Research Report

AVERY CALKINS, TIFFANY BERGLUND, DAVID SCHULKER, LOUIS T. MARIANO

Benchmarking Demographic Diversity in Air Force Functional Areas Against Near-Equivalent Civilians

The Air Force Occupational Diversity Benchmarking Workbooks

The Department of the Air Force (DAF) has placed a strategic focus on improving talent management, including how to build a diverse, equitable, and inclusive workforce. To support the DAF's efforts, in fiscal year (FY) 2021, the RAND Corporation's Project AIR FORCE was asked to (1) provide targeted benchmarks and a planning tool that will allow DAF to evaluate the demographic composition of the active-duty workforce overall and functional areas within this workforce and (2) identify practices and opportunities that the DAF can use to support diversity in critical career fields. This report is one of a series of five reports meant to address these tasks. As part of the first objective, we developed benchmarks for the gender and racial and ethnic diversity for a comprehensive set of DAF career fields and functional areas. We consider this report to be a companion to prior research and emerging research in this series, which benchmark the gender and racial and ethnic distribution of DAF accessions against the popula-

KEY FINDINGS

- A study on demographic diversity in each Department of the Air Force (DAF) functional area—using civilians in a small group of similar occupations, a broader group of similar occupations, and the entire civilian labor force in a nationally representative survey of the U.S. population—reveals that demographics are idiosyncratic to individual occupations, and the appropriate comparison group of civilians varies by occupation.
- The demographics of DAF occupations tend to be relatively similar to the demographics of matched civilian occupations.

Abbreviations

AAPI	Asian American and Pacific Islander
ACS	American Community Survey
AFSC	Air Force Specialty Code
CIP	Classification of Instructional Programs
DAF	Department of the Air Force
DMDC	Defense Manpower Data Center
DoD	U.S. Department of Defense
DT	Development Team
FAA	Federal Aviation Administration
FY	fiscal year
SOC	Standard Occupational Classification

tion of youth who are eligible to serve in the DAF. The benchmarks provided in this report should be used in combination with benchmarks at accession to the DAF. Accurate benchmarks are essential to providing context to observed disparities in diverse representation and analyzing barriers to participation. However, DAF was lacking a formal method for creating career field benchmarks using near-equivalent groups of civilian workers. In this report, we describe the construction of career field benchmarks, provide examples using several functional areas, and discuss considerations for interpreting these results. Accompanying this narrative, we have created the Air Force Occupational Diversity Benchmarking Workbooks, a pair of Excel workbooks (one for enlisted personnel and one for officers) containing benchmarks for the demographic distribution of DAF functional areas. The workbooks contain information on the gender and racial and ethnic distribution of each three-digit Air Force Specialty Code (AFSC), each two-digit AFSC for enlisted personnel occupations, and each competitive category for officers.[1] The demographic diversity of each of these AFSCs is, in turn, benchmarked using individuals in a small group of occupations, a broader group of occupations, and the entire civilian labor force in a nationally representative survey of the U.S. population.

Occupation-Based Benchmarking for DAF Functional Areas

U.S. regulatory policy affirms the importance of the occupation dimension in an organization's approach to barrier analysis. Management Directive 715, which guides federal agencies on how to create effective equal opportunity programs, requires agencies to annually assess their gender and racial and ethnic makeup by major occupation category (U.S. Equal Employment Opportunity Commission, 2003). Occupation-based benchmarks are essential to understanding equal opportunity because (1) organizations need different labor inputs depending on their missions and (2) the labor force working in each occupation differs by gender (Blau, Brummund, and Liu, 2013) and race and ethnicity (U.S. Bureau of Labor Statistics, 2019). These patterns of occupational segregation by gender and race and ethnicity also extend to the military (Armor, 1996; Firestone, 1992). Furthermore, an organization's policy options for mitigating barriers often depend on the occupation dimension, because many recruitment policies and requirements are tailored to occupation groups or functional areas and because opportunities to work in higher paygrades relate strongly with occupations (Keller et al., 2020). Thus, an occupation-specific analysis is critical to understanding and addressing barriers to gender or racial and ethnic diversity.

Within the DAF, Development Teams (DTs) are responsible for reviewing the demographic makeup of each functional community and conducting "gap and barrier analyses to address any negative trends" (Air Force Instruction 36-2640, 2018). Such analyses are meant to identify "employment practices" that "hamper the advancement" of personnel on the basis of a protected class such as gender or race and ethnicity (Air Force Instruction 36-205, 2016). DTs are the prime construct that DAF uses to ensure officers acquire the necessary skills and experiences to meet future requirements (Air Force Instruction 36-2640, 2018). A DT is a group of functionally aligned senior leaders who are responsible for members in each career field. For example, all pilots are under the functional authority of Headquarters Air Force A3; the Deputy Chief of Staff for Operations, Plans, and

Requirements designates a chair (typically O-6 or higher), who then identifies a set of development stakeholders, such as career field managers or major command functional leaders, to make up the DT. A recent independent analysis of racial and ethnic disparities by the DAF Inspector General found that DTs are not thoroughly executing their responsibility for reviewing demographic distributions and analyzing gaps and barriers (DAF Inspector General, 2020). Benchmarking resources are a key input into barrier analysis.

The military services use highly customized occupation definitions, so factoring occupations into a benchmark with an external population, such as workers in the civilian labor force, requires a rule for drawing equivalence between occupations in the two populations, often referred to as an occupation crosswalk. Researchers create these occupation *crosswalks* through a variety of methods. The most inexpensive (but also the most imprecise) methods rely on simple comparisons of keywords in job titles or, additionally, keywords in job descriptions. The most comprehensive military-to-civilian occupation crosswalk, maintained by the Defense Manpower Data Center (DMDC), employs the latter of these techniques (Solutions for Information Design, LLC, 2014). The primary flaw in job title and description comparison methods is that they tend to be too specific, missing cases in which civilian jobs might require knowledge or duties that are similar to a military occupation (i.e., is functionally similar), but the civilian job attributes are described using different vocabulary. To achieve a more accurate match, other methods incorporate detailed reviews of all knowledge, skills, abilities, and other attributes required in the jobs, or even surveys of workers in both populations to measure all their job tasks. More complete information on all work performed in each job enables a crosswalk using functional similarity rather than lexical similarity.[2] However, realizing the increased rigor in these more accurate methods requires more development time and resources, and as a result, studies employing these methods have focused only on a subset of high-priority occupations (Solutions for Information Design, LLC, 2014; Wenger et al., 2017).

In sum, an occupation-specific analysis could provide important clues to identifying barriers to demographic diversity and mitigating them. However, decisionmakers must view the results of such analyses in light of the occupational equivalence assumptions, recognizing that all crosswalks are imperfect and that the match quality will vary depending on method and occupation area.

Challenges of Benchmarking Air Force Occupations

DAF personnel differ from the civilian population in several ways. Because of requirements surrounding accession, promotion, and retirement, DAF personnel are younger and better educated, on average, than the U.S. population as a whole. DAF personnel also tend to have a higher likelihood to be U.S. citizens and are employed full-time. Generally speaking, there are gender and racial and ethnic differences in education, age, citizenship, and full-time work, and a benchmark of demographic diversity that does not control for them will be biased. Therefore, any comparison of the demographic diversity of the DAF and civilian population must adjust the civilian labor force so that these characteristics match. In addition, there are various characteristics that affect eligibility to serve in the military, such as physical health, which differ between the two populations and are correlated with gender and race and ethnicity (DeLeire and Levy, 2004). Although, ideally, we would adjust for such characteristics, they are not available in our data and therefore cannot be adjusted for. These differences should be kept in mind when interpreting benchmarks. Finally, propensity to serve in the military is correlated with gender and race and ethnicity and is also unobserved (Lim et al., 2014). However, although differences in propensity to serve likely affect the demographics of the DAF and should be kept in mind when interpreting benchmarks, DAF could influence propensity to serve through targeted outreach to women and underrepresented racial and ethnic groups.

Furthermore, the work of DAF differs in several dimensions from the work done in the civilian labor force. First, DAF personnel require unique

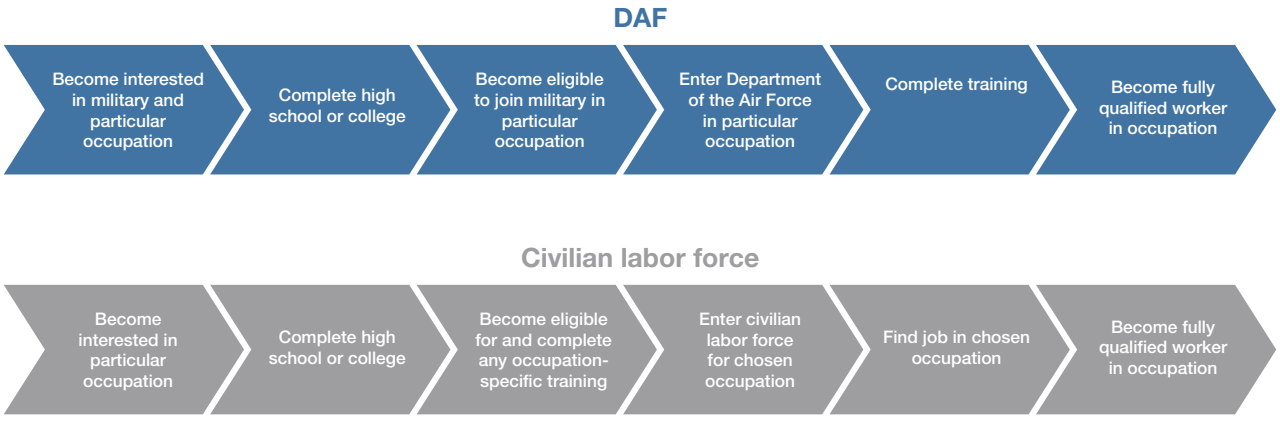
knowledge and skills to perform their jobs, even in occupations that seem nearly identical between the two populations, such as lawyers or criminal investigators. Second, other DAF occupations likely have no civilian counterpart that overlaps with all job attributes (e.g., combat controllers and airborne linguists). Finally, certain occupations, such as explosive ordinance disposal, are so closely aligned to the national security sector that civilian workers in these occupations might not be an independent and informative benchmark. The occupation-specific benchmarks we provide tend to work best when there is a high degree of overlap between DAF and civilian occupation knowledge, skills, and duties and the civilian labor market is not unduly influenced by U.S. Department of Defense (DoD) personnel policies. To provide the best possible information in light of these challenges, we offer policymakers a menu of options with more-general benchmarks available in cases in which no single civilian occupation provides a good benchmark for DAF. As we discuss in the conclusion, the benchmarks we provide in this report should be presented in combination with a qualitative discussion of the differences between DAF personnel and their civilian counterparts.

These differences between the military and civilian labor forces can be organized using the pipeline into DAF and civilian occupations. Flowcharts depicting the pipeline into both DAF and civilian occupations are provided in Figure 1. Some pairs of matched DAF-civilian occupations have more differences in the occupational pipeline than others. Take, as an example, the Judge Advocate General: DAF personnel in this area have similar training and perform similar responsibilities to civilian attorneys. The only major difference between the military and civilian labor force is interest in and eligibility to join the military, and demographic differences caused by differences in propensity to serve could be reduced through targeted outreach to women and racial and ethnic minorities or other initiatives. There are larger differences for pilots, who must complete college before entering the DAF but who do not need a bachelor's degree before entering the civilian labor force. The more differences there are in the two pipelines, the less comparable the two populations will be.

Constructing, Using, and Interpreting the Benchmarks

We use nationally representative survey data on the civilian labor force to estimate the gender and racial and ethnic distribution of groups of civilians who are, by several definitions, considered to be the near-equivalent of personnel in each DAF functional area. The civilian groups are adjusted to account for systematic differences between the DAF and civilian populations.

FIGURE 1
The Pipeline into DAF and Civilian Occupations



Data on Near-Equivalent Civilians

We used nationally representative survey data on the civilian labor force from the 2019 American Community Survey (ACS), provided by IPUMS USA (Ruggles et al., 2020). We make several adjustments to the civilian sample to bring it in line with DAF population. A summary of requirements underlying these adjustments follows (see Department of the Air Force, 2019, for accession requirements):

- Age: between 18 and 60 (inclusive)
- Education: at least high school or equivalent for enlisted personnel and at least a bachelor's degree for officers
- Citizenship: U.S. citizens[3]
- Employment: employed and works at least 35 hours per week
- Veteran status: never served in the military.

The requirements for age, education, and citizenship are meant to bring our civilian sample in line with the requirements to serve. We use only U.S. citizens between the ages of 18 (for enlisted personnel) and 19 (for officers, to match the youngest officer in the Air Force data) and 60 who have levels of education appropriate to the groups of DAF personnel to whom we are comparing them. For enlisted personnel comparisons, we use only civilians with at least a high school (or equivalent) education, whereas for officer comparisons, we use only civilians with at least a bachelor's degree.[4] We restrict our sample to full-time employment because the military is a full-time job, and selection into the labor market (and into full-time employment) is not independent of gender and race and ethnicity.[5] Finally, we exclude veterans from the civilian population to ensure that military policies do not affect the near-equivalent civilian labor force. Although veterans are a small share of most civilian occupations, they make up a relatively large share of civilian aviation occupations, and including them could bias the benchmarks for such occupations.

Our data do not include information on body composition, medical history, criminal background, drug use, or other eligibility requirements not captured in the ACS. Prior research and emerging research in this series provide a discussion on the impact of these requirements on the population eligible to enlist or be commissioned as an officer in the DAF, illustrating how these elements could affect the gender and racial and ethnic distributions of those eligible to serve in important ways (Lim et al., 2014). Data from national surveys provide information on the criteria missing from the ACS, and such information could potentially be incorporated into the benchmarks provided here. Incorporating such additional information into a benchmark would involve accounting for how these measures relate to those present in the ACS, for example, adjusting for criminal background only for the subpopulation that meet DAF education requirements. Given that this work focused on exploring the utility of the occupation dimension in benchmarks for military career fields, the reader should interpret these benchmarks with such limitations in mind and consider enriching them with additional features in future work expanding on the framework for generating functional area benchmarks presented in this report.

Approach to Constructing Benchmarks

Overall, we provide three benchmarks for each Air Force functional area. The first two benchmarks match each Air Force functional area to civilians in occupations or groups of occupations that are similar to that Air Force functional area. As we describe later, these occupations differ in how broadly we define *similar*. In both cases, we compare the gender and racial and ethnic distributions of Air Force and civilian groups, adjusting for education, age, and occupational mix. Our third benchmark compares the gender and racial and ethnic distribution of each Air Force functional area with that of the entire civilian labor force, adjusting for education and age.

Benchmarking Air Force Functional Areas Using Near-Equivalent Civilian Occupations

Types of Near-Equivalent Civilian Occupational Benchmarks

Our base group of benchmarks using near-equivalent civilian occupations uses matches between three-digit AFSC and the Standard Occupational Classification (SOC) system for civilian occupations. The

SOC system is a standardized system used to classify workers into occupations based on the work they perform (i.e., job responsibilities) (Executive Office of the President, 2018). SOCs are produced in four levels: two-digit, three-digit, five-digit, and six-digit. Two-digit SOCs represent very broad groups of workers (e.g., transportation workers), and each successive digit adds specificity: Workers classified under each three-digit SOC are a subset of the workers classified under the corresponding two-digit SOC.

We compare Air Force personnel in each three-digit AFSC with a group of civilians in the ACS with SOCs that are matched to AFSCs using the methods described in the next section.[6] For each AFSC, we provide the following two types of benchmarks:

- Narrow benchmark: A match between Air Force functional areas and five-digit SOC codes
- Broad benchmark: A match between Air Force functional areas and three-digit SOC codes.

An example of the narrow benchmark is a match between fighter pilots (11F) and the five-digit SOC for aircraft pilots and flight engineers (53-201). The corresponding broad benchmark for fighter pilots is a match to the three-digit SOC for air transportation workers (53-2). We chose the three-digit and five-digit SOC comparisons to balance specificity with having a large enough sample from the civilian data to make a valid comparison. In some cases, multiple AFSCs are matched to the same SOC; for instance, all pilot AFSCs are matched to the SOC for civilian pilots. This is because the SOC system is, in many cases, less precise than the AFSC system. In other cases, one AFSC is matched to multiple SOCs. This occurs when multiple SOCs include individuals who have similar job responsibilities to individuals in a given AFSC.

The two different matches are provided because the goals of the AFSC and SOC systems are different. The AFSC coding is designed as a personnel management system for the Air Force, whereas the SOC coding is designed to provide statistics on the labor market. The precision of the two systems is also different for this reason. This means that, in some cases, the broad benchmark is a better match for the AFSC, and, in other cases, the narrow benchmark is a better match. As we discuss in more detail later, the best choice of benchmark for each occupation will depend on the question being asked, the occupations being compared, and the magnitude of differences between the military and civilian pipelines into those occupations.

Choosing Near-Equivalent Civilian Occupations

Our matching process between Air Force functional areas and near-equivalent civilian occupations uses a crosswalk between three-digit AFSC and six-digit SOC for civilian occupations provided by DMDC (Solutions for Information Design, LLC, 2014). A single AFSC can be matched to multiple SOCs, and a single SOC can be matched to multiple AFSCs. We first aggregate the six-digit SOC into the corresponding five-digit and three-digit SOCs for the broad and narrow benchmarks. The conversion to five-digit SOC is performed for two reasons. First, many five-digit SOCs have only one six-digit subcategory. Second, there are few cases in the ACS in which a more specific occupation code than the five-digit SOC is available. For the majority of three-digit AFSCs, we used the DMDC occupation match with no additions or adjustments. We made adjustments to the DMDC match in the following two types of cases:

- DMDC matched a three-digit AFSC to the SOC for "military-specific occupations"
- Case-by-case improvements to the DMDC match.

Matches to military-specific occupations comprise most of our adjustments. Civilians in the ACS are by definition not coded in military-specific occupations. We therefore augmented the DMDC crosswalk to include new matches for each military-specific occupation. When possible, the matches were chosen using similarities between the job responsibilities listed in the SOC Manual and the Air Force Classification Guides (Air Force Personnel Center, 2021a; Air Force Personnel Center, 2021b; Executive Office of the President, 2018). For several Air Force occupations with job descriptions that partially matched the descriptions of several SOCs, we matched a single AFSC to multiple SOCs.[7] For a small number of occupations with combat responsi-

bilities in which no other match could be made, we matched the AFSC to a group of occupations identified by Wenger et al., 2017, as using skills similar to that of Army infantry. Finally, for officer occupations in which no other match could be made, we matched the occupation to the jobs corresponding to the college majors in Tier 1 of the occupation's Classification of Instructional Programs (CIP) matrix from the Air Force Officer Classification Directory (Air Force Personnel Center, 2021b). This was typically done for operations occupations, which were most often matched to several engineering occupations. (A list of military-specific occupations and the SOCs to which they were matched is available in Appendix A.)

Case-by-case improvements in the DMDC crosswalk had three main subtypes. The first was a series of adjustments made because of aggregations of occupations made in the public-use version of the ACS. The ACS combines some SOCs to protect respondents' privacy; in these cases, we corrected the DMDC crosswalk to match to the aggregated group of SOCs. The second was a small number of adjustments made to ensure that the comparison group of civilians was large enough to create a benchmark and contained personnel at an appropriate education and career level. For instance, officers in AFSC 61D (physicist/nuclear engineer) are matched in the DMDC crosswalk to engineering and science managers. This group of individuals in the ACS is both relatively small and not the best match to personnel at a lower level. We therefore added the SOCs for physicists and nuclear engineers to the crosswalk. Other adjustments made for this reason were similar in scope. Finally, we corrected one instance in which the DMDC crosswalk match appeared to be incorrect based on the matches made for similar occupations. (A list of updates to the DMDC crosswalk of the final two types is available in Appendix A; a crosswalk between the SOC codes used in the DMDC manual and the combined codes used in the ACS data is available from Ruggles et al., 2020.)

Correcting for Differences Between the Air Force and the Civilian Labor Force

The main challenge with benchmarking demographic diversity in the Air Force against the civilian labor force is that Air Force personnel differ from civilians in several ways. In particular, Air Force personnel must have at least a high school education (and, for officers, a bachelor's degree) (Department of the Air Force, 2019), and Air Force personnel are, on average, younger than the civilian population. Most Air Force personnel are U.S. citizens, and all active-duty personnel are employed full-time.

> The best choice of benchmark for each occupation depends on the question being asked, the occupations being compared, and the magnitude of differences between the military and civilian pipelines into those occupations.

We adjust the civilian labor force in two ways to account for these differences. First, as described previously, we limit the civilian sample to full-time employed U.S. citizens between the ages of 18 and 60 who have the appropriate level of education to join the Air Force as either enlisted personnel or officers. We also remove veterans to avoid having military policy affect the civilian population. Second, we weight the remaining civilian sample to better match the age and education distribution of DAF using the raking methods developed for the American National Election Study survey data (DeBell and Krosnick, 2009; Pasek et al., 2014).[8] These adjustments are particularly important for the more general benchmarks. Continuing the earlier example of the benchmark for fighter pilots, widening the aperture from civilian

pilots and flight engineers (five-digit SOC) to include all air transportation workers (three-digit SOC) could introduce some workers who are less educated than fighter pilots, but the weighting adjusts the civilian workers to realign them to the fighter pilot population. Ideally, the raking method would create an exact match between the age and education distributions. However, as suggested in Pasek et al., 2014, we cap the weight for individual civilians to avoid domination of the benchmark by a small number of individuals in the civilian group. Further details on weighting are available in Appendix B. Occupations with large differences in the education and age distribution between the civilian and DAF groups might be less likely to converge; in other words, we might not be able to find weights for the civilian workers such that the weighted civilians match the DAF population on age and education. We use convergence of the raking method, as well as the deviation between the age and education distributions for occupations in which only partial convergence is possible, as tools to evaluate the trustworthiness of individual benchmarks. Further technical details on the raking methods are available in Appendix B.

Aggregating Occupations into Larger Groups

To provide a broader view of the patterns of demographic representation in different DAF functional areas, we aggregate three-digit AFSCs into larger groups—in particular, two-digit AFSCs for enlisted personnel and competitive categories for officers. The main challenge of the aggregation is that civilians can be matched to multiple DAF functional areas. For instance, all pilot AFSCs are matched to the SOC for aircraft pilots and flight engineers. We therefore duplicate civilians who are matched to multiple AFSCs and assign each copy of a given civilian a different AFSC. We then adjust the civilian group for occupational mix in addition to education and age using the method described in the previous section.

Benchmarking DAF Functional Areas to the Entire Civilian Labor Force

Given the differences between the civilian and military workforce and the differences between even jobs that seem relatively closely matched, we provide an alternative benchmark for each DAF functional area: a comparison between personnel in that functional area and all civilians. As we did with the occupation-specific benchmarks, we limit the civilian sample to U.S. citizens who are employed full-time, are between the ages of 18 and 60, have the correct level of education, and have never served in the military. We then rake the civilian labor force so that the distribution of education and age matches that of the DAF functional area.

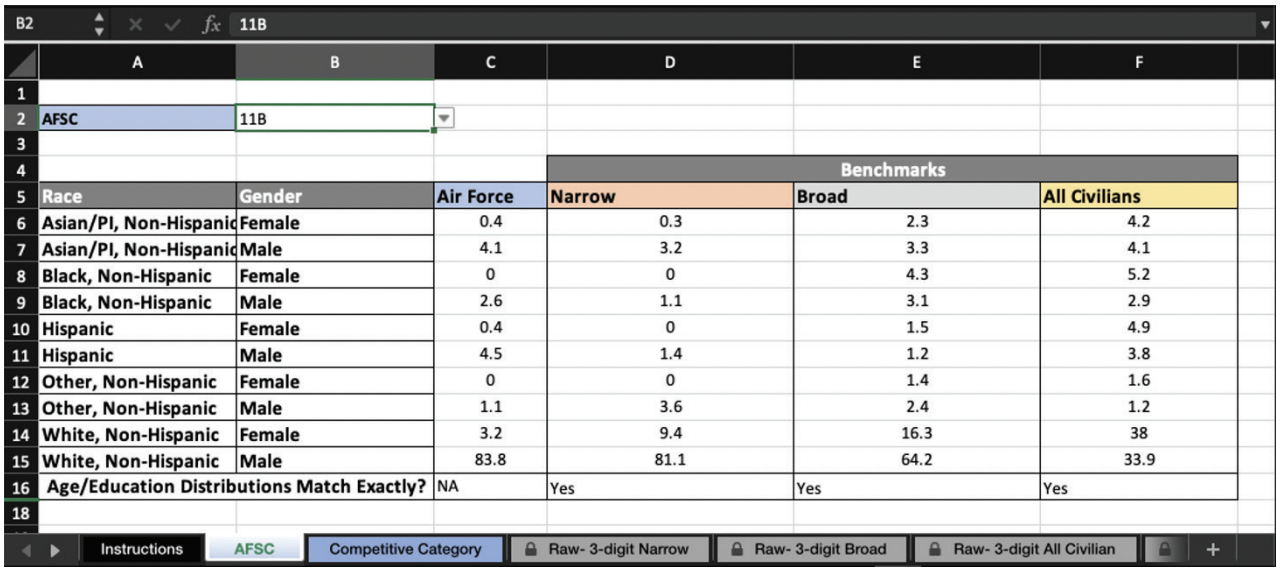
An Overview of the Occupational Diversity Benchmarking Workbook

The Occupational Diversity Benchmarking Workbooks are a pair of Excel workbooks providing benchmarks for the demographic distribution of each DAF occupation. There is one workbook for enlisted personnel occupations and one for officer occupations. The two workbooks work in the same way. The first tab, titled "Instructions," reiterates the instructions for use contained in this section. Each workbook includes two summary tabs, which should be used to look up the benchmark for individual occupations: one for three-digit AFSCs and one for more aggregated occupation groupings. These tabs are colored blue. The more aggregated group of occupations for officers is competitive category and the more aggregated group of occupations for enlisted personnel is two-digit AFSC. The remaining tabs include the raw data used to create the summary tabs; the raw data tabs are colored grey. Appendix C contains the pair of workbook files.

All summary tabs work in the same way. Figure 2 presents a screenshot of the summary tab for officers by three-digit AFSC, using AFSC 11B (bomber pilots) as an example. Users wishing to look at the benchmark for a particular AFSC or competitive category should select cell B2. A drop-down box will appear that will allow the user to select the functional area of interest. This will cause the tab to present the demographic distribution of that AFSC in the DAF in September 2020 in column C, Air Force, as well as the demographic distribution of the narrow, broad, and all civilians benchmarks in columns D through F.

FIGURE 2

Screenshot of the Occupational Diversity Benchmarking Workbook for Officers



B2 11B

	A	B	C	D	E	F
1						
2	AFSC	11B				
3						
4				Benchmarks		
5	Race	Gender	Air Force	Narrow	Broad	All Civilians
6	Asian/PI, Non-Hispanic	Female	0.4	0.3	2.3	4.2
7	Asian/PI, Non-Hispanic	Male	4.1	3.2	3.3	4.1
8	Black, Non-Hispanic	Female	0	0	4.3	5.2
9	Black, Non-Hispanic	Male	2.6	1.1	3.1	2.9
10	Hispanic	Female	0.4	0	1.5	4.9
11	Hispanic	Male	4.5	1.4	1.2	3.8
12	Other, Non-Hispanic	Female	0	0	1.4	1.6
13	Other, Non-Hispanic	Male	1.1	3.6	2.4	1.2
14	White, Non-Hispanic	Female	3.2	9.4	16.3	38
15	White, Non-Hispanic	Male	83.8	81.1	64.2	33.9
16	Age/Education Distributions Match Exactly?		NA	Yes	Yes	Yes
18						

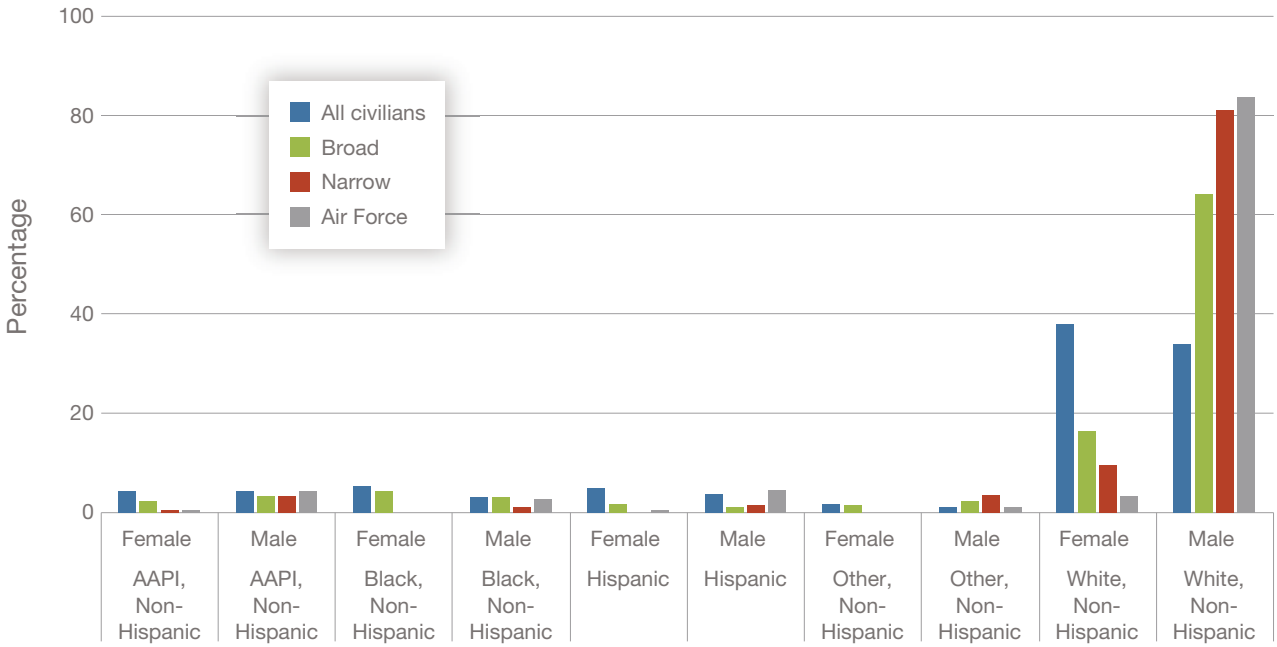
Instructions | AFSC | Competitive Category | Raw- 3-digit Narrow | Raw- 3-digit Broad | Raw- 3-digit All Civilian

In line 16 of the spreadsheet, we provide information on how closely the raking procedure was able to match the distributions of age and education between the Air Force and external civilian labor force. When the raking routine was able to exactly match the distributions, and in cases in which the civilian population is similar enough to the DAF population that raking is unnecessary (as described in Appendix B), the cell states "Yes." When benchmarks could not be produced because there are fewer than 30 personnel in the AFSC, the cell states "Cannot produce benchmark because AFSC is too small." When benchmarks could not be produced because the DAF and civilian populations were too different from each other in terms of age or education, the cell states "Cannot produce benchmark because AF is too different from civilians."[9] In some cases, the raking procedure is unable to improve the match between the age and/or education distributions of the military and civilian labor force any further than it already has, but a full match has not been produced (the reasons why such a thing might happen are described in more detail in Appendix B).[10] As a result, following raking there is some degree of difference between the age and education distribution of the military and civilian groups. In cases in which we believe the difference is large enough that the benchmarks should only be used with caution, we color the cell red; in cases in which we believe the difference is small enough that the benchmarks are likely trustworthy, we do not highlight the cell. A discussion of the degree of difference between the military and civilian labor force in terms of the age and education distributions is available in Appendix B.

Each summary tab also automatically provides a graph of the demographic distribution of the selected AFSC or competitive category in the DAF and all three benchmarks. Figure 3 provides an example graph. The occupation whose benchmarks are used to make the graph is the one that is currently selected on the summary tab—in this case, we again use 11B. The format of this graph is the same format that will be used for all graphs in this report that document the demographic distribution of a particular AFSC or competitive category. It should be read as follows: The leftmost bar in each gender and racial and ethnic group reports that group's demographic share of the all civilians benchmark for 11B. The bar that is second from the left in each group reports that group's demographic share of the broad benchmark for 11B. The bar that is second from the right in each group reports that group's demographic share of the

FIGURE 3

Example Graph from the Occupational Diversity Benchmarking Workbook



SOURCE: Authors' calculations using DAF administrative data and the ACS.

narrow benchmark for 11B. The rightmost bar in each gender and racial and ethnic group reports that group's demographic share of staff assigned to 11B. For each benchmark, the bars of that benchmark's color add up to 100 percent across all ten gender and racial and ethnic groups. In other words, the share of that benchmark across all groups must add to 100 percent. Similarly, each group's share of the staff assigned to 11B must sum to 100 percent.

Interpreting the Provided Benchmarks

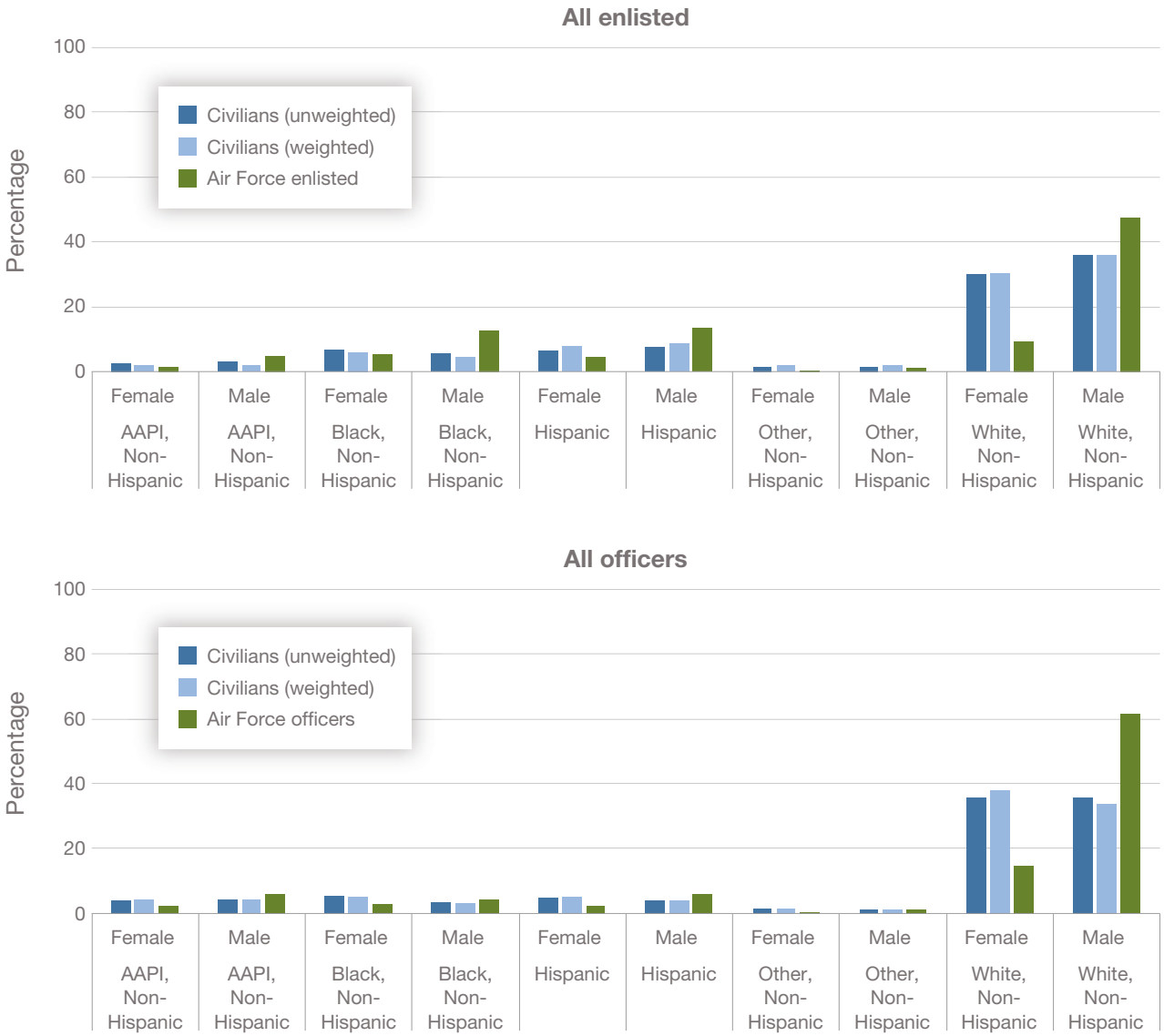
The Demographics of DAF

Although occupation-specific benchmarks are important tools in identifying functional area policies that might be barriers to diversity, managers must always interpret them in light of the demographics of the DAF population as a whole. Demographic groups that are significantly overrepresented in DAF overall relative to the eligible civilian labor force are typically overrepresented in occupation-specific benchmarks. For instance, even in occupations in which White men are only a small proportion of an occupation in the Air Force, such as nursing occupations, they are usually overrepresented relative to civilians in matched occupations. The same is true for demographic groups that are significantly underrepresented in DAF overall relative to the eligible civilian labor force. This section provides guidance on how to factor the DAF population demographics into one's interpretation of the benchmarks we provide.

Figure 4 compares the gender and racial and ethnic distribution of DAF enlisted (top panel) and officer (bottom panel) personnel with civilians. The leftmost bar in each gender or racial and ethnic group provides the raw share of civilians who fall into that group. The middle bar in each group provides the share of civilians who fall into that group when the civilian labor force is weighted to match the distribution of age and education in DAF. The rightmost bar in each gender or racial and ethnic group provides the share of DAF personnel who fall into that group. As before, bars of the same color sum

FIGURE 4

Gender and Racial and Ethnic Distribution of DAF and All Civilians



SOURCE: Authors' calculations using DAF administrative data and the ACS.

NOTE: Civilians are between the ages of ages 18 and 60, U.S. citizens, nonveterans, and employed full-time and either completed high school (enlisted personnel) or hold a bachelor's degree (officers).

to 100 percent. Among enlisted personnel, White men, Asian American and Pacific Islander (AAPI) men, Black men, and Hispanic men are all overrepresented, to some degree, in DAF.[11] Women of all races and Other men are underrepresented, to varying degrees.[12] The pattern is similar for officers, but White men are overrepresented to a greater degree among officers than among enlisted personnel, whereas racial and ethnic minority men are less overrepresented and racial and ethnic minority women are more underrepresented among officers than they are among enlisted personnel.

In light of the demographic distribution of DAF, Table 1 provides each gender and racial and ethnic group's degree of over- or underrepresentation across DAF, as compared with the entire relevant civilian sample. The degree of over- or underrepresentation is calculated using

$$\frac{\textit{DAF share} - \textit{weighted civilian labor force share}}{\textit{weighted civilian labor force share}} \times 100 \quad (1)$$

and represents the amount of over- or underrepresentation of each gender and racial and ethnic group in the *typical* DAF occupation, as compared with the *entire matched civilian labor force*.[13] Connecting this back to Figure 4, for each gender and racial and ethnic group, Equation (1) calculates the percentage by which the height of the orange (right) bar exceeds or falls short of the height of the green (middle) bar.

Users can refer to Table 1 to determine whether a group is more or less over- or underrepresented within a given occupation than expected—relative to a given benchmark—based on the demographics of DAF. To determine whether a group is more or less underrepresented than they would be in the civilian labor force, users should calculate the degree of over- or underrepresentation in that occupation, relative to the chosen benchmark, and compare it with the value for that group in Table 1. For instance, continuing with the bomber pilots example (AFSC 11B), 3.2 percent of 11B personnel are White women, whereas 9.4 percent of narrow benchmark near-equivalent civilians are women. The degree of White women's underrepresentation in this occupation is

$$\frac{3.2-9.4}{9.4} \times 100 = -66\%.$$

Table 1 tells us that, across the officer corps, White women are underrepresented by 62 percent, which is a smaller degree of underrepresentation than is present for officers in 11B. Therefore, in this occupation, White women are more underrepresented than expected across the entire officer corps.

TABLE 1

Expected Degree of Over- and Underrepresentation for Each Demographic Group

Demographic	Enlisted Personnel	Officers
AAPI women	–17%	–50%
AAPI men	150%	39%
Black women	–12%	–50%
Black men	174%	43%
Hispanic women	–44%	–58%
Hispanic men	60%	49%
Other women	–83%	–81%
Other men	–47%	–17%
White women	–69%	–62%
White men	32%	83%

NOTE: Expected degree of over- or underrepresentation is calculated using Equation (1).

Limitations

Existence in the Civilian Labor Force

Several DAF occupations do not exist in the civilian world: for instance, the special warfare, intelligence, and remotely piloted aircraft functional areas have, at most, partial civilian equivalents. Benchmarks are only ever as good as the chosen comparison group. Although we chose the closest possible civilian occupations to each military-specific occupation, the benchmarks between military-specific occupations and near-equivalent occupations should be interpreted with caution, taking into account whether selection into the military and near-equivalent civilian occupations are likely to be the same. This will likely depend on the similarity of requirements and responsibilities between DAF and the civilian labor force, the risk level of each military-specific occupation, and taste for military-specific activities.[14] A list of these matched occupations can be found in Appendix A.

Similarly, some military occupations, such as those dealing with the maintenance of weapons systems, do have direct civilian equivalents, but employment opportunities in those civilian equivalents are concentrated in the national security industry. Therefore, these civilian occupations are likely influenced, directly or indirectly, by military personnel policy and might not be separable from DAF.

Differences in Requirements and Responsibilities

An important difference between DAF and the civilian labor force, which should be kept in mind when using the Occupational Diversity Benchmarking Workbook, is that even some DAF occupations that exist in the civilian labor force have substantially different requirements and responsibilities from the

corresponding civilian occupation. These differences often manifest by creating differences between the pipelines into the occupation in the military and civilian labor forces, as illustrated in Figure 1.

Consider, for example, pilots. Both DAF and civilian pilots are trained aviators, often operating very similar types of aircraft in the functional areas involving airlift or aerial refueling. Yet, by virtue of being officers, nearly all DAF pilots hold at least a bachelor's degree, and many hold graduate degrees. In contrast, the Federal Aviation Administration (FAA) does not require that pilots hold bachelor's degrees; instead, pilots are required to achieve a certain number of flight hours, often by working as a flight instructor. Therefore, the pipelines into pilot occupations differ on the matter of how much education is completed prior to entering the labor force, in addition to differences that exist across DAF like eligibility and propensity to join the military. The result is that in determining the matched group of civilians used for benchmarking in the workbook, we retain only the 70 percent of civilian pilots who hold at least a bachelor's degree, eliminating the 30 percent without a bachelor's degree from the comparison. Furthermore, among those with at least a bachelor's degree, 63 percent are over the age of 40. Although these individuals are retained in the matched group, the raking routine assigns them a very low weight because most fighter pilots are under the age of 40. Therefore, the pipeline into the pilot occupation differs substantially between DAF and the civilian labor force, likely inducing large differences between the two workforces. Although we do remove these differences using the raking procedure, benchmarks for populations with such large differences should be interpreted as reflecting not the entire civilian workforce in similar occupations but the portion of the civilian workforce that is similar in age and education to the DAF workforce. In cases in which the requirements for and responsibilities of a DAF occupation differ substantially from the corresponding civilian occupation, using the more general benchmarks and comparing representation in the occupation with that of DAF overall (using Table 1) could provide a better understanding whether function-specific policies are limiting representation for a particular demographic group.

A related matter is the degree of control that DAF exercises over the pipeline for particular occupations, both inside and outside the civilian labor force. DAF provides all required training for most functional areas, whereas, in many cases, civilians must complete (and pay for) such training on their own before entering the workforce. These differences also create differences in the pipeline into occupations. For example, individuals who enter the DAF Air Traffic Control occupation (1C1) complete training as junior enlisted personnel and are not required to have a degree in air traffic control prior to accession (although they must meet minimum requirements on the Armed Services Vocational Aptitude Battery assessment prior to enlisting). Civilians, on the other hand, must complete at least an associate's degree in air traffic control before being hired into an air traffic control job, after which they complete training with the FAA and then participate in long-term on-the-job training (U.S. Bureau of Labor Statistics, 2020). Civilians will, therefore, be older on average than enlisted personnel when entering the air traffic control career. This is true in many enlisted personnel occupations, and some officer occupations, which require some type of certification or training prior to entering the labor market. Furthermore, a substantial portion of the labor force for many aviation jobs are veterans, as they already hold the training required for the job and are therefore potentially less expensive to hire. Although we remove veterans from our civilian sample when constructing benchmarks to avoid having military personnel policies affect the benchmarks, in many aviation occupations, the civilian labor force and the military labor force cannot truly be separated without potentially distorting the civilian sample.

Unobserved Differences

Finally, even among occupations (for example, medical occupations) in which the responsibilities and requirements are very similar in DAF and the civilian labor force, the demographics of DAF are unlikely to line up with those of the near-equivalent civilian labor force because of gender and racial and ethnic differences in characteristics that are not included in our data but affect their eligibility to serve in the military, such as health, weight, drug involve-

ment, and criminal history. Furthermore, there are well-documented gender and racial and ethnic differences in interest in serving in the military (Asch, Hosek, and Warner, 2007; Lim et al., 2014); the military might be able to directly influence propensity to serve through targeted outreach and recruiting of women or racial and ethnic minorities for key occupations.

Choosing a Benchmark

Decisionmakers should look at all three benchmarks and compare the results, keeping in mind that, as benchmarks get narrower, there are more limitations. Although the narrow benchmark is likely the group of civilians that is most similar to the DAF personnel in a given AFSC, it is also likely most subject to the limitations described in the previous section.

When this comparison has been made, the benchmark to focus on will depend both on the question being asked and on how important the limitations of the analysis are for a given occupation. The limitations of the analysis are strongest in military-specific occupations and in operations occupations. This is true even for operations occupations (like pilots) with a clear civilian equivalent. Limitations will also be stronger in cases in which most civilians in equivalent occupations work in the national security industry, such as munitions systems workers, in which interest in the military and in working in the national security industry could be highly correlated and in which civilians might be affected by military personnel policies. Although the narrow and broad benchmarks can still be used in these cases, they might not be the most useful benchmarks for the purposes of barrier analysis. In addition, if the results from the narrow and broad benchmarks are vastly different, the all civilians benchmark is likely the most appropriate. In these cases, we recommend that decisionmakers view these benchmarks in conjunction with benchmarks of the demographics of recent cohorts earlier in the pipeline than their becoming a fully qualified member of a given occupation—for instance, benchmarks of the demographics of DAF at the time of accession, among individuals qualified to *enter* a particular occupation, and representation across DAF.

Another consideration is: Does a comparison to a very narrow group seem most appropriate, or is there concern that comparing with a very narrow group might cut out individuals in the civilian labor force who might have been in a given occupation in DAF? For instance, the broad benchmark might be more appropriate in cases in which DAF provides a substantial amount of training that civilians must obtain and pay for themselves. The broad benchmark might also be more appropriate in cases, like cyber support, in which multiple civilian occupations might be a good match for a military occupation. However, in cases such as physician occupations, in which occupations are tightly linked between the military and civilian labor forces and in which comparing with a broader group of civilians will bring in a large number of individuals who are not eligible for such a position, the narrow benchmark is likely the better choice. Finally, in some cases, the narrow and broad benchmark will provide similar results and either can be used, depending on user preferences.

In the next section, we illustrate this process using a series of practical examples.

Results

We first discuss four examples of how to use the Occupational Diversity Benchmarking Workbook, each of which provides insights on the best usage of the benchmarks provided. We then discuss broader patterns.

Selected Examples

Fighter Pilots

Our first example, fighter pilots (11F), was chosen because it is a priority occupation for DAF. Previous RAND research has shown that historical gender and racial and ethnic differences in promotion rates can be explained by gender and racial and ethnic differences in selection into rated occupations (Lim et al., 2014). Although DAF has changed its promotion policies in the intervening years, it is still the case that pilot occupations are relatively more prestigious than other DAF occupations and have higher concentrations of White men than other DAF occupations.

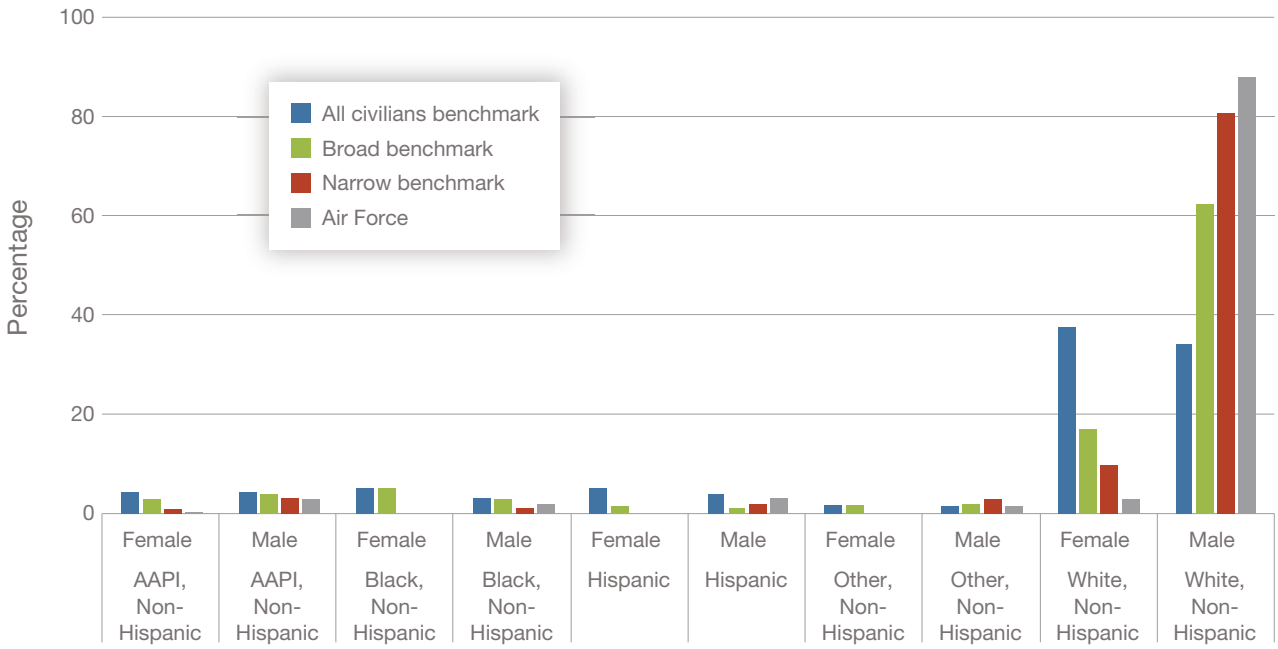
This is perhaps most true for fighter pilots. This example also highlights a case in which, although there are civilian pilots, the narrow and broad benchmarks might not truly be appropriate comparisons on their own.

The demographic distribution of fighter pilots and of the benchmarks we have created for them are shown in Figure 5. Table 2 provides the degree of over- or underrepresentation for each group, using Equation 1. The middle three columns provide the degree of over- or underrepresentation for each demographic group relative to each of the three benchmarks we provide for fighter pilots, whereas the rightmost column shows the degree of over- or underrepresentation across the entire officer corps. The color coding of the cells represents the difference between the levels of over- or underrepresentation for fighter pilots and across the officer corps: green represents overrepresentation, orange represents underrepresentation, pale colors represent a difference of under ten percentage points, and dark colors represent a difference of ten or more percentage points.

Compared with the narrow benchmark, which is civilian pilots, White, Black, and Hispanic men are overrepresented, but only Black and Hispanic men are overrepresented by more than they are across the entire officer corps. White men are substantially *less* overrepresented than they are across the entire officer corps, though that might be driven by the fact that they make up more than 80 percent of civilian pilots. AAPI men are represented at a similar level to male AAPI civilian pilots; however, we would expect AAPI men to be overrepresented in the officer corps. AAPI women and Other men are more underrepresented than they are across the entire officer corps. White women are underrepresented at a similar level to the amount they are underrepresented across the officer corps. There are no Black, Hispanic, or Other female pilots in either the military or in the ACS-generated estimates of the civilian labor force.[15]

FIGURE 5

Benchmarks for Fighter Pilots



SOURCE: Authors' calculations using DAF administrative data and the ACS.

NOTE: The all civilians, broad, and narrow benchmarks are weighted to account for differences in the age and education distribution between the DAF and civilian labor force.

TABLE 2

Degree of Over- or Underrepresentation for Each Demographic Group Among Fighter Pilots

Demographic	Fighter Pilots' Degree of Over- or Underrepresentation Versus Civilian Benchmarks			Over- and Underrepresentation for Overall Officer Corps
	Narrow Benchmark	Broad Benchmark	All Civilians Benchmark	
AAPI women	–88%	–96%	–98%	–50%
AAPI men	–6%	–26%	–29%	39%
Black women		–100%	–100%	–50%
Black men	80%	–38%	–42%	43%
Hispanic women		–100%	–100%	–58%
Hispanic men	78%	167%	–20%	49%
Other women		–100%	–100%	–81%
Other men	–50%	–26%	8%	–17%
White women	–70%	–83%	–92%	–62%
White men	9%	41%	158%	83%

NOTE: Fighter pilots' degree of over- or underrepresentation representation is calculated using Equation (1). Color coding of cells represents the difference between the levels of over- or underrepresentation for fighter pilots and across the officer corps: green represents overrepresentation, orange represents underrepresentation, pale colors represent a difference of under ten percentage points, whereas dark colors represent a difference of ten or more percentage points.

Compared with the broad benchmark, which is all air transportation employees, White and Hispanic men are more overrepresented than they are relative to the narrow benchmark, and Other men are less underrepresented than they are relative to the narrow benchmark. Hispanic men are also the only group that is overrepresented by more than expected across the officer corps. AAPI and Black men are now underrepresented rather than overrepresented, and women of all racial and ethnic groups are more underrepresented relative to the broad benchmark.

Even though the narrow benchmarks are closest to the demographics of fighter pilots, civilian pilots might not be a good benchmark for fighter pilots for the purposes of barrier analysis because of the differences in eligibility requirements, job responsibilities, and unobserved characteristics of military and civilian personnel. DAF also controls the entire job pipeline for fighter pilots and, therefore, does not necessarily face strict supply limitations in onboarding new pilots who are women or racial and ethnic minorities. For this reason, we recommend that decisionmakers view these benchmarks in conjunction with the benchmarks for the demographics of recent cohorts of accessions provided in emerging research in this series and with the demographics of the population eligible to *enter* the pilot force.

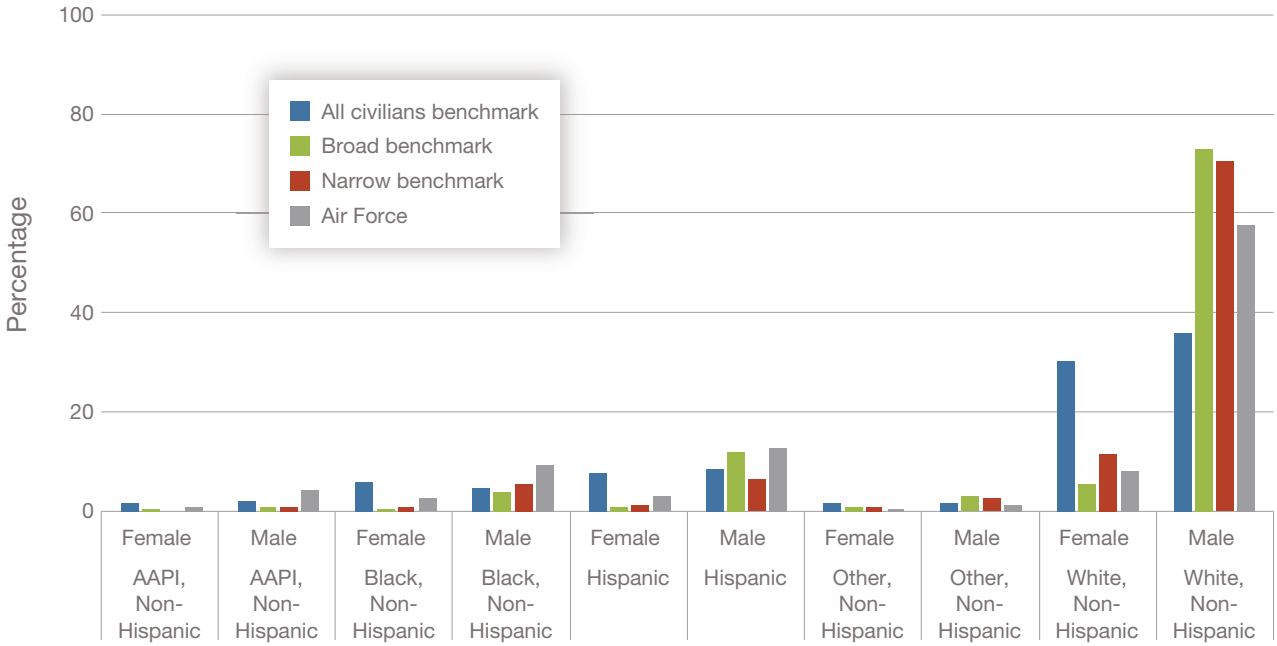
Munitions Systems

We chose this example because it highlights another type of case in which the narrow and broad benchmarks might be less appropriate: when a large proportion of civilians in similar occupations work in national security. We focus here on munitions systems (2W0), which is matched in the narrow benchmark to civilian explosives workers and to civilian supervisors of mechanics, repairers, and installers. The broad benchmark is extraction workers and supervisors of mechanics, repairers, and installers.

The demographic distribution of enlisted munition systems workers and of the benchmarks we have created for them are shown in Figure 6. Table 3 provides information on the degree of over- and underrepresentation of each group, relative to each benchmark. Compared with the narrow benchmark, White and Other men and women are underrepresented, whereas all other groups are overrepresented. However, Black men are less overrepresented than

FIGURE 6

Benchmarks for Munitions Systems



SOURCE: Authors' calculations using DAF administrative data and the ACS.

NOTE: The all civilians, broad, and narrow benchmarks are weighted to account for differences in the age and education distribution between the DAF and civilian labor force.

TABLE 3

Degree of Over- or Underrepresentation for Each Demographic Group Among Munitions Systems

	Munitions Systems Degree of Over- or Underrepresentation Versus Civilian Benchmarks			
Demographic	**Narrow Benchmark**	**Broad Benchmark**	**All Civilians Benchmark**	**Over- and Underrepresentation for Overall Enlisted Force**
AAPI women		300%	–53%	–17%
AAPI men	340%	450%	120%	150%
Black women	213%	525%	–58%	–12%
Black men	69%	158%	102%	174%
Hispanic women	164%	383%	–62%	–44%
Hispanic men	97%	4%	48%	60%
Other women	–50%	–63%	–83%	–83%
Other men	–54%	–61%	–29%	–47%
White women	–28%	53%	–73%	–69%
White men	–18%	–21%	61%	32%

NOTE: Munitions systems workers' degree of over- or underrepresentation representation is calculated using Equation (1). Color coding of cells represents the difference between the levels of over- or underrepresentation for munitions systems workers and across the entire enlisted force: green represents overrepresentation, orange represents underrepresentation, pale colors represent a difference of under ten percentage points, whereas dark colors represent a difference of ten or more percentage points.

Black men across the entire enlisted force. Compared with the broad benchmark, White men, Other men, and Other women are underrepresented, whereas all other groups are overrepresented. However, Black and Hispanic men are less overrepresented than they are across the entire enlisted force.

Compared with all civilians, men in all groups except Other are overrepresented; however, AAPI, Black, and Hispanic men are less overrepresented than they are across the entire enlisted force. Women of all racial and ethnic groups are underrepresented. White women are similarly underrepresented in munitions systems as they are across the entire enlisted force, and Other women are less underrepresented than they are across the entire enlisted force.

Like with fighter pilots, the narrow and broad benchmarks could be problematic comparisons, for very different reasons. Although some civilian explosives workers work in mining, construction, or other civilian industries, a sizeable share work in national security. The national security industry is made up of people who are interested in working with the military as civilians, which could be correlated with interest in serving in the military. In addition, it might be the case that a large proportion of the civilian labor force in this occupation is influenced by military personnel policies despite never having served in the military. For these reasons, although the narrow and broad benchmarks are suggestive that munitions systems might be a male-dominated occupation regardless of whether it is in the military or civilian labor force, the civilian labor force is not independent enough from DAF to conclude that the demographics of the DAF munitions systems occupation are driven solely by interest in the occupation rather than by factors like military personnel policy or propensity to serve. We therefore recommend that, like with fighter pilots, decisionmakers use these benchmarks in conjunction with the benchmarks for DAF accessions provided by emerging research in this series.

Officers in the Medical Corps and the Nurse Corps

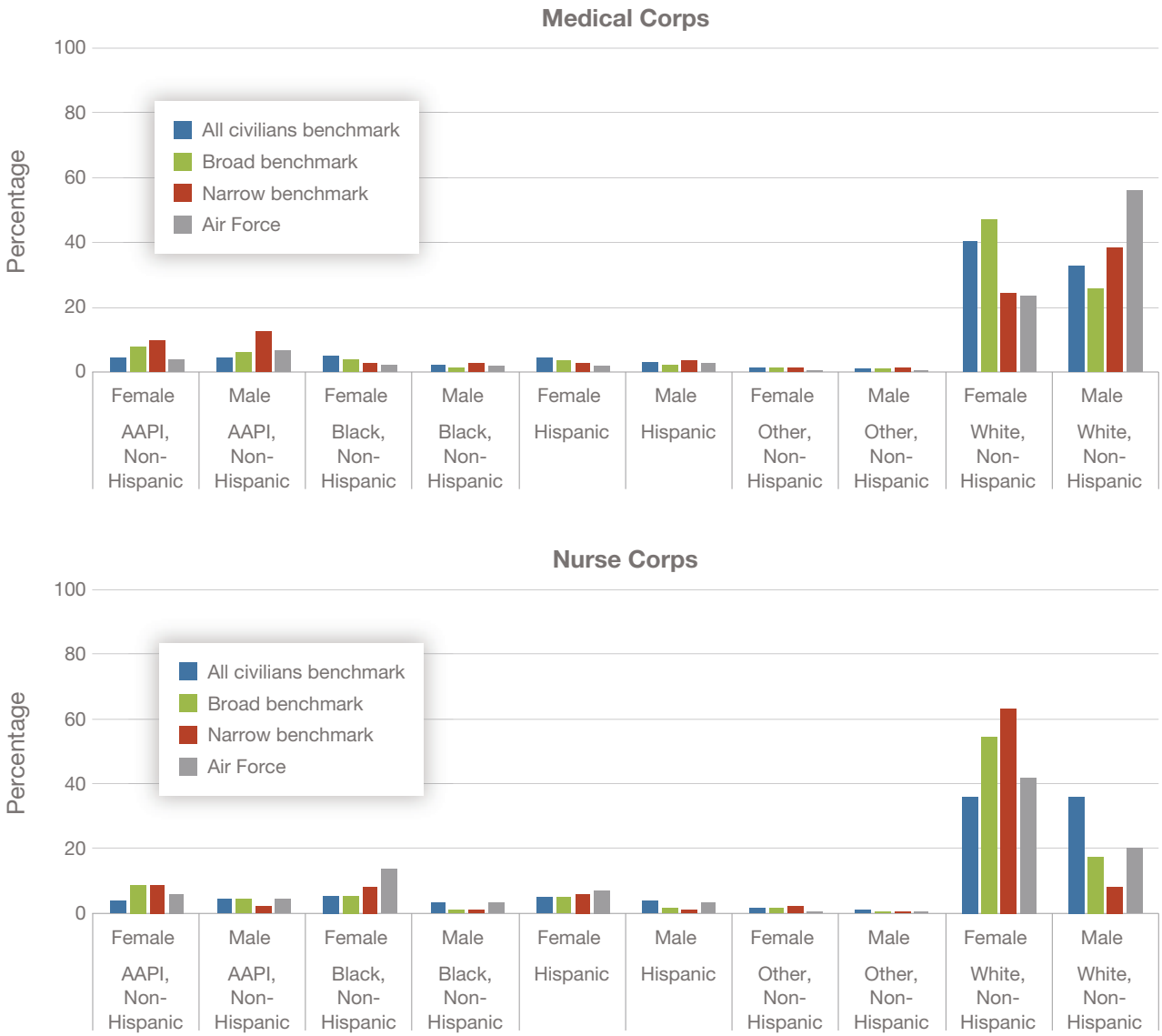
This example was chosen because it provides an interesting insight that was not available from previous analyses: Overrepresentation of a gender or racial and ethnic group in one occupation relative to the rest of DAF does not necessarily mean that that group is overrepresented in one DAF occupation relative to the civilian labor force. This example also highlights cases in which the narrow benchmark is the most appropriate.

In 2018, health care occupations were the most common type of occupation for female officers in almost every racial and ethnic group and the second most common type of occupation for AAPI male officers.[16] Overall, 37 percent of female officers and 21 percent of AAPI male officers, compared with 18 percent of all officers, were in health care occupations. Although health care occupations are also the second most common type of occupation for White male officers, White men are considerably less concentrated there—11 percent of White male officers were in health care occupations in FY 2018 (Office of the Under Secretary of Defense for Personnel and Readiness, 2020). Typically, the concentration of these groups in health care occupations is interpreted as overrepresentation of women and AAPI men in health care—and, in comparison to the rest of DAF, this is true. However, the results are different when comparing DAF officers with civilians in health care occupations.

Figure 7 plots the narrow, broad, and all civilians benchmarks for officers in the categories of Medical Corps and Nurse Corps. We focus here on a comparison between DAF and the narrow benchmark. The narrow benchmark is most appropriate for two reasons. First, the requirements and responsibilities for health care occupations in DAF, even for specialties like flight medicine, which do not have a direct civilian equivalent, are very similar to health care occupations in the civilian labor force, and the descriptions of the corresponding SOCs and AFSCs are also very similar. Second, physicians and nurses in the civilian labor force must meet very specific education and certification requirements to enter the occupation, and comparisons to all healthcare workers, who are included in the broad benchmark, would bring in civilians who are not qualified for these occupations even if they have the same level of education (a graduate degree for physicians and a bachelor's degree for nurses) and are of the same age. Table 4 provides

FIGURE 7

Benchmarks for Officer Health Care Competitive Categories



SOURCE: Authors' calculations using DAF administrative data and the ACS.

NOTE: The all civilians, broad, and narrow benchmarks are weighted to account for differences in the age and education distribution between the DAF and civilian labor force.

the degree of over- and underrepresentation of each group in the Medical Corps and the Nurse Corps.

The top of Figure 7 presents benchmarks for the Medical Corps, which includes physicians and surgeons. The narrow benchmark provides a comparison with civilian physicians and surgeons of similar ages and education levels. The representation of White women is similar to those groups among civilian physicians and surgeons; however, given the demographics of DAF relative to the civilian labor force, we would expect White women to be very underrepresented if selection into occupations was the same in DAF and the civilian labor force. White men are overrepresented (though by less than they are across the entire officer corps), and AAPI women and AAPI men are underrepresented. White men make up 56 percent of officers in the Medical Corps (compared with 38 percent of civilian physicians and

TABLE 4

Degree of Over- or Underepresentation for Each Demographic Group Among the Medical and Nurse Corps

Demographic	Medical Corps of Over- or Underrepresentation Versus Civilian Benchmarks: Narrow Benchmark	Broad Benchmark	All Civilians Benchmark	Over- and Underrepresentation for Overall Officer Corps
AAPI women	–57%	–46%	–9%	–50%
AAPI men	–49%	7%	41%	39%
Black women	–18%	–39%	–53%	–50%
Black men	–26%	43%	–13%	43%
Hispanic women	–30%	–46%	–56%	–58%
Hispanic men	–25%	23%	–13%	49%
Other women	–80%	–80%	–80%	–81%
Other men	–75%	–60%	–64%	–17%
White women	–3%	–50%	–42%	–62%
White men	47%	118%	71%	83%

Demographic	Nurse Corps Degree of Over- or Underrepresentation Versus Civilian Benchmarks: Narrow Benchmark	Broad Benchmark	All Civilians Benchmark	Over- and Underrepresentation for Overall Officer Corps
AAPI women	–26%	–26%	55%	–50%
AAPI men	110%	–2%	0%	39%
Black women	68%	139%	144%	–50%
Black men	191%	146%	–3%	43%
Hispanic women	21%	40%	46%	–58%
Hispanic men	154%	94%	–18%	49%
Other women	–68%	–67%	–57%	–81%
Other men	–25%	–57%	–75%	–17%
White women	–34%	–23%	17%	–62%
White men	151%	17%	–44%	83%

NOTE: Medical and Nurse Corps' degree of over- or underrepresentation representation is calculated using Equation (1). Color coding of cells represents the difference between the levels of over- or underrepresentation for the medical and Nurse Corps and across the entire officer corps: green represents overrepresentation, orange represents underrepresentation, pale colors represent a difference of under ten percentage points, whereas dark colors represent a difference of ten or more percentage points.

surgeons), whereas AAPI women make up 4.2 percent of officers in the Medical Corps (compared with 10 percent of civilians) and AAPI men make up 6.5 percent of officers in the Medical Corps (compared with 13 percent of civilians). These levels imply that White male officers are less overrepresented than expected in the Medical Corps, whereas AAPI female officers are slightly more underrepresented than expected and AAPI male officers are underrepresented when, if selection into the military was exactly the same for every occupation, they would be expected to be overrepresented. The Medical Corps is also the competitive category with the highest underrepresentation of Black male officers and the only competitive category in which Hispanic male officers are underrepresented. Black and Hispanic women are more underrepresented in the Medical Corps than they are in other competitive categories, but it is not one of the competitive categories in which either

group is *most* underrepresented relative to the civilian labor force.

The bottom of Figure 7 presents benchmarks for the Nurse Corps, which includes college-educated nurses. The gender and race and ethnicity distributions for these occupations are very different from the Medical Corps, especially relative to the narrow benchmark. White women comprise 42 percent of the Nurse Corps and 63 percent of comparable civilians; this is less underrepresentation of White women than expected for the entire officer corps but substantially more underrepresentation than the Medical Corps. However, White women are still a plurality of the Nurse Corps. AAPI women are 6.2 percent of the Nurse Corps and 8.4 percent of comparable civilians; this is less underrepresentation of AAPI than the level expected for the entire officer corps and substantially less underrepresentation than the Medical Corps. On the other hand, Black and Hispanic women are both overrepresented in the Nurse Corps relative to civilian nurses. In addition, men are substantially overrepresented in the Nurse Corps, although that is in large part because there is such a small share of civilian nurses. The Nurse Corps is in fact the area in which White and Hispanic men are most overrepresented in the officer corps: White men make up 20.1 percent of the Nurse Corps and 8.0 percent of comparable civilians, whereas Hispanic men make up 3.3 percent of the Nurse Corps and 1.3 percent of comparable civilians. Black and AAPI men are also substantially overrepresented in the Nurse Corps: Black men are 3.2 percent of the Nurse Corps and 1.1 percent of comparable civilians, whereas AAPI men are 4.2 percent of the Nurse Corps and 2 percent of comparable civilians.

From these analyses, we conclude that racial and ethnic minority men and women, and especially AAPI women and AAPI men, might be *less* concentrated than expected in health care occupations relative to the civilian labor force, and White women and White men might be *more* concentrated than expected in the same occupations—at least for those occupations that require professional degrees. That is, racial and ethnic minority men and women, and especially AAPI men and women, in the military might be more likely to be doctors than White men in the military but are less likely to be doctors than members of the same groups in the civilian labor force. Similarly, White and AAPI women in the military are more likely to be nurses than White men in the military but are less likely to be nurses than White and AAPI women in the civilian workforce. Given these patterns, DAF should examine remaining differences between job requirements and onboarding pipelines and consider ways to capitalize on the greater general interest in these career fields among racial and ethnic minorities and women.

Cyber Warfare and Cyber Support

Our fourth example was chosen for three reasons. First, it focuses on another type of priority occupation for DAF and for DoD at large—one for which there is a critical need for personnel. Second, this example highlights a known issue for diversity in DAF, which is that racial and ethnic minority personnel tend to be concentrated outside operations occupations. And third, this example highlights one of the difficulties of using this analysis to look at broad patterns of diversity and representation in DAF: Different occupations have different limitations and might not always be directly comparable even if they seem similar on the surface.

A growing area of interest for DoD has been cyber personnel. In this section, we compare and contrast the diversity of DAF and the matched civilian labor force for two enlisted cyber occupations: 1B4 (cyber warfare) and 3D0 (several cyber support functions). Although the matched occupations for these two AFSCs are somewhat different, both are matched to a group of civilian computer and telecommunications occupations, and the skills DAF personnel gain from working in these occupations likely translate well to most civilian cyber occupations. Figure 8 displays the demographic distribution of enlisted cyber warfare and cyber support occupations and the benchmarks we have created for them. Table 5 provides the degree of over- and underrepresentation of each group in cyber warfare and cyber support.

Because the skills used for cyber warfare likely translate well to a broad group of civilian computer and telecommunications occupations, the narrow and broad benchmarks seem like an appealing com-

FIGURE 8

Benchmarks for Enlisted Cyber Warfare and Cyber Support

SOURCE: Authors' calculations using DAF administrative data and the ACS.

NOTE: The all civilians, broad, and narrow benchmarks are weighted to account for differences in the age and education distribution between the DAF and civilian labor force.

parison. We focus on the broad benchmark for brevity. Relative to the benchmark, all groups of women are more underrepresented than they are across the entire enlisted force, and all racial and ethnic minority men except Other men are less overrepresented than they are across the entire enlisted force. White men, on the other hand, are slightly more overrepresented than they are across the entire enlisted force. However, the cyber warfare occupation is a military-specific occupation: Although we have provided a match, the job itself and the job responsibilities do not have a true match in the civilian labor force even though the skills used likely translate. Therefore, the pipelines into the military and matched civilian cyber warfare occupations might not truly be comparable, because individuals who are interested in the operations portion of cyber warfare might not also be interested in traditional civilian computing

TABLE 5

Degree of Over- or Underrepresentation for Each Demographic Group Among Enlisted Cyber Warfare and Cyber Support

Demographic	Cyber Warfare of Over- or Underrepresentation Versus Civilian Benchmarks: Narrow Benchmark	Broad Benchmark	All Civilians Benchmark	Over- and Underrepresentation for Overall Enlisted Force
AAPI women	–83%	–75%	–78%	–17%
AAPI men	34%	0%	136%	150%
Black women	–88%	–80%	–91%	–12%
Black men	23%	20%	47%	174%
Hispanic women	–94%	–91%	–97%	–44%
Hispanic men	69%	26%	58%	60%
Other women	–91%	–86%	–94%	–83%
Other men	–37%	–54%	–14%	–47%
White women	–93%	–87%	–94%	–69%
White men	66%	33%	108%	32%

Demographic	Cyber Support Degree of Over- or Underrepresentation Versus Civilian Benchmarks: Narrow Benchmark	Broad Benchmark	All Civilians Benchmark	Over- and Underrepresentation for Overall Enlisted Force
AAPI women	–25%	–14%	0%	–17%
AAPI men	6%	12%	235%	150%
Black women	100%	85%	–15%	–12%
Black men	173%	151%	173%	174%
Hispanic women	67%	48%	–48%	–44%
Hispanic men	59%	48%	42%	60%
Other women	–90%	–91%	–94%	–83%
Other men	–60%	–63%	–41%	–47%
White women	–55%	–55%	–77%	–69%
White men	–9%	–7%	41%	32%

NOTE: Cyber warfare and cyber support degree of over- or underrepresentation representation is calculated using Equation (1). Color coding of cells represents the difference between the levels of over- or underrepresentation for cyber warfare and cyber support workers and across the entire enlisted force: green represents overrepresentation, orange represents underrepresentation, pale colors represent a difference of under ten percentage points, whereas dark colors represent a difference of ten or more percentage points.

jobs. This means that the broad benchmark should be considered in conjunction with the civilians benchmark and with benchmarks of the enlisted force at accession provided by future research in this series, because it and the narrow benchmark might not be the most useful benchmarks for conducting barrier analysis. We therefore turn our attention to the all civilians benchmark, which should be used in conjunction with the narrow and broad benchmarks, as well as benchmarks at accession, when considering military-specific occupations. In comparison to the all civilians benchmark, all groups of women are more underrepresented than they are across the entire enlisted force, AAPI and Black men are less overrepresented than they are across the enlisted force, Other men are less underrepresented than they are across the enlisted force, White men are more overrepresented than across the entire enlisted force, and Hispanic men are roughly as overrepresented as they are across the enlisted force.

Like cyber warfare, the skills used in cyber support occupations likely translate well to a wide variety of civilian computer occupations, making the narrow and broad benchmarks an appealing choice. However, interest in military cyber support occupations is probably more strongly correlated with interest in civilian computing and telecommunications occupations, as the job responsibilities for the two are similar. We again focus on the broad benchmark for brevity. In comparison to the broad benchmark, Black and Hispanic women are overrepresented (despite being underrepresented in DAF at large), and AAPI and White women are less underrepresented than they are across DAF. Racial and ethnic minority men are less overrepresented and Other men are more underrepresented than they are across DAF. White men are slightly underrepresented in cyber support relative to the broad benchmark, despite being overrepresented in DAF at large.

Comparing these two analyses reveals that, relative to the broad benchmark, AAPI, Black, and Hispanic men and women are more strongly represented in the cyber support occupation than they are in the cyber warfare occupation; Black and Hispanic men and women exceed the cyber support benchmark by a considerable margin. This is consistent with prior work finding that racial and ethnic minority personnel might prefer military occupations that are more similar to civilian occupations (Harrell et al., 1999). However, decisionmakers should use this comparison with caution given that the cyber warfare occupation does not have a true civilian equivalent whereas the cyber support occupation has a clear civilian equivalent.

Broad Patterns

As we illustrated in the previous section, it is difficult to analyze broad patterns of representation using the provided benchmarks because the limitations of the broad and narrow benchmarks are different for different occupations. In this section, we provide some of the broad insights available from the Occupational Diversity Benchmarking Workbook.

As we mentioned earlier in the discussion of Figure 4, DAF is dominated by White men, although racial and ethnic minority men are often overrepresented relative to their level in the civilian labor force. As a result, men—especially White men—are overrepresented in most DAF occupations; the question is whether they are more or less overrepresented than expected given the analysis in the previous chapter.

We find that the demographics of a given DAF occupation are often more similar to the narrow and broad benchmarks than they are to the entire civilian labor force. And, consistent with prior research, in comparison to the civilian labor force, operations occupations are typically less diverse than other occupations (that is, White men are more overrepresented) (Harrell et al., 1999). However, this result should be interpreted with caution as operations occupations, especially military-specific occupations, differ from their corresponding civilian occupations by more than other types of occupations.

Conclusions

Benchmarking diversity in a functional area against credible external comparison groups is a critical step in understanding potential barriers to racial and ethnic minority and female representation. In this report, we described a method for constructing benchmarks using civilian near-equivalent fields and presented multiple examples of such benchmarking. We have provided the Occupational Diversity Benchmarking Workbook to assist DAF with barrier analysis specific to each functional area. For every functional area, we have included comparisons in the workbook between the demographics of DAF and three groups of civilian workers: a group in a very narrowly defined group of similar occupations, a group in a broadly defined group of similar occupations, and all civilians with an appropriate level of education for comparison to enlisted or officer personnel.

In general, we find that the demographics of DAF occupations tend to reflect the demographics of corresponding civilian occupations and the demographics of young adults interested in military service. That is, occupations dominated by White men in the civilian labor force tend to be somewhat more dominated by White men in DAF. We provide information on how to calculate the *expected* level of

representation for each demographic group, given the demographics of DAF overall, if the selection process was the same for all occupations. Occupations with a greater-than-expected level of underrepresentation (or a lower-than-expected level of overrepresentation) of a given group might benefit from an analysis of barriers to entry or retention in that occupation.

Several challenges and limitations exist in the construction of civilian benchmarks. The credibility and value of each of the three benchmarks presented should be considered in light of these challenges and limitations. The examples we discussed highlight these challenges. The near-equivalent civilian benchmarks, and, in particular, the narrow benchmark, is likely of greatest value when the job responsibilities, education requirements, and training pipeline are consistent between the DAF and civilian labor force. This was highlighted with the Medical Corps and Nurse Corps benchmarks. To a lesser extent, this value is also reflected in the cyber support example, in which job responsibilities and skill sets should readily translate to the near-equivalent civilian fields. In contrast, cyber warfare is an example in which the job responsibilities are military specific and do not have a true analogous civilian counterpart. In this case, the civilian benchmark should be viewed with caution, as individuals who are interested in the operations portion of cyber warfare might not also be interested in traditional civilian computing jobs, and, similarly, individuals in the near-equivalent civilian jobs might not have interest in the goals and mission of cyber warfare. The fighter pilot example is another case in which differences in job responsibilities between the DAF and civilian matched occupations are present despite the existence of a civilian counterpart. Several other challenges are also highlighted in the fighter pilot example, including differences in age and education requirements and functional differences in the training pipeline, which are fully controlled by DAF. Finally, unobservable differences between the DAF and matched civilian occupations might be present for any of the benchmark comparisons, including the propensity to enter a military career, which is known to differ by gender and race and ethnicity. As these challenges highlight, understanding the benchmarks requires more than merely comparing the numbers. Understanding the context of the comparisons being made is critical to proper use and conclusions. For each functional area, the challenges might be idiosyncratic and require unique consideration.

Recommendation: Personnel performing barrier analyses in functional areas should always review and present these quantitative benchmarks with an assessment of the qualitative differences in work context between military personnel and their civilian counterparts. The examples presented show that individual occupational benchmarks do not conclusively reveal whether a discrepancy is because of a DAF policy or a contextual difference between military and civilian work. Thus, DTs or other personnel using the benchmarks require additional information on such contextual differences. Personnel in some functional areas might, through research or experience, possess the expertise in training and job requirements for near-equivalent civilian areas (although maintaining this expertise will be tested by the turnover among personnel assigned to compete such analytic tasks). Others might benefit from a broader set of standards and guidelines or from training on the requirements, responsibilities, and pipeline into the workforce for the functional area's civilian counterparts. Furthermore, even the most well-constructed individual benchmark cannot convey all relevant information in isolation. At best, it is a single piece of information that, when viewed in context with other relevant information, yields a fuller understanding of the demographic diversity in a functional area—an early step in facilitating an understanding of whether further analyses to examine for barriers to diversity is warranted.

The benchmarks we have provided should be used in tandem with other benchmarks of diversity to determine the source of over- or underrepresentation of a particular group in a particular occupation. Users should first compare the demographic diversity in a given occupation with the upstream demographic distribution of recent cohorts, such as the population that is eligible to join the military, the population that joins the military, and the population that enters a particular occupation. Users should then compare the diversity in a given occupation with the narrow, broad, and all civilians benchmarks provided in the workbooks. If the demographics of said

occupation are relatively similar to the benchmarks provided in the Occupational Diversity Benchmarking Workbook, then over- or underrepresentation of certain groups might be the result of gender or racial and ethnic differences in preferences for a particular occupation rather than a particular barrier in the military, even if the demographics of that particular occupation differ greatly from those of DAF at large. However, if there are large differences between the demographics of a given DAF occupation and both the upstream demographics of recent cohorts and the demographics of the near-equivalent civilian population, something specific to that occupation in the military might be creating a barrier.

Appendix A. Near-Equivalent Occupations

Table A.1 lists AFSCs and their SOC matches. Table A.2 shows case-by-case updates to the DMDC crosswalk.

TABLE A.1
Military-Specific AFSCs and Their SOC Matches

AFSC	AFSC Title	SOC	SOC Title	Source
13A	Astronaut	17-201	Aerospace engineers	Responsibility match
13A	Astronaut	53-201	Aircraft pilots and flight engineers	Responsibility match
13B	Air battle manager	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
19Z (13C)	Special tactics	33-101	First-line supervisors of law enforcement workers	Responsibility match
19Z (13C)	Special tactics	33-102	First-line supervisors of firefighting and prevention workers	Responsibility match
19Z (13C)	Special tactics	33-201	Firefighters	Responsibility match
19Z (13C)	Special tactics	33-305	Police officers	Responsibility match
19Z (13D)	Combat rescue officer	11-916	Emergency management directors	Wenger, 2017
19Z (13D)	Combat rescue officer	29-204	Emergency medical technicians and paramedics	Wenger, 2017
19Z (13D)	Combat rescue officer	29-204	Emergency medical technicians and paramedics	Wenger, 2017
19Z (13D)	Combat rescue officer	33-101	First-line supervisors of law enforcement workers	Wenger, 2017
19Z (13D)	Combat rescue officer	33-102	First-line supervisors of firefighting and prevention workers	Wenger, 2017
19Z (13D)	Combat rescue officer	33-109	Miscellaneous first-line supervisors, protective service workers	Wenger, 2017
19Z (13D)	Combat rescue officer	33-201	Firefighters	Wenger, 2017
19Z (13D)	Combat rescue officer	33-202	Fire inspectors	Wenger, 2017
19Z (13D)	Combat rescue officer	33-305	Police officers	Wenger, 2017
19Z (13D)	Combat rescue officer	47-222	Structural iron and steel workers	Wenger, 2017
19Z (13D)	Combat rescue officer	49-101	First-line supervisors of mechanics, installers, and repairers	Wenger, 2017
19Z (13D)	Combat rescue officer	49-904	Industrial machinery installation, repair, and maintenance workers	Wenger, 2017
19Z (13D)	Combat rescue officer	49-909	Miscellaneous installation, maintenance, and repair workers	Wenger, 2017
19Z (13D)	Combat rescue officer	53-104	First-line supervisors of transportation and material moving workers	Wenger, 2017
19Z (13D)	Combat rescue officer	53-502	Ship and boat captains and operators	Wenger, 2017
19Z (13D)	Combat rescue officer	53-503	Ship engineers	Wenger, 2017
19Z (13L)	Air liaison officer	11-307	Transportation, storage, and distribution managers	Responsibility match
19Z (13L)	Air liaison officer	17-102	Surveyors, cartographers, and photogrammetrists	Responsibility match
19Z (13L)	Air liaison officer	17-303	Surveying and mapping technicians	Responsibility match
19Z (13L)	Air liaison officer	53-104	First-line supervisors of transportation and material moving workers	Responsibility match

Table A.1—Continued

AFSC	AFSC Title	SOC	SOC Title	Source
19Z (13L)	Air liaison officer	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
19Z (13L)	Air liaison officer	53-604	Traffic technicians	Responsibility match
13N	Nuclear and missile operations	17-216	Nuclear engineers	Responsibility match
13N	Nuclear and missile operations	19-405	Nuclear technicians	Responsibility match
13N	Nuclear and missile operations	51-801	Power plant operators, distributors, and dispatcher	Responsibility match
13O	Multidomain warfare officer	11-102	General and operations managers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	11-202	Marketing and sales managers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	11-302	Computer and information systems managers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	11-302	Computer and information systems managers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	11-904	Architectural and engineering managers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	13-119	Miscellaneous business operations specialists	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	15-122	Computer and information research scientists	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	15-124	Database and network administrators and architects	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	15-125	Software and web developers, programmers, and testers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	15-202	Mathematicians	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	15-204	Statisticians	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	17-102	Surveyors, cartographers, and photogrammetrists	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	17-201	Aerospace engineers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	17-204	Chemical engineers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	17-205	Civil engineers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	17-206	Computer hardware engineers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	17-207	Electrical and electronics engineers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	17-211	Industrial engineers, including health and safety	Combined 13N, 13M, and 13S

Table A.1—Continued

AFSC	AFSC Title	SOC	SOC Title	Source
13O	Multidomain warfare officer	17-214	Mechanical engineers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	17-303	Surveying and mapping technicians	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	19-201	Astronomers and physicists	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	19-202	Astronomers and physicists	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	19-209	Miscellaneous physical scientists	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	53-201	Aircraft pilots and flight engineers	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	53-202	Air traffic controllers and airfield operations specialists	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	53-202	Air traffic controllers and airfield operations specialists	Combined 13N, 13M, and 13S
13O	Multidomain warfare officer	53-604	Traffic technicians	Combined 13N, 13M, and 13S
13S	Space operations	11-307	Transportation, storage, and distribution managers	CIP and responsibility match
13S	Space operations	15-202	Mathematicians	CIP and responsibility match
13S	Space operations	15-204	Statisticians	CIP and responsibility match
13S	Space operations	17-201	Aerospace engineers	CIP and responsibility match
13S	Space operations	17-207	Electrical and electronics engineers	CIP and responsibility match
13S	Space operations	19-201	Astronomers and physicists	CIP and responsibility match
13S	Space operations	19-202	Astronomers and physicists	CIP and responsibility match
14N	Intelligence	33-302	Detectives and criminal investigators	Responsibility match
1A0	In-flight refueling specialist	49-301	Aircraft mechanics and service technicians	Responsibility match
1A0	In-flight refueling specialist	53-603	Transportation service attendants	Responsibility match
1A1	Flight engineer	33-102	First-line supervisors of firefighting and prevention workers	Wenger, 2017
1A1	Flight engineer	33-201	Firefighters	Wenger, 2017
1A1	Flight engineer	47-101	First-line supervisors of construction trades and extraction workers	Wenger, 2017
1A1	Flight engineer	47-211	Electricians	Wenger, 2017
1A1	Flight engineer	47-215	Pipelayers, plumbers, pipefitters, and steamfitters	Wenger, 2017

Table A.1—Continued

AFSC	AFSC Title	SOC	SOC Title	Source
1A1	Flight engineer	49-101	First-line supervisors of mechanics, installers, and repairers	Wenger, 2017
1A1	Flight engineer	49-202	Radio and telecommunications equipment installers and repairers	Wenger, 2017
1A1	Flight engineer	49-301	Aircraft mechanics and service technicians	Wenger, 2017
1A1	Flight engineer	51-101	First-line supervisors of production and operating workers	Wenger, 2017
1A1	Flight engineer	53-201	Aircraft pilots and flight engineers	Wenger, 2017
1A1	Flight engineer	53-502	Ship and boat captains and operators	Wenger, 2017
1A2	Aircraft loadmaster	11-307	Transportation, storage, and distribution managers	Wenger, 2017
1A2	Aircraft loadmaster	33-102	First-line supervisors of firefighting and prevention workers	Wenger, 2017
1A2	Aircraft loadmaster	33-201	Firefighters	Wenger, 2017
1A2	Aircraft loadmaster	33-202	Fire inspectors	Wenger, 2017
1A2	Aircraft loadmaster	33-305	Police officers	Wenger, 2017
1A2	Aircraft loadmaster	47-222	Structural iron and steel workers	Wenger, 2017
1A2	Aircraft loadmaster	49-101	First-line supervisors of mechanics, installers, and repairers	Wenger, 2017
1A2	Aircraft loadmaster	49-904	Industrial machinery installation, repair, and maintenance workers	Wenger, 2017
1A2	Aircraft loadmaster	49-909	Miscellaneous installation, maintenance, and repair workers	Wenger, 2017
1A2	Aircraft loadmaster	53-104	First-line supervisors of transportation and material moving workers	Wenger, 2017
1A2	Aircraft loadmaster	53-104	First-line supervisors of transportation and material moving workers	Wenger, 2017
1A2	Aircraft loadmaster	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1A2	Aircraft loadmaster	53-502	Ship and boat captains and operators	Wenger, 2017
1A2	Aircraft loadmaster	53-503	Ship engineers	Wenger, 2017
1A3	Airborne mission systems specialist	33-102	First-line supervisors of firefighting and prevention workers	Wenger, 2017
1A3	Airborne mission systems specialist	33-201	Firefighters	Wenger, 2017
1A3	Airborne mission systems specialist	33-202	Fire inspectors	Wenger, 2017
1A3	Airborne mission systems specialist	33-305	Police officers	Wenger, 2017
1A3	Airborne mission systems specialist	47-101	First-line supervisors of construction trades and extraction workers	Wenger, 2017
1A3	Airborne mission systems specialist	47-211	Electricians	Wenger, 2017

Table A.1—Continued

AFSC	AFSC Title	SOC	SOC Title	Source
1A3	Airborne mission systems specialist	47-215	Pipelayers, plumbers, pipefitters, and steamfitters	Wenger, 2017
1A3	Airborne mission systems specialist	47-222	Structural iron and steel workers	Wenger, 2017
1A3	Airborne mission systems specialist	49-101	First-line supervisors of mechanics, installers, and repairers	Wenger, 2017
1A3	Airborne mission systems specialist	49-202	Radio and telecommunications equipment installers and repairers	Wenger, 2017
1A3	Airborne mission systems specialist	49-301	Aircraft mechanics and service technicians	Responsibility match
1A3	Airborne mission systems specialist	49-904	Industrial machinery installation, repair, and maintenance workers	Wenger, 2017
1A3	Airborne mission systems specialist	49-909	Miscellaneous installation, maintenance, and repair workers	Wenger, 2017
1A3	Airborne mission systems specialist	51-101	First-line supervisors of production and operating workers	Wenger, 2017
1A3	Airborne mission systems specialist	53-104	First-line supervisors of transportation and material moving workers	Wenger, 2017
1A3	Airborne mission systems specialist	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1A3	Airborne mission systems specialist	53-502	Ship and boat captains and operators	Wenger, 2017
1A3	Airborne mission systems specialist	53-503	Ship engineers	Wenger, 2017
1A8	Airborne intelligence, surveillance, and reconnaissance	15-129	Miscellaneous computer occupations	Responsibility match
1A8	Airborne intelligence, surveillance, and reconnaissance	27-201	Actors, producers, and directors	Responsibility match
1A8	Airborne intelligence, surveillance, and reconnaissance	27-302	News analysts, reporters and journalists	Responsibility match
1A8	Airborne intelligence, surveillance, and reconnaissance	27-309	Miscellaneous media and communication workers	Responsibility match
1A8	Airborne intelligence, surveillance, and reconnaissance	27-309	Miscellaneous media and communication workers	Responsibility match
1A8	Airborne intelligence, surveillance, and reconnaissance	33-302	Detectives and criminal investigators	Responsibility match
1A8	Airborne intelligence, surveillance, and reconnaissance	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1A9	Special mission aviator	33-102	First-line supervisors of firefighting and prevention workers	Wenger, 2017

Table A.1—Continued

AFSC	AFSC Title	SOC	SOC Title	Source
1A9	Special mission aviator	33-201	Firefighters	Wenger, 2017
1A9	Special mission aviator	33-202	Fire inspectors	Wenger, 2017
1A9	Special mission aviator	33-305	Police officers	Wenger, 2017
1A9	Special mission aviator	47-222	Structural iron and steel workers	Wenger, 2017
1A9	Special mission aviator	49-101	First-line supervisors of mechanics, installers, and repairers	Wenger, 2017
1A9	Special mission aviator	49-904	Industrial machinery installation, repair, and maintenance workers	Wenger, 2017
1A9	Special mission aviator	49-909	Miscellaneous installation, maintenance, and repair workers	Wenger, 2017
1A9	Special mission aviator	53-104	First-line supervisors of transportation and material moving workers	Wenger, 2017
1A9	Special mission aviator	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1A9	Special mission aviator	53-502	Ship and boat captains and operators	Wenger, 2017
1A9	Special mission aviator	53-503	Ship engineers	Wenger, 2017
1C0	Aviation resource management	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1C3	Command and control operations	33-102	First-line supervisors of firefighting and prevention workers	Wenger, 2017
1C3	Command and control operations	33-201	Firefighters	Wenger, 2017
1C3	Command and control operations	33-202	Fire inspectors	Wenger, 2017
1C3	Command and control operations	33-305	Police officers	Wenger, 2017
1C3	Command and control operations	47-222	Structural iron and steel workers	Wenger, 2017
1C3	Command and control operations	49-101	First-line supervisors of mechanics, installers, and repairers	Wenger, 2017
1C3	Command and control operations	49-904	Industrial machinery installation, repair, and maintenance workers	Wenger, 2017
1C3	Command and control operations	49-909	Miscellaneous installation, maintenance, and repair workers	Wenger, 2017
1C3	Command and control operations	53-104	First-line supervisors of transportation and material moving workers	Wenger, 2017
1C3	Command and control operations	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1C3	Command and control operations	53-502	Ship and boat captains and operators	Wenger, 2017
1C3	Command and control operations	53-503	Ship engineers	Wenger, 2017

Table A.1—Continued

AFSC	AFSC Title	SOC	SOC Title	Source
1C5	Command and control battle management operations	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1C6	Space systems operations	17-302	Engineering technologists and technicians, except drafters	Responsibility match
1C6	Space systems operations	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1C7	Airfield management	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1N0	All source intelligence analyst	33-302	Detectives and criminal investigators	Responsibility match
1N2	Signals intelligence	17-302	Engineering technologists and technicians, except drafters	Responsibility match
1N2	Signals intelligence	33-302	Detectives and criminal investigators	Responsibility match
1N4	Intelligence analyst	33-302	Detectives and criminal investigators	Responsibility match
1Z1	Pararescue	11-916	Emergency management directors	Responsibility match
1Z1	Pararescue	29-204	Emergency medical technicians and paramedics	Responsibility match
1Z1	Pararescue	33-102	First-line supervisors of firefighting and prevention workers	Wenger, 2017
1Z1	Pararescue	33-109	Miscellaneous First-line supervisors, protective service workers	Wenger, 2017
1Z1	Pararescue	33-201	Firefighters	Wenger, 2017
1Z1	Pararescue	33-202	Fire inspectors	Wenger, 2017
1Z1	Pararescue	33-305	Police officers	Wenger, 2017
1Z1	Pararescue	47-222	Structural iron and steel workers	Wenger, 2017
1Z1	Pararescue	49-101	First-line supervisors of mechanics, installers, and repairers	Wenger, 2017
1Z1	Pararescue	49-904	Industrial machinery installation, repair, and maintenance workers	Wenger, 2017
1Z1	Pararescue	49-909	Miscellaneous installation, maintenance, and repair workers	Wenger, 2017
1Z1	Pararescue	53-104	First-line supervisors of transportation and material moving workers	Wenger, 2017
1Z1	Pararescue	53-502	Ship and boat captains and operators	Wenger, 2017
1Z1	Pararescue	53-503	Ship engineers	Wenger, 2017
1Z2	Combat control	17-102	Surveyors, cartographers, and photogrammetrists	Responsibility match
1Z2	Combat control	17-303	Surveying and mapping technicians	Responsibility match
1Z2	Combat control	53-202	Air traffic controllers and airfield operations specialists	Responsibility match
1Z2	Combat control	53-604	Traffic technicians	Responsibility match
1Z3	Tactical air control party	17-102	Surveyors, cartographers, and photogrammetrists	Responsibility match
1Z3	Tactical air control party	17-303	Surveying and mapping technicians	Responsibility match
1Z3	Tactical air control party	53-202	Air traffic controllers and airfield operations specialists	Responsibility match

Table A.1—Continued

AFSC	AFSC Title	SOC	SOC Title	Source
1Z3	Tactical air control party	53-604	Traffic technicians	Responsibility match
1Z4	Special reconnaissance	17-102	Surveyors, cartographers, and photogrammetrists	Responsibility match
1Z4	Special reconnaissance	17-303	Surveying and mapping technicians	Responsibility match
1Z4	Special reconnaissance	33-102	First-line supervisors of firefighting and prevention workers	Wenger, 2017
1Z4	Special reconnaissance	33-201	Firefighters	Wenger, 2017
1Z4	Special reconnaissance	33-202	Fire inspectors	Wenger, 2017
1Z4	Special reconnaissance	33-305	Police officers	Wenger, 2017
1Z4	Special reconnaissance	47-222	Structural iron and steel workers	Wenger, 2017
1Z4	Special reconnaissance	49-101	First-line supervisors of mechanics, installers, and repairers	Wenger, 2017
1Z4	Special reconnaissance	49-904	Industrial machinery installation, repair, and maintenance workers	Wenger, 2017
1Z4	Special reconnaissance	49-909	Miscellaneous installation, maintenance, and repair workers	Wenger, 2017
1Z4	Special reconnaissance	53-104	First-line supervisors of transportation and material moving workers	Wenger, 2017
1Z4	Special reconnaissance	53-202	Air traffic controllers and airfield operations specialists	Wenger, 2017
1Z4	Special reconnaissance	53-502	Ship and boat captains and operators	Wenger, 2017
1Z4	Special reconnaissance	53-503	Ship engineers	Wenger, 2017
1Z4	Special reconnaissance	53-604	Traffic technicians	Wenger, 2017
21M	Munitions and missile maintenance	17-201	Aerospace engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-202	Agricultural engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-203	Bioengineers and biomedical engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-204	Chemical engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-205	Civil engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-206	Computer hardware engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-207	Electrical and electronics engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-208	Environmental engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-211	Industrial engineers, including health and safety	CIP and responsibility match
21M	Munitions and missile maintenance	17-212	Marine engineers and naval architects	CIP and responsibility match

Table A.1—Continued

AFSC	AFSC Title	SOC	SOC Title	Source
21M	Munitions and missile maintenance	17-213	Materials engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-214	Mechanical engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-215	Mining and geological engineers, including mining safety engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-216	Nuclear engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-217	Petroleum engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-219	Miscellaneous engineers	CIP and responsibility match
21M	Munitions and missile maintenance	17-301	Drafters	CIP and responsibility match
21M	Munitions and missile maintenance	17-302	Engineering technologists and technicians, except drafters	CIP and responsibility match
21M	Munitions and missile maintenance	17-303	Surveying and mapping technicians	CIP and responsibility match
62E	Developmental engineer	11-904	Architectural and engineering managers	Responsibility match
62E	Developmental engineer	17-201	Aerospace engineers	Responsibility match
62E	Developmental engineer	17-201	Aerospace engineers	Responsibility match
62E	Developmental engineer	17-202	Agricultural engineers	Responsibility match
62E	Developmental engineer	17-203	Bioengineers and biomedical engineers	Responsibility match
62E	Developmental engineer	17-204	Chemical engineers	Responsibility match
62E	Developmental engineer	17-205	Civil engineers	Responsibility match
62E	Developmental engineer	17-206	Computer hardware engineers	Responsibility match
62E	Developmental engineer	17-206	Computer hardware engineers	Responsibility match
62E	Developmental engineer	17-207	Electrical and electronics engineers	Responsibility match
62E	Developmental engineer	17-207	Electrical and electronics engineers	Responsibility match
62E	Developmental engineer	17-208	Environmental engineers	Responsibility match
62E	Developmental engineer	17-211	Industrial engineers, including health and safety	Responsibility match
62E	Developmental engineer	17-211	Industrial engineers, including health and safety	Responsibility match
62E	Developmental engineer	17-212	Marine engineers and naval architects	Responsibility match
62E	Developmental engineer	17-213	Materials engineers	Responsibility match
62E	Developmental engineer	17-214	Mechanical engineers	Responsibility match
62E	Developmental engineer	17-214	Mechanical engineers	Responsibility match
62E	Developmental engineer	17-215	Mining and geological engineers, including mining safety engineers	Responsibility match
62E	Developmental engineer	17-216	Nuclear engineers	Responsibility match

Table A.1—Continued

AFSC	AFSC Title	SOC	SOC Title	Source
62E	Developmental engineer	17-217	Petroleum engineers	Responsibility match
62E	Developmental engineer	17-219	Miscellaneous engineers	Responsibility match
62E	Developmental engineer	17-219	Miscellaneous engineers	Responsibility match
62E	Developmental engineer	47-207	Construction equipment operators	Responsibility match

TABLE A.2

Case-by-Case Updates to the DMDC Crosswalk

AFSC	Description of Change to Matched SOC	Reason
15W	Add 19-202 and 19-204	Add employees at a more appropriate career level.
21A	Add 17-201 and 11-305	Add employees at a more appropriate career level.
31P	Add 33-101	Add employees at a more appropriate career level.
35P	Add 25-303	Add employees at a more appropriate career level.
42F	Add 29-124	Podiatric surgeons were previously matched only to podiatrists; they are now also matched to surgeons.
43H	Add 21-109	Add employees at a more appropriate career level.
44K	Change 19-104 to 29-121	Pediatricians were the only physicians matched to medical scientists; this change matches them to physicians.
61C	Add 19-203	Add employees at a more appropriate career level.
61D	Add 19-201 and 17-216	Add employees at a more appropriate career level.
71S	Add 33-302	Add employees at a more appropriate career level.

Appendix B. Technical Details of Raking Method

We used a traditional raking method to produce the Occupational Diversity Benchmarking Workbook. Raking weights the matched civilian labor force so that the marginal distributions of age and education (and for the more-aggregated benchmarks, occupation) match the marginal distributions of those characteristics in the Air Force. We use the R package anesrake to produce the weights (Pasek et al., 2014; Pasek, 2018).

DeBell and Krosnick, 2009, provides a helpful guide to the method. In addition, consider a simple numerical example. Suppose that in some Air Force occupation, 50 percent of the personnel have a bachelor's degree and 50 percent have a graduate degree, and that 75 percent of the personnel are ages 19 through 28 and 25 percent are ages 29 through 33. In the comparable civilian occupation, suppose that 60 percent of personnel have a bachelor's degree and 40 percent have a graduate degree, and that 50 percent of the personnel are ages 19 through 28 and 50 percent are ages 29 through 33, when weighted using standard survey weights. We rake the civilian occupation to match the Air Force as follows. First, to make the distribution of education match, we multiply the survey weights for all civilians with a bachelor's degree by 50/60, and we multiply the survey weights for all civilians with a graduate degree by 50/40. This process brings the reweighted civilian population to 50 percent bachelor's degree holders and 50 percent graduate degree holders. Next, to make the distribution of age match, we multiply the new weights for all civilians ages 19 through 28 by 75/25, and we multiply the new weights for all civilians ages 29 through 33 by 50/25. However, this might bring the education distribution for the reweighted civilians out of alignment with the Air Force. If so, the anesrake package automatically and iteratively repeats this process until both the age and education distributions for the reweighted civilians exactly match the marginal distributions for the Air Force or until (as described later) the weights on an individual civilian reach the maximum value we have specified (which prevents any single individual from having too high a weight).

For benchmarks of three-digit AFSCs, the civilian sample is raked on highest level of education and age, in which age is binned using the quartiles of age in DAF (calculated separately for officers and enlisted personnel).[17] For benchmarks of more aggregated AFSCs, the civilian sample is raked on the AFSC to which each civilian (or duplicated civilian, for those matched to multiple) is matched, in addition to binned age and highest level of education. As suggested by Pasek et al., 2014, we consider a deviation of 2 percent or less on any characteristic (age; education; or, in the aggregated benchmarks, occupation) between the DAF and civilian labor force to be small enough that that variable does not need to be raked. Deviation is the calculated square of the deviation from the average category of each variable. If no variable included in the raking routine deviates by 2 percent or more, then we report the shares of each gender and racial and ethnic group in the civilian sample weighted only by the ACS sample weights.

The starting weights for each individual are the sampling weights provided by the ACS, which are used to ensure that the civilian sample is representative of the U.S. full-time workforce. Weights for each individual are capped at five times their ACS sample weight to prevent any given civilian from being given too high a weight.

As mentioned in the main text, there are several cases in which the raking procedure is unable to bring the age and education distributions of the civilian group into exact alignment with the Air Force. This most likely occurs because of the cap on the raked weights: In occupation groups in which the distribution of age and education differs substantially between the DAF and civilian labor force, it might be the case that a relatively large cell in the Air Force corresponds to a relatively small cell in the matched civilian group. If that is true, then the weights for each individual civilian in that small cell would need to be relatively high—potentially larger than the cap—to make the age and education distributions match exactly. Once the cap is hit, the raking procedure might not be able to adjust the weights enough for a perfect match between the military and civilian groups.

In cases in which the raking procedure does not fully converge, we use a cutoff rule to deter-

mine whether the civilian and military samples are similar enough on observed characteristics for the benchmark to be a useful comparison. For procedures that do not converge, we first divide the deviation reported by anesrake by the sum of the weights to get the per-person deviation. We then impose a cutoff rule: If the per-person deviation is smaller than 1× 10−5, we assume that the military and weighted civilian populations are similar enough for comparison. When the deviation is larger, the benchmarks should be used with caution. The reason that we impose a cutoff rule using per-person deviation is because the deviation reported by anesrake is generally larger for larger civilian samples, which makes direct comparison between different benchmarks difficult.

Appendix C. Occupational Diversity Benchmarking Workbook

See *RAND_RRA988-3.AppendixC.zip* for the Occupational Diversity Benchmarking Workbooks, available at www.rand.org/t/RRA988-3.

Notes

[1] In this report, we use a binary gender construct (male and female) because this aligns with DAF personnel data collection.

[2] See Wenger et al. (2017), in which a team of researchers applied this method to a subset of U.S. Army occupations. By measuring job tasks directly, instead of using occupation names and descriptions, they found that civilian firefighters and crewmembers for water vessels actually matched well to Army combat occupations in the occupation attributes even though their job descriptions are very dissimilar.

[3] Although noncitizens can enlist in the Air Force, this is rare, and we drop noncitizens from the comparison group for that reason.

[4] We drop a small number of officers who do not hold a college degree and a small number of officers in physician occupations who hold only a bachelor's degree. We also drop a small number of enlisted personnel who have graduate degrees when no one in the group of civilians they are matched to has a graduate degree. Although it is possible to enlist without a high school graduate equivalency degree (GED) or high school diploma, this is very rare, and we dropped individuals without at least a GED from the data.

[5] Aside from the well-known gender differences in labor force participation (see, e.g., Blau and Kahn, 2013), the labor force participation of men without a college degree in the United States has been declining over the past several decades, and the decline was larger for Black men than for White men (Binder and Bound, 2019—see the online appendix for race- and ethnicity-specific figures). Similarly, our ACS data show that Black men in particular are less likely than White men to be in the labor force or employed full-time.

[6] Benchmarks are produced only for occupations with at least 30 personnel. We also suppress benchmarks when the effective sample size (post-adjustment) of the near-equivalent civilian labor force is smaller than 30.

[7] For example, AFSC 1Z2, Combat Control, was matched to air traffic controllers, traffic technicians, surveyors, and surveying and mapping technicians. The responsibilities of this occupation are described as including "terminal control (air traffic control [ATC]) and targeting," hence the match to air traffic controllers and traffic technicians, and "tactical level surveillance and reconnaissance functions," which is matched to surveyors in other similar occupations in the DMDC crosswalk (Air Force Personnel Center, 2021a). We added surveying and mapping technicians to better match the likely education level of enlisted personnel.

[8] Age is binned based on the quartiles of the distribution of age in the Air Force, calculated separately for enlisted personnel and officers. Age had to be binned to run the raking procedure, and quartiles (rather than smaller or larger bins) were chosen to balance processing speed against information loss. As described in more detail later, we lack information on characteristics such as physical health, drug involvement, body composition, and criminal history, which also affect both the demographics of the civilian labor force and eligibility to serve in the military, so we do not include them in the raking method. The ACS also does not include information on work experience; however, it is standard in the economics literature to proxy for work experience using a combination of age and education.

[9] Such differences manifest in a small effective sample size of civilians following the raking procedure. What this means is that a large number of civilians fall into age or education categories that are rare in the Air Force and therefore are assigned weights close to zero.

[10] In these cases, the raking procedure converges in that the weights themselves converge, but the population marginals do not match perfectly between the Air Force and civilian samples.

[11] All individuals who indicate Hispanic or Latino ethnicity are included in the Hispanic group. Throughout the rest of this report, when we refer to *White*, *AAPI*, *Black*, or *Other* racial and ethnic groups, they should be interpreted as non-Hispanic.

[12] *Other* includes non-Hispanic American Indian, Alaska Native, and multiple races.

[13] Because there is a significant degree of sorting into different civilian occupations based on gender and race and ethnicity (U.S. Bureau of Labor Statistics, 2019; Blau, Brummund, and Liu, 2012), we might expect there to be fewer differences in representation between Air Force occupations and matched civilian occupations.

[14] Prior studies have found that racial and ethnic minorities might have a greater preference for military occupations where they will learn transferrable skills (Harrell et al., 1999, p. 54).

[15] None of the Black, Hispanic, or Other female respondents to the ACS were pilots.

[16] The sole exception is women of two or more races, who are most concentrated in tactical operations. The "two or more races" group is included in our Other group.

[17] The education levels used are high school or equivalent, some college, associate's degree, bachelor's degree, and graduate degree. The bins for officers are {[19,29), [29,34), [34,40), [40,60]}, and the bins for enlisted personnel are {[18,23), [23,27), [27,34), [34,60]}.

Bibliography

Air Force Instruction 36-205, "Affirmative Employment Program (AEP), Special Emphasis Programs (SEP), and Reasonable Accommodation Policy," Washington, D.C.: U.S. Air Force, December 1, 2016.

Air Force Instruction 36-2640, "Executing Total Force Development," Washington, D.C.: U.S. Air Force, August 30, 2018.

Air Force Personnel Center, "Air Force Enlisted Classification Directory (AFECD): The Official Guide to the Air Force Officer Classification Codes," Randolph, Tex., October 31, 2021a.

———, "Air Force Officer Classification Directory (AFOCD): The Official Guide to the Air Force Officer Classification Codes," Randolph, Tex., 2021b.

Armor, David J., "Race and Gender in the U.S. Military," *Armed Forces and Society*, Vol. 23, No. 1, Fall 1996, pp. 7–27.

Asch, Beth J., James R. Hosek, and John T. Warner, "New Economics of Manpower in the Post-Cold War," in Todd Sandler and Keith Hartley, eds., *Handbook of Defense Economics*, 1st ed., Vol. 2, No. 64, 2007.

Binder, Ariel J., and John Bound, "The Declining Labor Market Prospects of Less-Educated Men," *Journal of Economic Perspectives*, Vol. 33, No. 2, 2019, pp. 163–190.

Blau, Francine D., Peter Brummund, and Albert Yung-Hsu Liu, "Trends in Occupational Segregation by Gender 1970–2009: Adjusting for the Impact of Changes in the Occupational Coding System," *Demography*, Vol. 50, No. 2, 2013, pp. 471–492.

Blau, Francine D., and Lawrence M. Kahn, "Female Labor Supply: Why Is the United States Falling Behind?" *American Economic Review*, Vol. 103, No. 3, 2013, pp. 251–256.

DAF Inspector General—*See* U.S. Department of the Air Force Inspector General.

DeBell, Matthew, and Jon A. Krosnick, *Computing Weights for American National Election Study Survey Data*, Ann Arbor, Mich., and Palo Alto, Calif.: American National Election Studies, nes012427, 2009.

Defense Manpower Data Center, MOC Crosswalk, dataset, undated. As of August 6, 2021:
https://www.onetcenter.org/dl_files/2019/military_crosswalk.zip

DeLeire, Thomas, and Helen Levy, "Worker Sorting and the Risk of Death on the Job," *Journal of Labor Economics*, Vol. 22, No. 4, October 2004, pp. 925–953.

Executive Office of the President, *Standard Occupational Classification Manual*, Washington, D.C.: Office of Management and Budget, 2018.

Firestone, Juanita M., "Occupational Segregation: Comparing the Civilian and Military Work Force," *Armed Forces & Society*, Vol. 18, No. 3, Spring 1992, pp. 363–381.

Harrell, Margaret C., Sheila Nataraj Kirby, Jennifer Sloan McCombs, Clifford M. Graf II, Christopher McKelvey, and Jerry M. Sollinger, *Barriers to Minority Participation in Special Operations Forces*, Santa Monica, Calif.: RAND Corporation, MR-1042-SOCOM, 1999. As of August 1, 2021:
https://www.rand.org/pubs/monograph_reports/MR1042.html

Keller, Kirsten M., Maria C. Lytell, David Schulker, Kimberly Curry Hall, Louis T. Mariano, John S. Crown, Miriam Matthews, Brandon Crosby, Lisa Saum-Manning, Douglas Yeung, Leslie Adrienne Payne, Felix Knutson, and Leann Caudill, *Advancement and Retention Barriers in the U.S. Air Force Civilian White Collar Workforce: Implications for Demographic Diversity*, Santa Monica, Calif.: RAND Corporation, RR-2643-AF, 2020. As of July 28, 2021:
https://www.rand.org/pubs/research_reports/RR2643.html

Lim, Nelson, Louis T. Mariano, Amy G. Cox, David Schulker, and Lawrence M. Hanser, *Improving Demographic Diversity in the U.S. Air Force Officer Corps*, Santa Monica, Calif.: RAND Corporation, RR-495-AF, 2014. As of August 20, 2021:
https://www.rand.org/pubs/research_reports/RR495.html

Office of the Under Secretary of Defense for Personnel and Readiness, "Population Representation in the Military Services: Fiscal Year 2018 Summary Report," Washington, D.C.: 2020. As of August 5, 2021:
https://www.cna.org/pop-rep/2018/index.html

Pasek, Josh, Matthew DeBell, and Jon A. Krosnick, "Standardizing and Democratizing Survey Weights: The ANES Weighting System and anesrake," Working Paper, July 26, 2014. As of July 26, 2021:
https://surveyinsights.org/wp-content/uploads/2014/07/Full-anesrake-paper.pdf

Pasek, Josh, "anesrake: ANES Raking Implementation," R package version 0.80, April 28, 2018. As of July 26, 2021:
https://CRAN.R-project.org/package=anesrake

Ruggles, Steven, Sarah Flood, Ronald Goeken, Josiah Grover, Erin Meyer, Jose Pacas, and Matthew Sobek, "IPUMS USA: Version 10.0," dataset, Minneapolis, Minn.: IPUMS, 2020. As of June 14, 2022:
https://doi.org/10.18128/D010.V10.0

Solutions for Information Design, LLC, "Pilot Study: Translating Military Skills to Civilian Employment," Washington, D.C.: U.S. Department of Labor, September 26, 2014.

U.S. Bureau of Labor Statistics, *Labor Force Characteristics by Race and Ethnicity, 2018*, Report 1082, Washington, D.C.: October 2019.

U.S. Bureau of Labor Statistics, "Air Traffic Controllers," in *Occupational Outlook Handbook*, Washington, D.C.: U.S. Department of Labor, 2020.

U.S. Department of the Air Force, *Air Force Manual 36-2032: Military Recruiting and Accessions*, Washington, D.C.: Department of the Air Force, September 27, 2019.

U.S. Department of the Air Force Inspector General, *Report of Inquiry (S8918P): Independent Racial Disparity Review*, Washington, D.C.: Department of the Air Force, December 2020.

U.S. Equal Employment Opportunity Commission, "Equal Employment Opportunity," Washington, D.C.: Equal Employment Opportunity Management Directive 715, October 1, 2003. As of August 10, 2021: https://www.eeoc.gov/federal-sector/management-directive/section-717-title-vii

Wenger, Jeffrey B., Ellen M. Pint, Tepring Piquado, Michael G. Shanley, Trinidad Beleche, Melissa A. Bradley, Jonathan Welch, Laura Werber, Cate Yoon, Eric J. Duckworth, and Nicole H. Curtis, *Helping Soldiers Leverage Army Knowledge, Skills, and Abilities in Civilian Jobs*, Santa Monica, Calif.: RAND Corporation, RR-1719-A, 2017. As of July 26, 2021: https://www.rand.org/pubs/research_reports/RR1719.html

About the Authors

Avery Calkins is an Associate Economist at the RAND Corporation. She is a labor economist whose research centers on gender and occupational choice, broadly defined. Since joining RAND, she has contributed to several projects concerning the military workforce. She holds a Ph.D. in Economics from the University of Michigan, an MA in Economics from the University of Michigan, and a BS in Economics from Carnegie Mellon University.

Tiffany Berglund is a Quantitative Analyst at the RAND Corporation. Her research in military recruiting and retention across multiple services, includes benchmarking eligible populations and the impacts of recruiting resources on enlistment supply and diversity in the armed forces. She has extensive experience in how eligibility requirements impact the demographic distributions of accession cohorts in the military, including DAF, USCG, and U.S. Army.

David Schulker is a Senior Policy Researcher at the RAND Corporation who focuses on quantitative workforce analysis and planning. His prior work has examined human resource management challenges in the DoD related to outreach, recruiting, career progression, talent management, workforce development, and retention. He is a graduate of the U.S. Air Force Academy and a former Air Force officer, and he received his Ph.D. in Policy Analysis from the Pardee RAND Graduate School.

Louis T. Mariano is a Senior Statistician at the RAND Corporation. His research in military personnel, primarily for the Unites States Department of the Air Force, includes the dynamics of career selection, promotion systems, and retention of military personnel. He has conducted extensive research on how these systematic elements impact diverse groups within the DAF, including women and racial and ethnic minorities, within the officer, enlisted, and civilian ranks.

About This Report

This report examines the distribution of race, ethnicity, and gender among Department of the Air Force (DAF) active duty personnel relative to similarly situated workers in the U.S. civilian labor force. Accurate benchmarks are essential to providing context to observed disparities in diverse representation and analyzing barriers to participation. In this report, the authors describe the construction of career field benchmarks using civilian workers in near-equivalent occupations and discuss considerations for interpreting comparisons. These new benchmarks can be incorporated into barrier analysis alongside other benchmarks of demographic diversity.

The research reported here was commissioned by SAF/ODI and conducted within the Workforce, Development, and Health Program of RAND Project AIR FORCE as part of a fiscal year 2021 project, "Data-Enabled Talent Management through Targeted Benchmarks, Best Practices, and Partnerships."

RAND Project AIR FORCE

RAND Project AIR FORCE (PAF), a division of the RAND Corporation, is the Department of the Air Force's (DAF's) federally funded research and development center for studies and analyses, supporting both the United States Air Force and the United States Space Force. PAF provides the DAF with independent analyses of policy alternatives affecting the development, employment, combat readiness, and support of current and future air, space, and cyber forces. Research is conducted in four programs: Strategy and Doctrine; Force Modernization and Employment; Resource Management; and Workforce, Development, and Health. The research reported here was prepared under contract FA7014-16-D-1000.

Additional information about PAF is available on our website: www.rand.org/paf/

This report documents work originally shared with the DAF on August 31, 2021. The draft report, issued on September 27, 2021, was reviewed by formal peer reviewers and DAF subject-matter experts.

Acknowledgments

We thank Tony Lawrence for programming assistance and Monica Rico for research assistance. We are also grateful for the constructive guidance and comments provided by the SAF/ODI staff. We are also thankful for the constructive feedback from Claude Setodji, as well as our peer reviewers, John Crown and Kim Hall of RAND and Greg Ridgeway of the University of Pennsylvania.

For more information on this publication, visit www.rand.org/t/RRA988-3.

www.rand.org