

The Effects of an All-In-One Appointment Approach on Dental Readiness

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Abstract

Purpose/Hypothesis. Army Dental Command (DENCOM) has recently implemented the Go First Class (GFC) program across its enterprise. The GFC program combines a routine dental examination with teeth cleaning and minor repairs into an all-in-one appointment. Our hypothesis states that the GFC Program is positively associated with an increased amount of active duty soldiers achieving DRC 1 (the highest state of readiness).

Design/Methods/Materials. This is a post-test, quasi-experimental, retrospective, cross-sectional study. The timeframe of the study was a three-month period before GFC implementation and a three-month period after GFC implementation. After accounting for missing/unreliable data, the sample decreased in size from an original 308,995 observations to a study group of 222,090.

Findings/Results. We found our model to be significant at the 0.01 alpha significance level. Additionally, all of the independent variables were found to have a statistically significant association with the dependent variable. We interpreted the results to mean that a soldier was six times more likely to be DRC 1 after the GFC implementation than before.

Conclusions. The results indicated that the GFC program's implementation is highly associated with a soldier achieving DRC 1. Additional findings provided negative associations with tobacco use and dental readiness.

Value/Relevance. This study serves as the foundational research into the GFC program and its association with changes in dental readiness. Its results will provide Army leadership with the appropriate knowledge to make decisions regarding the future of the GFC program, to include recommendation of the program to other branches of the military.

The Effects of an All-In-One Appointment Approach on Dental Readiness

The health of the mouth and surrounding craniofacial structures is vital to a person's overall health and well-being (U.S. Department of Health and Human Services, 2011). With this in mind, the United States Army Dental Command (DENCOM) has made it its mission to strengthen the health of the United States Army by improving the oral health of its soldiers. Recently, the Army Surgeon General introduced policies that set the stage for a transformation of Army Medicine from a healthcare system to a system for health. Increased focus on wellness, as opposed to treatment of acute conditions, is a cornerstone of this groundbreaking endeavor (Army Medicine, 2012). In response to the wellness campaign, DENCOM implemented the Go First Class (GFC) initiative at a majority of its facilities. GFC is an Army-wide plan that simultaneously joins dental readiness and wellness in a combined all-in-one appointment. What once required several visits to achieve is now accomplished in one all-inclusive appointment. The GFC program incorporates routine annual exams, dental hygiene, simple fillings, and a varnishing into one visit at the clinic. The legacy model of Army dental care provided all of these services, but it was problematic due to the requirement for patients to endure multiple visits to the clinic for issues that could be resolved in one encounter. The extra time spent making appointments, traveling to appointments, and receiving inefficient care separated soldiers from their military units for an excess amount of time and did not motivate soldiers to return for follow-up care. The goals of the new program are to increase prevention of dental disease, reduce time spent at dental appointments, and increase readiness levels in an all-inclusive appointment.

The Department of Defense utilizes the Dental Readiness Classification (DRC) system to define readiness and dental treatment requirements. The system uses the following coding

system for classification of an individual's readiness: DRC 1 (no treatment required), DRC 2 (routine treatment required), DRC 3 (emergency/major treatment required), and DRC 4 (annual exam required). Individuals who are classified as DRC 1 and DRC 2 are considered dentally ready and are deployable, while those classified as DRC 3 and DRC 4 are considered not ready and are non-deployable. Classifications of DRC 3 and DRC 4 are temporary in nature, but still require dental treatment in order for the individual to reach a deployable status. Deployable status, or readiness, is an integral measurement used in training status by military commanders to help determine their personnel capability in the case of a deployment in support of contingency operations. Poor readiness statistics indicate that a unit would be unable to reach its ultimate potential in a deployed environment due to manpower losses related to dental disease or dental emergencies. A classification of DRC 1, the optimum readiness level, indicates that the soldier maintains the highest state of dental wellness and is therefore less likely to develop dental emergencies or dental problems that could affect the performance of his or her assigned duties (Hyson, Whitehorne, & Greenwood, 2008).

The purpose of this research project is to determine the association and effects of DENCOM's GFC campaign on achieving the highest state of dental wellness (DRC 1). Since the GFC program is still in its infancy and insufficient literature on the effects of the program is available, a baseline association analysis was deemed essential for stakeholders in the program. With this in mind, our research team quantitatively measured the GFC campaign's effect on dental health outcomes through analysis of data documenting active duty soldiers' DRC classifications pre- and post-implementation of GFC. Those affiliated with Army dentistry will find this pioneering research useful in making decisions regarding future planning and funding allocations for the GFC program. Army dentistry's funding and staffing models did not change

in conjunction with the program's enactment, but the results of this study warrant further consideration for senior military leaders. An illustration of the program's effectiveness in dental health promotion and disease prevention on individual soldier's wellness may encourage widespread support of the program and expand implementation into other military settings.

Literature Review

The GFC program is service-specific to the Army and does not have a similar initiative in any of the other armed forces; therefore, this study represents a unique opportunity to document the results at a relatively early stage of the program's inception. In this study, we attempt to define the characteristics of wellness and readiness in a way that is applicable to the Army. To do this, we examined how oral health is affected by preventive measures, tobacco use, socioeconomic status, age, and gender. Each of these characteristics was utilized in our study as an independent variable to associate with DRC. The GFC program incorporates the major components that lead to wellness outcomes at the individual level, while simultaneously addressing disease prevention, access to care, and quality of care. Our research question is "What factors affect active duty soldiers achieving the highest state of dental wellness (DRC 1)?" Our hypothesis is that the GFC program is positively associated with an increased amount of active duty soldiers achieving DRC 1. Therefore, we expect that there will be an increased number of soldiers attaining DRC 1. We will determine impact on wellness and readiness by comparing the pre-implementation rates of DRC 1 readiness with post-implementation rates. The GFC Program is designed to affect the dental wellness and readiness of soldiers; this study is designed to understand this effect.

Prevention is a major key to overall oral health (Petersen & Kwan, 2009); prevention is achieved through the daily activities of brushing, flossing, fluoride use, and through annual

examinations. Many scholars agree that regular preventive oral hygiene is necessary to maintain the overall health of an individual (Giannobile et al., 2013; Peterson & Kwan, 2009). Ignoring oral health prevention can lead to painful consequences, malnutrition, and dehydration; in the military, these negative effects have implications that extend to a soldier's potential to deploy in support of wartime contingency operations (Petersen & Kwan, 2009).

A recent study conducted at the Michigan Center for Oral Health Research showed that individuals with low risk factors for periodontitis and tooth loss had no discernable difference in wellness between individuals who had semi-annual dental visits and cleanings and individuals who only went once annually (Giannobile et al., 2013). In contrast, individuals with high risk profiles, or who had a history of diabetes, smoking, or the interleukin-1 genotype, demonstrated increasingly higher periodontitis and tooth loss instances with fewer dental visits (Giannobile et al., 2013). A recommendation of the study was that most people would benefit from an annual visit to the dentist and a cleaning, but those with risk factors should visit the dentist more often for treatments (Giannobile et al., 2013).

Oral health is also linked to overall health, especially with long-term chronic conditions developed later in life, which expands the need for preventive oral health services beyond that of just oral health. A study conducted found a correlation between dental infections and dental caries with the development of myocardial infarctions (Mattila et al., 1989). In another study, periodontal disease was associated with coronary heart disease (Geismar, Stoltze, Sigurd, Gyntelberg, & Holmstrup, 2006). Infection caused by major periodontal disease is also linked to an increased risk for stroke (Pussinen et al., 2004). In addition, research shows that type-2 diabetes has a negative impact on periodontal disease, and the disease is exacerbated by poor

dental prevention habits, which can further affect the outcomes of people afflicted with diabetes. (Jansson, Lindholm, Lindh, Groop, & Bratthall, 2006).

The need for preventive measures can be further illustrated in a military context in the amount of Dental Disease and Non-Battle Injuries (D-DNBI) seen in military conflicts and field exercises since the Vietnam War era (Simecek et al., 2014). During the Vietnam War, dental emergencies were disruptive and could incapacitate personnel for as long as seven days due to a shortage of dental personnel and facilities, as well as the terrain (Simecek et al., 2014). A survey conducted in 1968 found that dental emergencies in Vietnam exceeded a rate of 142 per 1,000 men (Neel, 1973). A pre-deployment program focused on preventive services and treatments centered on dental issues that needed the most attention (those issues likely to need emergency treatment in the next 12-18 months) contributed to a 50% decrease in dental emergencies within the next nine months (Neel, 1973).

D-DNBIs continued to be an issue in conflicts and exercises after the Vietnam War. In a study conducted by Lieutenant Colonel Thomas Payne and Colonel William Posey (1978) over a 39-day field exercise, the total estimated loss of duty time for dental emergencies was 13 days per 1,000 soldiers. This would translate to a yearly total of 121.5 lost duty days per 1,000 troops (Payne & Posey, 1978).

A retrospective study conducted by Lieutenant Colonel John King (1992) after Operations Desert Shield and Desert Storm found that the rate of dental emergencies fluctuated from 217 to 713 per 1,000 soldiers. The highest rates for dental emergencies occurred in the months immediately preceding and following the ground war (King, 1992). In several other studies, the rates for dental emergencies from deployments in Bosnia were estimated between 156 to 437 per 1,000 soldiers (Chaffin, 2001; McKee, Kortepeter, & Ljaamo, 1998; Moss, 2002).

In 2014, a retrospective study on D-DNBI was conducted (Simecek et al., 2014). This study focused on U.S. Army dental emergencies seen between May of 2009 and December of 2011 in Operation Iraqi Freedom (OIF) and between July of 2010 and December of 2012 in Operation Enduring Freedom (OEF). The study showed peak rates of dental emergencies in 2010, with an overall rate of 144.05 D-DNBIs per 1,000 troops (Simecek et al., 2014). Rates for OEF were significantly lower than that of OIF, with OIF at 124.51 per 1,000 and OEF at 70.69 per 1,000 (Simecek et al., 2014). During the study period, the researchers found that 60% of D-DNBIs were from the active duty component (Simecek et al., 2014). In comparison to the rates of previous conflicts, the OIF/OEF rates are substantially lower.

Another risk factor to Army dental readiness is tobacco use. Tobacco use is linked to several oral health problems, including cancers of the mouth, throat, and tongue, oral mucosal lesions, and periodontal disease (U.S. Department of Health and Human Services, 2000). A 2009 study found that while tobacco use is on the decline in the general population of the United States, use in the Army is not declining and may be increasing in several age groups (Nelson, Pederson, & Lewis, 2009). The study found that soldiers use tobacco products in order to make friends, combat stress, stay awake, socialize, and to relieve boredom (Nelson et al., 2009). Soldiers are counseled by healthcare providers at annual check-ups on the risks associated with tobacco use; however, tobacco use continues to be an issue for both short-term and long-term soldier medical and dental wellness (Nelson et al., 2009).

In addition to tobacco use, dental service utilization has a direct impact on dental readiness. Utilization of dental health services and preventive measures is affected by several individual factors. A 2012 study conducted by Thomas Wall, Dr. Marko Vujcic, and Dr. Kamyar Nasseh found that while utilization of dental services was on the rise among children

and young adults, utilization among adults over age 20 was steadily decreasing. The study examined dental care utilization data collected from the National Health Interview Survey between 1997 and 2010 (Wall, Vujcic, & Nasseh, 2012). In this timeframe, utilization of dental care rose from 71.8% to 77% of the population for patients aged 2 to 20 years (Wall et al., 2012). During the same period, utilization by adults aged 21 to 64 years decreased from 66.4% to 61.8% and for adults over the age of 65, the percentage dropped from 74.4% to 69.6% of the population (Wall et al., 2012).

Socioeconomic status was a large factor in the decrease in the adult population seeking dental services. Utilization by patients below the poverty level decreased from 46.1% in 1997 to only 38.7% in 2010, a change of 7.4% (Petersen & Kwan, 2009). In contrast, utilization for those above the poverty level only decreased by 1.4%, from 79.2% in 1997 to 77.8% in 2010 (Petersen & Kwan, 2009). The researchers found that decreases in dental utilization were not solely caused by the economic downturn that began in 2008, but actually began in 2003. The decrease in health insurance policies including dental services is most likely to blame.

Variations in dental care utilization can be found based on both gender and race in adults over the age of 18. Vaidya, Partha, and Karmakar (2012) conducted a study on gender differences in the utilization of preventive care services and found that more women than men utilized such services (Vaidya et al., 2012). In the case of dental care, woman utilized at a rate of 54.62%, compared to 45.38% for men (Vaidya et al., 2012). Shi, Lebrun, and Tsai published a study in 2010 on ethnic differences in care utilization. In this study, 87% of blacks and 77% of Hispanics reported no dental visits within the last year compared to non-Hispanic whites (Shi, Lebrun, & Tsai, 2010).

In a comparison study between U.S. Army personnel and an employed civilian cohort, Army personnel were found to be 80% compliant in yearly dental visits regardless of age, gender, and race compared to civilian rates (Chisick, 1995). Two factors that may influence these differences are access to free dental care and dental exam requirements for military personnel (Chisick, 1995). The lack of disparity in dental care usage in the Army population was also shown in another study conducted by Chisick in 1993. The results found that, when age was controlled, there were no significant difference in usage between enlisted and officer personnel (Chisick, 1993).

An additional criterion to consider in evaluating the effectiveness of the GFC program is access. The integration of a dental exam, hygienic cleaning, and minor restorative procedures can be considered to be a significant improvement in access, as the program eliminates the need for multiple separate appointments that were previously needed to achieve the same outcome. The ability to make an appointment and see a provider in a reasonable amount of time defines access in a clinical environment (U.S. Department of Health and Human Services, 2011). Improved access and efficiency influence patient satisfaction as a whole and have a demonstrable effect on future patient-dentist relationships. In a study conducted by Chaffin, Mangelsdorff, and Finstuen (2007), environmental factors consisting of the number of days waited for an appointment showed a significant impact on patient satisfaction.

The other main criterion that is addressed by the GFC program is quality. Quality of care can be defined in several ways. The American Medical Association defines quality as "...care which consistently contributes to the improvement or maintenance of quality and/or duration of life" (American Medical Association, Council of Medical Services, 1986). The Institute of Medicine states, "Quality of care is the degree to which health services for individuals and

populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge” (Institute of Medicine, 1990). The application of these definitions in the Army is demonstrated through the use of DRC (the dependent variable in this study), and serves as a proxy representative for quality of care and a current state of wellness.

Conceptual Model

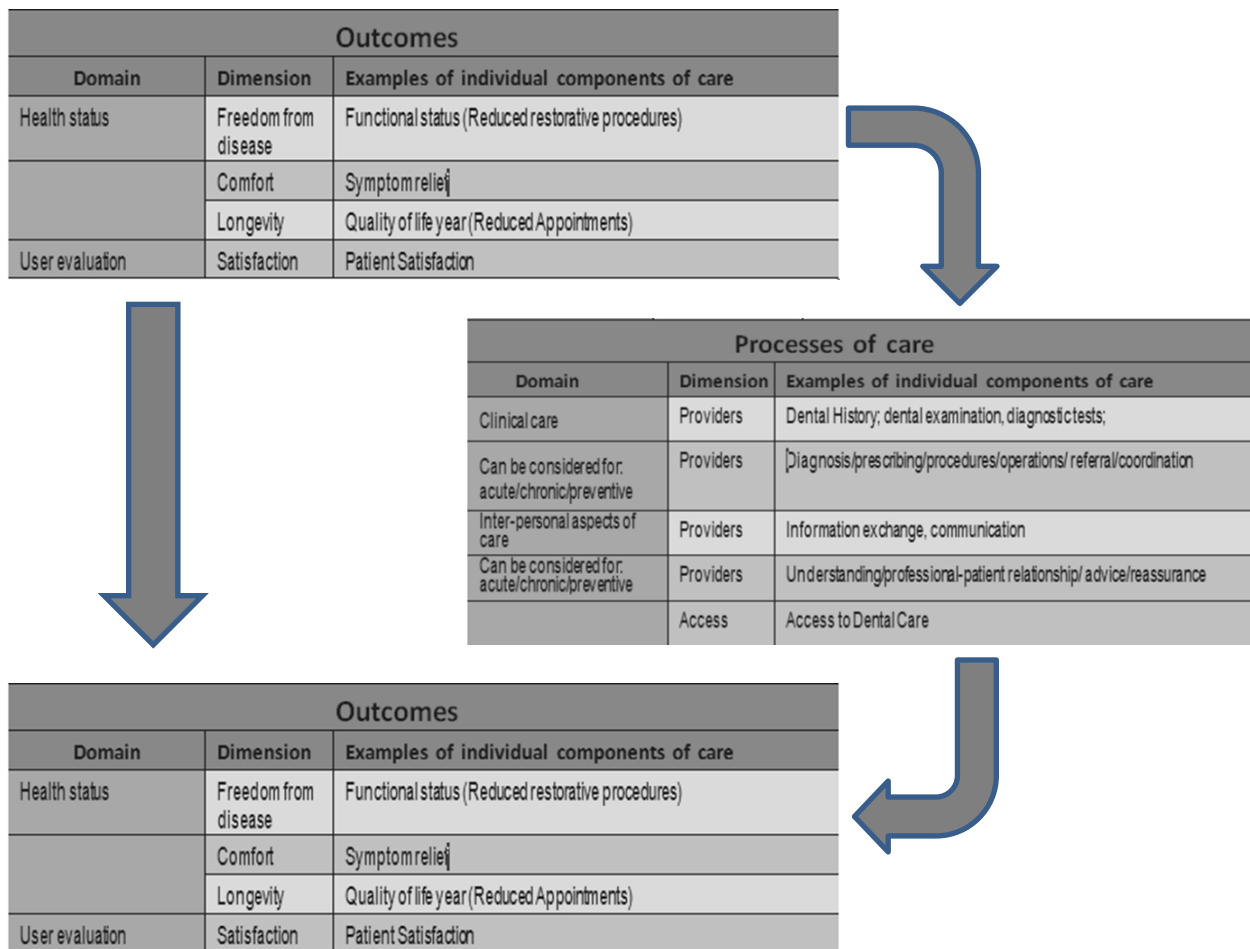


Figure 1. Conceptual Model, adapted from Campbell & Tickle (2013)

The conceptual model above denotes several dimensions that are relevant and present in the literature that we reviewed in conjunction with this study. The most influential structural category relates to personal characteristics present in our sample, and more importantly, the characteristics and attributes that could be obtained from our data source. There are certainly other components within the structural aspects of the above model that are relevant; however, the data to analyze how these components impacted care would have been difficult to obtain. Furthermore, Army dental clinics vary in terms of staffing, operational hours, and infrastructure. We adapted the conceptual model from the work of Campbell and Tickle (2013), and in our adaptation, the three main dimensions of care were explored to illustrate two separate pathways to outcomes. This aligns with the practical application of care throughout the Armed Forces, with a specific focus on the means by which soldiers in the Army receive care at dental clinics at over 30 Army installations. Within the process dimension, we focused on the “access” sub-category as it relates to the vehicle by which care is provided to soldiers (scheduled appointments). Finally, the outcomes dimension contains the focus of our study. The functional status in the model serves as the primary indication of the quality of care that was delivered, measured by freedom from (or absence of) oral disease in a patient. We were also particularly interested in the “longevity” dimension, as it correlates to reduced appointments. Although we were not able to measure a reduction in appointments, we wanted to note that this represents a parallel to the GFC program; the GFC program is designed to improve outcomes while also reducing the volume of appointments through the combined appointment concept.

Empirical Model

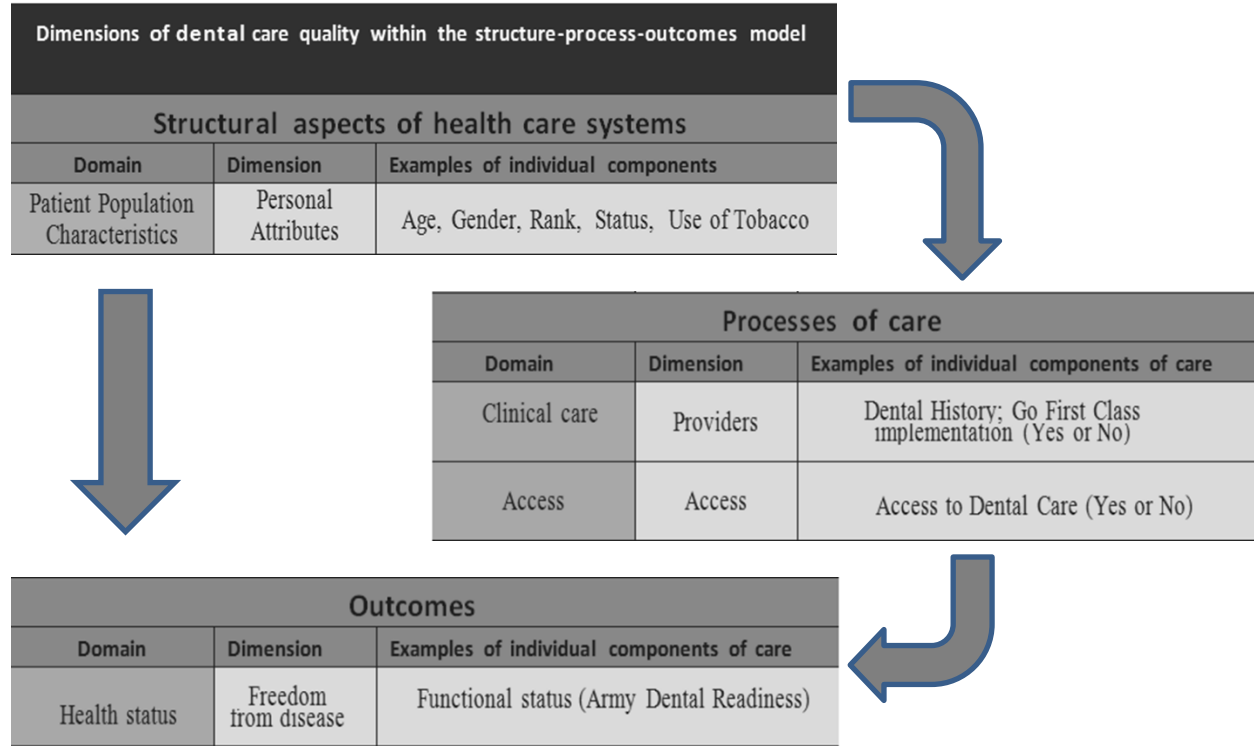


Figure 2. Empirical Model, adapted from Campbell & Tickle (2013)

We further distilled the initial adaptation of the conceptual model into the above empirical model for the purposes of our study. The empirical model focuses on the most relevant, applicable, and available elements that were measured and analyzed in our data set. Within the “structure” dimension, we have the personal attributes that apply to the sample of encounters in our data. The “process” dimension contains similar information, except the focus is on the implementation of the GFC program, and we know that the effective date of the new GFC campaign aligned with the beginning of Fiscal Year 2013. As previously mentioned, the GFC program affects the access point of care by combining several appointments into one visit for most annual regular care needs. We fully expect that it may have taken some clinics a bit longer to fully incorporate the new program into the scheduling process, and that the

appointment process may have been inefficient as providers adapted to the new process. This is essentially the main independent variable in our study. The “outcomes” dimension is yet another adaptation from the conceptual model, and it is focused on the assignment of DRC at the individual soldier level. This represents the dependent variable in our study.

Methods

The Go First Class initiative was implemented across the majority of DENCOM clinics in 2013; the initial inception of the program began in the Western Regional Dental Command (WRDC) and was deemed successful at improving the health of soldiers in this region. Specifically, there was an apparent increase in soldiers that attained DRC 1 during this initial trial, and this increase in readiness was attributed to the implementation of the GFC program. Colonel Brian Kalish, the WRDC Director of Operations at the time, began widespread implementation of the GFC campaign across Army Dental Command, and the program has been officially in place for approximately one year.

This study was a post-test, quasi-experimental, retrospective design using data provided by DENCOM through the Corporate Dental Application (CDA); the timeline focuses on patient encounters from a three-month period prior to the implementation of the GFC program and a three-month period after the implementation of the program. We used logistic regression to test for any association between the dependent variable and the independent variables. We also performed a univariate analysis of variance, bivariate correlation analysis, and checked the assumption generated to ensure the value was met for logistic regression. All statistical analysis was performed in IBM’s SPSS Statistics (version 21).

Our unit of measurement for this study is the individual soldier, and we examined the general population of the Army, with several exceptions, noted below and in the included

eligibility criteria (Figure 3, below). We intended to exclude active duty personnel in a basic training status because those soldiers may be in poor dental health, and would not be accurate reflections of the active duty population. Unfortunately, the data did not provide the necessary level of detail to draw confident inferences about the training status of a particular soldier. Therefore, we excluded any soldiers stationed on installations that are collocated with basic training, which are Fort Benning, Fort Jackson, Fort Leonard Wood, and Fort Sill.

The output variable was DRC. Dental Readiness Classification is a tiered method of classifying the overall dental health of an individual soldier, with “DRC 1” representing no treatment needs, and “DRC 4” signifying a requirement for an annual exam, a cleaning, and any other necessary restorative procedures. We converted DRC, a categorical measurement, into a dichotomous variable. DRC 1 was represented by a binary input of “1,” signifying that a soldier has attained the highest state of readiness. The GFC program’s purpose is to improve the number of soldiers that can attain this level of readiness. Similarly, DRC 2, 3, and 4 were collectively converted into a binary input of “0,” which corresponds to a soldier that has remained in a lower readiness state. Independent variables consisted of rank, gender, age, tobacco use, and date of encounter.

The independent variable “date of encounter” is the key independent variable that we examined for this study, as it signifies whether or not the GFC program was in place during the exam. We converted this variable into a dichotomous variable as well. As previously noted, the GFC program was implemented in Fiscal Year 2013; we converted all encounters prior to January 1, 2014 as a binary input of “0” indicating that the implementation had not yet occurred. We converted all dates after January 1, 2014 to a binary input of “1,” indicating that GFC implementation had occurred. This was the best approximation of a date that will encompass the

entire transition period as the program started at each of the Army's dental clinics in Fiscal Year 2013, and we expected that some dental clinics were not ready to support GFC appointments on October 1, 2012.

We utilized dummy variables for the independent variable "rank" due to the large sample size and the delineation between each of the grades in the enlisted and officer records. The reference variable for "rank" was any record that corresponded to a soldier in the grades of E1-E5 as this group represented the largest volume of records in our data. Three additional dummy variables were used to represent the grades of E6-E9, O1-O3 and WO1-CW2, O4-O10 and CW3-CW5. These groupings represent samples of the data with relatively equivalent time in military service and similar socio-economic levels. There are some outliers in these groupings, particularly in the two senior groups of service members (senior enlisted and senior officers). However, logistic regression is robust against outliers, and we do not believe that an additional grouping of grades (officer or enlisted) would add value to our analysis due to the very small amount of encounters that would be coded as senior service members, relative to the sample size.

We also converted the independent variable "tobacco use" into dummy variables. For this variable, the value of "0" corresponds to an absence of tobacco use, and this was our reference for the three dummy variables that correspond to the use of tobacco products. Each of the dummy variables assigned correspond to the type of product used. Smokeless tobacco was assigned its own dummy variable and, cigarettes, cigars, or other smoke producing products were also coded separately. A third dummy variable was used if a soldier disclosed that he/she used both smokeless and smoke producing products.

Gender was also another independent variable that was measured, and it was coded as a dichotomous variable, with "0" representing females and "1" representing males. Finally, we

utilized “age” as our final independent variable. Age will remain a ratio variable for the regression as it provides a sufficient level of detail in the analysis without any manipulation. Both gender and age are represented in our literature review, and we intended to make full use of the data provided to us.

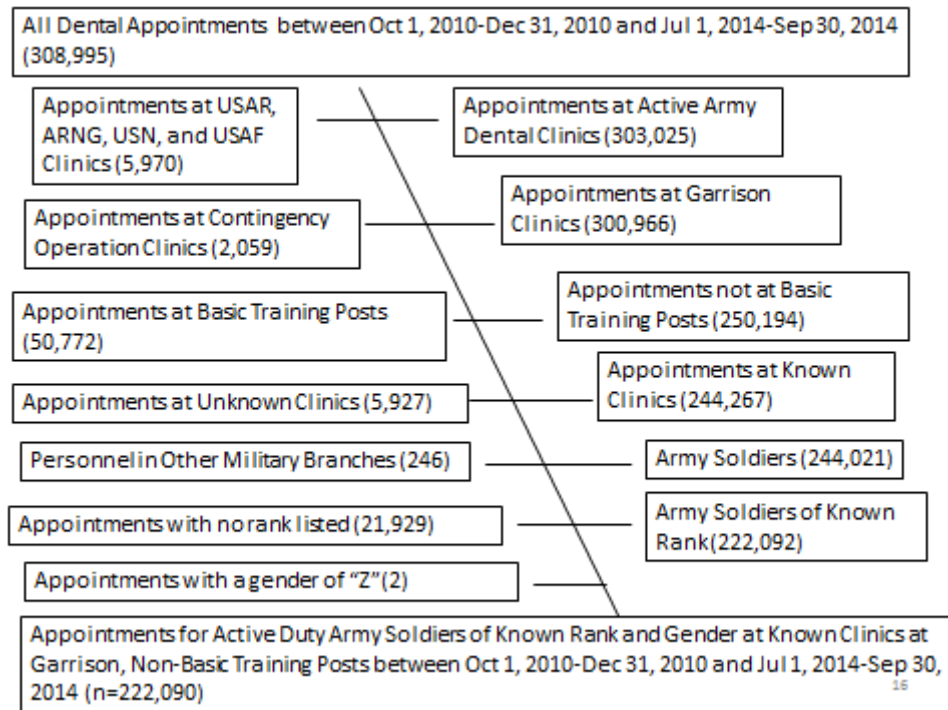


Figure 3. Inclusion/Exclusion criteria, decreasing the initial data set of 308,995 observations to a final study group of 222,090 observations with no missing data.

Table 1

Variable Table

Concept	Measure/Variable	Variable Name in SPSS	Use in Analysis	Level of Measurement	Data Type	Measurement Unit
Readiness Category	Dental Readiness Category	DRC	Dep	Nominal	Binary	0 = DRC 2, 3, 4 1 = DRC 1
Personal Characteristic	Age	Age	Ind	Ratio	Continuous	Years (0-99)
Personal Characteristic	Gender	Gender	Ind	Nominal	Binary	0 = Female 1 = Male
Personal Characteristic	Rank	Rank	Ind	3 Dummy Variables	Categorical	0 = E1-E5 (reference) 1 = E6-E9 2 = O1-O3 and W01-CW2 3 = O4-O10 and CW3-CW5
Personal Characteristic	Substance Use	SubUse	Ind	3 Dummy Variables	Categorical	0 = No use (reference) 1 = Smokeless tobacco 2 = Tobacco 3 = Both tobacco products
Time Period	Exam Date	GFC_IND	Ind	Nominal	Binary	0 = Prior to GFC 1 = Post GFC

Results

According to the Omnibus Tests of Model Coefficients (Step 1), the overall test of the model used in our study is statistically significant since the p-value was well below the .001 level and less than our stated alpha significance level of .01. In addition, the Block and Model significance results indicate a similar p-value of less than .001. Since our model was significant, we proceeded to evaluate the associations of the dependent variable with the independent variables from the model. Our classification table presented an overall percentage of 92.8%, indicating the amount of cases for which the dependent variable was correctly predicted in the model. Of our sample of 222,090 soldiers, 206,099 were correctly predicted by this method. Furthering the validity of the model, the Wald chi-square test is significant and shows that the constant does not equal zero, and that our predictor variables have an effect. Additionally, the “Variables in Equation” table reported significance values for each independent variable that was well below our stated level of significance. Considering these results, we are able to confidently

assert that all of our independent variables observed in the model have a statistically significant association with the dependent variable “DRC class.”

Table 2

Model Significance

	df	Sig.
Step	9	0.000
Block	9	0.000
Model	9	0.000

Table 3

Regression Results

Variable Name	Beta	Standard Error	Wald	Odds Ratio	<i>p</i>	99% C.I.	
						Lower	Upper
GFC_IND	1.82	0.023	6050.871	6.172	0.000	5.811	6.556
Senior_Enlisted	0.275	0.026	114.450	1.317	0.000	1.232	1.407
Junior_Officers	0.477	0.027	319.287	1.612	0.000	1.505	1.727
Senior_Officers	0.664	0.034	373.477	1.943	0.000	1.779	2.123
Tobacco_SL	-0.231	0.035	44.548	0.794	0.000	0.727	0.868
Tobacco_Smoke	-0.257	0.025	104.675	0.773	0.000	0.725	0.825
Tobacco_both	-0.349	0.059	35.401	0.706	0.000	0.607	0.821
Sex	-0.187	0.022	68.952	0.830	0.000	0.783	0.879
Age	0.021	0.001	264.965	1.021	0.000	1.018	1.025
Constant	-4.51	0.049	8622.138	0.011	0.000		

Our key independent variable “GFC Indicator” was significant in the model, and represented the largest association among all the other independent variables that were measured in our study. We can interpret this association through both the odds ratio and the Beta value reported in Table 3 of our SPSS output. The independent variable (GFC_Ind) signifies that a soldier was over six times more likely to be classified as DRC 1 post implementation of the GFC program. This independent variable also had the largest Beta value, which confirmed that it was the most influential in the model, and speaks directly to our research question confirming an association of the GFC program with increased numbers of soldiers in DRC 1.

The independent variable of “rank” also had a significant impact on dental wellness. As discussed in the methods section, we utilized three dummy variables to determine if there was any association with rank; in this study, rank serves as a proxy representation of socio-economic status. Our reference group for “rank” was junior enlisted personnel (E1-E5) due to the number of records in this category (approx. 120,000). Each of the rank dummy variables had odds ratios varying from 1.317 to 1.943 and corresponding Beta values demonstrating an association with DRC. Simply put, the higher rank in either the enlisted or officer military hierarchy resulted in greater associations with the attainment of DRC 1.

The literature reviewed for this study does indicate that patients with incomes in close proximity to a poverty status have worse overall dental outcomes, and we believe that there is a link between the published literature and our study, but it is not a clear parallel. Junior enlisted personnel generally have an enhanced level of stability concerning their income and basic housing needs that most civilians lack; however, individuals with lower levels of income may make inherently less healthy decisions regarding their diets, and this behavior is likely present in both the military and civilian community. Dietary choices can influence the advancement of dental caries, which could adversely affect the attainment of either DRC 1 or the likelihood that a soldier will receive a GFC appointment.

Tobacco use had a demonstrable negative impact on the achievement of DRC 1 in this study. Soldiers that engaged in both types of tobacco use (smoking and smokeless tobacco) were almost 30% less likely to be classified as DRC 1. Additionally, personnel that used either tobacco product (independently of each other) had adjusted odds ratios of either 20% or 22% less likely to be classified as DRC 1. The supporting literature confirms our findings that tobacco use negatively impacts oral health. There are myriad negative health impacts associated with

tobacco use published in an enormous breadth of literature and this study can confirm those negative associations. In particular, our study documents that tobacco use is associated with a lowered state of oral health, measured in dental readiness classification.

Gender was also associated with DRC in our study, and females were 17% more likely to be associated with DRC 1 in our sample. This also parallels the trends in the literature available; the summation of the literature tended to present that women were more likely to use preventive care in the Vaidya et al. study. We cannot conclusively say that women were more likely to use preventive care in our sample, but the greater association with DRC 1 is the final product of a higher likelihood to maintain greater maintenance and preventive care practices. Again, this finding parallels the literature to an extent and establishes another connection with civilian trends and active duty military member practices.

Age was also significant in this model, but proportionally it offered the least association (2%) with the dependent variable; however, this is interesting because our findings differ from existing studies that link age with dental health. Holding all other independent variables constant, our interpretation of the odds ratio for age is that the odds of being DRC 1 are 1.021 times higher for soldiers one year older compared to those one year younger. Another aspect to consider in examining the results from the age independent variable is that we have demonstrated the independent variable “rank” is strongly associated with DRC classification, and promotion can be attributed to increases in age. A soldier simply cannot reach certain career milestones without accruing a substantial amount of time in service, which would result in older personnel populating the upper ranges of the rank structure. The other overarching premise is simply that annual dental exams are a requirement for all personnel on active duty. There is no parallel policy or practice in the civilian population, beyond general recommendations to see a dental

professional annually. The military policy for this annual examination certainly contributed to increased use among our sample, regardless of age, and explains the difference between the existing literature and our results.

According to the variables in the equation output table, we are able to derive the equation for association of the dependent variable with each of the independent variables. Where p is the probability of being DRC 1, we can express our logistic regression equation as:

$$\text{Log}(p-1p) = -4.510 + 1.820*\text{GFC_Ind} + .275*\text{Senior_Enl} + .477*\text{Junior_Off} + .664*\text{Senior_Off} \\ + -.231*\text{Tobacco_SL} + -.257*\text{Tobacco_Smoke} + -.349*\text{Tobacco_Both} + -.187*\text{Sex} + .021*\text{Age}$$

The statistical assumption that was generated from the logistic regression was checked and found to be satisfactory. Multi-collinearity is not a concern in our study since our correlation matrix indicates that we do not have a Pearson's r -value greater than 0.9 among any of our independent variables. Standard errors were eliminated by ensuring that we did not have any missing data and that none of our predictor variables were perfectly correlated with the dependent variable. Finally, none of the independent variables had an adjusted odds ratio of one, or a confidence interval that included a value of 1, which would have invalidated the results for a variable.

Discussion

The results of our study demonstrate that there is a significant association between attainment of DRC 1 and the implementation of the GFC program. Each independent variable assigned demonstrated a statistically significant association with the dependent variable. Specifically, the results are in concurrence with the available literature, indicating that age, gender, and tobacco use have an impact on dental wellness.

There were several limitations in this study. The first of which was the lack of visibility of the GFC campaign at the individual appointment level. DENCOM has stated that the overarching goal of the GFC program is to increase the number of soldiers that attain DRC 1. Army Dental Command believes that the inception of the GFC program will enhance overall dental health, and will lead to less restorative procedures in the Army population. It is essential that DENCOM incorporates a tracking mechanism to identify specific GFC encounters. This level of detail will be necessary to conclusively associate the GFC program with increased soldiers attaining DRC 1.

An additional complexity that we encountered was simply that each clinic has limitations in providing the all-in-one appointment for every patient. This shortcoming may be due to a variety of issues to include staffing shortages or complicated dental illness at the soldier-level. As stated above, the ability to verify that an individual appointment was a GFC appointment could concretely associate the program with increased readiness. We recommend that individual dental clinics begin to collect data on GFC appointments for use in a continuation of this study or in future research.

Another limitation of our study concerns the timeframe of the observations, both pre and post-GFC implementation. Our data consists of every dental appointment for three-month periods both before and after GFC implementation. A larger sample size on either side of the intervention would have provided further validation of the results we obtained, or it would have lessened the stronger results we observed in our data set.

The Army's drawdown of combat operations in Iraq and Afghanistan over the past few years may be a credible threat to the internal validity for this study. With fewer soldiers deploying in support of contingency operations, there is more opportunity for individuals to

maintain dental health and subsequently achieve DRC 1 at a higher rate than during the busier periods of the Global War on Terror. It is possible that the increase in DRC 1 in the post-test group was influenced not only by the implementation of the GFC campaign, but also by the drawdown of the wars in Iraq and Afghanistan. We recommend that deployment information be recorded and incorporated into future research into this subject, especially if the timeframe is the same.

Additionally, a threat to internal validity is the coding of Dental Readiness Class at the clinic level. It is possible that an individual soldier's DRC could be entered into the database incorrectly, unbeknownst to the patient. A mistake such as this is remedied once the aforementioned soldier realizes his/her readiness has not been updated. However, any data pulled on DRCs before the code is changed will give an inaccurate reflection of overall readiness at the unit level. It is also unknown if any coding corrections will result in a new observation, a change in the existing data field, or if it will impact the validity of the entire record.

Another threat to internal validity is the transparency and availability of readiness data to dental clinics, unit commanders, and individuals. Increased capabilities of information systems have afforded stakeholders with instant visibility on dental readiness statistics. We must acknowledge that this level of transparency and increased access to information contributed to the rise in DRC 1 in the post-test observation group.

Another limitation for this study was the dearth of available literature concerning any of the military branches and dental readiness. There are very few published studies analyzing dental readiness in the contemporary military forces. Our literature review focused on the available published research with any inferences that could be attributed to the independent variables utilized in this study. Additional published studies covering military dental readiness

and wellness would have been beneficial in making inferences about the data. Therefore, this study should serve as foundational research for continued analysis of the effects on dental readiness in the Army.

Conclusion

As previously mentioned, the implementation of GFC has demonstrated an association with the number of soldiers that have attained DRC 1. It is clear that the program has had some beneficial impact on the oral health of soldier in the Army; however, we cannot conclude that GFC was the predominant factor that contributed to this enhanced level of health. The aforementioned sections briefly discussed limitations to our study, and the chief limiting factor was the lack of data about the specific appointment type during a patient encounter. This level of detail could conclusively demonstrate or dispel that GFC was the overarching factor in the enhanced readiness of soldiers.

Army Dental Command has provided us with a sample of records that corresponded with timeframes before and after the implementation of the program, and our results confirm their internal statistics about the reduction of procedures required by soldiers after the GFC program was put into full effect. Furthermore, our results concur with our original hypothesis that the implementation of the GFC program is positively contributing to dental health.

This study also contributes to the vast array of literature that confirms the link between tobacco use and negative health outcomes. We were not surprised to find that personnel that used tobacco products were less likely to be classified as DRC 1. What was particular enlightening was the odds ratio attributed to male personnel that used smokeless tobacco compared to female personnel. The incidence of the use of regular tobacco products (cigarettes) was split fairly evenly between the two genders (within a 2% odds ratio). The literature we

found supporting this study indicates that tobacco use in the US is on the decline; however, there was no specific information concerning the trend of tobacco use in military personnel. It is clear that soldiers continue to use tobacco for a variety of reasons, but what remains somewhat mysterious is the use of tobacco despite the plethora of cessation programs and mass media present that actively campaigns against the use of tobacco.

This study can readily support policy changes at dental clinics and in Army units. Dental clinics will be able to use this study to support the unconfirmed data present relating health outcomes to the implementation of GFC; Go First Class can be attributed to some of the positive impacts that have occurred in readiness over the last year, but unfortunately, we cannot commit to any greater association or prediction based upon our results. Our study also has implications for personnel assigned to dental clinics, who might be more apt to meet internal challenges such as staff shortages with the understanding that their work is increasing readiness levels. Additionally, Army commanders can also draw some initial conclusions about the increases in soldiers attaining DRC 1 through the implementation of GFC. Commanders will have additional evidence to ban or limit the use of tobacco products for soldiers under their command, and can even target specific ranks of soldiers when promoting wellness in the unit.

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