

## **Devising a Manpower Model from USAF Recruit Dental Needs**

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### **Abstract:**

With a continued focus on readiness, safety, continuous process improvement and efficiency, regular reviews of staffing models must be performed to best allocate staff and resources, provide required care and ensure mission dentally ready Airmen. **Objective:** The objective of this study was to explore a potential new staffing model by using existing data from the 2018 Air Force Recruit Oral Health Study (AFROHS) and applying existing USAF dental provider practice patterns. **Methods:** Average time to complete procedures as well as Current Dental Terminology (CDT) code-based practice patterns for each type of dental specialty were extracted from historical data collected by the USA Corporate Dental Application database (CDA). These data and patterns were then

applied to data from the 2018 US Air Force Recruit Oral Health Surveillance Study which provided the types and quantities of existing treatment needs of 1,216 incoming recruits. **Results:** Meeting all identified treatment needs of 10,000 recruits within 180 days would require 35 General Dentists, 14 Oral and Maxillofacial surgeons, 8 Prosthodontists, 6 AEGD-1 trained dentists, and other disciplines. **Conclusions:** A new potential staffing model is similar to the current model with an emphasis on the role of general dentists. Additionally, this study illuminates the fact that general dentists historically perform 74% of specialty procedures which is critical in the effort to ensure readiness. It also offers a provider mix necessary to meet the needs of 10,000 recruits in 180 days. This study is limited by the fact that only cross-sectional data were used therefore should not be used to predict future ongoing dental treatment requirements. Also, only data from enlisted recruits, and not officers, was available, although the latter typically have fewer dental needs upon entry into the Service. These findings do not suggest policy, but could offer leadership some evidence in the context of this study to support decisions in manpower allocations.

## **Background**

The primary mission of dentistry in the military is “Achieving superior oral health and global readiness through safe, effective, and patient-centered care.”<sup>1</sup> A critical component of this mission includes ensuring appropriate numbers and types of oral health providers are available to meet the oral health needs of the service members. Ideally, this means being able to identify oral health needs and predict manning and resource requirements. The U.S. Department of Defense (DoD) has sponsored surveys, studies, or surveillance

activities to evaluate Dental Readiness Class (DRC), oral health status, and subsequent dental treatment needs of incoming recruits in 1994 <sup>2</sup>, 2000 and 2008. <sup>3</sup> Most recently, the Air Force sponsored a survey for its recruits in 2018. Recruits are examined because they represent trends in oral health status from the general, non-institutionalized public and they are the incoming population for which future needs potentially will need to be met by the DoD for the longest period of time.<sup>4</sup> From the 1994 study, the U.S. Air Force developed a model and standard of manning in 1997 which is still used today; it was designed to meet the needs at that time, but it has not been updated since.<sup>5</sup> The current model for Air Force manning is population-based. For every 650 active duty, one general dentist is provided. At training bases, the ratio is one dentist per 2000 students. Overseas locations have slightly differing ratios when dependents of active duty members need to be treated, but the method is the same. Once a base has nine general dentists, specialists are added incrementally, starting with periodontists and prosthodontists.<sup>6</sup>

Developed in 1997, the current Air Force dental manning model may not be suited to changes that have occurred in oral health in the United States. Rozier et al. described a decline in untreated caries in 6-11 year olds from 1988-1994 to 2011-2012.<sup>7</sup> Those who were 11 years old in 2012 would be in the age group of incoming Air Force recruits, who had a median age of 20. Given such trends, a review of the Air Force dental manning model would be indicated. The aim of this study was to examine the treatment needs of a representative sample of Air Force recruits obtained over the span of twelve months and determine whether or not the existing dental manpower model could be adjusted to meet those needs in a more efficient manner. According to 2011-2016 National Health

and Nutrition Examination Survey (NHANES) data, the prevalence of caries (having a history of decayed, missing or filled teeth) was 82% in 20 – 34 year olds, and 92.5% in 25 – 49 year olds.<sup>8</sup> These two age groups capture the Air Force recruit population entering between Feb 2018 and Jan 2019, with the median age being 20 years old and a range of 17 – 37 years. The prevalence of dental caries in the 2018 Recruit Oral Health Surveillance study was 98.3%.<sup>9</sup>

## **Methods**

The 2018 Air Force Recruit Oral Health Surveillance Study was designed to gather data for determining manpower requirements and other aspects of readiness planning.<sup>9</sup> Approximately 33,000 recruits enter the United States Air Force (USAF) annually. The recruits included in the study were randomly selected upon reporting for their in-processing dental screening. During the surveillance study, 1,216 were randomly selected for the study to achieve a statistical power of 80%, a margin of error of 4% and a 95% confidence interval. It is important to note that a random number generator was used to select the recruits, but each recruit selected was asked to volunteer and the selection process was engineered to account for recruits declining to participate. Prior to data collection, all examiners attended a 3-day calibration course. Also, to avoid seasonal bias, near equal numbers of recruits were examined each month from February 2018 to January 2019. Females, Reserve and Air National Guard recruits were oversampled to increase precision of population estimates in these groups. Weighting factors were Service Component and gender. Clinical examination findings were recorded in a software program written specifically for the data collection. Oral pathology,

temporomandibular dysfunction, malocclusion, removable prosthetic needs, edentulism, periodontal health—as recorded by PSR (periodontal screening record), restorations, and other dental treatment needs were recorded as well as the corresponding dental readiness class (DRC) for each.<sup>10</sup> From this study, which included a comprehensive intraoral clinical examination accompanied by panoramic and bite wing radiographs, the type and volume of treatment needed by the recruits was gathered. From this information, the frequency of findings in each treatment category was calculated and the mean number of units needed per recruit was determined (Table 1). For operative, a single restoration amounted to one unit. For oral surgery, a tooth indicated for extraction equated to one oral surgery unit. For fixed prosthodontics, a planned crown, abutment, or pontic was considered a single unit. For endodontics, a single root canal procedure was considered a single unit. For periodontal treatment, the single unit was more involved. The decision to indicate that the average recruit needs one prophylaxis was based on the mode Periodontal Scoring and Reporting (PSR) score of 2, for which a prophylaxis is usually indicated, with 17.3% of recruits having a PSR score higher than 2 and 6.4% of recruits having a PSR score less than 2. Hence, a prophylaxis was considered as a single unit of periodontal treatment. Additionally, 4.1% of recruits were identified as needing periodontal therapy that placed them in DRC 3—or nondeployable—status. For this population, the code D0180 representing a comprehensive periodontal evaluation and the entire D4000 series which represents periodontal therapy was included. For orofacial pain, temporomandibular disorder (TMD), orthodontic and oral diagnostic treatment needs, a positive finding indicated the need for a consultation only, but no treatment would be suggested by the exam. Therefore, the frequency of these referrals was calculated.

**Table 1: Recruit dental needs from the 2018 Air Force Recruit Oral Health Survey**

<b>Recruit Dental Needs</b>	
<b>Discipline</b>	<b>Average Number of Units/Recruit</b>
<b>Entrance exam</b>	1
<b>Prophylaxis</b>	1
<b>Operative</b>	1.4
<b>Oral surgery</b>	1.3
<b>Fixed Prosthodontics</b>	1.7
<b>Endodontics</b>	0.1
	<b>% of Recruits Needing a Consultation</b>
<b>TMD</b>	0.3
<b>Orthodontics</b>	14.3
<b>Oral Diagnosis</b>	4.1
<b>Periodontics</b>	4.1

The next step in determining what compliment of providers would best meet the recruit needs was to determine which providers historically perform various types of procedures. This information was obtained from the U.S. Army's Corporate Dental System (CDS), which retrospectively provided Current Dental Terminology (CDT) codes claimed by each type of provider across the entire Air Force over the same time period as the recruit oral health study. CDT codes were selected from workload history which represented the same types of needs found from the surveillance study to determine which type of provider would contribute to each type of need. For an entrance exam, the codes representing a new patient exam, bitewing radiographs and a panoramic radiograph were selected. For the operative category, the CDT D2000 series (with the exception of the D2700 codes) was used which represents general restorative procedures such as "fillings" and single-unit crowns. For fixed prosthodontic treatment, the entire D6000



**Note: OMFP=Oral and Maxillofacial Pathologist; OMFR=Oral and Maxillofacial Radiologist; OMFS=Oral and Maxillofacial Surgeon; OPA=Oral Preventive Assistant; TMD=Temporomandibular Disorder; Prophy = periodic standard dental cleaning; Oper = operative dental treatment**

This same database was queried to identify the average duration of appointment that providers would book when a specific CDT code is claimed. This same consolidation of codes (e.g. D3000 for endodontics) was used to estimate time requirements for each recruit by a provider of any type. A few estimates had to be made, particularly for a new patient exam and for a prophylaxis as these are procedures that seldom claim a single code and thus could not be provide a time estimate, as seen in Table 3.

**Table 3: Time estimates per procedure based on historical scheduling from CDA**

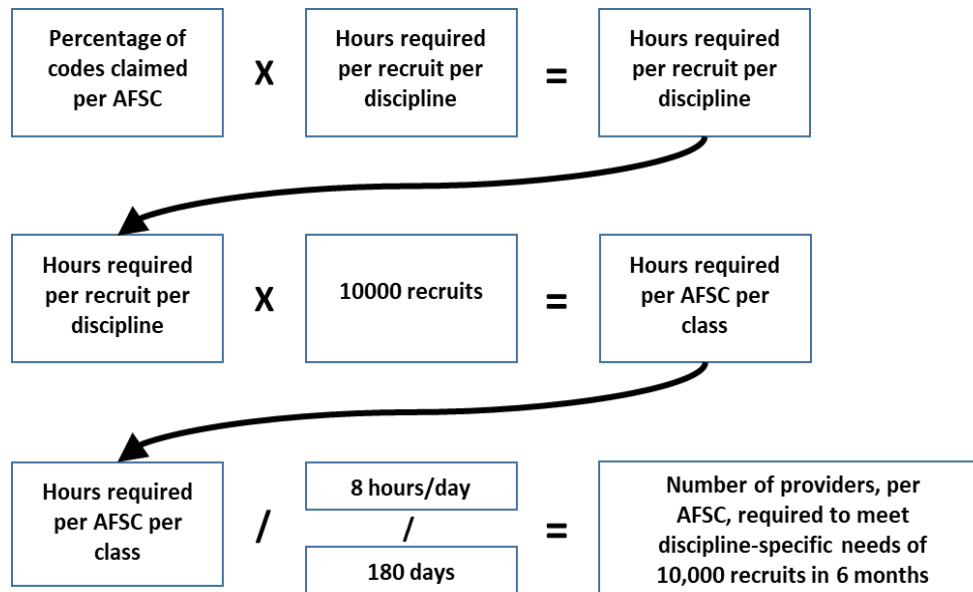
Procedure Categories			Average Duration in Minutes
D0150 New exam	D0274 bitewings	D0330 panograph	60
D1110 prophylaxis	D1330 OHI	D0330 Fluoride	60
D2000 series Average across operative			102
D3000 Average across endodontics			135
D7000 series Average across oral surgery			117
D6000 series			111



<b>Average across fixed-prosthetics</b>	
<b>D99202 TMD consultation</b>	120
<b>D9310 Average orthodontic consultation</b>	34
<b>D0000 series Average oral diagnosis evaluation</b>	30
<b>D0180 + D4000 series Periodontal evaluation and treatment</b>	120

Using the information from recruit dental needs and historical data about provider contribution to procedure types and duration of appointments, a provider mix developed which could most efficiently meet all of the identified needs of a theoretical group of recruits in a given period of time (Figure 1). The number of theoretical recruits was expanded to 10,000 and a time frame of 6 months was established to create a stratification of provider type.

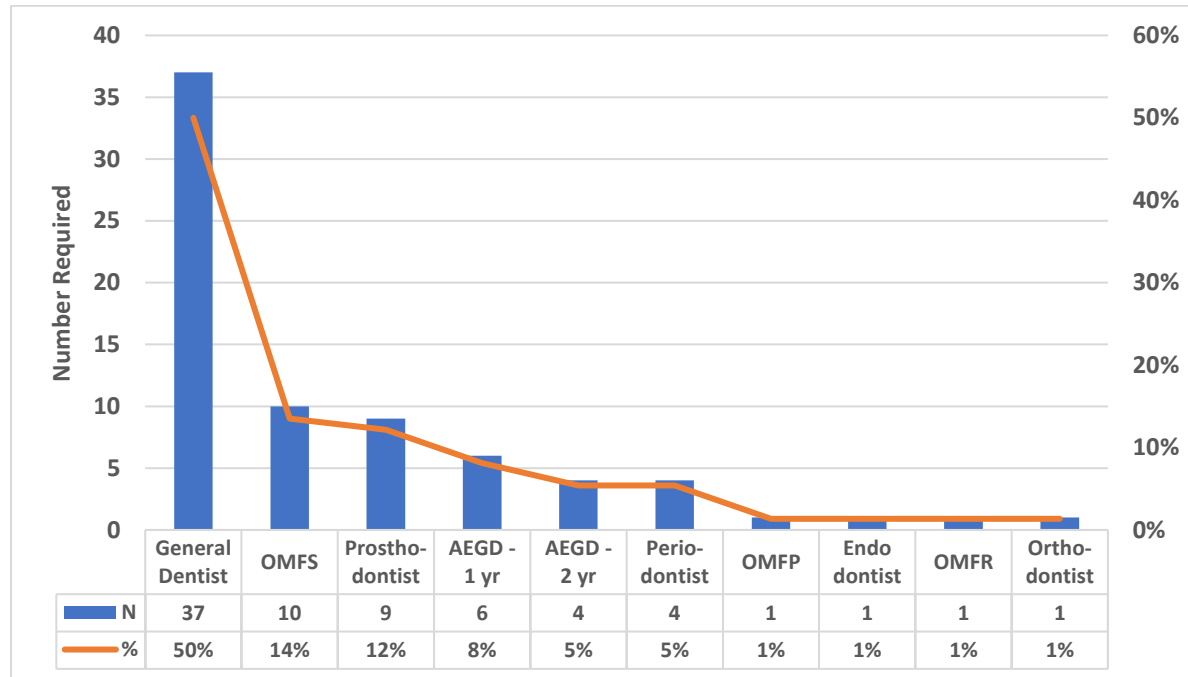
**Figure 1: Method of calculation for provider stratification**



## Results

Meeting the dental needs of 10,000 recruits in 6 months would require 74 dental providers (Figure 2). The majority of these providers are general dentists who comprise 50% (n = 37) of the total provider mix. Oral and maxillofacial surgeons (OMFS) are the second most needed and make up 14% (n = 10) of the provider mix, followed by prosthodontists who comprise 12% (n = 9). General dentists with one or two years of advanced education in general dentistry (AEGD-1 yr and AEGD-2 yr) each comprise 8% and 5% respectively of the provider mix. Because there can be overlap in the clinical care provided between AEGD-1 yr dentists and general dentists, adding the two together would be clinically practical which would suggest routine general dentistry would comprise 55% of the provider mix. Periodontists made up 5% of the required provider mix followed by oral and maxillofacial pathologists, endodontists, oral and maxillofacial radiologists and orthodontists, each of which comprised 1% of the provider mix.

**Figure 2: Providers Required to Meet the Dental Needs of 10,000 Recruits in Six Months**



**Note: OMFS=Oral and Maxillofacial Surgeon; OMFP=Oral and Maxillofacial Pathologist; OMFR=Oral and Maxillofacial Radiologist.**

### Discussion

As would be expected, this analysis indicates general dentists are the most in demand, which likely correlates to predominance of general restorative needs of the recruits. The higher representation of oral and maxillofacial surgeons (OMFS) most likely correlates to the need for extraction of third molars. In the AFROHS, an indication for an extraction was categorized as “oral surgery.” However, in Table 2 it is noted that general dentists perform 39% of oral surgery and OMFS perform 49% of surgery. This is likely explained by the fact that general dentists are often credentialed to perform most routine extractions

as well as extraction of erupted third molars. In contrast, OMFS providers are likely to perform more complex extractions and other less frequent or more time-consuming surgical procedures, which would reduce the proportion of their contribution to “oral surgery” procedures.

In the period assessed, of all the codes that were claimed by any type of provider, general dentists also claimed 74% of these codes. This implies that general dentists within the Air Force perform an assortment of specialty-type procedures and this has shown to be critical in the effort to ensure readiness, but for the sake of this study, it de-emphasizes the need for specialists—with the exception of prosthodontists. The increased need for prosthodontists can be attributed to an observed difference amongst recruits from previous studies in having a greater need for fixed prosthodontic treatment, or crowns. This may reflect a trend toward implant restoration or improved endodontic procedures resulting in retention of teeth needing cuspal coverage. In contrast, no recruits were identified to have a need for removable prosthodontic treatment, which is not surprising given the recruit median age of 20. However, removable prosthodontic treatment is still needed at times for tooth replacement, temporary measures during longer treatment plans, and restoration of function after trauma or disease. Indeed, during the same time period of the AFROHS, 52 prosthodontists only completed 396 (36%) of removable procedures (D5000-5899) versus 583 dentists (A, C, and general dentists) who completed a total of 64%. Still, removable prosthodontic procedures comprised only 0.03% of all dental procedures performed in the Air Force.<sup>11</sup> The utilization of Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) dentistry within the U.S.

Military complicates data compilation for an assortment of reasons. Historically, any tooth having had a root canal requires cuspal coverage treatment for the servicemember to be considered deployable. Historically, this was either a 4+ surface amalgam or a crown, both of which are considered operative treatment. CAD/CAM procedures can be coded with a variety of new codes and considerations, of which are specific to the military and are not uniformly documented across the enterprise. Additionally, due to a gradual transition to a new electronic health record at the time of this study, not all procedure codes are captured predictably.

Another specialty that is likely de-emphasized is periodontics. In the AFROHS, advanced periodontal needs were deemed a reason for placing a recruit into class III—or nondeployable—in 4.1% of recruits. The majority of periodontal needs would be met with a dental prophylaxis, but 4.1% required not only a prophylaxis but also a comprehensive periodontal evaluation and treatment ranging from scaling and root planning to flap osseous surgery. The unknown range of treatment complicates projecting treatment needs. Oral and maxillofacial pathology (OMFP) and oral and maxillofacial radiology (OMFR) were not eliminated despite minimal direct patient care. This can be attributed to the bridge between recruit needs and the historical production of these provider types. There were a number of recruits with identified oral pathology concerns, and Air Force guidelines require OMFR involvement for certain types of two- and three-dimensional imaging.<sup>12</sup> When this is combined with how these providers have coded their workloads, these two disciplines indeed contribute to readiness despite not often having direct patient contact. Although included in Table 2, pediatric dentists were not included in the results

and Figure 2 because pediatric dental needs were not relevant to the data collection during the AFROHS and pediatric dentists would not feasibly contribute to accomplishing recruit dental needs. However, there is a role for pediatric dentists in the Air Force, primarily in overseas locations supporting family members needs as well as stateside supporting residency training programs.

The proposed staffing model is similar to current manpower models which emphasize the role of general dentists and their ability to perform some procedures sometimes deemed as specialty procedures. In the Air Force Dental Service, incoming general dentists are almost always entered into an Advanced Education in General Dentistry residency for one year (AEGD – 1 yr) if not into other specialties. The AEGD – 1 yr training allows them to be credentialed for procedures some general dentists may deem “specialty” procedures, altering the traditional practice pattern of a general dentist.

Studies have been performed to critically evaluate practice patterns of civilian dentists as well. For example, Solomon, et al. determined that 90.6% of civilian general dentists over a four-year period coded for molar endodontic therapy, which could be considered a specialty-type procedure.<sup>13</sup> Within the Air Force, only 54.2% of molar endodontic therapy procedures were performed by A (AEGD – 2 yr), C (AEGD – 1yr), or General Dentists. The same study showed that 93.4% of civilian general dentists did *not* code for a single periodontal osseous surgery procedure over the same period, which was attributed, in part, to dental school competencies.<sup>13</sup> This is in contrast to the Air force where 43.3% of all periodontal osseous surgery procedures were performed by either A, C, or General

Dentists. Factors for disparity amongst military versus civilian general dentists could include disincentives from managed care for civilian general dentists making referrals, as well as the age and health status of the patient population. Also, military dentists are trained in a manner that fulfills the mission of supporting readiness which requires the ability to perform a broader scope of procedures should they be assigned to a smaller clinic or more austere environment. Cottrell et al. reported a much higher rate of referral amongst general dentists—regardless of the treatment required—when complicating medical history was involved.<sup>14</sup> While not all members of the Air Force are devoid of chronic health conditions, the population is generally understood to be younger and somewhat healthier than their civilian counterparts.<sup>15,16</sup> A study by Cobb et al. would suggest the opposite regarding referral frequency, where it was found that over a 20 year period, periodontal disease is notably worse amongst the general population but referrals to periodontists have been reduced. The authors postulated that student loan debt was a contributor for new dentists slowing down referrals.<sup>17</sup> In the military healthcare system, income is not reduced by making referrals to other providers, though the availability of specialists, particularly in remote locations, may influence the number of referrals generated.

This manpower model does not necessarily reflect the most efficient system of care delivery and should not be taken as such, as a study of the dental clinics at the Department of Veterans Affairs demonstrated that increasing the assistant to dentist ratio was the most influential factor in raising productivity.<sup>18</sup> This study did not consider the support staff at all, nor did it weigh the amount of time providers within the military have

devoted to duties other than healthcare delivery. The existing manpower model consisted of an initial dentist to patient ratio of 1:650. The manpower model in this analysis indicates a ratio of 1:125. This may be attributed to the fact that appointment durations were included in the analyses. Financial profit is not a driving factor in the scheduling of Air Force dental care, although procedure productivity is a critical metric frequently evaluated. Administrative procedures, comprehensive documentation, and extensive infection control and infection preventive measures each contribute to longer appointment times than may be clinically necessary and staggered booking of multiple patients for one provider could not be accurately ascertained for this study. Both of these factors likely alter the dentist to patient ratio to a less efficient estimation.

It must also be noted that recruit dental needs are a cross-sectional assessment of dental needs upon entry into the service, and they are not the only population served by military healthcare providers. While the dental needs upon entry have an established correlation to continuing dental treatment needs,<sup>19</sup> they do not reflect indications for additional treatment later in a member's career, particularly in the case of full mouth rehabilitation, replacement of old restorations, trauma, and periodontal disease. Also, the current study is based on the dental needs of enlisted recruits; the compliment of incoming military officer dental needs was not considered in this study.

Another critical limitation of this study is the lack of separating orofacial pain as a specialty from other Air Force Specialty Codes (AFSC) in the CDS, thus it cannot be stratified against other providers using this method.



## **Conclusions**

This study offers a provider mix necessary to meet the needs of 10,000 enlisted recruits in 180 days. General dentists with or without advanced training in general dentistry were the most commonly indicated provider type based on recruit dental needs and historical practice patterns. They historically have performed many procedures that may be deemed specialty procedures, thereby de-emphasizing the need and role of certain dental specialties. These findings suggest a less efficient model than is currently used, which is likely attributable to limitations associated with obtaining accurate historical appointment scheduling factors. These findings do not suggest policy, but could offer leadership some evidence in the context of this study to support decisions in manpower allocations.

## **Disclaimer**

The views expressed are those of the authors and do not reflect the official views or policy of the Uniformed Services University, Department of Defense, or its Components. The authors do not have any financial interest in the companies whose materials are discussed in this abstract.

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