Oral Health Practices, Knowledge and Attitudes amongst United States Army Active Duty Enlisted Soldiers

A Thesis
Presented to the Faculty of the Advanced Education in General Dentistry, Two-Year Program, United States Army Dental Activity, Fort Hood, Texas
And the Uniformed Services University of the Health Sciences – Post Graduate Dental College
In Partial Fulfillment of the Requirements for the Degree of
Master of Science in Oral Biology

By

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Royal Canadian Dental Corps

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Learning to Care for Those in Harms’ Way
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Oral Health Practices, Knowledge and Attitudes amongst United States Army Active Duty Enlisted Soldiers

A REPORT ON

The Level of Oral Health Practices, Knowledge and Attitudes of US Army Enlisted Soldiers within ranks from E1 to E9 given the high standard of oral health care and preventive programs that exists in the US Army.

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Disclaimer

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ABSTRACT

Purpose: The primary purpose of this study was to assess the oral health knowledge, practice and attitude amongst US Army Active Duty Enlisted soldiers and to see if it increases and improves with rank from E1 to E9 given the high standard of oral health care in the US army.

Methods: An observational study using paper questionnaires was distributed randomly across army dental clinics at the Fort Hood Army installation. All data was analyzed using IBM SPSS Software Version 25. Oral knowledge and oral practice scores were compared against rank, race, sex and education using an independent T-Test or ANOVA test as applicable. A Correlation Test was conducted between oral knowledge and oral practice scores.

Results: Data from 560 questionnaires showed no significant increase in oral practice scores with rank. However, there was a significant increase in oral knowledge scores (p < .05). There was a significant positive correlation between oral practice and oral knowledge scores (p < .05). Female soldiers had significantly higher mean oral knowledge and oral practice scores than male soldiers (p < .05). Oral practice and oral knowledge scores increased significantly with education (p < .05). There were differences in oral practice and oral knowledge based on race.

Conclusions: This study revealed critical information on strengths and deficiencies in specific areas of oral practice, knowledge and attitudes among US Army Active Duty Soldiers. The US Army has a strong oral health care practice in place compared to other militaries and civilian organizations. Findings from this study can be used to improve our existing preventive and clinical dental practices and, in turn, enhance the overall strength and effectiveness of our US Army.
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</table>
INTRODUCTION

The first ever US Surgeon-General’s report titled “Oral Health in America” released in May 2000, called attention to a “silent epidemic” of dental and oral diseases that burdens millions of children and adults throughout the United States. The report was a critical reminder that oral health is integral to overall health and that there are profound oral health disparities related to income, age, gender and race within the American population due to lack of information or access to preventive oral measures. According to the report, the barriers to oral health included lack of access to care due to limited income or lack of insurance, transportation, the flexibility to take time from work and a lack of oral education. The Surgeon General’s Report called for a National Oral Health Plan to provide opportunities for individuals, communities and health professionals to work together to maintain and improve the nation’s oral health with an emphasis on awareness and use of common preventive tactics such as personal oral hygiene habits; community programs such as water fluoridation and tobacco cessation programs; and health-care provider based interventions such as examination for oral and pharyngeal cancers. Ten years later during the Health and Human Services Oral Health Initiative 2010 Campaign, which set oral health goals for 2020, it became evident that many of the challenges such as preventive education, above others, identified 10 years ago in the Surgeon-General’s Report have still not been adequately addressed. Many oral health conditions are now being recognized as public health problems with untreated dental caries considered the most prevalent condition throughout the world and severe periodontal disease being ranked sixth.
Military Significance of Study

The Executive Research titled “Dental Health in the Army Reserves and National Guard – A Mobilization Problem?” analyzed the dental health of 7,512 Reserve and National Guard soldiers revealing that the lowest pay grades had the highest percentage of dentally “UNFIT” (CLASS 3) soldiers with E1’s comprising 46% and E2’s comprising 40% of the CLASS 3 population among Enlisted Soldiers. The distribution of CLASS 3 soldiers was also disproportionate among pay grades: Enlisted soldiers (32%), Warrant Officers (16%) and Commissioned Officers (9 %).1

During the Vietnam War, the annual rate for dental emergency visits among US soldiers ranged between 140 and 210 per 1,000 troops. In an investigation of Army personnel participating in a prolonged field training exercise in 1985, the dental emergency rate was 167 per 1,000 troops, and dental emergencies comprised 21.5% of the total medical sick call.1 Another study found that, excluding injuries, dental complaints ranked second only to upper respiratory infections as a cause for lost duty time.10 Despite improvements to health care in the military, the overall dental emergency rates during a six month peacekeeping operation in Bosnia in 2000 was documented as being 156 per 1,000 soldiers.8 As a result, General Shineski, Chief of Staff of the Army in 2000 initiated the transformation of the Army with the goals of making the army force more lethal, agile and versatile. A key component to this transformation was to deploy healthier soldiers by implementing new dental population health measures within the army.9 One of these measures employed by the US Army Dental Command was that all soldiers received a caries risk assessment (CRA) every year and those who were high caries risk (HCR) received appropriate intervention and preventive services as outlined in the HCR program protocols. The HCR Program supported DENCOM's Intervention
and Prevention Program and Army Medicine's 2020 Campaign Objective 3-1.3 to promote Oral Health. The HCR program consisted of treating active diseases, fluoride treatments, nutrition counselling and dietary analysis with emphasis on oral disease risk factors such as cariogenic foods and beverages, hydration, poor diet quality, tobacco type and amount, and sleep inadequacy. The purpose of the HCR program was to improve and sustain dental readiness and oral health through clinical and community oral health promotion and disease prevention. It was implemented as a method of interfering with the progression of oral disease to prevent further harm and improve health. The HCR Program was also designed to allow dental practitioners to identify high risk patients and customize delivery of care, while increasing individual consumerism where soldiers would have more knowledge and control for their own self-care.15

Dental caries and periodontal diseases, though largely preventable, remain one of the most prevalent chronic diseases in our soldiers and our nation.4 Evidence-based research has showed that identification of high risk groups or individuals and delivery of a standardized risk management protocol was an effective means of preventing and controlling oral disease.3

Available information about oral health knowledge, practices and attitudes in military forces especially the US military was sparse.1,25 Several different studies on other international military communities in Netherlands, Australia, India, Croatia, Iran and Italy identified poor oral knowledge and oral practices within their soldiers; the need for better oral hygiene education; and significant improvements in preventive services within their military organizations. 6,21,25,39,40,41
Knowledge about oral health is necessary to pursue healthy oral practices and studies show that there is an association between increased knowledge and better oral health practices.²³ A study by Buunk-Werkhoven et al., showed that army recruits' oral hygiene behavior in the Dutch army improved by promoting a more positive attitude and by enhancing perceived behavior control.⁶

In the US Army, oral hygiene knowledge, practices and attitudes of Enlisted soldiers should be at an optimal level. This is attributed to their readily available access to quality oral health care and the US Army Dental Command’s emphasis on preventive army dentistry and overall dental fitness. Enlisted soldiers are an integral component of the total active and deployable duty force within the US Army. The oral health of our soldiers is integral to the overall success of the deployability and effectiveness of the US Army.

PURPOSE

The primary purpose of this study was to assess the level of oral practice, knowledge and attitude amongst United States Active Duty Army Enlisted Soldiers and to see if it increased and improved with rank from E1 to E9. This study also assessed the correlation between oral knowledge and oral practice of US soldiers and how these variables were influenced by sex, education and race. The secondary purpose was to identify deficiencies and strengths in the efficacy of the implemented preventive programs and dental policy for our US soldiers.
RESEARCH QUESTIONS/HYPOTHESES

Research Question 1: Do oral practice scores increase amongst US Enlisted Army Soldiers with increase in rank from E1 to E9?

Null Hypothesis 1: Oral practice scores do not increase significantly with increase in rank from E1 to E9.

Research Question 2: Do oral knowledge scores increase amongst US Enlisted Army Soldiers with increase in rank from E1 to E9?

Null Hypothesis 2: Oral knowledge scores do not increase significantly with increase in rank from E1 to E9.

Research Question 3: Is there a correlation between oral practice and oral knowledge scores in the US Enlisted Army population?

Null Hypothesis 3: There is no significant correlation between oral practice and oral knowledge scores in the US Enlisted Army population.

MATERIALS AND METHODS

Design

A cross sectional questionnaire was distributed randomly to US Army Active Duty Enlisted Soldiers from the rank of E1 to E9 who came for dental appointments at random army
dental clinics with the Fort Hood Army installation over a three month period. Fort Hood is the largest army base in the US with over 50,000 soldiers at any given time and a mission to prepare US soldiers to rapidly deploy and conduct the full range of military operations under the command of Army, Joint, and Multi-National Forces. Questionnaires were formulated following literature review and validated in conjunction with a statistician and dental public health staff officer within the US Army. A pilot study was conducted where questionnaires were distributed to 10 random US Enlisted Army soldiers in order to ensure that the questionnaire was easily interpreted and answered in a timely manner of less than 5 minutes followed by proper data analysis. As part of the US Army protocols, our study design was reviewed and approved through an electronic Institutional Review Board (eIRB) to protect the rights and welfare of human subjects involved in research activities being conducted under US Army authority.

Questionnaire

All subjects were informed that answering the questionnaires was voluntary and not personally identifiable. The questionnaires consisted of 4 parts: (1) Demographic Questions; (2) Five Oral Hygiene Practice Questions; (3) Fifteen Oral Hygiene Knowledge Questions; and (4) Four Oral Hygiene Attitude Questions. A copy of the questionnaire with correct answers (highlighted in bold) and scoring format (with scores in parenthesis beside each answer) is included in Appendix A.

Sample Size

With the aid of a statistician, we used the A-priori Sample Size Calculator to tell us the minimum required total sample size and per-group sample size for a two tailed t-test study.
given the probability level (p<0.05), the desired statistical power level (0.8) and the anticipated effect size (Cohen’s d) (0.3). Our effect size (Cohen’s d) was 0.3, because we anticipate a small difference between our two groups: Junior Enlisted (E1-E4) and Senior Enlisted (E5-E9) Army personnel. As a result of the above calculations we needed a minimum total sample questionnaire size of 352 subjects. Therefore, the minimum required sample size per group (E1-E4 vs E5-E9) was 176 subjects each.

Statistical Analysis

All data from the questionnaires were analyzed using IBM SPSS Software Version 25. In terms of primary data analysis, the five oral practice questions were scored out of a total maximum score of fifteen. We assigned a range of one to three points per oral practice question depending on the answer. The fifteen oral knowledge questions had only one correct answer worth one point each and this section was scored out a total maximum score of fifteen. The four oral attitude questions were not scored but each question was evaluated independently for trends in attitude amongst our Enlisted Army Soldiers. Each correct answer and scoring system applied to the questionnaire has been identified in Appendix A. Upon collection of all questionnaires, we grouped our E1-E9 enlisted ranks into two independent study groups: Junior Enlisted ranks (E1-E4) and Senior Enlisted ranks (E5-E9). The dependent variables were the oral knowledge and oral practice scores. The independent variables were sex, race, education and rank of the Enlisted Soldiers. Oral knowledge and oral practice mean scores were compared against rank, sex, education and race. A Correlation Test using Pearson’s R was run to see if there was a relationship between oral knowledge and oral practice mean scores. Any mean score above 80% was designated as “good”, 60%-80% designated as “fair” and less than 60% designated as “poor” in terms of assessing oral knowledge and oral practice behaviors. An
independent T-Test was used to compare the significance between two mean scores and a one-way ANOVA test was used to compare the significance between more than two mean scores. A p-value < 0.05 was considered statistically significant.

RESULTS

A total of 627 questionnaires were collected randomly throughout different army dental clinics at Fort Hood. 67 questionnaires were excluded from the study as a result of being incompletely answered. Figure 1 shows the total number of respondents in each of our ranks from E1 to E9 that were part of our final study.

Fig 1: Total Number of Respondents accepted into the study per rank.
US Army Enlisted Ranks from E1 to E9 were further compiled into two main independent study groups designated as Junior Enlisted (E1 – E4) and Senior Enlisted (E5 – E9) soldiers. Figure 2 shows a total of 290 respondents in our Junior Enlisted group and 270 respondent in our Senior Enlisted group, which exceeds our required sample size of 176 respondents in each study group.

Fig 2: Respondents comprising our two main study groups: Junior Enlisted (E1 – E4) and Senior Enlisted (E5- E9) soldiers.

ORAL PRACTICE SCORES AMONGST US ENLISTED ARMY RANKS

Figure 3 shows the mean values of oral practice scores from the ranks of E1 to E9. The maximum attainable score for the Oral Practice section was fifteen.
Figure 3: Mean oral practice scores from the ranks of E1 to E9.

An Independent Sample T-Test was conducted to evaluate if there was a statistically significant difference in oral practice scores between our Junior and Senior Enlisted soldiers. Junior Enlisted group (E1-E4) (N=290) had a mean score of \(8.84\) (SD= 2.74) compared to our Senior Enlisted group (E5-E9) (N=270), who had a mean score of \(8.89\) (SD= 2.66). Levine’s F Test, \(F(558)= 0.43, p= 0.50\) and the Independent T-Test, \(t(558)= -0.22, p= 0.82\) reveal no significant different between our junior and senior enlisted ranks. The mean difference was 0.05 with a 95% confidence interval for the difference between the means of 0.50 and 0.39 (Figure 4). Therefore, the null hypothesis was accepted that there is no significant increase in oral practice scores as we increase in rank from E1 to E9.
Figure 4: Independent T-Test for oral practice scores between Junior and Senior Ranks.

**ORAL KNOWLEDGE SCORES AMONGST US.ENLISTED ARMY RANKS**

Figure 5 shows the mean of oral knowledge scores from the ranks of E1 to E9. The maximum attainable score for the Oral Knowledge section was fifteen.

Figure 5: Mean oral knowledge scores from the ranks of E1 to E9.
An Independent Sample T-Test was conducted to evaluate if there was a statistically significant difference in oral knowledge scores between our Junior and Senior Enlisted soldiers. Junior Enlisted soldiers (E1-E4) (N=290) had a mean score of 9.87 (SD= 1.98) compared to Senior Enlisted soldiers (E5-E9) (N=270), who had a mean score of 10.49 (SD= 1.92). Levine’s F Test, F(558)= 0.08, p= 0.77 and the Independent T-Test, t(558)= -3.70, p < 0.05, revealed a statistically significant difference between Junior and Senior Enlisted ranks. The mean difference was 0.61 with the 95% confidence interval for the difference between the means of 0.93 and 0.28 (Figure 6). Since oral knowledge scores were statistically significant with an increase in rank, the extent of this significance was determined by calculating the value of Cohen’s $d$ and the effect-size correlation, $r_{Y1}$, using the means and standard deviations of our two groups. The equation calculator at https://www.uccs.edu/lbecker/, calculated our Cohen’s $d$ to be 0.3 and our effect size to be 0.16 in terms of absolute value. The significance of the Cohen’s $d$ values are as follows:
d= 0.2 is a small effect  
d= 0.5 is a moderate effect  
d= 0.8 or > is a large effect  

The effect size was small based on Cohen’s conventions (1988) in terms of Oral Knowledge between our two groups. Therefore, the null hypothesis was rejected because there was a small yet significant increase in oral knowledge scores with an increase in rank.

CORRELATION BETWEEN ORAL KNOWLEDGE AND ORAL PRACTICE SCORES

A Correlation Test between oral knowledge scores and oral practice scores using Pearson’s R revealed the relationship between two continuous variables. Pearson’s R ranges between -1 and +1, where -1 means a perfect inverse relationship; 0 indicates no relationship at all; and +1 indicates a direct positive relationship. Anything between 0 and 1 or 0 and -1 indicates varying strengths of relationship.
In this study, the correlation between oral practice and oral knowledge scores was significant at $p < 0.05$ and exists in the real world. The Pearson R (0.097) was close to zero, which meant that the null hypothesis was rejected as there was a small positive correlation between oral practice scores and oral knowledge scores.
Figure 8: Number of respondents based on level of education.

Figure 8 showed the total number of respondents in this study based on education in terms of attending high-school or less, college and post-graduate studies. Post-graduate studies were identified as any education beyond college such as Professional School, Master’s Degree or PhD. Figure 9 showed the mean oral practice scores between groups based on education.
Figure 9: Mean oral practice scores based on level of education.

![Mean Oral Practice Score vs Education](image)

Figure 10: Homogeneity of Variances Test in oral practice scores based on differences in education.

<table>
<thead>
<tr>
<th>Test of Homogeneity of Variances</th>
</tr>
</thead>
<tbody>
<tr>
<td>OralPracticeScores</td>
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<tr>
<td>Based on Mean</td>
</tr>
<tr>
<td>Based on Median</td>
</tr>
<tr>
<td>Based on Median and with adjusted df</td>
</tr>
<tr>
<td>Based on trimmed mean</td>
</tr>
</tbody>
</table>

The Levine’s F Test based on mean, F(2, 557)= 0.03, p= 0.96 showed homogeneity of variances in our different education groups (Figure 10).
Figure 11 showed statistically significant differences between group means as determined by one-way ANOVA ($F(2, 557) = 3.64$, $p < 0.05$). A post hoc Games-Howell test was run to confirm where the differences occurred between our different education groups, as a result of unequal group sizes (Figure 12). No significant differences existed between any of the groups based on the Games-Howell Test although the difference in mean scores between high-school and college education was really close to “trending towards being significant” ($p=0.052$). Therefore, it can be stated that oral practice scores increase with education.
Post Hoc Tests

Dependent Variable: OralPracticeScores
Games-Howell

<table>
<thead>
<tr>
<th>(I) Education</th>
<th>(J) Education</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
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<td>.245</td>
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<td>Post-Graduate Studies</td>
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<td>-1.57, .11</td>
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<tr>
<td>College</td>
<td>High School or Less</td>
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<td>College</td>
<td>.162</td>
<td>.353</td>
<td>.891</td>
<td>-.67, 1.00</td>
</tr>
</tbody>
</table>

Fig 12: Games-Howell Multiple Comparisons Test for unequal group sizes.

Figure 13 showed the mean oral knowledge scores amongst our US Enlisted soldiers based on education.

Figure 13: Mean oral knowledge scores based on education.
Figure 14: Homogeneity of Variances Test in oral knowledge scores based on differences in education.

The Levine’s F Test based on mean, $F(2, 557)= 0.98, p= 0.37$ shows homogeneity of variances for our different education groups (Figure 14).

<table>
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<th>df2</th>
<th>Sig.</th>
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<td>Based on Median</td>
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<td>557</td>
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<td></td>
<td>Based on Median and with adjusted df</td>
<td>.706</td>
<td>2</td>
<td>547.539</td>
<td>.494</td>
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<td></td>
<td>Based on trimmed mean</td>
<td>.730</td>
<td>2</td>
<td>557</td>
<td>.482</td>
</tr>
</tbody>
</table>

Fig 15: ANOVA Test for oral knowledge scores between our education groups.

Figure 15 showed statistically significant differences between group means in terms of education as determined by one-way ANOVA ($F(2, 557) = 6.47, p < 0.05$).
Figure 16: Games-Howell Multiple Comparisons Test for unequal group sizes.

In Figure 16, a post hoc Games-Howell test was run to confirm where the differences occurred between our education groups due to unequal group sizes. The Games-Howell test showed significant differences exist between the groups with a high-school verses post-graduate education level ($p < 0.05$). Therefore, oral knowledge scores increased with higher education in the US Enlisted Army population.

### IMPACT OF SEX ON ORAL KNOWLEDGE AND ORAL PRACTICE

Figure 17 showed the mean oral knowledge and oral practice scores in our US Enlisted Army cohort based on sex given the total number of male respondents ($N = 429$) and female respondents ($N = 131$).
An Independent Sample T-Test was conducted between male and female US Army Enlisted soldiers to evaluate if there was a statistically significant difference in oral practice scores (Figure 18). Male soldiers (N=429) had a mean score of 8.65 (SD= 2.72) compared to our female soldiers (N=131), who had a mean score of 9.56 (SD= 2.51). Levine’s F Test, F(558)= 0.56, p= 0.45 and the Independent T-Test, t(558)= -3.41, p < 0.05 revealed a significant difference in oral practice scores between males and females. The mean difference was 0.91 with the 95% confidence interval for the difference between the means of 1.43 and 0.38. Using the equation calculator at https://www.uccs.edu/lbecker/, we calculated our Cohen’s “d” to be 0.34 and our effect size “r” to be 0.17 in terms of absolute value. This means that our effect size

Figure 17: Mean of oral knowledge and oral practice score based on sex.
was small based on Cohen’s conventions (1988) in terms of oral practice scores between male and female soldiers. Therefore, there is a small yet significant difference in oral practice measures between male and female enlisted soldiers in the US Army with females having better oral practices measures.

Fig 18: Independent Samples T-Test for oral practice scores based on sex.

An Independent Sample T-Test was conducted between male and female Enlisted soldiers (Figure 19) to evaluate if there was a statistically significant difference in oral knowledge scores. Male soldiers (N=429) had a mean score of 9.98 (SD= 2.0) compared to our female soldiers (N=131), who had a mean score of 10.79 (SD= 1.7). Levine’s F Test, F(558)= 
2.8, p= 0.09 and the Independent T-Test, t(558)= -4.14, p < 0.05 revealed significant difference in oral knowledge scores between males and females. The mean difference was 0.81 with the 95% confidence interval for the difference between the means of 1.18 and 0.42. Using the equation calculator at https://www.uccs.edu/lbecker/, our Cohen’s “d” was 0.43 and our effect size “r” was 0.21 in terms of absolute value. This means that our effect size was small based on Cohen’s conventions (1988) allowing us to conclude that there is a small yet statistically significant difference in oral knowledge scores between male and female Enlisted Army soldiers. Therefore, it is statistically significant that both oral knowledge and oral practice scores are higher in female Enlisted soldiers than male Enlisted soldiers.

![T-Test for Oral Knowledge Scores vs Sex](image)

**Fig 19: Independent Samples T-Test for oral knowledge scores based on sex.**
Figure 20: Number of respondents based on race amongst our US Enlisted Army Cohort.

Figure 20 showed the number of respondents in this study based on Race.
Figure 21 showed the mean of oral practice scores based on race. Overall, Whites and American Indian/Alaskan Natives had the lowest oral practice scores.
In Figure 22, the Levine’s F Test based on mean, $F(6, 553)= 2.51, p < 0.05$ showed that assumption of homogeneity of variances was violated between the different race groups. There were statistically significant differences between group means as determined by one-way ANOVA ($F(6, 553) = 2.697, p < 0.05$).
### Post Hoc Tests

<table>
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<th>(I) Race</th>
<th>(J) Race</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
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<td>American Indian/Alaska Native</td>
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<td>1.000</td>
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<td>Native Hawaiian/Pacific Islander</td>
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<td>.652</td>
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<tr>
<td></td>
<td>Other</td>
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<td>.418</td>
<td>.036</td>
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<tr>
<td>African American</td>
<td>White</td>
<td>.603</td>
<td>.301</td>
<td>.414</td>
<td>-1.29 - 1.50</td>
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<tr>
<td></td>
<td>Hispanic</td>
<td>-.364</td>
<td>.322</td>
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Figure 23: Games-Howell Multiple Comparisons Test for unequal group sizes.

A Post-Hoc Games-Howell Test showed significant differences exist in oral practice scores between Hispanics and Whites. Therefore, significant differences exist in oral practice scores based on race in the US Enlisted Army population.
Figure 24 showed that Hispanics had the lowest mean oral knowledge score out of all the race groups in this study, which was inversely correlated to the mean oral practice scores in Figure 21.
In Figure 25, Levine’s F Test based on mean, $F(6, 553) = 0.61, p = 0.72$ showed homogeneity of variances between our different races. There were statistically significant differences between group means as determined by one-way ANOVA ($F(6, 553) = 3.916, p < 0.05$).
**Post Hoc Tests**

| Dependent Variable: OralKnowledgeScore | Games–Howell |

<table>
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<th>Race</th>
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<th>Sig.</th>
<th>95% Confidence Interval</th>
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<td>.923</td>
<td>-1.56</td>
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| African American |                        |            |      |                         |             |             |
| White           | -.345                  | .209       | .652 | -.97                   | .28         |
| Hispanic        | .515                   | .243       | .344 | -.21                   | 1.24        |
| Asian           | .081                   | .681       | 1.000| -2.25                  | 2.42        |
| American Indian/Alaska Native | .247      | .768       | 1.000| -3.05                  | 3.55        |
| Native Hawaiian/Pacific Islander | -.192     | .480       | .240 | -2.85                  | .46         |
| Other           | -.745                  | .382       | .461 | -1.94                  | .45         |

| Hispanic |                        |            |      |                         |             |             |
| White    | -.859^                 | .214       | .002 | -1.50                  | -.22        |
| African American | -.515     | .243       | .344 | -1.24                  | .21         |
| Asian    | -.434                  | .683       | .994 | -2.77                  | 1.90        |
| American Indian/Alaska Native | -.267   | .769       | 1.000| -3.57                  | 3.03        |
| Native Hawaiian/Pacific Islander | -1.707^ | .482       | .042 | -3.37                  | -.05        |
| Other    | -1.260^                | .384       | .035 | -2.46                  | -.06        |

Fig 26: Games-Howell Multiple Comparisons Test for unequal group sizes.

A Post Hoc Games-Howell test was run to confirm where the differences occurred between races especially due to unequal group sizes. The Games-Howell test showed significant differences exist in oral knowledge scores between Hispanics and Whites. Therefore, significant differences exist in oral knowledge scores based on race in the US Enlisted Army population.
ORAL PRACTICE QUESTIONS ANALYSIS

Figures 27-31 revealed trends in oral practice behavior in our study population on various different areas. These trends were fairly consistent between Junior and Senior Enlisted Ranks.

Figure 27: Brushing habits of US Army Enlisted Soldiers at Fort Hood.

Figure 27 revealed that 74% of US Army Enlisted soldiers brushed at least twice a day and 23% brushed once a day.
Figure 28, on the other hand, revealed that unlike brushing frequency in Figure 27, most soldiers rarely or never flossed at all on a regular basis. Overall, 70% of soldiers never or rarely flossed.
Figure 29: Snacking habits of US Army Enlisted Soldiers at Ford Hood.

Figure 29 revealed that snacking was a very popular practice in the US army population.
Figure 30: Toothbrush changing habits of US Army Enlisted Soldiers at Fort Hood.

Figure 30 revealed that most of the US Enlisted soldiers changed their toothbrush frequently within 3 months.
Figure 31: Beverage consumption habits of US Army Enlisted Soldiers at Fort Hood.

Figure 31 showed that 64% of US Enlisted soldiers reported water as their most frequent beverage intake on a daily basis. The next most common beverages consumed frequently on a daily basis were soft drinks/punch (12%), energy drinks (8%), coffee/tea without sugar (9%), coffee/tea with sugar (6%) and protein shakes (1%).
An analysis of the number of wrong answers for each of the 15 Oral Knowledge questions out of 560 questionnaires is depicted below in Figure 32.

Figure 32: Total number of wrong answers (out of 560 respondents) for each Oral Knowledge Question (K1- K15)
ORAL ATTITUDE QUESTIONS ANALYSIS

Responses from all four Oral Attitude questions were graphed below for further analysis.

Figure 33: Responses To Why Soldiers Visit The Army Dental Clinic

Figure 33 revealed that most US Enlisted soldiers only visited the Army Dental Clinic because they needed to stay “GREEN” on MEDPROS in order to meet work requirements. Only 34% really visited the dental clinic because they cared about their oral health.
Figure 34 revealed that most US Enlisted soldiers preferred hands-on teaching aids (43%) to educate them about brushing and flossing. However, there was also a fair distribution of request for other modes of education such as handouts (24%), oral presentation (18%) and video (15%).
Figure 35: Responses To Where Soldiers Receive Most Of Their Dental Education

Figure 35 showed that US Enlisted soldiers received most of their dental education from dental teams. No clarification was made on which member of the dental team participated in delivering this education.
Figure 36: Responses to main reasons for soldiers not brushing or flossing during deployments and field trainings.

Figure 36 revealed that most soldiers don’t brush and/or floss during deployments or field exercises due to lack of time or lack of resources and access to oral hygiene kits.
DISCUSSION

The most common oral diseases being dental caries and periodontal disease, are considered to be behavioral diseases because adoption of healthy oral habits is crucial in controlling them. To a great extent, their prevention and control depend on a person’s lifestyle and behavior.\textsuperscript{17}

Oral health knowledge is considered to be an essential pre-requisite for health related behavior.\textsuperscript{4} However, a weak association seems to exist between knowledge and behavior in cross-sectional studies.\textsuperscript{30} In this study, involving 560 US Army Enlisted soldiers, there was no significant difference in the mean oral practice scores between our Junior Enlisted soldiers (E1-E4) and Senior Enlisted soldiers (E5 - E9). Therefore, the null hypothesis was accepted that there is no increase in oral practice with an increase in rank from E1 to E9. However, there was a significant increase in oral knowledge scores (p < 0.05) between US Army Enlisted soldiers as rank increased from E1 to E9, which meant the null hypothesis was rejected. There was also a small yet statistically significant positive correlation between oral practice scores and oral knowledge scores (p < 0.05). Unlike most other studies, this positive correlation can be attributed partly to the US Army culture, where access to dental care has no restrictions; everyone is obligated to get a dental exam at least once a year and maintain dental fitness; and due to the effort placed in implementation of strong preventive oral health policies within the military organization. Based on a self-created criteria of good (>80%), fair (60%-79%) and poor (<60%) in this study, the mean oral practice score out of 15 was 8.86 (59%), which reflects that our soldiers have poor oral practices. However, the mean oral knowledge score out of 15 was 10.2 (68%), which reflects that our soldiers have fair oral knowledge. Overall, it seems that
the oral practices and oral knowledge of US Active Duty Enlisted soldiers were better than those found in military and civilian population studies of a similar nature.6, 23, 24, 25, 41

Oral Practice Behavior

Figures 27 – 31 clearly depicts the oral practice behavior prevalent in our US Army Enlisted soldiers. The American Dental Association (ADA), which powers the profession of dentistry to advance the overall oral health of the public clearly states that the goals of healthy oral hygiene habits include brushing your teeth twice a day for two minutes with fluoridated toothpaste; flossing once a day to remove plaque; changing your toothbrush every 3-4 months; eating a balanced diet that limits sugary beverages and snacks; and visiting the dentist regularly for prevention and treatment of oral disease. In this study, 74% of the soldiers brushed 2x/day or more, 23% brushed 1x/day and only 3% rarely or never brushed their teeth (Figure 27). Brushing frequency in the US army was much higher than other army studies such as the Jordanian army (60% brushed 2x/day) and the Israeli army (78% reported brushing regularly).25,40 A systematic review and meta-analysis showed a clear effect that infrequent tooth brushing was associated with severe forms of periodontal disease.49 70% of our soldiers changed their toothbrush every 3 months, 18% changed it within 6 months and 12% changed it once a year or when the bristles were worn out (Figure 30). On a given day, the most frequently consumed beverage by soldiers was water (64%), soft drinks/punch (12%), energy drinks (8%), coffee/tea without sugar (9%), coffee/tea with sugar (6%) and protein shakes (1%). In terms of flossing, 7% of soldiers flossed 2x/day or more, 23% flossed 1x/day and unfortunately 70% rarely or never flossed their teeth. Despite controversies involving flossing, the FDA and ADA indicate that dental floss reduces caries and a systematic review on flossing and interproximal
caries showed that there is current low-level evidence consistent with the hypothesis that regular and meticulous flossing can drastically lower interproximal caries in cohorts with poor toothbrushing habits and low fluoride exposure.\textsuperscript{22} Consumption of sugary snacks was highly prevalent in our US soldier population, with 23\% consuming snacks 2x/day or more, 47\% consuming snacks 1x/day and only 30\% rarely or never consumed sugary snacks. Therefore, our dental teams should be aware that while our Enlisted soldiers displayed highly positive oral practice habits in terms of the ADA’s recommendation for brushing, toothbrush changing frequency and healthy beverage consumption, they also displayed highly negative oral practice habits in terms of flossing and “sugary” snack consumption.

Oral Health Knowledge Analysis

Even though mean oral knowledge scores increased in rank from E1 to E9, Figure 32 analyzed the number of soldiers who got each oral knowledge question wrong. On the positive side, 96\% of soldiers answered oral knowledge question #8 correctly and were able to identify that good oral health is very important to general health and well-being, which was one of the concerns of the US Surgeon-General’s 2000 report titled “Oral Health in America”.\textsuperscript{44} On the negative side, approximately 65\% of the US Army Enlisted soldiers in this study answered oral knowledge questions #1, #6 and #15 incorrectly. Question #1 and #6 were designed to test an individual’s knowledge on the multi-factorial process of tooth decay, which is the most prevalent dental disease. It is concerning that US army soldiers were unaware of why sugar contributed to tooth decay and were also unable to identify diet and bacteria as the main risk factors for tooth decay. Even though 97\% of US army soldiers brushed 1-2x/day, almost 62\% were unaware that soft bristles are important to maintain good oral health. A study by Zanatta
et al., revealed that medium toothbrushes have a greater ability to cause gingival abrasion than soft toothbrushes ($p < 0.01$).\textsuperscript{48} In oral knowledge question #5, 50% of soldiers were unable to identify smoking and alcohol as the two most critical risk factors for Oral Cancer. In oral knowledge question #7, 48% of soldiers did not know that periodontitis, which is the second most prevalent oral health disease, is gum disease of the tissues that surrounds their teeth. Therefore, it is quite clear that our Enlisted soldier population lacks significant knowledge in terms of the etiology and effects of the major dental diseases that affect our oral health: Caries, Periodontitis and Oral Cancer. Even though tobacco use by US military personnel on active duty has seen an overall decrease from 51% to 33%, it greatly exceeds that found in the civilian population. In addition, deployment duration and frequency, as well as, long-standing military culture and norms is associated with higher intake of alcohol and smoking habits among our US soldiers.\textsuperscript{28} The combined negative behaviors of smoking and alcohol consumption combined with the lack of oral cancer knowledge within our US army population, should be extremely concerning as health care providers. 90% of the soldiers didn’t floss on a daily basis and 50% didn’t know in oral knowledge question #2 that the primary purpose of flossing was to remove plaque that formed on the surfaces of teeth. It is concerning that our soldiers are barely flossing and unaware of the benefits of flossing on oral health. The above data validates some of the concerns that were raised in Health and Human Services Oral Health Initiative 2010 Campaign, with emphasis on lack of optimal preventive education.\textsuperscript{43}
Ironically, oral attitude question #3 showed that 65% of Enlisted Soldiers received their dental education from their dental health care team (Figure 35). The type of oral health information presented and which member of the dental team provided this information would have been useful and is something that can be looked at in future studies. In our study, oral attitude question #2 showed that Enlisted Soldiers are very closely divided on the best way to deliver oral hygiene instructions on brushing and flossing through hands on teaching aids (41%), handouts (24%), oral presentation (18%) and video (15%). In a survey answered by 606 US army dentists in 2000, results showed that delivery of dental health promotion and preventive dentistry services such as oral hygiene instruction, oral cancer screening and counseling, tobacco counseling, periodontal counseling, sealant education and placement, mouthguard education and blood pressure screening was suboptimal in three regards. First, many of these services were not being delivered frequently enough. Second, exclusive reliance on one channel of communication with the most popular mode used by these dentists being oral presentation was ineffective. Third, resources for educational materials, many of which are expensive or free of charge, were underused. It was suggested to use the TEAM approach to oral health education, which advocates to “Teach Every Available Moment”. Many visual educational tools such as videos and posters offer the additional advantage of delivering educational messages without active participation of clinic staff. Primary reliance on educational materials used by Army dentists was prepared by the ADA or the Army with low reliance on other great resources such as the American Heart Association, the National Oral Health Information Clearinghouse or the Tobacco Free Steering Committee. Other studies have shown that educational lectures were effective tools in improving and promoting oral
knowledge among military personnel and school children.\textsuperscript{31,37} Given the large gaps evident in some aspects of dental knowledge within our US soldiers, perhaps military dentistry can collaborate on a national level to teach army dental providers on how to deliver proper health promotion and preventive education in an effective and concise manner.

Studies in the Dutch Army, showed that recruit’s oral hygiene behaviors may be improved by promoting a more positive attitude especially by enhancing perceived behavior control.\textsuperscript{6} In the US army, all soldiers are required to visit the dental army clinic once a year for an annual exam unlike their civilian counterparts. Oral attitude question #1 (Figure 33) assessed the primary reason for why soldiers visit the Army Dental Clinics. 56% visited the army dental clinic to stay “GREEN” so that they could deploy and meet job requirements, 5% wanted to make sure they had pending dental work completed before leaving the military, 4% had dental emergencies and only 35% really cared about their oral health. Unlike our civilian counterparts, it is evident that access to oral health care in the military is not an obstacle. Studies have shown a greater utilization of army dental clinics by US soldiers than soldiers from other countries.\textsuperscript{45} Active Duty US Army personnel have dental utilization rates that greatly exceed their employed civilian cohorts.\textsuperscript{11} In addition, barriers to dental care present in the civilian population, especially for minorities, are greatly diminished in the US Army.\textsuperscript{11} Therefore, given the need to be “GREEN” and meet job requirements as well as the motivation for self-care make it easy for us to gain access to our US soldiers. However, enhancing and maintaining their oral health practices and oral knowledge requires ongoing commitment and teamwork. A study by Buunk-Werkhoven et al., suggested using a motivational and structural educational approach on soldiers, since intention and attitude had a significant association with actual oral hygiene behavior.\textsuperscript{6}
It is quite common in military populations to neglect oral hygiene during times of deployment or field training given the high level of stress and busy operational demands. Oral attitude question #4 (Figure 36) showed that the main reason soldiers neglected oral hygiene during deployments and field training was because of a lack of time (40%); lack of resources or access to the oral hygiene kit (37%); stress (12%); and lack of perceived importance by soldiers (7%). Proper oral hygiene is even more critical during deployments since it affects overall health and fitness of our soldiers on many different levels. Stress and lack of time are not valid excuses for the US army soldier, who is trained to cope with these obstacles on a daily basis. Acute necrotizing ulcerative gingivitis (ANUG), colloquially known as trench mouth, is a common, non-contagious, and extremely painful infection of the gums with sudden onset, that also affected thousands of soldiers during WW1. Predisposing factors to ANUG include poor oral hygiene, smoking, malnutrition and psychological stress. Therefore, thought and planning needs to be placed on improving access to oral hygiene aids for our US army soldiers on deployments, perhaps by making oral hygiene aids a permanent part of the MRE’s, which are the main operational pre-packaged food ration boxes for the United States Armed Forces. In addition, a review of US army dental emergency rates during deployments revealed that majority of dental emergencies were related to new incidence of caries (11.5%), periodontal pain (6%), pulpal pathology (13.1%), pericoronitis (18.5%) and defective restorations (23.1%), which are ultimately related to a failure of proper oral hygiene measures. Only 1.3% of the deployment emergencies were related to trauma, which further validates why preventive education on oral hygiene knowledge and practices is critical for our soldiers while in garrison and on deployment. A US army study in 2000 estimated the cost of dental treatment to restore Active Duty and Recruit US Military Personnel to optimal health. This 2000 study estimated
the total costs to be $1.9 billion for active duty personnel and $203 million for military recruits. In both the active duty population and military recruits, the mean estimated cost of preventive and diagnostic care, which includes oral prophylaxis, radiographs and sealants was much lower than the mean cost of periodontal or fixed prosthetic/restorative care.\textsuperscript{12} These facts, once again highlight the importance of preventive oral hygiene measures in any given population.

**Role of Sex and Education in Our Study**

This study evaluated the role of sex and education in terms of oral knowledge and oral practice among our US Enlisted soldiers. The mean oral knowledge scores increased with higher education and there was a significant difference in oral knowledge scores between soldiers with a high-school verses post-graduate education level (p < 0.05). The mean oral practice scores also increased for Enlisted Soldiers with a higher level of education and we can argue that the mean scores between high-school and college education was trending towards significance (p=0.052). Female soldiers had a significantly higher mean oral knowledge (p < 0.05) and oral practice (p < 0.05) score than male soldiers. Several other studies support our current findings for impact of sex and education on oral hygiene measures. Female gender and higher education revealed a significantly positive relationship with higher oral hygiene scores based on toothbrushing and use of dental floss frequencies, thereby, indicating better personal oral hygiene practices.\textsuperscript{14} A systematic review and meta-analysis indicated that poor oral health involving caries and dental pain was significantly associated with increased odds of poor academic performance and absenteeism in children and adolescents.\textsuperscript{36} The potential connections between oral health and education suggest that wider use of school-based dental programs focusing on preventing oral diseases could potentially lead to improvements in both
oral health and academic performance, overcoming the access and financial barriers to oral health. In addition, both the Surgeon Generals Oral Health 2000 report and the American Dental Association (ADA) highlight the link between oral health and general health, with oral diseases potentially influencing systemic conditions such as diabetes and cardio-vascular disease. Thus, heightened awareness of oral disease in children may contribute to a more holistic approach to aspects of child development such as psycho-social function, quality of life and educational performance.

**Oral Practice and Oral Knowledge between different Races**

In the US, oral health care disparities exist between minority and other mainstream populations. The US Surgeon General’s Report on Oral Health in 2000 found that minority populations bear a disproportionate burden of oral disease in the US. By 2025, non-white racial groups are expected to approach 40% of the US population. Research shows that cultural awareness and competency among oral health professionals should be emphasized, since race impacts oral health practices and oral health care perceptions. In a comparison of oral health practices and oral health perceptions among African American and Asian Americans, African Americans had more adverse oral health perceptions, less concerns about the value of saving their teeth and higher incidence of dental disease than Asian Americans. African Americans also had inferior access to care, and cost and low finances were more significant barriers for African Americans when compared to Asian Americans. Another study compared oral health problems among non-Hispanic Whites, Mexican Americans and African Americans over the age of twenty using the NHANES (National Health and Nutrition Examination Surveys) and found that African Americans experience more oral health problems.
with age. Hispanics, on the other hand are not only the nation’s fastest growing minority group, but also its largest and have a significant oral health dilemma in the US. Young Hispanics are significantly less likely to finish high-school than their White, Asian or African-American cohorts and as a result more likely to be poor, unemployed and uninsured. According to the 1988-1991 data collected by Health Statistics, the percentage of untreated oral disease for Hispanics (40%) and non-Hispanic blacks (48%) was nearly double that for non-Hispanic whites (24%). The percentage of children who had never visited a dentist was highest among Hispanics and twice as many Hispanic children are likely to have untreated dental caries as are non-Hispanic white children. Therefore, it is clear that Hispanics and African Americans are two races more significantly affected by oral health disparities due to multiple confounding variables. This was validated in a study by Wu et al., where they found significantly higher number of decayed, missing and filled teeth in 742 non-Hispanic Blacks and 934 Hispanic individuals over the age of 60yrs in comparison to 2,679 non-Hispanic white individuals.

In this study, there were significant differences in oral practice and oral knowledge scores based on differences in race. Alaska Natives and White soldiers had the lowest mean oral practice scores, whereas African Americans and Hispanic had the higher mean oral practice scores (Figure 21). Hispanics also had a significantly higher mean Oral Practice Score than Whites ($p < 0.05$). In terms of oral knowledge scores, Hispanics and African American soldiers had the lower mean oral knowledge scores with whites having the highest mean Oral Knowledge scores (Figure 24). In fact, Whites had a significantly higher mean Oral Knowledge score than Hispanics ($p < 0.05$). It is difficult to correlate findings from our study to older studies previously mentioned on race, since we didn’t assess our patients clinically and also
because all our US soldier population, regardless of race, had equal access to optimal dental care. However, as oral health care provider who treat soldiers from diverse races and backgrounds, especially those entering the military ranks early in their career, it is mindful to remember that oral health disparities do exist among certain racial groups such as African Americans and Hispanics in the US especially outside of Army institutions.

**Limitations of Our Study**

It is difficult to adequately compare and correlate our study with those of other military and civilian populations. All the other studies used a variety of different questionnaires or surveys and scoring criteria as well as different primary objectives. Perhaps our questionnaire can be used as a standard in future studies of this nature especially within the military populations. In addition, we couldn’t correlate our questionnaire with clinical diagnostic parameters such as the decayed, missing, and filled (DMFT) index to assess caries or the community periodontal index (CPI) to assess periodontal status. Most similar military studies in other countries were sparse and mainly focused on incoming recruits unlike our study, which looked at all Enlisted ranks from E1 to E9. However, most of the military studies in Italy, India, Croatia, Israel, Australia and Netherlands identified a high rate of dental caries and periodontal disease in their study population, as well as an identification of poor oral hygiene practices and oral knowledge and a need for better preventive services. In our study, it would also have been more significant to compare individual Enlisted Army ranks from E1 to E9 as opposed to Junior vs Senior rank cohorts, but this would require a significantly larger sample population within each rank. All the above limitations would affect the total resources and time allocated to complete our study, but these limitations should be addressed in future studies.
CONCLUSION

The present study found the following relevance to oral hygiene measures in US Enlisted Active Duty Army soldiers from the rank of E1 to E9 at Fort Hood:

1) Oral Practice scores do not increase with rank in the US military.
2) Oral Knowledge scores significantly increase with rank in the US military.
3) There is a small yet significant correlation between Oral Knowledge and Oral Practice scores.
4) Female soldiers have significantly higher Oral Practice and Oral Knowledge scores than male soldiers.
5) Higher Education is associated with significantly higher Oral Knowledge and Oral Practice scores.
6) There are significant differences in Oral Practice and Oral Knowledge scores between races.

Analysis of our questionnaires also revealed a lot of critical information on the oral attitudes of our soldiers; strengths and deficiencies in specific areas of oral practice and oral knowledge; and delivery of health promotion materials. The US Army has a very robust and strong oral health care practice in place for its soldiers compared to most other militaries and civilian organizations. However, findings from this study can be used to improve our existing preventive and clinical dental practices and, in turn, continue to enhance the overall strength and effectiveness of our US army.
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APPENDIX A

Dental Health Questionnaire

Only Enlisted Active Duty (E1-E9) are to fill out this questionnaire on their own accord. All participation is voluntary and members will remain anonymous. The information being collected is only for research purposes and will not be used to determine clinical care. Please circle only one answer or the best option for every question. Please do not include your name or personal information on this questionnaire. We would like to thank you for your time as we intend to use this questionnaire to assess and improve the delivery of dental services to our US soldiers.

DEMOGRAPHIC INFORMATION

1) Enlisted Rank (Active Duty Personnel Only)

   E1   E2   E3   E4   E5   E6   E7   E8   E9

2) Age Group (in years)

   a. 16-18
   b. 19-24
   c. 25-29
   d. 30-45
   e. 46 +

3) Male or Female

4) Medical Unit or Non-Medical Unit

5) Years of Total Service in US Military

   a) 0-2   b) 3-5   c) 6-10   d) 11-20   e) 21+

6) Race

   a. White
   b. Black or African American
   c. Hispanic or Latino
   d. Asian
   e. American Indian or Alaska Native
   f. Native Hawaiian or Other Pacific Islander
   g. Other
7) **Education level**

- a. High school diploma
- b. GED
- c. Associates Degree/Trade/Vocational Certificate
- d. Some college
- e. Undergraduate degree
- f. Masters degree
- g. Professional/PHD/MD

**ORAL HEALTH PRACTICES (SCORE OUT OF 15)**

1) How often do you brush your teeth?

   a) More than twice a day  (3)
   b) Twice a day  (2)
   c) Once a day  (1)
   d) A few times a week, or less

2) How often do you floss between your teeth?

   a) Rarely or Never  (3)
   b) A few times a week  (1)
   c) Once a day  (2)
   d) More than once a day  (3)

3) On average, How often do you consume “sugary” snacks on a daily basis?

   a) Rarely or Never  (3)
   b) Once a day  (2)
   c) Twice a day  (1)
   d) More than twice a day

4) How often do you change your toothbrush?

   a) When the bristles in my tooth brush are worn out  (3)
   b) Once a month.  (2)
   c) Once every 3 months  (2)
   d) Once every 6 months  (1)
   e) Once a year
5) Which beverage do you drink most frequently in a given day?

a) Water (3)
b) Coffee/Tea without sugar (2)
c) Protein Shakes (1)
d) Coffee/Tea with Sugar
e) Soft Drinks/Fruit Punch
f) Energy Drink

ORAL HEALTH KNOWLEDGE (SCORE OUT OF 15)

1) Sugar contributes to tooth decay because?

a) Sugar is made of glucose molecules that stick to and directly harms teeth
b) Sugar combines with proteins in saliva to create a hard layer on teeth
c) **Sugar is broken down by bacteria into acid that breaks down teeth** (1)
d) Sugar is not a factor in tooth decay but rather is a major factor in Diabetes

2) What are the two most important oral hygiene habits to prevent tooth decay and gum disease?

a) Mouthwash and healthy diet
b) **Brushing and Flossing** (1)
c) Brushing and Vitamin Intake
d) Flossing and Mouth-wash

3) Does fluoride in toothpaste make any difference to the health of your teeth?

a) No, it makes no difference at all
b) **Yes, it improves oral health by strengthening teeth and reducing dental decay** (1)
c) No, it is dangerous for teeth and overall health

4) What is plaque?

a. The protective coat that naturally occurs on teeth
b. A harmless substance that can be removed completely with brushing
c. **A sticky film of bacteria that collects on the surface of teeth** (1)
d. A whitening substance that makes your teeth whiter

5) The two most critical risk factors for ORAL CANCER are:

a. Alcohol Intake and Smoking (1)
b. Poor Diet and Genetics
c. Lack of Oral Hygiene and Alcohol Intake
6) Tooth Decay is a disease, which is caused by the interaction of these main factors:
   a. **Bacteria and Diet** (1)
   b. Smoking, Alcohol and Sugar
   c. Sugar and Genetics

7) Periodontitis is:
   a. **Gum disease of the tissues that surround and support your teeth** (1)
   b. Condition where the teeth wear down due to heavy forces
   c. Inflammation of the jaw joints that involves swelling and bleeding
   d. Another name for having several cavities at the same time

8) Maintaining good Oral Health is very important to general health and well-being:
   a) Yes (1)
   b) No
   c) Depends on the oral health condition

9) Adult Tooth Loss is a normal part of aging
   a. True
   b. False (1)

10) What is the most important purpose of flossing your teeth regularly?
    a) Remove food stuck between teeth
    b) **Loosen plaque that is forming on the sides of teeth** (1)
    c) As a substitute for poor brushing

11) What is the best indicator of gum disease?
    a) Stained or Discolored teeth
    b) Gum Recession
    c) **Bleeding Gums** (1)

12) The two most common dental diseases are:
    a) **Gum Disease and Tooth Decay** (1)
    b) Bad Breath and Gum Disease
    c) Dental Decay and Gum Recession
    d) Tooth wear and Gum Disease

13) Bad Breath can be improved significantly by brushing your tongue:
a. **Yes** (1)
b. **No**

14) The minimum time you should spend brushing your teeth is:
   a. 30 seconds
   b. 1 minute
   c. **2 minutes or more** (1)

15) When buying a toothbrush, what kind of bristles should you pick to help you brush your teeth and gums effectively?
   a. **Soft Bristles** (1)
   b. Medium Bristles
   c. Hard Bristles

**ORAL HEALTH ATTITUDE**

1) The main reason I visit the Army dental clinic is because:
   a. I have to get routine check-ups/treatment to become GREEN on MEDPROS
   b. I really care about my oral health
   c. I am about to get out and would like to have my dental work completed
   d. Only when I am in pain or have trouble with my teeth, gums or mouth

2) The best way for dental providers to educate me about brushing and flossing as well as other preventive dental topics is through?
   a. Hands-on teaching aids
   b. Videos
   c. Handouts and/or Posters
   d. Oral Presentation

3) Most of my dental education on proper brushing and flossing comes from:
   a. Internet and/or TV
   b. Visits with my dental providers
   c. Family and/or Friends
   d. I have never really been shown how to brush or floss properly by my dental provider
4) What is the main reason if any for not brushing/flossing during deployments/field training?

a. Stress
b. Lack of resources or access to hygiene kit
c. Lack of Time
d. It’s just not that important down-range