Risk indicators of urgent[1] and extensive[2] dental treatment needs in U.S. Air Force recruits

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Abstract

Introduction: Dental Readiness Classifications (DRC) enable the Military Health System to prioritize dental care in garrison, minimizing dental emergencies and mission degradation during deployments. Over half (52.4%) of 2008 military recruits presented with high-priority urgent needs classified as DRC3 upon initial dental examination and 18.1% required extensive treatment, needing 7 or more restorations, in order to achieve operational dental readiness. The purpose of this study is to identify risk indicators for urgent and extensive dental treatment needs in U.S. Air Force (USAF) recruits so that Dental Corps leadership can target interventions to maximize oral health, prioritize resources, and reduce health expenditures in this patient population.

Methods: A secondary data analysis was performed of deidentified survey and clinical exam data from the 2018-2019 USAF Recruit Oral Health Surveillance study conducted at Lackland Air Force Base from February 2018 to February 2019. Select demographic and self-reported variables were analyzed with two outcome variables: *urgent* (DRC3) and *urgent and extensive* (DRC3+7) dental treatment needs. Univariate log binomial regression was performed to determine relative risk of DRC3 and DRC3+7 by independent variable. The Uniformed Services University of Health Sciences IRB board approved the study as an exempt protocol.

Results: Among the 1,335 recruits studied, the overall prevalence of urgent dental needs was 21.5%, while 5.5% of participants had both urgent and extensive needs. The study group was mostly male (69%), non-Hispanic white (60%), age 17-19 (48%), had not graduated high school (47%), had private dental insurance coverage (50%) and self-reported: no need for dental care in the past year (65%), excellent or good condition of teeth (63%), toothbrushing more than once a day (58%) and daily consumption of one to three servings of sugary beverages (62%) and foods (69%). Statistically significant differences in relative risk for DRC3 were found for all independent variables except gender and education level. Risk indicators significant for DRC3 and DRC3+7 were age 25-29; Other and Black race/ethnicity; Medicaid insurance; uninsured; self-reported fair, poor, or unsure current condition of teeth; and past year needed care but did not go ($p<0.05$). The majority of DRC3 and DRC3+7 cases were in the small subset of recruits who self-reported fair, poor, or unknown current condition of teeth or need for dental care in the past year without a dental visit.

Conclusions: Among USAF recruits, oral health disparities are observed in certain groups. The study findings can inform targeted utilization of resources and interventions to efficiently optimize oral health and operational dental readiness and decrease dental expenditures. Additionally, a two-question screening tool is proposed to facilitate priority assignment for dental examination during boot camp. This tool has the potential to correctly identify nearly 90% of those with urgent and extensive dental treatment needs at half the typical workload.

[1] Urgent=Dental Readiness Class 3 (DRC3)

[2] Urgent and Extensive= Dental Readiness Class 3 and 7 or more restorations needed (DRC3+7)

Introduction

The Department of Defense (DoD) Oral Health and Readiness System assigns servicemembers a Dental Readiness Classification (DRC) upon annual dental examination.[1-3,5,6] The objective of this system is to "standardize dental readiness, assess oral health, prioritize dental care, minimize the number of dental emergencies, and emphasize the importance of good oral health to all active duty and reserve forces."[2] DRC1 indicates no current dental treatment needs while DRC2 indicates current nonurgent dental treatment needs unlikely to result in a dental emergency within one year. Servicemembers classified as DRC1 and DRC2 are considered dentally fit for deployment, meeting the requirement for Operational Dental Readiness (ODR). The classification of DRC3 indicates a requirement of urgent or emergent dental treatment to correct a dental condition that is likely to cause a dental emergency within one year. It is typically expected that these needs are remedied prior to deployment. DRC4 indicates an examination is needed for status determination.

The Dental Corps measures mission success as 95% ODR of the personnel entrusted to their care, meaning 95% of all military personnel are dentally ready for operational assignment and deployment at any given time.[1-3,5, 6] ODR is mission-critical for military dental providers, individual servicemembers and their line commanders. Ideally, military recruits would arrive at their first duty station operationally ready with no unmet urgent dental needs.[1,16]

DRC3 and DRC4 patients are prioritized into available appointment times, mitigating potential dental emergencies in garrison—while access to the full complement of healthcare services are available—and avoiding dental casualties downrange.[1-4,16] Studies show an inverse relationship between dental readiness and dental emergency.[1,2,10] Some data indicates that almost half of DRC3 patients will experience a dental emergency within two months, which can be especially costly to personal health and safety in an operational environment.[16] If dental or surgical support is not readily available, a servicemember experiencing a dental emergency may need to be medically evacuated (MEDEVAC) from a combat environment, involving numerous personnel, compromising mission integrity, and costing up to $200,000.[16] Since 2000 almost

11% of combat environment MEDEVACS were initiated due to dental emergency, highlighting the public health, military operational effectiveness, and financial implications of ODR.[16]

The Tri-Service Center for Oral Health Studies (TSCOHS) conducted DoD-wide recruit oral health surveys in 1994, 2000 and 2008 with the primary aim of estimating "the level of dental readiness, oral health, and dental treatment needs of recruits entering military service."[7] The 2008 DoD recruit oral health study found that 52.4% of military recruits entered service with high-priority urgent dental treatment needs classified as DRC3.[7] Operative needs (40%) were the most common urgent treatment needs with a mean value of 3.4 needed restorations per recruit.[7] Nearly one in five recruits required 7 or more restorations, a disheartening statistic nearly unchanged in this population since 1994.[7] Further evaluation is necessary to determine characteristics of this group more burdened by oral disease.

In less than eight weeks at Basic Military Training (BMT), the parent service is tasked with physically and mentally preparing healthy and qualified Airmen, Sailors, Soldiers and Marines. The grueling schedule is loaded with mission-essential general military requirements; consequently, dental care may occur only if the recruit experiences a dental emergency or if an urgent condition is identified during the in-processing dental screening. If allocated, time is a limiting factor in the ability to provide comprehensive recruit dental care. When recruits present to BMT with urgent, extensive and specialty treatment needs, there is a significant challenge to achieving dental readiness in the time frame.[1]

Factors Related to Poor Oral Health

Dental caries is a multifactorial disease of the oral cavity affected by numerous risk factors. Demographics, diet, and other habits can all affect the incidence and severity of disease in an individual. 2016 National Health and Nutrition Examination Survey (NHANES) data for the age group encompassing the average incoming age of military recruits indicates a higher prevalence of total dental caries in Hispanics and greater untreated dental caries in non-Hispanic blacks compared to other racial/ethnic groups.[11] Other studies highlight dental insurance status or

income level as major social determinants of oral health and wellness.[17] Oral health disparities in the general population are likely to appear in recruits entering military service and vice versa.[1] The 2008 DoD Recruit study found the following variables most predictive of entering military service without urgent dental treatment needs: female gender, having dental insurance, having visited the dentist within one year of entry, and having a college degree.[7]

Even with consistent annual access to care, dental health among military service members is difficult to achieve, reinforcing the impact of personal knowledge and habits on oral health.[15,16] Oral health literacy reflects ones awareness of causes of dental problems as well as personal behaviors and the dental care network available to remedy them.[19] Teenagers with lower oral health literacy are more likely to experience dental decay.[19] Oral hygiene frequency and frequency of dietary sugar intake are likely to show significant impact on the extent of dental disease as reflected in American Dental Association (ADA) Caries Risk Assessment (CRA) Guidelines.[3,12] Performing preventive oral hygiene at least twice daily with fluoridated toothpaste and once daily flossing is encouraged as an evidence-based means of decreasing risk of dental disease and subsequent impacts to ODR.[3,12-14,16] CRA considers more than 3 servings daily of sugary/starchy food or drinks as a cariogenic, or caries-inducing, diet.[3,12]

It is also important to note that overall health is inclusive of oral health.[15,16] Current evidence supports the oral-systemic connection and has shifted the outdated mentality that the mouth can be disconnected from the body in terms of health.[15,16] Systemic and chronic diseases can both manifest in the oral cavity and be exacerbated by diseases of the oral cavity.[15,16] Oral diseases and concerns can be related to headaches, difficulty sleeping, decreased concentration, improper nutrition, gastrointestinal distress, cardiovascular disease, pneumonia, dementia, and diabetes to name a few.[14-16] This study, to determine the risk indicators related to urgent and extensive dental treatment needs in military recruits has the potential to enhance the overall health and warfighting effectiveness of future servicemembers.[1]

Methods

The study protocol was approved as exempt by the Uniformed Services University of Health Sciences Institutional Review board in compliance with all applicable Federal regulations governing the protection of human subjects (IRB# DBS.2020.053). Secondary analysis was performed on deidentified cross-sectional survey and clinical exam data from the 2018-2019 USAF Recruit Oral Health Surveillance study conducted at Lackland Air Force Base from February 2018 to February 2019. The surveillance—modeled after the 1994, 2000, and 2008 DoD Recruit Oral Health Surveys—was a stratified, cross-sectional survey of randomly selected Air Force recruits as they presented for their in-processing dental examination. Recruits were stratified by service component (Active Duty, Reserve, or Guard) and selected for participation utilizing a random number generator and a lineal list of the in-processing recruits. Those identified by random selection were asked in private, by a dental assistant, if they would like to voluntarily participate in the study. Dental assistants were utilized to minimize potential bias by perception of coercion or authority by a higher-ranking dental professional. Emphasis was placed on the voluntary nature of the study and that participation would not influence in-processing, recruit training, military career, or any subsequent opportunity to receive dental care. The response rate of recruits agreeing to participate in the survey was 60%. Recruits who verbally agreed to participate were given an Informed Consent and Privacy Act Statement document to read and ask questions before beginning the electronic survey. Electronic surveys were administered utilizing Survey Monkey on an electronic tablet. Dental examinations were performed by calibrated clinicians and input into a password-protected and encrypted laptop by calibrated and trained dental assistants. Study identifiers were utilized to match the clinical and survey data.

The questionnaire included 44 questions that were similar to the ones found in previous national civilian and military oral health surveys and dental history questionnaires. Questions about dental utilization history and perceived need were similar to NHANES allowing comparison among select measures between the civilian and the military populations. Additional questions about dietary and oral hygiene habits, tobacco use, and a self-assessment of their dental health and family members' dental health were included. Recruit responses to

the questionnaire were linked to their corresponding clinical findings by a unique Surveillance ID, offering an opportunity to identify possible associations between clinical and non-clinical variables. Only aggregate data were reported. Respondents' results were not reported individually. Neither the recruit's name nor social security number (SSN) was linked to or placed on the questionnaire. A Data Use Agreement was established between the primary investigator of the 2018-2019 Air Force Recruit Oral Health Surveillance Study and the investigator conducting the secondary analysis.

To determine risk indicators for urgent and extensive dental treatment needs in USAF recruits, select clinical outcomes from the initial dental examination were compared against select demographic and self-reported characteristics from the survey. A classification of DRC3 indicates *urgent* treatment needs, and the additional need for 7 or more restorations (DRC3+7) was considered the study criteria for *urgent and extensive* dental treatment needs. Gender, age, race/ethnicity, education level and insurance status were the demographic variables analyzed. Five potential risk indicators were selected from the survey questionnaire including: 1) average number of times toothbrushing daily, 2) average daily servings of sugary beverages and 3) sugary/starchy foods, 4) self-reported current condition of teeth, and 5) need for dental care in the 12 months preceding military service without a dental visit. The need for care question was worded "Was there any time in the past 12 months where you felt you needed dental care but you did not go?" Response options for all variables are shown in Table 1.

Data Analysis

Descriptive statistics from the 2018-2019 Air Force Recruit Oral Health Surveillance Study were reported by converting the selected variables to categorical data wherever necessary and determining the number and percentage of participating recruits in each response category. Secondary analysis included univariate log binomial regressions to determine relative risk of DRC3 and DRC3+7 by risk category (95% Confidence Intervals). Both outcome variables were analyzed as dichotomous variables. For urgent needs analysis, DRC3 was considered "yes" and DRC1 and DRC2 were considered "no." For urgent and extensive needs analysis, both DRC3 and

7 or more restorations needed were the sole criteria for classification as DRC3+7. No recruits were identified as DRC 4 since this indicates a need for a dental examination, which was completed as part of the surveillance. SAS version 9.4 (Statistical Analysis Software, Cary, NC) was utilized. Statistical support was provided by a biostatistician within the 59th Medical Wing at Lackland Air Force Base.

Results

The source surveillance study included 1,362 USAF recruits in-processed at Lackland AFB between February 2018 and February 2019. Due to missing or incomplete survey and clinical outcome data, the final sample sizes for secondary analysis were 1,335 for the urgent needs

Table 1: Summary descriptive statistics of study population

	n (%)
Gender	
Male	917 (68.7)
Female	418 (31.3)
Age†	
17-19	635 (47.7)
20-24	487 (36.6)
25-29	135 (10.1)
30+	75 (5.6)
Race/Ethnicity	
White	800 (59.9)
Other	55 (4.1)
Black	265 (19.9)
Asian	33 (2.5)
Hispanic	182 (13.6)
Education level	
<HS Grad	627 (47.0)
HS Grad	507 (38.0)
Some college (No degree)	94 (7.0)
College Grad	107 (8.0)
Insurance status	
Private Insurance	667 (50.0)
Tricare Dental Plan	105 (7.9)
Medicaid	109 (8.2)
None/Uninsured	150 (11.2)
Don't Know/Unsure	304 (22.8)
Average daily toothbrushing	
More than once a day	767 (57.5)
Once a day	496 (37.2)
Less than once a day	72 (5.4)
Average daily sugary beverage servings	
None (0)	210 (15.7)
1-3	828 (62.0)
4 or more	297 (22.2)
Average daily sugary/starchy food servings	
None (0)	203 (15.2)
1-3	926 (69.4)
4-6	206 (15.4)
Self-Reported Current Condition of Teeth	
Excellent/Good	834 (62.5)
Fair	417 (31.2)
Poor	59 (4.4)
Don't know/Unsure	25 (1.9)
Past year needed care did not go	
No, did not need care	873 (65.4)
Yes, needed care but did not go	462 (34.6)
Outcome measures	
DRC3	287 (21.5)
DRC3+7‡	66 (5.5)
Participants N=1335	

†N=1332 for age variable
‡N=1194 for "urgent and extensive" needs analysis

analysis and 1,194 for the urgent and extensive needs analysis. Table 1 describes the baseline characteristics of the 1,335 incoming Air Force recruits included in this study. Over two thirds of the participants were male (68.7%) and a vast majority (84.2%) were under age 25. White (59.9%) was the most commonly reported race/ethnicity followed by Black (19.9%) and Hispanic (13.6%). Most participants had not graduated high school (47%). Only 8.0% had graduated college. Almost a quarter of the recruits (22.8%) were unsure if they had any dental insurance prior to military service, but two-thirds reported having some form of previous dental insurance coverage whether private (50.0%), Tricare dependent dental plan (7.9%) or Medicaid (8.2%).

Nearly all participants (94.6%) reported toothbrushing at least once per day. Daily consumption of one to three servings of sugary or starchy foods (69.4%) or beverages (62.0%) was common. Approximately two out of every three participants reported no need for dental care in the past twelve months (65.4%) and excellent or good current condition of teeth (62.5%). Only 4.4% considered their teeth to be in poor condition. The overall prevalence of the studied clinical outcomes was 21.5% urgent dental needs and 5.5% urgent and extensive dental treatment needs.

Relative risk (RR) and 95% confidence intervals (CI) for each of demographic variables are reported in Table 2. Only gender and education level were found to have no statistically significant differences in relative risk. Subgroups within age, race/ethnicity, and insurance status had significantly higher relative risk for both DRC3 and DRC3+7. Compared to the youngest age group, the 25-29 year old age group was nearly two times more likely to report to boot camp with urgent needs and nearly three times more likely to report with both urgent and extensive needs. White recruits were nearly two times less likely than Black, Asian, and Other recruits to have urgent needs. Those who listed Other as their race/ethnicity had the highest RR for both urgent (RR=2.26, 95% CI=1.56 to 3.28)and urgent and extensive needs (RR=2.70,95% CI=1.19 to 6.13). Recruits who were uninsured or Medicaid beneficiaries prior to entering military service had the highest RR for DRC3 and DRC3+7 compared to those with prior private

dental insurance coverage. Those enrolled in Medicaid before enlisting were most likely to have more than seven restorations in an urgent treatment plan upon initial dental examination.

Table 2: Prevalence and relative risk of urgent[1] and extensive[2] dental treatment needs in study sample by demographic characteristic

	Urgent Needs Analysis			Urgent and Extensive Needs Analysis		
	N	DRC3 n (%)		N	DRC3+7 n (%)	
Overall prevalence	1335	287 (21.5%)		1194†	66 (5.5%)	
Gender			RR (95% CI)‡			RR (95% CI)
Male	917	199(21.7)	Reference	816	50 (6.1)	Reference
Female	418	88 (21.1)	0.97 (0.78 to 1.21)	378	16 (4.2)	0.69 (0.40 to 1.20)
Age						
17-19	635	119 (18.7)	Reference	573	22 (3.8)	Reference
20-24	487	104 (21.4)	1.14 (0.90 to 1.44)	433	26 (6.0)	1.56 (0.90 to 2.72)
25-29	135	47 (34.8)	**1.86 (1.40 to 2.46)**	123	14 (11.4)	**2.96 (1.56 to 5.63)**
30+	75	17 (22.7)	1.21 (0.77 to 1.89)	65	4 (6.2)	1.60 (0.57 to 4.51)
Race/Ethnicity						
White	800	135 (16.9)	Reference	713	33 (4.6)	Reference
Other	55	21 (38.2)	**2.26 (1.56 to 3.28)**	48	6 (12.5)	**2.70 (1.19 to 6.13)**
Black	265	80 (30.2)	**1.79 (1.41 to 2.27)**	231	22 (9.5)	**2.06 (1.23 to 3.46)**
Asian	33	11 (33.3)	**1.98 (1.19 to 3.28)**	32	2 (6.3)	1.35 (0.34 to 5.38)
Hispanic	182	40 (22.0)	1.30 (0.95 to 1.78)	170	3 (1.8)	0.38 (0.19 to 1.23)
Education level						
<HS Grad	627	138 (22.0)	Reference	560	33 (5.9)	Reference
HS Grad	507	103 (20.3)	0.92 (0.74 to 1.16)	452	24 (5.3)	0.90 (0.54 to 1.50)
Some college (No degree)	94	25 (26.6)	1.21 (0.84 to 1.74)	81	5 (6.2)	1.05 (0.42 to 2.61)
College Grad	107	21 (19.6)	0.89 (0.59 to 1.34)	101	4 (4.0)	0.67 (0.24 to 1.86)
Insurance status						
Private Insurance	667	118 (17.7)	Reference	592	26 (3.2)	Reference
Tricare Dental Plan	105	22 (21.0)	1.18 (0.79 to 1.78)	94	3 (4.4)	0.73 (0.22 to 2.35)
Medicaid	109	31 (28.4)	**1.61 (1.14 to 2.26)**	101	12 (11.9)	**2.71 (1.41 to 5.19)**
None/Uninsured	150	46 (30.7)	**1.73 (1.30 to 2.32)**	131	12 (9.2)	**2.09 (1.08 to 4.02)**
Don't Know/Unsure	304	70 (23.0)	**1.30 (1.00 to 1.69)**	276	13 (4.7)	1.07 (0.56 to 2.05)

1 Urgent= Dental Readiness Class 3 (DRC3)
2 Urgent and Extensive= DRC3 AND needs 7 or more restorations (DRC3+7)
†141 missing data points for DRC3+7 analysis
‡Relative Risk (RR) and 95% Confidence Interval (CI). **Statistically significant RR in bold font.**

Table 3 reports the prevalence and relative risk of treatment needs by self-reported characteristic. Daily toothbrushing, daily consumption of sugary beverages, and daily consumption of sugary/starchy foods each had subgroups at significantly higher risk for urgent needs; however, the risk for urgent and extensive needs was not significantly different within these subgroups. Participants who brushed exactly once daily were at significantly higher risk of urgent dental needs (RR=1.27; 95% CI=1.03 to 1.56) compared to those who reported brushing more than once per day. Interestingly, the 5% of participants who brushed even less—less than once per day, rarely, or never—showed increased risk for DRC3, but it was found to be non-significant. Recruits who reported average daily consumption of 4 or more sugary

beverages or sugary/starchy foods had a higher risk of DRC3 and DRC3+7 needs than those who reported no consumption of sugary drinks or foods; however, the risk was only statistically significant for urgent treatment needs.

Table 3: Prevalence and relative risk of urgent[1] and extensive[2] dental treatment needs in study sample by self-reported characteristic

	Urgent Needs Analysis			Urgent and Extensive Needs Analysis		
	N	DRC3 n (%)		N	DRC3+7 n (%)	
Overall Prevalence	1335	287 (21.5%)		1194†	66 (5.5%)	
Avg. daily toothbrushing			RR (95% CI)‡			RR (95% CI)
More than once a day	767	149 (19.4)	Reference	693	33 (4.8)	Reference
Once a day	496	122 (24.6)	***1.27 (1.03 to 1.56)***	435	30 (6.9)	1.45 (0.90 to 2.34)
Less than once a day	72	16 (22.2)	1.14 (0.73 to 1.80)	66	3 (4.6)	0.95 (0.30 to 3.03)
Avg. daily sugary beverage servings						
None (0)	210	34 (16.2)	Reference	181	7 (3.9)	Reference
1-3	828	168 (20.3)	1.25 (0.90 to 1.75)	746	38 (5.1)	1.32 (0.60 to 2.90)
4 or more	297	85 (28.6)	**1.77 (1.24 to 2.52)**	267	21 (7.9)	2.03 (0.88 to 4.68)
Avg. daily sugary/starchy food servings						
None (0)	203	31 (15.3)	Reference	193	8 (4.4)	Reference
1-3	926	194 (21.0)	1.37 (0.97 to 1.94)	826	40 (4.8)	1.11 (0.53 to 2.32)
4 or more	206	62 (30.1)	**1.97 (1.34 to 2.90)**	185	18 (9.7)	2.23 (0.99 to 4.99)
Self-Reported Current Condition of Teeth						
Excellent/Good	834	122 (14.6)	Reference	737	13 (1.8)	Reference
Fair	417	117 (28.1)	**1.92 (1.53 to 2.40)**	382	34 (8.9)	**5.05 (2.70 to 9.45)**
Poor	59	41 (69.5)	**4.75 (3.75 to 6.01)**	52	17 (32.7)	**18.53 (9.53 to 36.04)**
Don't know/Unsure	25	7 (28.0)	**1.91 (0.99 to 3.67)**	23	2 (8.7)	**4.93 (1.18 to 20.59)**
Past year needed care did not go						
No, did not need care	873	113 (12.9)	Reference	775	19 (2.5)	Reference
Yes, needed care but did not go	462	174 (37.7)	**2.91 (2.36 to 3.58)**	419	47 (11.2)	**4.58 (2.72 to 7.69)**

1 Urgent= Dental Readiness Class 3 (DRC3)
2 Urgent and Extensive= DRC3 AND needs 7 or more restorations (DRC3+7)
†141 missing data points for DRC3+7 analysis
‡Relative Risk (RR) and 95% Confidence Interval (CI). **Statistically significant RR in bold font.**

The study variables with subgroups at significantly higher risk for both urgent and extensive treatment needs were self-reported current condition of teeth, and past year needed care but did not go. Statistical analysis of these two survey questions revealed profound results. Self-reported current condition of teeth was inversely associated with risk of both urgent and extensive dental treatment needs. Recruits who reported *fair* dental condition had a twofold risk for urgent needs and five times the risk for urgent and extensive needs. *Poor* condition carried an even greater RR of 4.75 (95% CI=3.75 to 6.01) for urgent needs and 18.53 (95% CI= 9.53 to 36.04) for urgent and extensive needs. Recruits who were unsure how to self-assess their oral health status were also at significant RR of DRC3 (RR=1.91; 95% CI= 0.99 to 3.67) and DRC3+7 (RR=4.93; 95% CI=1.18 to 20.59). Only 37.5% of participants reported the current

condition of their teeth as fair, poor, or unsure (Table 1); however, this group makes up the majority of all DRC3 (57.5%) and DRC3+7 (80.3%) cases.

The need for care question was worded "Was there any time in the past twelve months when you felt you needed dental care but did not go." Recruits who answered "yes, but did not go" were approximately 3 times more likely to have urgent dental treatment needs and 5 times more likely to have urgent and extensive needs compared to those answering no. While one-third of recruits (34.6%) answered yes to this question, they account for 60.6% of all DRC3 and 71.2% of all DRC3+7 cases.

Discussion

In fiscal year 2018, 170,900 young Americans enlisted for active duty service, including 30,343 joining the USAF.[18] These new accessions come from a variety of geographic locations, socioeconomic backgrounds, and cultural and personal value systems. Their health and hygiene knowledge, attitudes and beliefs are equally diverse. The Military Health System (MHS) is tasked with education, prevention, and maintenance regarding their health status. Knowledge of risk indicators for health concerns in the recruit population is key to the MHS defense against poor health outcomes. This study contributes to that body of knowledge by identifying risk indicators for both urgent and extensive dental treatment needs in USAF recruits.

Of the ten study variables, eight exhibited statistically significant differences in relative risks for DRC3. Only gender and education level were found to have no statistical significance in the urgent needs analysis. The habit-based risk indicators—average daily toothbrushing, average daily sugary beverages, and average daily sugary/starchy foods—were all significant for DRC3 but not for the additional extensive needs component. An increased frequency of sugary/starchy food and drink consumption seemed to be associated with increased risk of urgent and extensive dental treatment needs, but statistical significance fell short perhaps due to small sample size (66) in the secondary analysis and consequently wide confidence intervals. Since only 5.4% of the study population reported toothbrushing less than once daily, including

rarely or never, the power of statistical analysis of this variable may have been affected. Unexpectedly, the study data showed no increased risk for negative outcomes in the group claiming less than optimal oral hygiene habits. It is possible that some bias may have impacted the data integrity on this self-report question as participants may have been reluctant to report hygiene practices that they know to be less than recommended despite the promise of confidentiality.

The variables significant for both DRC3 and DRC3+7 were age, race, insurance status, self-reported current condition of teeth, and past year needed care but did not go. Caries experience is cumulative over time; therefore, it could be postulated that an older recruit may have increased risk for dental treatment needs because they may be more likely to have experienced prior caries, thus increased possibilities for broken or failing dental restorations.[8,9] Interestingly, the oldest age group was not the highest risk group—the 25-29 year age cohort had the greatest RR for urgent (RR=1.86; 95%CI=1.40 to 2.46) and extensive (RR=2.96; 95%CI=1.56 to 5.63) treatment needs. Multivariate analysis may help clarify why this cohort was particularly vulnerable to extensive decay as they may have had other confounding risks. Racial health inequities are widely documented. Black and Hispanic youth have been found to be at increased risk of total dental caries experience or untreated dental decay.[11] In this study, a race/ethnicity of Other or Black carried greatest RR for urgent and extensive dental treatment needs. Postulating that the uninsured or Medicaid cohort might enter military service at greater risk of DRC3, particularly as family income may be a confounding factor, is an evidence based assumption.[7,11,12,17] The study data agreed with previous studies as both the uninsured recruits and recruits previously covered under Medicaid entered service at significantly greater RR for both urgent and extensive needs.

The two self-reported status variables were selected for analysis as potential proxy measures of oral health literacy. Self-reported current condition of teeth and need for dental care accurately aligned with clinical diagnosis and treatment plans might indicate greater understanding of dental health, whereas, a self-report in stark contrast to actual needs might indicate limited

health literacy and knowledge. The study data indicates that most USAF recruits accurately assess their own oral health. Less than 2% stated they "don't know" the condition of their teeth. Among those who classified their dental condition, an inverse relationship existed between oral condition and relative risk of negative outcomes. As self-assessment deteriorated, RR of urgent and extensive dental treatment needs increased, with the "poor" group nearly five times as likely to be classified DRC3 by a dentist and even more likely to have extensive treatment needs. This indicates that most recruits enter service with a baseline assessment of their own oral health in line with their actual status. Although enlisted recruits may understand their level of health or disease, they may not appreciate how to positively impact their current condition, and this is where oral hygiene education should focus.

Based on the study results, the authors propose the use of a simple two question screening as selection criteria for priority assignment for dental examination during boot camp (Table 4). This triage tool has the potential to detect nearly three-fourths (74.9%) of all DRC3 recruits and 9 out of 10 of those with both urgent and extensive treatment needs (89.4%) at half the typical patient workload. Utilization of this simple two question triage tool would suggest only half of all recruits take valuable time away from military training for a dental examination while capturing the vast majority of the "sickest" dental patients. Nearly 90% of recruits who will

Table 4: Potential Impact and Validity of a One or Two-Question Screening Tool for Priority Assignment for Dental Examination at Boot Camp

Screening Question(s)	Criteria*		Impact		Sensitivity[a]		Specificity[b]	
	Exclusion	Selection	Exams Saved†	Workload‡	DRC3	DRC3+7	DRC1, DRC2	Not DRC3+7
What condition would you say your teeth are in?	Excellent, Good	Fair, Poor, Unsure	23,256	37.5%	57.5%	80.3%	67.9%	60.3%
Was there any time in the past 12 months when you felt you needed dental care but did not go?	No	Yes	24,335	34.6%	60.6%	71.2%	72.5%	63.2%
Both Questions	Excellent, Good AND[c] No	Fair, Poor, Unsure OR[d] Yes	18,605	50.0%	74.9%	89.4%	56.8%	46.0%

*: Screening question answers prompting exclusion from, or selection for, dental exam
†: Annual number exempt from exams weighted to 37,211 annual recruits
‡: % total recruits receiving dental exam
a: % with negative outcome correctly triaged for exam
b: % without negative outcome correctly triaged for exemption
c: Both criteria must be met for exclusion from dental exam
d: Selection for dental exam if ANY criteria met

need the most time and attention to achieve ODR could be rapidly identified while saving resources and decreasing operating costs at BMT. This could become standard practice at recruit training commands or be utilized in times of limited resources when definitive care needs to be postponed or triaged as in recent natural disasters and pandemic events.

Roughly one in five recruits within the study population entered military service with urgent dental needs requiring treatment in order to meet operational readiness. For some, this may have been a single, simple restoration or extraction; for others, a complex, multi-appointment treatment plan involving referral to specialists may be required. For the 5.5% who began their military career with greater than seven urgent dental needs, it can be assumed that their path to operational dental readiness is more arduous than most. Even with major behavioral changes, they remain at higher risk for future dental treatment needs.[12] Cost, workforce requirements, number and length of appointments, and limited duty or SIQ (sick in quarters) duration vary based on complexity and specialty service needs. Further studies could provide estimates on these metrics in order to improve planning and efficiency in the MHS.

Conclusion

Prevention efforts have improved population level oral health metrics over the last quarter century.[17] Even with declining caries experience overall, the discrepancies between the healthiest and sickest groups of our population are widening.[17] Servicemembers are not immune to these nationwide trends. Among USAF recruits, oral health inequities are observed in certain groups. Without intervention, these same Airmen will carry an inordinate burden of oral disease—and its associated pain, performance effects, and risks—throughout their military careers and lives. MHS leadership is specially entrusted with ensuring a medically ready force while meeting healthcare's triple aim of improved patient experience, improved health, and reduced costs. In doing so, we must assess the health inequities amidst our ranks, and strategize broad-based approaches to narrow the gaps. The study findings can inform targeted utilization of resources and interventions to efficiently optimize oral health and operational dental readiness, guide workforce and resource allocation, and decrease dental expenditures.

Acknowledgements

LCDR Jessica Norris, DMD, MPH, Dentist, US Navy Dental Corps

Lt Col Scott Irwin, DDS, MPH, Director, Tri-Service Center for Oral Health Studies and Assistant Professor, Uniformed Services University of the Health Sciences Postgraduate Dental College

Dr. Jisuk Park, PhD, Biostatistician, Science and Technology, 59th Medical Wing, Lackland AFB

Dr. Rhonda Stephens, DDS, MPH, Public Health Dentist Supervisor and Dental Public Health Residency and Grants Administrator, North Carolina Department of Health and Human Services, Division of Public Health, Oral Health Section

Dr. Mark Moss, DDS, PhD, Associate Professor, Department of Foundational Sciences, East Carolina University School of Dental Medicine

Dr. Jane Weintraub, DDS, MPH, Adjunct Professor, Health Policy and Management, UNC Gillings School of Global Public Health and Alumni Distinguished Professor, Dental Ecology, UNC Adams School of Dentistry

The opinions or assertions contained herein are the private ones of the author(s) and are not to be construed as official or reflecting the view of the DoD, USUHS, ECU or UNC.

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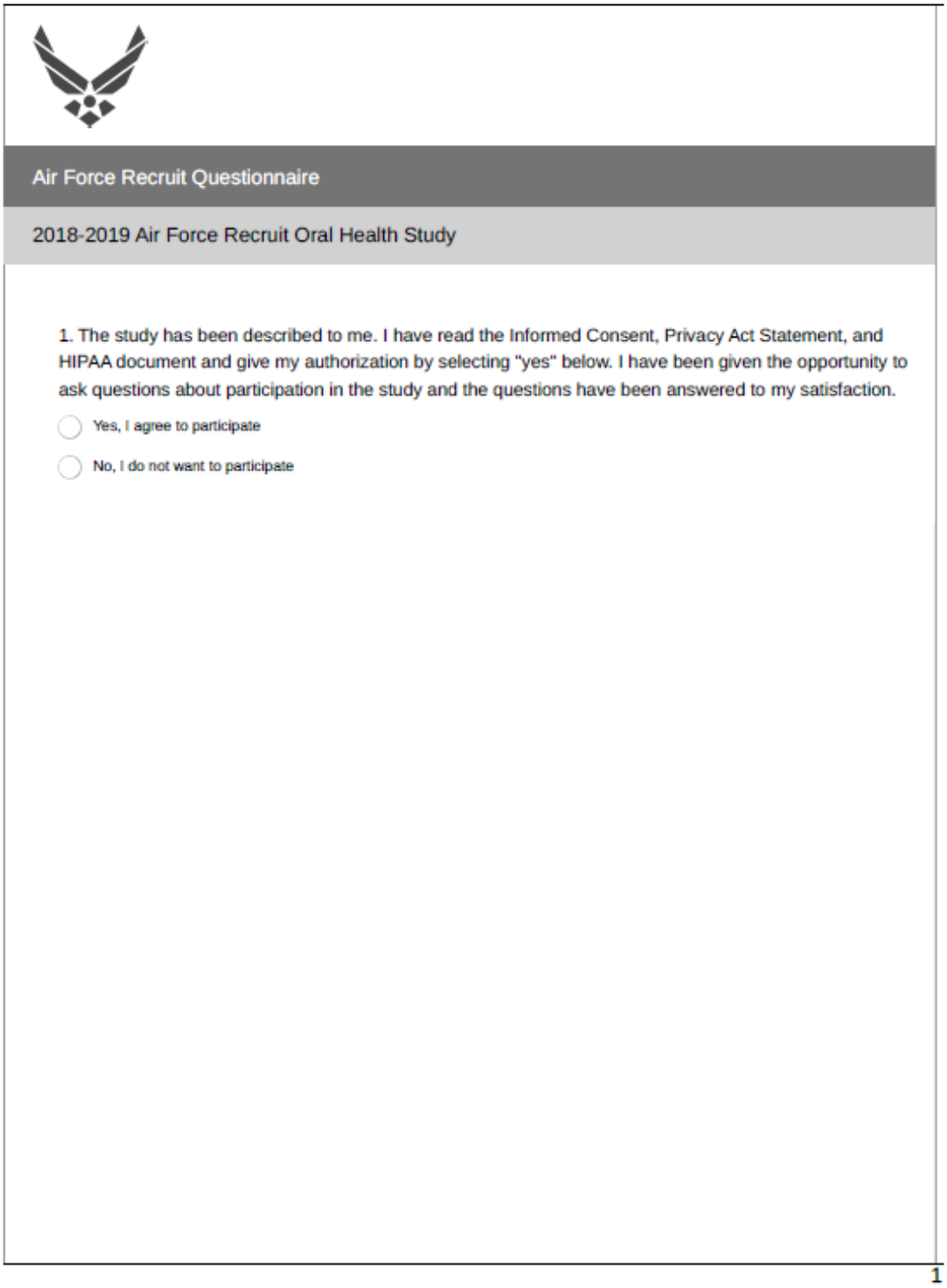
Appendix:

Air Force Recruit Questionnaire (2018-2019 Air Force Recruit Oral Health Study)



Air Force Recruit Questionnaire

2018-2019 Air Force Recruit Oral Health Study

1. The study has been described to me. I have read the Informed Consent, Privacy Act Statement, and HIPAA document and give my authorization by selecting "yes" below. I have been given the opportunity to ask questions about participation in the study and the questions have been answered to my satisfaction.

- ○ Yes, I agree to participate
- ○ No, I do not want to participate

1

Air Force Recruit Questionnaire

2018-2019 Air Force Recruit Oral Health Study

2. Before reporting to the recruit center, how long has it been since your last dental visit?

- ◯ Within the last 12 months
- ◯ 1-2 years
- ◯ 3-5 years
- ◯ More than 5 years
- ◯ Have never been to the dentist

3. Before reporting to the recruit center, within the PAST 12 MONTHS, have you received any of the following dental treatments? (*Mark "Yes" or "No" for each*)

	Yes	No
Teeth cleaning	○	○
Emergency care	○	○
Teeth filled	○	○
Teeth pulled	○	○
Root canal	○	○
Gum surgery	○	○
Braces	○	○
Crowns (caps) or bridges	○	○
Full dentures or partial dentures	○	○
Oral surgery, other than tooth pulled	○	○
Implant	○	○
Night guard, TMJ splint, (NOT athletic mouth guard)	○	○
Cosmetic dentistry (veneers, tooth facings, etc)	○	○

4. Before reporting to the recruit center, which type of dental insurance coverage did you have?

- ○ TRICARE Dental Plan or TDP (military dependent care insurance)
- ○ Private dental insurance (e.g. parents' insurance, Delta Dental, Kaiser, Blue Cross, UCCI, etc. . . . not TDP)
- ○ Government subsidized insurance (e.g. Medicaid)
- ○ No dental insurance coverage
- ○ Don't know

5. Before reporting to the recruit center, was there any time in the PAST 12 MONTHS when you felt you needed dental care but did not go? (Mark all that apply)

- [ ] No, no need to go
- [ ] Yes, but could not get an appointment
- [ ] Yes, but did not know a dentist or clinic to go to
- [ ] Yes, but could not get off work
- [ ] Yes, but the wait was too long in the clinic
- [ ] Yes, but could not easily get to the dental clinic
- [ ] Yes, but do not like going to the dentist
- [ ] Yes, the dental care was too expensive

6. Do you feel that you are currently in need of dental treatment?

- ◯ No
- ◯ Yes, right away
- ◯ Yes, within 6 months
- ◯ Yes, but could wait than 6 months

7. What condition would you say your teeth are in?

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor
- ◯ Don't know
- ◯ Does not apply to me

8. Was the chance to get your teeth fixed a major reason for you to join the military?

- ◯ Yes
- ◯ No

9. How would you describe the overall dental health of your immediate family members?

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor
- ◯ Don't know
- ◯ Does not apply to me

10. Since you reported to this training center, have you had pain in your mouth bad enough to make you want to see the dentist?

- ◯ Yes
- ◯ No

11. How often during the PAST 12 MONTHS have you had an aching pain anywhere in your mouth?

All of the time	Most of the time	Once in a while	Never	Can't remember
◯	◯	◯	◯	◯

12. How often during the PAST 12 MONTHS have you had a hard time doing household jobs, going to work, or attending school because of problems with your teeth, mouth, dental work, or dentures?

All of the time	Most of the time	Once in a while	Never	Can't remember
◯	◯	◯	◯	◯

13. How often during the PAST 12 MONTHS have you found it uncomfortable to eat or drink because of problems with your teeth, mouth, dental work or dentures?

All of the time	Most of the time	Once in a while	Never	Can't remember
◯	◯	◯	◯	◯

14. How often during the PAST 12 MONTHS have you been self-conscious because of problems with your teeth, mouth, dental work or dentures?

All of the time	Most of the time	Once in a while	Never	Can't remember
◯	◯	◯	◯	◯

Air Force Recruit Questionnaire

Please answer these questions based on your tobacco, eating, and oral hygiene habits BEFORE YOU REPORTED TO THE RECRUIT CENTER

15. Have you ever noticed and unusual color, roughness, lump, bump, or sore in your mouth that would not go away?

- ◯ Yes
- ◯ No
- ◯ Don't know

16. Have you ever used e-cigarettes/vape WITH nicotine?

- ◯ Yes
- ◯ No

17. Have you ever used e-cigarettes/vape WITHOUT nicotine?

- ◯ Yes
- ◯ No

18. Have you ever smoked a hookah WITH nicotine?

- ◯ Yes
- ◯ No

19. Have you ever used a hookah WITHOUT nicotine?

- ◯ Yes
- ◯ No

20. Have you ever smoked at least 100 cigarettes (5 packs) in your entire life?

- ◯ Yes
- ◯ No

21. Before reporting to the recruit center, on the average, about how many cigarettes did you smoke per day?

0 50 100

22. Have you smoked a pipe and/or cigars at least 50 times in your entire life?

- ◯ Yes
- ◯ No

23. Before reporting to the recruit center, about how often did you smoke a pipe or cigars?

- ◯ Everyday / Nearly Everyday
- ◯ Occasionally / Seldom
- ◯ Never

24. Before reporting to the recruit center, how many times have you ever made a~~s~~erious attempt to stop smoking?

- ◯ 0
- ◯ 1
- ◯ 2 or 3
- ◯ 4 or 5
- ◯ 6 or more
- ◯ Does not apply to me. I don't smoke.

25. Before reporting to the recruit center, had you successfully quit smoking?

- ◯ Yes
- ◯ No
- ◯ Does not apply to me. I don't smoke.

26. Have you used smokeless tobacco (chewing tobacco, dip, and/or snuff) at least 20 times in your entire life?

- ◯ Yes
- ◯ No

27. Before reporting to the recruit center, about how often did you use smokeless tobacco (chewing tobacco, dip and/or snuff)?

- ◯ Everyday / Nearly Everyday
- ◯ Occasionally / Seldom
- ◯ Never

28. Before reporting to the recruit center, on the average, about how often did you use smokeless tobacco products per day? (Count every time you placed chewing tobacco, dip, and/or snuff, in your mouth)

0 50 100

29. Before reporting to the recruit center, how many times have you ever made a serious attempt to stop using smokeless tobacco?

- ◯ 0
- ◯ 1
- ◯ 2 or 3
- ◯ 4 or 5
- ◯ 6 or more
- ◯ Does not apply to me. I don't use smokeless tobacco.

30. Before reporting to the recruit center, had you successfully quit using smokeless tobacco products?

- ◯ Yes
- ◯ No
- ◯ Does not apply to me. I don't use smokeless tobacco.

31. Before reporting to the recruit center, on average, about how often did you brush your teeth?

- ◯ More than once a day
- ◯ Once a day
- ◯ Less than once a day
- ◯ Rarely or never

32. Before reporting to the recruit center, on average, about how often did you floss your teeth?

- ◯ At least 1 time per day
- ◯ 4 to 6 times per week
- ◯ 2 to 3 times per week
- ◯ 1 time per week
- ◯ Rarely / never

33. Before reporting to the recruit center, on average, about how often did you use a fluoride product (toothpaste, rinse, mouthwash, gel, etc.)?

- ◯ More than once a day
- ◯ Once a day
- ◯ Less than once a day
- ◯ Rarely or never
- ◯ Don't know if product(s) contained fluoride

34. Before reporting to the recruit center, did you routinely drink tap water or bottles water?

- ◯ I primarily drank tap water
- ◯ I drank about equal amounts of bottled and tap water
- ◯ I primarily drank bottled water
- ◯ I usually drank other beverages, instead of water

35. Before reporting to the recruit center, about how many servings (8-12 oz) did you usually have of **regular** (not diet) soda, fruit juice/drink, energy drink, sweetened tea, coffee with sugar and/or creamer, or sports drink **BETWEEN** meals?

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 or more

36. Before reporting to the recruit center, about how many servings (8-12 oz) did you usually have of **regular** (not diet) soda, fruit juice/drink, energy drink, sweetened tea, coffee with sugar and/or creamer, or sports drink **WITH** meals?

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 or more

37. Before reporting to the recruit center, about how many servings (8-12 oz) did you usually have of **diet** soda, diet fruit drink, diet energy drink, diet tea, or diet sports drink **BETWEEN** meals?

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 or more

38. Before reporting to the recruit center, about how many servings (8-12 oz) did you usually have of **diet** soda, diet fruit drink, diet energy drink, diet tea, or diet sports drink **WITH** meals?

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 or more

39. Before reporting to the recruit center, about how many servings did you usually have of sugary / starchy foods (sports bars, doughnuts, pastries, crackers, cookies, candy, ice cream, pies and cakes) **BETWEEN** meals?

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 or more

40. Before reporting to the recruit center, about how many servings did you usually have of sugary / starchy foods (sports bars, doughnuts, pastries, crackers, cookies, candy, ice cream, pies and cakes) **WITH** meals?

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 or more

41. Before reporting to the recruit center, about how many**daily** servings did you usually have of dairy products (milk, cheese, yougurt, etc) or calcium-containing food such as dark, green leafy vagetables (spinach, broccoli, greens, kale, etc)?

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 or more

42. Before reporting to the recruit center, about how many daily servings did you usually have of fruits and vegetables?

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 or more

43. In what STATE / TERRITORY did you spend the majority of your life until you were 18 years of age?

44. To your knowledge, have you ever received the HPV vaccine? (Gardasil, Gardasil 9, or Cervarix)?

- ◯ Yes
- ◯ No