHRQoL social gradient within the military given the complex nature of social determinants and oral health inequalities. Watt<sup>9</sup> stated: “A conceptual shift is needed away from this biomedical/behavioural ‘downstream’ approach, to one addressing the ‘upstream’ underlying social determinants of population oral health.”

A similar argument can be put for general health. Daly *et al.*<sup>31</sup> (2013) state that in order to reduce health inequalities, there has to be effective action on the determinants of health. The dilemma is that many of the ‘upstream’ determinants of health that lead to (oral) health inequalities are social

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and political and to a large extent beyond the scope of oral health advocates<sup>32</sup>. The military population is unique, dental care is institutionalised; being free to the ADF member, comprehensive, and compulsory. Additionally, the quality of care is overseen by senior dental officers and there is a robust preventative and health promotion program<sup>22, 23</sup>. The living conditions for service personnel are of a high standard. Hence, the existing material and social circumstances of the determinants of oral health inequalities are largely addressed within the ADF. It has been recognised that military rank equates to a socioeconomic class structure<sup>33</sup> and those from lower socioeconomic upbringing tend to be at a lower rank within the military. It maybe that the attitudes and behaviour of ADF members from their upbringing are strong determinants of oral health inequality and that this explains why optimal and compulsory dental care is not enough to counteract the social gradient in oral health. However, improved access to dental care may reduce the social OHRQoL gradient<sup>7, 11</sup>.

It was interesting that the deployed and non-deployed ADF members did not have differing OHRQoL<sup>33</sup>. It would not be unreasonable to hypothesize that high operational personnel are exposed to more general anxiety producing experiences which may be translated into poorer OHRQoL. However, there were no differences in the level of post-traumatic stress syndrome symptoms or psychological distress between the SI veterans and the comparison group. Similarly, there were no significant differences between the groups on various general health measures or in lifestyle factors, for example tobacco smoking and alcohol consumption. Self-reported exposure to traumatic stress was low for all the ADF members, which may explain the lack of difference in these conditions between the two groups.

Due to the young age of the ADF group and the 44% response rate, one should be careful in extrapolating the results to the general Australian population. The 86.4% of males in this study compared with 49.7% of males in the Australian population in June 2007<sup>43</sup> and the age groups proportions in this study of 18 to less than 35 years of 54.2%, 35 to less than 45 years of 32.9% and 45 to 65 of 12.9% compares with 34.54% in the 20 to 34 year age group, 24.3% in the 35 to less than 45 year age group and 41.2% in the 45 to 65 year age group. A shortcoming of the study was the potential response bias caused by missing data<sup>33</sup>. There may have been effects of other deployments which could not be accounted for. How long the ADF recruits had been in the ADF was not known and this may have had an impact on their access to care and then on their OHRQoL. A strength of the study was that the OHIP-14 score were participants' perceptions on the impacts of oral health and general health on their quality of life. The frequency-matched comparison group design was another strength of the study. Further research is needed to discover if the social gradient in oral health is greater or less in the ADF than in the general adult population.

## CONCLUSION

There was an OHRQoL social gradient between military ranks in the ADF indicating that though access to universal, optimal and compulsory dental services may improve oral health-related quality of life, it may not enough to counteract the OHRQoL social gradient.

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Table 1 Study participant composition

Variable	n	%
Male	376	86.4
Age: 18-<35 years	236	54.2
35-<45 years	143	32.9
45-65 years	56	12.9
Highest Education: No Postsecondary Education	151	38.7
Diploma or other	142	36.4
Degree	97	24.9
Global Health Statement: Excellent-Good	361	86.4
Fair/Poor	57	13.6
Rank: Commissioned Officer	106	24.6
Non-Commissioned Officer	179	41.6
Other Ranks	145	33.7
Army	200	56.8
Air Force	66	18.8
Navy	86	24.4

Table 2 Number and percentage of respondents answering “very often”, “fairly often” or “occasionally”

<b>OHIP-14 Items</b>	<b>n</b>	<b>%</b>
Trouble pronouncing words	17	4.4
Taste affected	18	4.7
Painful aching	55	14.4
Uncomfortable to eat	49	12.8
Been self-conscious	60	15.7
Felt tense	35	9.2
Diet unsatisfactory	8	2.1
Interrupted meals	12	3.2
Difficult to relax	20	5.3
Been embarrassed	34	8.9
Been a bit irritable	17	4.5
Difficulty doing jobs	7	1.9
Life less satisfying	16	4.2
Unable to function	2	0.5

Table 3 Bivariate comparison of rank and socio-demographic variables.

<b>Variable</b>	<b>Total</b>	<b>Rank</b>						<b>p</b>
		<b>Commissioned Officer</b>		<b>Non-Commissioned Officer</b>		<b>Other Ranks</b>		
		<b>n</b>	<b>Row %</b>	<b>n</b>	<b>Row %</b>	<b>n</b>	<b>Row %</b>	
Sex: Male	372	83	22.3	165	44.3	124	33.3	<0.01
Female	58	23	39.7	14	24.1	21	36.2	
Age: 18-<35 years	233	54	23.2	59	25.3	120	51.5	<0.01
35-<45 years	141	29	27.4	89	63.1	23	16.3	
45-65 years	56	23	20.6	31	55.4	2	3.6	

Highest Education: No post secondary Ed.	150	4	2.7	77	51.3	69	46.0	<0.01
Diploma or other	139	12	8.6	70	50.4	57	40.0	
Degree	97	78	80.4	14	14.4	5	5.1	
Global Health Statement: Excellent-Good	357	93	26.0	150	42.0	114	31.9	0.03
Fair/Poor	56	8	14.3	21	37.5	27	48.2	

Table 4 Bivariate comparison of OHIP-14 summary scores, socio-demographic variables, global health statement and military rank.

Variable	OHIP-14 Summary Scores					
	Severity		Extent		Frequency of impacts	
	Mean	<i>p</i>	Mean	<i>p</i>	%	<i>p</i>
Sex: Male	2.8	0.85	0.24	0.58	7.2	0.91
Female	2.9		0.18		6.8	
Age: 18-<35 years	2.7	0.34	0.32	0.28	7.2	0.45
35-<45 years	2.6		0.10		5.6	
45-65 years	3.7		0.20		10.7	
Highest Education: No post secondary Ed	3.0	0.68	0.31	0.64	7.9	0.33
Diploma or other	3.2		0.27		9.1	
Degree	2.3		0.08		4.1	
Global Health Statement: Excellent-Good	2.5	0.03	0.20	0.21	6.6	0.13
Fair/Poor	4.7		0.41		12.2	
Rank: Commissioned Officer	2.3	0.52	0.07	0.03	4.7	0.57
Non-Commissioned Officer	2.8		0.19		7.8	
Other Ranks	3.1		0.40		7.6	

Table 5 Stratified analysis of military rank, socio-demographic variables and OHIP-14 summary scores

Variable	OHIP-14 summary scores											
	Severity				Extent				Frequency of impacts			
	Military Rank				Military Rank				Military Rank			
	Comm. Officer	Non-Comm. Officer	Other Ranks	<i>p</i>	Comm. Officer	Non-Comm. Officer	Other Ranks	<i>p</i>	Comm. Officer	Non-Comm. Officer	Other Ranks	<i>p</i>
	Mean	Mean	Mean		Mean	Mean	Mean		%	%		
Sex												
Male	2.5	2.7	3.1	<0.01	0.06	0.20	0.43	0.02	4.8	7.9	8.1	0.62
Female	1.5	2.1	3.2	0.40	0.09	0.10	0.25	0.80	4.3	7.1	4.8	0.93
Age												
18-<35 years	2.0	2.4	3.2	<0.01	0.06	0.29	0.47	0.03	3.7	10.2	7.5	0.41
35-<45 years	2.5	2.7	1.2	0.12	0.11	0.10	0.00	0.08	6.9	5.6	0.00	0.47
45-65 years	2.7	3.7	13.5	<0.01	0.04	0.27	1.00	<0.01	4.3	9.7	3.6	<0.01