Evaluation of Dental Emergency Outcomes of the Oral Health Fitness Classification of the South African Military Health Service (SAMHS) in Gauteng, South Africa.*

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RESUME

Evaluation de la classification d'aptitude bucco-dentaire du Service de santé Sud-Africain dans la région de Gauteng en relation avec les urgences dentaires.

Les urgences dentaires sont une menace pour toute mission militaire et un souci majeur pour les planificateurs. Elles empêchent les soldats de remplir leur mission et elles réduisent leur efficacité au combat. L'objectif de cette étude était de déterminer le pourcentage d'urgences dentaires dans le Service de santé Sud Africain. Une étude transversale rétrospective a été menée en 2009 sur les membres des forces armées d'Afrique du Sud (SANDF) qui avaient été classés en catégories d'aptitude bucco dentaire (OHF) 1 et 2 dans la région de Gauteng (AMHU GT). Les membres de l'AMHU GT furent suivis pendant un an pour savoir s'ils avaient présenté une urgence dentaire. L'analyse des données reposait sur des testés de chi 2 et des analyses de régression logistique. Le taux de significativité était fixé à p < 0,05. Le taux d'urgences dentaires pour les AMHU GT était de 307/1 000 hommes et par an. La plupart des urgences furent des soins dentaires (58,5 %) et des extractions (13 %). Les patients étaient les plus probablement touchés par une urgence dentaire s'ils étaient blancs, de sexe féminin, classés OHF2 et âgés de plus de 50 ans. Le taux des urgences dentaires dans les SANDF est élevé lorsqu'on le compare avec celui d'autres pays et il est variable suivant la race, l'âge et le genre.

KEYWORDS: Dental emergency, Oral Health Fitness Classification, South African National Defence Force, Dental restorations.

MOTS-CLÉS : *Urgences dentaires, Aptitude bucco-dentaire, Forces Armées Sud Africaines, Soins dentaires.*

INTRODUCTION

The South African Military Health Service (SAMHS) is one of the four arms of the South African National Defence Force (SANDF)[1]. The main function of the SAMHS is to support the other three arms of the force by providing health services to members of the SANDF, their families, retirees and some members of parliament seconded by the State President.

An integral component of the SANDF's overall medical readiness program is dental readiness. An individual's medical readiness is defined as he or she being fully medically ready in all categories, including Oral Health Fitness Classification (OHF) 1 or 2. The OHF classification utilised by the SANDF is similar to the classification used by the North Atlantic Treaty Organisation (NATO) members, which is defined in the Standard Agreement (STANAG) 2466[2]. Military personnel are classified into

four OHF classification/dental fitness categories as follows: Category or Class 1, fully dentally fit; Category or Class 2, dental treatment is required but the condition is not expected to cause a problem within the next year; Category or Class 3, treatment is required and the condition is expected to cause a problem within the next year; and Category or Class 4, dental examination has expired after 12 months or the member has never been classified.

According to the Oral Health Care System of the SAMHS, dental care delivered to achieve OHF is focused towards treating those conditions, which, if left untreated, could result in a dental emergency (DE) within 12 months. DE is a condition that causes pain, uncontrolled haemorrhage, acute infection or loss of masticatory function, which significantly impact on the patient's performance of duties[1]. DE is a threat to the military mission because it takes soldiers away from their assigned places of duty. The prevention and treatment of dental diseases are important factors in maintaining a combat-ready military force[3]. Therefore, dental care should be delivered to avoid DEs[1]. The Department of Defence (DoD) Oral Health and Readiness Classification System standardizes dental readiness, assesses oral health, prioritizes dental care, minimizes the number of DEs and emphasizes the importance of good oral health to all active duty- and reserve forces[4]. DEs can significantly degrade the ability of mission accomplishment in a highly technological force that depends on each soldier's unique experience and knowledge of team tactics and crew-served weapons.

The purpose of the study was therefore to evaluate the DE outcomes of the OHF classification of the SAMHS in Area Military Health Unit Gauteng (AMHU GT), South Africa.

The population groupings referred to in the results of this study comprise: Asians, 2.5% of the population and mainly people of Indian descent; Blacks, 79% of the population and descendants of African peoples who migrated in a southerly direction from central Africa; Coloureds, 8.9% of the population who are people of mixed parentage, mainly descendants of the indigenous Khoikhoin people, the Malayan slaves and the White settlers; and Whites, 9.5% of the population, descendants of the European settlers, mainly Dutch, British, German, French, Portuguese, Greek, Italian and Jewish[5].

METHODS

The study design was a cross-sectional retrospective study that analysed records of members of the SANDF who received an OHF classification of 1 and 2 in AMHU GT during 2009. The records were followed up for 12 months after their initial OHF classification to determine the DE rate as well as to analyse the profile of the DEs that developed.

AMHU GT classifies on average about 140 members of the SANDF per week. The OHF classifications as well as all the dental treatment records of members of the SANDF are captured on the dental system mainframe. All the members that received OHF classification 1 and 2 in Gauteng during 2009 constituted the study population (n = 6,352). The records of members were followed up for 12 months after they were classified to assess if they had developed a DE within that period.

Data Analysis

Data analysis was carried out with the use of STATA version 10 software (STATA Corporation, College Station TX) and SPSS version 20. Group differences were assessed using chi-square statistics. Multi-variable adjusted logistic regression was carried out with the use of a backward deletion approach, starting with a full model of factors significantly associated with DE in the bivariate analysis. Statistical significance was set at 5%.

RESULTS

Dental Emergency Rate in Area Military Health Unit, Gauteng

In 2009, the total number of soldiers who received an OHF classification in Gauteng was 6,352 of which 69.9% were male and 30.1% female. The study participants were mostly black Africans (71.7%; n = 4,557). The age range of soldiers who received an OHF classification in Gauteng in 2009 was aged between 20 and 64 with a mean age of 40.13. Of the study population of 6,352, 30.7% (n = 1947) developed a DE within a year of classification.

Types of Emergencies

Dental restorations as a group contributed the most (58.5%), followed by extractions (13.0%) and recementation of crowns and bridges (9.0%). Denture problems at (3.6%) contributed the least to DEs (Figure 1).

Bivariate Analysis

Bivariate association between gender and DE stratified by age group is shown in Table 1. DEs are expressed as a percentage of the total number of people in the sample for gender and age group.

Data in Table 1 clearly shows that for the age group 20 to 50 the difference in DEs for males and females was highly significant ($p < 0,05$). There was no statistical

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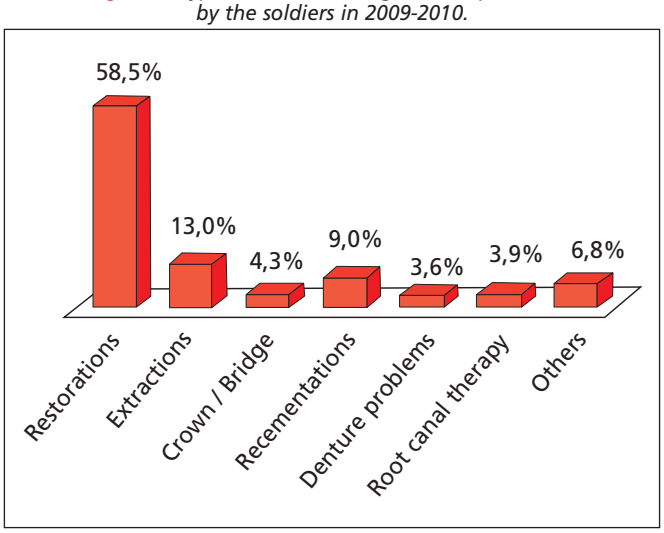
Figure 1: Types of dental emergencies experienced by the soldiers in 2009-2010.



significant difference in DEs by gender in the older age group ($p > 0.05$). Table 1 further shows that the prevalence of DE increases with age, with the age group 20 to 30 contributing the least and the age group 51 and higher contributing the most. Females of all the age groups consistently contributed more than males towards DEs ($p < 0.05$).

Table 2 shows the bivariate association between race and DE stratified by age groups. DEs are expressed as a percentage of the total number of people in the sample for a particular race group for that age group.

For all age groups the differences in DEs for the different races was highly significant ($p < 0.05$). White military personnel in all the age groups consistently contributed more towards DEs than the other race groups, except in the age group 51 and higher where Asians contributed more. Blacks contributed the least to DEs.

Table 3 shows the bivariate association between OHF classification and DE stratified by age groups. DEs are expressed as a percentage of the total number of people in the sample for OHF classification for that age group.

Table 3 shows that for the age group 20 to 50 the difference in DEs for the age groups was highly significant ($p < 0.05$) with OHF 2 contributing more towards DEs than OHF 1 but for age group 51 and higher there was no difference in DE between the patients who were classified as OHF 1 and those classified as OHF 2 ($p = 0.846$).

Table 1: Bivariate Association between Gender and Dental Emergency stratified by Age Groups.

Age group	Male		Female		p-value
	DEs (%)	n	DEs (%)	n	
20-30	167 (22.4)	744	167 (28.3)	590	0.014
31-40	315 (25.6)	1231	177 (32.5)	545	0.003
41-50	508 (27.5)	1845	197 (37.5)	525	0.000
51 and higher	292 (47.1)	620	123 (49)	251	0.61
Total	1282 (28.9)	3158	665 (34.8)	1248	0.000

Table 2: Bivariate Association between Race and Dental Emergency stratified by Age Groups.

Age group	Black		White		Coloured		Asian		p-value
	DEs (%)	n	DEs (%)	n	DEs (%)	n	DEs (%)	n	
20-30	257 (22.9)	1123	34 (35.8)	95	38 (36.9)	103	5 (38.5)	13	0.001
31-40	268 (22.2)	1262	174 (47.7)	365	42 (33.3)	126	8 (34.8)	23	0.000
41-50	415 (23.6)	1758	244 (51.6)	473	40 (31.7)	126	6 (46.2)	13	0.000
51 +	140 (33.8)	414	246 (60,6)	406	19 (50)	38	10 (76.9)	13	0.000
Total	1080 (23.7)	4557	699 (52.2)	1340	139 (35.4)	393	29 (46.8)	62	0.000

Table 3: Bivariate Association between OHF Classification and Dental Emergency stratified by Age Groups.

Age group	OHF 1		OHF 2		p-value
	DEs (%)	n	DEs (%)	n	
20-30	142 (20.1)	706	192 (30.6)	628	0.000
31-40	209 (24.5)	852	283 (30.6)	924	0.004
41-50	277 (27.4)	1012	428 (31.5)	1358	0.029
51 and higher	182 (48)	379	233 (47.40)	492	0.846
Total	811(27.5)	2950	1136(33.4)	3402	0.00

Logistic Regression

For logistic regression, DEs were used as dependent variables while the predictors or independent variables were gender, race, OHF classification and age groups. For the purpose of logistic regression, the age group 51 and higher, Whites, OHF classification 2 and males were used as references.

The results of the logistic regression analysis are shown in Table 4.

Table 4 indicates that with males as reference, females are 38% more likely to develop an emergency than males (OR-1.38; 95% CI: 1.22-1.56). With race and with whites as reference all the other races are below one, which means that Whites are more likely to have an emergency. Whites are closely followed by Asians and Coloureds while Blacks are the least likely to have a DE. The results given in Table 4 indicate that Blacks have 70%, Coloureds 45% and Asians 22% less chance of having a DE than Whites. Using OHF 2 as reference the results are that OHF 1 patients are 33% least likely to have a DE than OHF 2 patients. With age and with the age 51 and older group as a reference, the 20 to 40 year old age group has 45% less chance of experiencing a DE and the 41 to 50 year old age group 38% less chance.

Table 4: Logistic Regression

Characteristics		Odds Ratio	95% Confidence Interval
Gender	Male	1.0	
	Female	1.38	1.22-1.56
Race	White	1.0	
	Asian	0.78	0.46-1.31
	Black	0.30	0.26-0.35
	Coloured	0.55	0.43-0.70
OHF	OHF 2	1.0	
Classification	OHF1	0.67	0.60-0.76
Age group	≥ 51	1.0	
(Years)	20-30	0.55	0.45-0.67
	31-40	0.54	0.45-0.64
	41-50	0.62	0.53-0.74

DISCUSSION

On the basis of DEs reflected in literature the DE rate for the SANDF can be defined as high. The DE rate of 307/1,000 per year for the SANDF can be compared with that of the UK forces at base units, which was 308/1,000 per year in 2001[6]. This DE rate compared favourably with that found in the US army in 1981 to 1982, which was 320/1,000 per year. In the very same army the DE rate during 1983 to 1984 dropped to 270/1,000 per year[7]. DE rates reported thereafter for the US army were much lower – 230/1,000 per year for soldiers deployed to Somalia in 1993 and 140/1,000 per year to 150/1,000 per year for the soldiers deployed to Iraq in 2003[8].

An analysis of the type of DEs showed that dental restorations contributed 58.5%, extractions and related complications 13%, crown and bridge-related emergencies contributed 4.3% and emergency root canal treatments 3.9%.

In order to reduce DEs in the SAMHS, there is a need to know what percentage of the emergencies could have been prevented and what percentage were non-preventable. Very little consensus exists on which DEs are preventable and which are not[9]. Emergencies such as aphtous ulcers, herpetic lesions, root sensitivity, restoration fractures and trauma are considered not preventable[9]. While this is true, it is also accepted that some of the trauma on anterior teeth that are malaligned could have been prevented by orthodontic treatment[9]. Furthermore, the fact that an unscheduled visit by a patient, as a definition of DE, can be attributable to an individual pain threshold as opposed to disease progression or infection adds to the complexity.

Payne and Posey considered DEs due to dental caries and gingival conditions as preventable and all others as non-preventable[10]. Keller considered all DEs non-preventable, except DEs due to pulpal disease, periodontal conditions and pericoronitis[7] and Teweles and King considered fractured teeth (which otherwise appeared sound) fractured restorations, restored teeth that required endodontic treatment and the results of traumatic injury to be non-preventable[11].

If one considers the abovementioned definitions one could conclude that emergencies resulting from dental caries and periodontal conditions are preventable while all other DEs are non-preventable. According to this definition, more than 90% of the DEs described in the current study could be classified as preventable and to reduce the DE rate these preventable emergencies should be specifically targeted.

The results of this study show that female patients of all age groups consistently contributed more than males toward DEs. Studies show that when dental caries rates are reported by gender, females are found to exhibit higher prevalence rates than males[12, 13]. In a study from the Canary Island females were found to have twice the frequency of dental caries than males[14]. The explanation for females having a higher percentage of caries could be explained by one of three theories: earlier eruption of teeth in girls, the resulting longer exposure of teeth to a cariogenic oral environment; easier access to food supplies by women and frequent snacking during food preparation; and hormonal differences and pregnancy[12].

Research performed on laboratory animals reveals that caries rates increase proportionally with increasing estrogen levels, whereas increasing androgen levels have no effect. An association exists between increased thyroid levels in the blood and a decrease in caries rate[12]. Fluctuations in the level of estrogens influenced thyroid activity, and led to a reduction in the saliva flow rate and an increase in caries rate[12]. It was found that females had a significantly lower mean saliva flow rate than men, for both unstimulated whole saliva and stimulated saliva and that postmenopausal women were reported to have a reduced salivary flow rate[12].

Pregnancy is one life-history event that presents an extreme case of hormonal fluctuation. During pregnancy, estrogen levels reach a peak that is higher than at any other time in the life history of a female and, for this reason, caries rates also increase among pregnant women as compared to women who are not pregnant. Pregnancy modifies the biochemical composition of saliva, reducing the buffer capacity and promoting bacterial growth – factors that play a pivotal role in cariogenesis[14].

In a study of 504 pregnant women, a correlation between pregnancy and caries rates was established. There was a positive correlation between the number of children a woman had and the total incidence of caries[15]. A number of investigators have noted sex-hormone-mediated alteration of the subgingival flora and the subsequent increase in gingival inflammation[16, 17].

All the factors referred to immediately above could account for a higher prevalence of DEs found in females as compared to males.

Age and Dental Emergencies

This study consistently showed that DEs increased with age. A study conducted on 10,000 subjects that ranged from 5 to 20 years of age showed that caries is an age-dependent phenomenon. Dental caries begins shortly after eruption, increase in the late teens and then plateau during the third decade of life[18].

The composition and flow rate of human saliva can be indirectly affected by factors including disease, medical procedures and medications, through their effects on the endocrine system. «Xerostomia», a term describing dryness resulting from low salivary flow, is positively correlated with increased caries rates in the elderly and those who suffer from a variety of ailments, including arthritis, diabetes and hypertension[12]. The medical conditions referred to here are experienced by the elderly and therefore support the findings of this study, which shows a positive correlation of DEs with an increase in age.

A National Health and Nutrition Examination Survey (NHANES) conducted in 1999–2004, that examined people between 20 and 64 years of age showed that the prevalence of dental caries increases with age, occurs more in females than males and more in Whites than other races[19]. This survey correlates with the current study in terms of the results and the age distribution.

Race and Dental Emergency stratified by Age

The summary results for race and emergency in this study showed that Whites contributed more than Blacks to DEs; 52.1% and 23% respectively. The other two major race groups in South Africa – Asian and Coloured – occupy positions between Whites and Blacks. These findings are also evident from the NHANES study[19]. In another study conducted in Atlanta, Georgia, it was concluded that for every tooth at all ages and for both males and females, Black individuals experience fewer dental caries than Whites and that differences in caries experience between Blacks and Whites was large and consistent[18].

The latest survey to determine the prevalence of edentulousness in the South African population gave the following results: Asians 4.5%, Black 6.3%, Coloured 51.6% and White 16.2%, with females being more likely to be edentulous than males[20]. The study conducted for AMHU GT shows a higher rate of DEs for Whites than all the major racial groups, which is a finding that is consistent with literature[18, 19, 21].

Oral Health Fitness and Dental Emergencies stratified by Age

The summary results for OHF classification showed that OHF 2 for all age groups consistently contributed more than OHF 1 toward DEs. This finding is consistent with the definition of the OHF classification, which defines people in OHF 1 as people who, at the time of examination, are of optimal dental health and who do not require an appointment or dental treatment while those in OHF 2 are «patients who have oral conditions that if not treated or followed up, have the potential but are unlikely to cause DEs within 12 months»[2]. (In line with the definitions) it is therefore expected that OHF 2 patients will have more DEs than OHF 1.

Logistic Regression

The logistic regression model used for the study was shown to adequately fit the data both by the Hosmer-Lemeshow statistic and a higher percentage of the cases classified correctly as emergencies and therefore the conclusion is that a member is more likely to experience a DE if White, female, OHF 2 and older than 50 and that a member is least likely to experience a DE if Black, male, of OHF 1 classification and in the age group 31 to 40.

Apart from age, race was also found to be associated with DEs among military personnel in South Africa. White and Coloured soldiers were more likely to have DEs, which is a finding that is consistent with the literature[20,22, 23]. A South African survey showed that in the South African general population, Whites and Coloureds had the highest prevalence of edentulousness (16.2% and 51.6%), with females being more likely to be edentulous than males[20].

The findings of this study nevertheless need to be interpreted within its limitations. This was a cross-sectional study and therefore inferences on causality should be made with caution, as there is no evidence of the temporal order of events. This study assumed that the OHF classification performed on the subjects is valid, reliable and objective. This assumption might be incorrect and might have contributed to a percentage of emergencies.

CONCLUSION

The DE rate of SANDF was 307/1,000 per year. This DE rate could be regarded as high if compared to other countries. The high DE rate could well be attributed to

the fact that the patients were initially not classified correctly. It is therefore recommended to the SAMHS that oral health personnel must be trained and calibrated in the OHF classification index. The number of preventable emergencies is high and, if reduced, will ensure that the DE rate of SAMHS/SANDF will also reduce. It is therefore recommended that the oral health professionals be enlightened about this and steps be taken to ensure that preventable DEs are reduced.

ABSTRACT

Dental emergencies are a threat to the military mission and a major concern for military planners. They take soldiers away from their assigned places of duty and reduce combat effectiveness. The objective of this study was to determine the rate of dental emergencies in the South African Military Health Services. A cross-sectional retrospective record analysis of members of the South African National Defence Force (SANDF) who received an Oral Health Fitness (OHF) classification of 1 and 2 in Area Military Health Unit Gauteng (AMHU GT) was carried out in 2009. The AMHUGT members were followed up for a year to determine if they developed dental emergencies. Data analysis included chi-square tests and logistic regression analysis. The level of significance was set at $p < 0.05$.The dental emergency rate for AMHU GT was 307/1,000 per year. Most of the dental emergencies were dental restorations (58.5%) and extractions (13%). Patients were more likely to experience a dental emergency if they were White, female, of OHF 2 classification and older than 50. The dental emergency rate for the SANDF is high compared to military health units from other countries and is influenced by race, age and gender.

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