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SEXUAL ASSAULT AND SEXUAL HARASSMENT IN THE U.S. MILITARY

Volume 5. Estimates for Installation- and Command-Level Risk of Sexual Assault and Sexual Harassment from the 2014 RAND Military Workplace Study

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Prepared for the DoD Sexual Assault Prevention and Response Office
Approved for public release; distribution unlimited

For more information on this publication, visit www.rand.org/t/RR870z7

Library of Congress Cataloging-in-Publication Data is available for this publication.
ISBN: 978-1-9774-0051-2

Published by the RAND Corporation, Santa Monica, Calif.

Preface

The Sexual Assault Prevention and Response Office in the Office of the Secretary of Defense selected the RAND Corporation to provide a new and independent evaluation of sexual assault, sexual harassment, and gender discrimination across the U.S. military. The U.S. Department of Defense (DoD) asked the RAND research team to redesign the approach used in previous DoD surveys, if changes would improve the accuracy and validity of the survey results for estimating the prevalence of sexual crimes and violations. In the summer of 2014, RAND fielded a new survey as part of the RAND Military Workplace Study.

This report, Volume 5 in our series, describes survey data analyses designed to identify how risk of sexual assault and sexual harassment varies across military installations and major commands. The complete series that collectively describes the study methodology and its findings includes, to date, the following reports:

- *Sexual Assault and Sexual Harassment in the U.S. Military: Top-Line Estimates for Active-Duty Service Members from the 2014 RAND Military Workplace Study*
- *Sexual Assault and Sexual Harassment in the U.S. Military: Top-Line Estimates for Active-Duty Coast Guard Members from the 2014 RAND Military Workplace Study*
- *Sexual Assault and Sexual Harassment in the U.S. Military: Volume 1. Design of the 2014 RAND Military Workplace Study*
- *Sexual Assault and Sexual Harassment in the U.S. Military: Volume 2. Estimates for Department of Defense Service Members from the 2014 RAND Military Workplace Study*
- *Sexual Assault and Sexual Harassment in the U.S. Military: Annex to Volume 2. Tabular Results from the 2014 RAND Military Workplace Study for Department of Defense Service Members*
- *Sexual Assault and Sexual Harassment in the U.S. Military: Volume 3. Estimates for Coast Guard Service Members from the 2014 RAND Military Workplace Study*
- *Sexual Assault and Sexual Harassment in the U.S. Military: Annex to Volume 3. Tabular Results from the 2014 RAND Military Workplace Study for Coast Guard Service Members*
- *Sexual Assault and Sexual Harassment in the U.S. Military: Volume 4. Investigations of Potential Bias in Estimates from the 2014 RAND Military Workplace Study*

- *Sexual Assault and Sexual Harassment in the U.S. Military: Volume 5. Estimates for Installation- and Command-Level Risk of Sexual Assault and Sexual Harassment from the 2014 RAND Military Workplace Study*
- *Sexual Assault and Sexual Harassment in the U.S. Military: Annex to Volume 5. Tabular Results from the 2014 RAND Military Workplace Study for Installation- and Command-Level Risk of Sexual Assault and Sexual Harassment*.

These reports are available online at www.rand.org/surveys/rmws.

This research was conducted within the Forces and Resources Policy Center of the RAND National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the Unified Combatant Commands, the Navy, the Marine Corps, the defense agencies, and the defense Intelligence Community.

For more information on the Forces and Resources Policy Center, see www.rand.org/nsrd/ndri/centers/frp or contact the director (contact information is provided on the web page).

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Summary

While the prevalence of sexual assault in the military has been estimated regularly for each of the services and for the service academies, it would be useful to know the rate of sexual assault and sexual harassment among personnel serving in individual military installations or commands. Such information could help identify the need for additional training or prevention efforts, educate leaders about problems in their commands, improve understanding of the organizational or environmental risk factors for sexual assault and harassment, and provide interpretational context for statistics that document the number of official reports of sexual assault at specific installations.

Unfortunately, to be useful, estimates of sexual assault prevalence must be precise, which can pose a challenge when constructing estimates of an event that has a fairly low rate (e.g., less than 2 percent per year) in small groups.[1] The goals of the current analyses are twofold: first, to establish whether statistical methods can be developed to produce sufficiently precise prevalence estimates to distinguish the risk profiles of military installations and commands, and, second, to use those methods to examine which installations, commands, or other groupings of service members are associated with especially high or low risk. Identification of installations with high or low risk may provide insights into patterns of risk across installations or shared characteristics of locations with abnormal risk profiles. In addition, estimates of risk at the installation and command levels provide important context for understanding rates of official reporting of sexual assaults collected by the Sexual Assault Prevention and Response Office in the Office of the Secretary of Defense.

These analyses are designed to take advantage of the unusually large sample of survey respondents who participated in the RAND Military Workplace Study (RMWS), as well as the wide range of information that is available about service members from their personnel records. Using these data, we apply advanced statistical estimation techniques called *small-area estimation* to produce prevalence estimates within installations and commands.

[1] The U.S. Department of Defense requires that the following statement be included in this report: Reference to *sexual assault* is based on survey respondents' answers to questions about their experiences but does not reflect whether a sexual assault was substantiated by an investigation. Use of the terms *perpetrator* and *victim* in this report are not intended to presume the guilt or innocence of an individual.

Methods

Small-area estimation techniques were used to produce prevalence estimates for each installation and command using data on active-component personnel in fiscal year (FY) 2014 provided to us by the Defense Data Manpower Center and data from survey responses in the RMWS. Rather than a simple averaging of survey responses in each installation or command, small-area estimation techniques produce estimates from multilevel regression models predicting sexual assault. This has the potential to improve the precision of the estimates because they are derived partially from models estimated on a large sample (approximately 150,000 respondents in our case) rather than being based entirely on the relatively small samples from an individual installation (e.g., 100 respondents). The method uses a two-stage modeling approach. A first stage uses a flexible machine-learning algorithm (Generalized Boosted Models) to predict sexual assault from a range of individual service member characteristics, as well as the observable characteristics of the installations and commands. A second stage uses a Bayesian multilevel model that combines the prediction from the first phase with random effects for each installation and command. The overall prevalence estimate for a given installation or command is then computed as the predicted probability of sexual assault averaged over the Bayesian posterior distributions for all of the individuals in the installation, with each person weighted as a function of the portion of the period he or she was assigned to that installation.

Total sexual assault risk at each installation can be decomposed into the portion of total risk that can be explained by the individual characteristics of personnel assigned there and the portion of total risk that is not explained by the characteristics of assigned personnel, which we refer to as *installation-specific risk*. Estimates of installation-specific risk are useful for comparing installations in a manner that adjusts for the fact that some observed differences in sexual assault risk across installations can be predictable from differences in the individual risk characteristics of the installations' personnel. For example, different types of U.S. Army personnel serve at Fort Bragg than at the Pentagon, which may partially explain the difference in estimated sexual assault risk for these installations. To compute installation-specific risk, we create two risk predictions: one based on the individual characteristics of personnel at the installation and one for the personnel's total risk estimate based on their individual characteristics and the characteristics of their duty assignment (including the effect of their installation and command). Installation-specific risk measures the extent to which personnel at a given installation have, on average, higher risk or lower risk than similar personnel with other duty assignments. Installation-specific risk should be treated as purely descriptive—as the portion of risk not explained by the individual characteristics in our model—and should not be interpreted as being caused by any specific feature of the installation or command.

Results

We find that statistical techniques can be used to identify differences in sexual assault and harassment risk across installations and commands with good precision and that these differences are sometimes large. Moreover, the results of the analysis offer important insights into the distribution of risk across the services. The results may also provide clues about the conditions that contribute to sexual assault risk and about strategies that could be used to prevent sexual assault and harassment.

A large proportion of all sexual assaults occur at a relatively few large installations for each of the services. The Army and Marine Corps, for instance, each have installations where we estimate there were more than 500 sexual assaults of women and men in 2014. By targeting prevention, training, and other interventions at the largest and highest-risk installations, the services might efficiently make important reductions in their sexual assault rates.

Each service member's estimated risk of being sexually assaulted in the one-year period of study depends to a substantial extent on his or her duty assignment to a particular unit, command, and installation. In one military service, for instance, women could see their risk doubled or halved, depending on the installation or ship to which they are assigned. Moreover, installation-specific risk is often a large portion of the total risk at an installation or command. For instance, in some commands, 16 percent of all sexual assaults of women were associated with command-specific risk.

Our estimates of sexual assault and sexual harassment risk are highly correlated across installations. These strong associations suggest that sexual assault and sexual harassment have very similar predictors at both the individual and installation levels. Knowing that there is a strong and shared underlying risk could help better investigate what those common risk factors are. This finding also has implications for how the services can track, investigate, and prevent sexual assaults and sexual harassment.

Caveats and Limitations

There are important limitations to the estimates of installation and command risk we present in this report. Some of the key limitations include the following:

- *Estimates for sexual assault and sexual harassment risk in this report are for FY 2014, and risk may be different today.* It is possible that some factors contributing to risk in some installations or commands in FY 2014 are no longer present today, in which case the estimates provided in this report would not accurately describe current risks.
- *The risk estimates in this report are just for active-component personnel.* Many bases have reserve-component personnel on active-duty status, civilian employees, con-

tractors, and others. This report provides estimates for the rates of sexual assault experienced only by active-component members assigned to the installation or ship.

- *The estimates describe the risk of sexual assault to service members assigned to specific installations or commands, not the risk of assaults occurring at the installation or while on duty in a command.* We are estimating the total number of personnel assigned to each installation who were sexually assaulted at any point during the year, whether or not the assault happened on the installation. In some cases, this means that assaults occurred when the member was home on leave or on temporary duty elsewhere.
- *This report does not reveal why risk is higher or lower at different installations, and there is a wide range of possible explanations for these differences.* This report describes the distribution of sexual assault and sexual harassment risk, not why some installations have higher or lower risk. There are many possible causes for the observed differences in risk across installations. For example, the differences may result from differences in command climate, alcohol availability and price, crime rates in the surrounding civilian community, or the transitory presence of one or more sexual predators. Although the current study cannot identify the causal role of these or other factors, ongoing research may help answer these questions.
- *Estimates for eight installations where basic military training occurs exclude the experiences of roughly half of those locations' FY 2014 trainees.* Because the RMWS, like U.S. Department of Defense surveys of sexual assault risk, did not include service members with fewer than six months of active-duty service at the time of survey administration, roughly half of the trainees at installations providing basic military training were omitted from the sample. The affected installations were Fort Benning, Fort Jackson, Fort Leonard Wood, Fort Sill, Naval Station Great Lakes, Lackland Air Force Base, and the Marine Corps Recruit Depots at Parris Island and San Diego. Our risk estimates are representative of service members in the sample frame, but because these installations have a significant proportion of individuals who are not in the sample frame, our estimates are not representative of all service members at these installations. For these eight installations, our estimates of sexual assault risk overemphasize the experiences of personnel with lengthier military careers, such as trainers and administrators. We cannot say whether this emphasis raises or lowers these installations' risk estimates, so the reported rates should be interpreted with caution. Estimates of the total number of assaults, which are derived from the total number of personnel in the sample frame, are sufficiently inaccurate for those eight installations that we have omitted them from this report.
- *Service academy estimates exclude the experiences of cadets and midshipmen.* Estimates for Army Garrison West Point (which includes the U.S. Military Academy), the Naval Support Activity Annapolis (which includes the U.S. Naval Academy),

and the U.S. Air Force Academy all exclude the experiences of cadets and midshipmen because they were not included in the 2014 RMWS.

- *We were not able to produce estimates for Marine Corps major commands.* We did not receive access to major command information for the Marine Corps. Instead, we had unit-monitored command codes and parent-monitored command codes, which allow for aggregation of units typically well below the major command level. Moreover, we did not have access to labels describing these lower-level aggregations of commands. Therefore, our Marine Corps command risk estimates are not directly comparable to the major command estimates we produced for the other services, and they are difficult to interpret for anyone who does not know what the commands are that correspond to the monitored command codes. For this reason, the Marine Corps command estimates appear only in the appendix at the end of this report.
- *We provide risk estimates only for the largest installations and ships.* To protect the confidentiality of RMWS survey respondents, no estimates are provided for men or women at an installation or ship unless at least 50 members of the same sex who were assigned to the installation or ship completed the RMWS survey. Units or installations with fewer respondents were typically aggregated with other smaller clusters of personnel in the same city, country, or postal zone. Smaller ships were typically aggregated with other smaller ships by their mailing addresses, so these smaller ships were clustered with other units typically in the same fleet and from the same home port.
- *Our estimates assume that risk to individuals is relatively constant over a service member's tenure at any particular installation or ship.* When members served at more than one installation during FY 2014, we attributed their calculated sexual assault risk to each installation they served at during the year in proportion to the time they spent at each. This procedure will produce unbiased estimates of risk for each of the installations where an individual served, unless risk varies with the length of time the member served at a location. If, for instance, risk is high in the first month a member serves at a new installation but is low thereafter, then our assumption that risk at each installation is constant over a service member's time there would be violated and could lead to some bias in our procedure.

Conclusions and Recommendations

In this section, we highlight some of the implications of our analyses and suggest new steps that could be taken to combat sexual assault and harassment against service members:

- This study demonstrates that the method of estimating risk of sexual assault and sexual harassment developed here produces sufficiently precise estimates of the

distribution of risk to identify installations and commands with clearly differentiated risk profiles.
- These risk estimates should be disseminated to military leadership to make them more aware of problems in their commands and to identify progress on command objectives.
- Because a large number of sexual assaults are concentrated at a relatively small number of large installations, specialized training, prevention, and response interventions may be most efficiently deployed to those locations.
- There appear to be several patterns in the list of high- and low-risk installations (such as high risk on ships and low risk at medical facilities); however, additional research is needed to understand and accurately characterize the structural, organizational, or environmental factors that contribute to these patterns.
- The current study produces small-area estimates for installations and major commands, but the same methods could be used for investigating risk across a wide range of organizational structures. In particular, it would be useful to use a more interpretable definition of major commands for the Marine Corps. It would also be useful to explore alternative ways of clustering ships than using the arbitrary clusters provided by postal codes.
- Sexual assaults are underreported in the military, as elsewhere. The military has good information about the number of official reports of sexual assault made by personnel at individual installations. These data could be compared with estimates like ours of the total number of sexual assaults at these installations to establish where underreporting may be more or less common, as well as the characteristics of the installations most closely associated with problems of underreporting of sexual assault.
- It may be possible to use the Defense Equal Opportunity Management Institute's Organizational Climate Survey (DEOCS) to identify units and installations where sexual harassment risk and, by extension, sexual assault risk are greatest. Because DEOCS assesses sexual harassment and is given to a large portion of the total force every year, that data source may be useful for indicating not just where sexual harassment risk is greatest but also possibly where sexual assault risk is especially high or low. Additional research is needed to assess whether DEOCS data could support such estimates.

Acknowledgments

For this volume of the *Sexual Assault and Sexual Harassment in the U.S. Military* series, we are grateful for the valuable insights and suggestions provided by reviewers of earlier drafts of this report. In particular, we would like to acknowledge Michael Decker, Michael Hansen, Lisa Harrington, Rod Little, Brad Martin, and Layla Parast.

Abbreviations

AA	Armed Forces Americas
AB	Air Base
ADM	administrative
AE	Armed Forces Europe
AF	Air Force
AFB	Air Force Base
AFELM	Air Force Element
AFL	Armed Forces of Liberia
AP	Armed Forces Pacific
APO	Army Post Office
ASW	anti-submarine warfare
BUMED	Bureau of Medicine and Surgery
BUPERS	Bureau of Navy Personnel
CMCC	Command Monitored Command Code
CNI	Commander, Naval Installations
CNO	Chief of Naval Operations
CU	Cuba
DEOCS	Defense Equal Opportunity Management Institute's Organizational Climate Survey
DIA	Defense Intelligence Agency
DISA	Defense Information Systems Agency
DMA	Defense Media Activity
DMDC	Defense Manpower Data Center
DoD	U.S. Department of Defense
DPO	Diplomatic Post Office

FORSCOM	U.S. Army Forces Command
FPO	Fleet Post Office
FY	fiscal year
GBM	Generalized Boosted Models
GR	Germany
HQ	headquarters
IMCOM	Installation and Management Command
ISR	intelligence, surveillance, and reconnaissance
IT	Italy
JA	Japan
JB	Joint Base
JCS	Joint Chiefs of Staff
KS	South Korea
KU	Kuwait
MC	Marine Corps
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCBH	Marine Corps Base Hawaii
MCC	major command code
MCCDC	Marine Corps Combat Development Command
MCMC	Markov Chain Monte Carlo
MCRD	Marine Corps Recruit Depot
MEF	Marine Expeditionary Force
MLG	Marine Logistics Group
NAS	Naval Air Station
NATO	North Atlantic Treaty Organization
NAVAIR	Naval Air Systems Command
NAVCAMS	Naval Communication Area Master Station
NAVDIST	Naval District
NAVFAC	Naval Facilities Engineering Command
NAVSTA	Naval Station
NAVSUBBASE	Naval Submarine Base
NAVSUP	Naval Supply Systems Command
NB	Naval Base

NETC	Naval Education and Training Command
NNMC	National Naval Medical Center
NSA	Naval Support Activity
NTTC	Naval Technical Training Center
OSD	Office of the Secretary of Defense
RMWS	RAND Military Workplace Study
SAPRO	Sexual Assault Prevention and Response Office
SD	standard deviation
SETAF	Southern European Task Force
SPAWAR	Space and Naval Warfare Systems Command
SPECWAR	Special Warfare Command
TRADOC	U.S. Army Training and Doctrine Command
TU	Turkey
UIC	unit identification code
USAF	U.S. Air Force
USEUCOM	U.S. European Command
USMC	U.S. Marine Corps
USNA	U.S. Naval Academy
USNR	U.S. Navy Reserve
USSTRATCOM	U.S. Strategic Command
USTRANSCOM	U.S. Transportation Command
WGRA	Workplace and Gender Relations Survey of Active Duty Members

CHAPTER ONE

Introduction

In the summer of 2014, RAND conducted a large survey of the sexual assault and sexual harassment experiences of members of the U.S. military. More than half a million members were invited to participate in the RAND Military Workplace Study (RMWS), and more than 170,000 completed the survey. The unprecedented scale of the study created new opportunities for understanding sexual assault and sexual harassment in military settings. It was, for instance, the first time a survey captured a sufficient number of sexually assaulted men to establish how these sexual assaults differ from those on women. Prior reports in this series used the large sample to support detailed investigations of the risk factors and circumstances of sexual assault, service branch differences in the risk of sexual assault and harassment, and differences in the risk of sexual assault faced by members of the active and reserve components of the U.S. military. These analyses have provided new insights into the nature of sexual violence in the military and how to target and prevent it.

In this report, we examine how the risk of sexual assault and sexual harassment varies across installations and large commands.[1] The Sexual Assault Prevention and Response Office (SAPRO) in the Office of the Secretary of Defense (OSD) requested this study to clarify whether risk is especially concentrated in specific installations or commands and to explore whether patterns in risk could be used to guide improved allocation of training and prevention resources. In addition, localization of risk could help SAPRO identify those installations or commands where official reporting of sexual assault is higher or lower than in the service as a whole. Finally, sexual assault and harassment estimates at the installation or unit level could be used to identify risk indicators that would support more-rapid interventions than are currently available. For instance, comparing installation risk with responses on the frequently administered Defense Equal Opportunity Management Institute's Organizational Climate Survey

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(DEOCS) could identify patterns in DEOCS responses that serve as leading indicators of an environment that poses a high risk of sexual assault or sexual harassment.

Before this analysis, the best information available to SAPRO on the distribution of sexual assaults across installations or commands came from official reports of assault. These are somewhat hard to interpret, however, because sexual assault is known to be substantially underreported, and more so for men than women. Therefore, installations with higher rates of sexual assault reporting could be those with a particularly high sexual assault risk or they could be the ones providing the support and safety needed to facilitate reporting. Further complicating the interpretation of installation-level reports of sexual assault is that installations vary considerably in the types of personnel assigned to them. An installation with large populations of younger, less-educated, unmarried, and more-junior-ranking service members would be expected to have a higher rate of sexual assaults than would the Pentagon, for instance, because these population characteristics are strongly correlated with sexual assault risk (Morral, Gore, and Schell, 2015a). Therefore, even if official reports accurately reflected installations' sexual assault risks, differences among installations might reflect population differences as much or more than any differences in command climates or other installation-specific characteristics.

In the analyses described in this report, we separately account for risk associated with the population characteristics of each installation or command and risks that appear to be installation- or command-specific. In Chapter Two, we explain some of the limitations of the data we used to identify installations and commands, and we detail the statistical methodologies used to produce our estimates. In Chapter Three, we describe sexual assault risk across installations and commands, naming those large installations and commands where total risk and installation-specific risk appear to be especially high or low. Tabular results with risk estimates for all installations and commands meeting our definition of "large" can be found in Part A of the annex to this report. In Chapter Four, we present sexual harassment risk findings for installations and commands, with tabular results in Part B of the annex. Finally, in Chapter Five, we discuss what we believe are the most actionable findings from these analyses and make several recommendations for reducing sexual assault and harassment in the military based on our findings.

CHAPTER TWO

Approach to Estimating Risk at Installations and Major Commands

There are several challenges to estimating sexual assault and sexual harassment risk in installations or major commands. Among these challenges, we must define what counts as an installation and associate individual service members with installations even though many moved, entered, or left service during the studied year. We must generate estimates of low-prevalence events even though many installations had relatively few survey respondents in the RMWS. We must account for the effect on these estimates of differential survey nonresponse across installations. We wish to differentiate service members' sexual assault risk that is associated with their demographic characteristics from risk that is not fully explained by, for instance, their age, service branch, and marital status. In this chapter, we describe our approach to these and other analytic choices we made to produce the estimates we report.

This report presents risk estimates for installations and commands only when they have enough personnel assigned to them to ensure that the privacy and confidentiality of individual respondents is protected. Because groups need to be fairly large to allow reliable estimates, the omitted estimates have high uncertainty and would not have been useful for policy guidance. Specifically, we present estimates only for installations and commands that (1) had 100 or more service members assigned to them in an average month during fiscal year (FY) 2014 and (2) included 50 or more RMWS respondents. These size requirements are applied for each gender and service branch; for example, to produce an estimate for Marine Corps women at a given installation, there needed to be 100 Marine Corps women at that base in an average month, and we had to have 50 RMWS respondents who were Marine Corps women who served at that installation during the study year. Because women and men were sampled at different rates in the RMWS and had different response rates, the requirement for 50 or more RMWS respondents caused us to omit estimates for most installations with fewer than 700 men or 150 women in a given service. In this report, we refer to the installations that meet our size requirements as *large installations* and to the commands that meet the requirements as *large commands*.

RAND Military Workplace Study and Data

Data used for these analyses include administrative data provided by the Defense Manpower Data Center (DMDC) and survey data collected as part of the RMWS. In early 2014, the U.S. Department of Defense (DoD) asked the RAND National Defense Research Institute to conduct an independent assessment of sexual assault, sexual harassment, and gender discrimination in the military. The RMWS was one of the largest surveys of its kind: Almost 560,000 active- and reserve-component service members were invited to participate, and more than 170,000 completed the web-administered survey. Although the RMWS includes a small number of respondents from the reserve component and from the Coast Guard, the present analyses focus exclusively on results from the active component and the four DoD services.

Details of the overall study design can be found in Volume 1 of this report series (Morral, Gore, and Schell, 2014). Among the active-component DoD personnel analyzed here, the RMWS sampled 100 percent of the women and 25 percent of the men. Within gender groups, personnel were sampled with equal probability. Members of the active component were randomized to receive either the new RMWS measures of sexual assault and harassment or the measures used in the 2012 Workplace and Gender Relations Survey of Active Duty Members (WGRA), conducted by DoD. The data analyzed here combine these two measurements to allow for a larger sample at each installation. Additionally, after the primary data collection was completed, the RMWS website continued to operate and sampled personnel could complete their survey after the nominal end date. This was done to allow us to better investigate the characteristics of the nonrespondents in the primary study (see Morral, Gore, and Schell, 2015b, Chapter Two). The current analyses include these 3,908 late respondents who completed the survey on the web. Finally, the analyses of sexual harassment risk are based on slightly fewer respondents than the analyses of sexual assault risk. While all respondents randomized to the RMWS measures received the sexual assault module, approximately 33 percent of respondents who received the RMWS measures were skipped out of the full harassment module to reduce survey response burden. Estimates of the risk for sexual harassment are based only on respondents who received the full RMWS sexual harassment module.

Although the sample is not an equal probability sample overall, it is an equal probability sample among men and among women. In this report, we do not present risk estimates that integrate across genders, and the underlying statistical models are run either fully stratified by gender or allowing interactions by gender. Thus, the survey design does not have an effect on the overall analysis because the only groups sampled with different probabilities are effectively analyzed as separate samples.

Because the RMWS did not sample service members with fewer than six months of active-duty service at the time of survey administration, roughly half of the trainees at installations providing basic military training were omitted from the sample frame. The affected installations were Fort Benning, Fort Jackson, Fort Leonard Wood, Fort

Sill, Naval Station Great Lakes, Lackland Air Force Base (AFB), and the Marine Corps Recruit Depots at Parris Island and San Diego. Our risk estimates are representative of service members in the sample frame, but because these installations have a significant proportion of individuals who are not in the sample frame, our estimates are not representative of all service members at these installations. For these eight installations, our estimates of sexual assault risk overemphasize the experiences of personnel with lengthier military careers, such as trainers and administrators. We cannot say whether this emphasis raises or lowers these installations' risk estimates, so the reported rates should be interpreted with caution. Estimates of the total number of assaults, which are derived from the total number of personnel in the sample frame, are sufficiently inaccurate for those eight installations that we have omitted them from this report.

Characterizing Organizational Units in Each Service Branch

The basic data used to link all service members to installations and major commands came from DMDC personnel files for FY 2014, which represents the year over which sexual assault and harassment was assessed in the 2014 RMWS. For each month in that year, we have records of all active-duty personnel indicating their duty unit identification code (UIC), the zip code to which their duty UIC was assigned during the month, and the major command code (MCC) to which their duty UIC was assigned. In some cases, service members may have been nominally assigned to one unit while performing duties with another unit. Our analyses are based solely on their duty units.

All of the primary statistical analyses are based on either duty UIC zip codes or duty MCCs. However, these variables each required substantial recoding (described next) to meet our analytic goals and the need to maintain the confidentiality of RMWS participants.

Linking Zip Codes to Installations

We identified the installation at which each service member served in FY 2014 on the basis of the zip code of his or her duty unit in each month of that year. Typically, several UICs shared the same zip code and were thus classified as serving at the same installation. For installations in the United States, we assigned installation name labels to zip codes in accordance with a crosswalk of zip codes, UIC codes, and installation names for FY 2014 provided to us by DMDC in July 2016. When more than one installation shared a single zip code, we assigned all members of each service branch to the installation corresponding most closely to the member's service branch. For instance, zip code 92110 was listed in the DMDC crosswalk as corresponding to the San Diego Navy Submarine Base and to Air Force Plant 19. In this case, we assumed that all Air Force personnel in this zip code were at the Air Force plant and that all other personnel were at the submarine base. In addition, in a few cases, we corrected what we believed were errors in the DMDC crosswalk, such as spelling mistakes or incorrect assignments of zip codes to installations. For instance, zip code 89018 was mislabeled as Nellis AFB rather than Creech AFB. Similarly, zip code 96786 was listed in the DMDC file as Naval Communication Area Master Station (NAVCAMS), Eastern Pacific but is also the main address of Schoefield Army Barracks. In this case, we retained the NAVCAMS label for Navy and Marine Corps personnel but substituted Schoefield for Army and Air Force personnel.

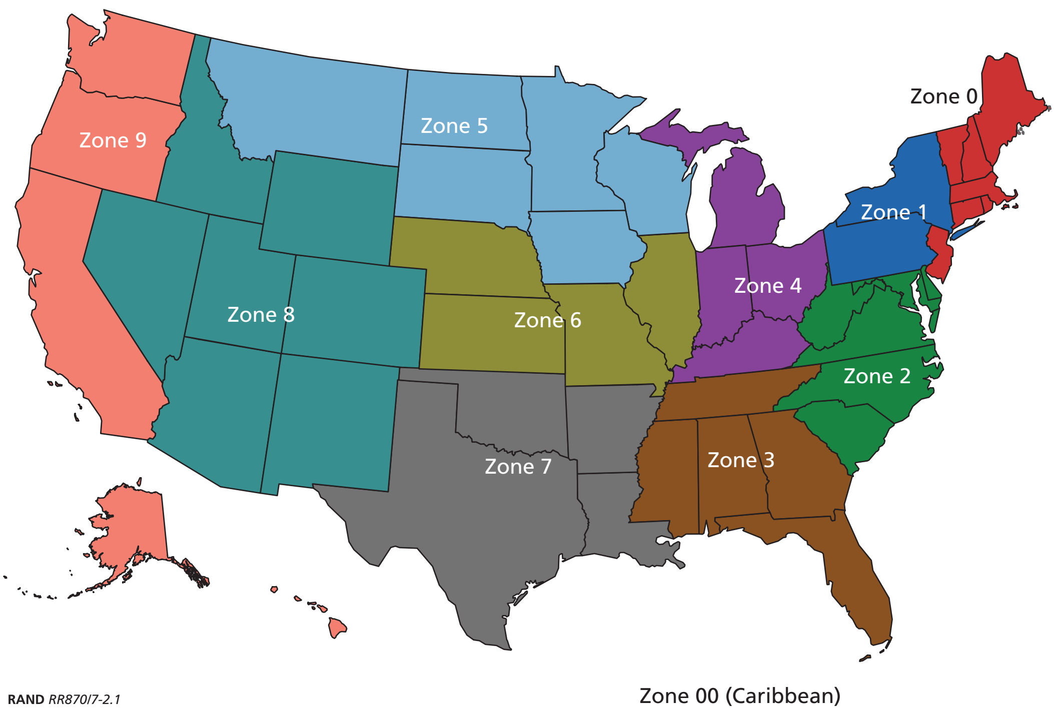
Units that were overseas for part or all of FY 2014 usually had Army Post Office (APO), Fleet Post Office (FPO), or Diplomatic Post Office (DPO) codes instead of zip codes. When possible, we assigned installation names to these codes using a crosswalk of APO, FPO, and DPO codes with installations as they were assigned on April 1, 2015, provided to us by the Military Postal Service Agency. We aggregated all DPO addresses into a "Various Embassies/Consulates" category. In some cases, however, APO or FPO codes did not correspond to an installation label included in this crosswalk. When we could place the unlabeled postal code in a specific postal region (Armed Forces Americas [AA], Armed Forces Europe [AE], and Armed Forces Pacific [AP]), this information was included in the unit label (e.g., "Unknown AE"). In other cases, UICs had addresses with no overseas postal code but instead had a country or city identifier, such as "GB" for Great Britain. We labeled service members in these UICs as being in an unknown location in the country (e.g., "Unknown United Kingdom").

Similarly, there were some units in the data set with location information that was completely missing or withheld. In the DMDC data set, these units were listed as having a location of "ZZZ." We combined these units into a single "Missing" installation group.

While aircraft carriers have their own FPO addresses, most ships share an FPO address with one or more other ships in their fleet. When the FPO code was associated with a single ship or base name, we use that name. When it was associated with multiple ships, we note that in the label (e.g., "Various AP Ships 96660"). Although aggregation of units in postal codes results in meaningful clusters of personnel in other services, aggregation of ships in FPO codes results in relatively arbitrary clusters of ships within fleets.

Our *installation* analysis aggregated members with different zip codes when these codes were known to belong to a single installation. For foreign installations, we aggregated all DPO addresses into a single "Various Embassies/Consulates" category. APO addresses were aggregated by city (or, in a few instances, by island, such as Okinawa and Guam). We aggregated ships only within individual FPO addresses. Zip codes that were not linked with installations in the DMDC crosswalk were aggregated at the one-digit postal code level (the zones in Figure 2.1). Although there were 779 installation clusters after implementing these procedures, we report on only the 271 clusters that met our minimum size requirements for a large installation (see Table 2.1).

Figure 2.1
Postal Areas Used in the Installation Level of Analysis



RAND *RR870/7-2.1*

In short, we group UICs into larger clusters using their addresses. This was done primarily by postal codes: We used zip codes domestically; APO, FPO, and DPO codes internationally; and city or country names internationally when postal codes were not available. These codes were then labeled using information from DMDC and the Military Postal Service Agency. These postal code labels may refer to military installations, ships, groups of ships, cities, or countries. Postal codes without descriptive labels have been labeled as "Unknown." In a few instances, these labels refer to groups of units that may share little in common other than their size, that they are all located in a single city or country, or that their unit address was missing in the DMDC records. For some fleet post office codes, the Military Post Office directory lists the name of a mobile command within the Marine Corps rather than an installation name. These mobile addresses follow a unit, like a headquarters unit, as it moves between locations. Following our labeling convention, we use that command name as the installation label in this report. It is clear, however, that the estimates do not apply to all Marines within the command, only those with units that were attached to the particular FPO with that label in the Military Post Office Directory. Although we use installation names throughout this report, the zip codes used to specify these named installations can be found in Part C of the annex to this report.

Table 2.1
Levels of Analysis for Service Member Sexual Assault Risk

Clustering Type	Installation	MCC
Primary clustering	Duty UICs with U.S. addresses were clustered by installations (using the DMDC installation crosswalk). Foreign APO addresses were clustered by city (using the Military Post Office Directory). FPO addresses were clustered by unique FPO codes. DPO addresses were clustered in a single "Various Embassies/ Consulates" category.	Duty UICs were clustered in shared major commands (except Marine Corps UICs, which were clustered in Marine Corps Command MCCs).
Clustering procedure when primary codes or labels are missing	When postal codes were missing, duty UICs were clustered by country or by APO or FPO region, when possible, and were otherwise labeled as "Missing." When a UIC zip code did not correspond to an installation in the DMDC crosswalk, it was clustered in a postal region.	Duty UICs with missing MCCs were clustered in a "Missing MCC" label.
Unique clusters across services	N (Total) = 779 N (Men) = 756 N (Women) = 699	N (Total) = 230 N (Men) = 228 N (Women) = 214
Unique clusters across services meeting size criteria	N (Total) = 271 N (Men) = 266 N (Women) = 229	N (Total) = 135 N (Men) = 134 N (Women) = 96

Identification of Large Commands

In addition to location information for each service member's unit in FY 2014, we had information about each person's MCC from DMDC. We used these duty unit MCCs to produce sexual assault and sexual harassment prevalence estimates for high-level commands in the Army, Navy, and Air Force. Command risk estimates for the Marine Corps differ, as described later. Source information on the names of MCCs came from several places. For the Army, we pulled command codes from the Force Management System Website (FMSWeb), which is owned by the U.S. Army Force Management Support Agency. The labels we used for these codes were current as of June 14, 2016, although we are aware of one code that appears to be mislabeled in the FMSWeb database. Specifically, the Army major command "TA" label was listed in the FMSWeb database as belonging to U.S. Army Accessions Command since October 2011. However, because U.S. Army Accessions Command was discontinued in 2011, the soldiers with MCC "TA" must have been serving in a different command. In this case, therefore, we replaced Army Accessions Command with Army Recruiting Command because this is the command associated with the "TA" label in the current MCC table maintained by the Defense Logistics Agency (Defense Logistics Agency, 2017).

For the Navy, we linked DMDC MCCs to the two-digit command codes listed in the Navy Manpower Analysis Center (2015)'s *Activity Manpower Management Guide*, supplemented with codes found in the Navy Personnel Command (2015)'s list of codes for DoD commands. For the Air Force, we used the reference tables for unit manpower document codes (Headquarters Air Force, 2015).

The data contained in the duty MCC variable provided by DMDC are substantially different for the Marine Corps than for the other services. In the other three branches, this code takes on a small number of values (< 100), and most of these categories contain several thousand service members. In the Marine Corps, the duty MCC variable supplied by DMDC takes on 2,000 values, and the vast majority of these categories contain fewer than 100 Marines.

To produce something similar to the estimates of major commands for the other services, we needed to aggregate the Marine Corps values of duty MCCs into larger organizational units. DMDC was unable to provide any individual-level variable that allowed for a higher-level command aggregation for the Marine Corps than the duty MCC variable, and SAPRO was unable to obtain this information from the Marine Corps. However, SAPRO did provide a crosswalk that links Marine Corps MCCs with other types of organizational labels or units in the Marine Corps (as of September 25, 2014). Within this crosswalk, duty MCC could be linked to a larger organizational unit labeled Command Monitored Command Code (CMCC). For the purposes of our major command analysis, we replaced the original MCC with the corresponding CMCC. In some cases, however, a single MCC linked to multiple CMCCs. In those instances, we did not recode the original MCC value. Because those original MCCs are almost always too small to be reportable, those MCC clusters that were not recoded are typically dropped from the results presented in this report. As a practical matter, organizational units we present in the major command analyses correspond to the CMCC in the Marine Corps organizational file. We do not, however, have definitive descriptive labels for those codes, nor do we know if these are the most appropriate codes for representing the command structure of the Marine Corps. The Marine Corps declined to provide assistance in identifying the most useful organizational units or the best labels for the existing codes. Because assignment to major commands in the Marine Corps is not definitive and the labels of those clusters may be incorrect, we note this uncertainty on tables or figures containing estimates for Marine Corps women and men at the major command level, and we relegate these analyses to the appendix at the end of this report. In addition, a complete list of duty MCC values that we aggregated in each CMCC is presented in Part D of the annex to this report.

Statistical Methods

The methodological approach we used to estimate the one-year risk of sexual assault and sexual harassment at installations and major commands in FY 2014 was identical. Therefore, we describe the approach for only sexual assault risk at installations.

Our estimates of the one-year prevalence of sexual assault for individual installations are derived from the RMWS survey, which assessed these experiences in approximately 140,000 active-duty service members. One simple method to produce these estimates would have been to compute the prevalence of each outcome among the individuals who completed the survey at each installation (e.g., if 1 in 10 male survey respondents at an installation reported a sexual assault, the estimated prevalence at that installation would be 10 percent). We did not use this simple approach because it has the following problems:

1. Prevalence estimates made this way have much greater uncertainty for small installations than big installations. This means that small-installation estimates are more likely to take on extreme (and inaccurate) values than estimates for large installations, making them more likely to be incorrectly identified as being at unusually high or low risk.
2. We know that survey nonrespondents have characteristics that put them at greater risk of sexual assault than respondents (e.g., nonrespondents tend to be low-ranking and enlisted). We addressed this potential source of bias in our servicewide estimates of risk using nonresponse weights. However, our nonresponse weights were not designed to work within individual installations. We believe that the modeling approach we describe in the next section is likely to produce more valid estimates than one that attempts to develop nonresponse weights that work well in each of more than 1,000 reporting categories required for the installation analysis.
3. Deriving prevalence estimates for an installation using only a small number of survey respondents would ignore available and relevant information about installation risk. We know which installations have a greater proportion of high-risk personnel (e.g., female, young, low-ranking, unmarried). We can use this information about the installation to improve our estimates of sexual assault prevalence at each installation.

Rather than taking the simple average rate of sexual assaults among survey respondents from each installation, we used a *small-area estimation* statistical technique to generate sexual assault risk estimates. Specifically, we combined information on risk factors of sexual assault identified in our earlier work (Ghosh-Dastidar, Schell, and Morral, 2014; Ghosh-Dastidar et al., 2016; Schell and Morral, 2015) with actual survey responses at each installation to obtain estimates with lower error. These two pieces of information are combined in a multilevel model to minimize error prediction. For installations with fewer survey respondents, the final estimate depends more on the modeled risk based on risk factors of members at that installation and depends less on the (few) survey responses. For large installations with many survey responses, the installation risk estimate depends more on the observed prevalence of sexual assault from that installation.

Overview of the Modeling Approach

Our modeling approach regularizes estimates across installations: Especially high or low installation risk estimates are pulled toward the average of similar installations, particularly when the estimates are based on comparatively few observations. Regularization prevents the proliferation of effects that appear to be large and statistically significant but that are caused by random fluctuations that occur with small samples.

We implemented this approach in two stages. First, we used a nonparametric machine-learning algorithm, Generalized Boosted Models (GBM), to estimate sexual assault risk for each person in the survey sample. This regression model included individual-level risk factors (e.g., rank, marital status) and cluster-level risk factors (e.g., average age of members in the cluster) as predictors. In the second stage, we used a Bayesian multilevel model to predict sexual assault using three types of fixed and random predictors: a "fixed" portion of the model taken from the earlier machine-learning regression, a "random" portion of the model that captures variation across clusters, and an estimate of each individual's response propensity to account for any remaining relationship between factors that are associated with both survey nonresponse and the outcome.

This second model was then used to create all of the estimates presented in the report. Specifically, the model was used to predict the risk of sexual assault for each service member (respondents and nonrespondents). Then, these service member–specific risk estimates were averaged within installations to create the estimated risk of sexual assault for each installation. The rest of this chapter describes these models and procedures in detail.

Generalized Boosted Models of Risk

The goal of the first-stage model (GBM) is to provide the most accurate prediction of sexual assault risk for individual service members without using the clusters of interest (installations and major commands) as direct predictors in the model. The prediction model was estimated on the full sample of active-duty respondents, including both those randomized to receive the prior WGRA form (using the questions from that form assessing *sexual harassment* and *unwanted sexual contact*) and those receiving the RMWS form (with questions assessing *sexual harassment* and *sexual assault*). We created combined outcomes by merging the two sexual harassment measures and by merging the *unwanted sexual contact* and *sexual assault* measures. This was done to maximize the sample size for use in small-area estimation (Rao and Molina, 2015) and because we have previously documented considerable overlap in the constructs measured by the two methods (see Morral, Gore, and Schell, 2015b). The model included a predictor variable to indicate which responses were taken from the prior WGRA form.

The total data set combining RMWS and WGRA outcome measures included sexual assault outcomes on 150,438 active-component service members (excluding Coast Guard members). This includes approximately 5,138 individuals who completed the online survey after the official closing date and were not included in the primary study estimates (for a discussion of these cases, see Morral, Gore, and Schell, 2015b, Chapter Two). Because some respondents were randomized to not receive the full sexual harassment questions in order to reduce response burden, fewer respondents are available for those analyses (N = 98,499).

We used a wide range of variables to predict sexual assault for individual service members in the sample (Table 2.2). These include both the service members' individual characteristics, as well as some cluster characteristics. Most of the individual characteristics were drawn from DMDC personnel records for both respondents

Table 2.2
Model Predictors for the Generalized Boosted Models Algorithm

Individual characteristics
Form (RMWS, WGRA)
Gender
Date of birth
Race code (8 categories)[a]
Ethnic affinity code (12 categories)[a]
Marital status code (8 categories)
Total number of dependents
Education level code (21 ordinal categories)
Armed Forces Qualification Test score
Service branch (4 levels)
Pay grade (20 levels)
Date of entry into military services
Military accession type/source of commission (13 categories)[a]
Days of active-duty service in the past year
Cumulative lifetime months of active federal military service
Projected end date for current term of employment
Separated or retired after sampling (Y/N)
Months deployed since 9/11/2001
Months deployed since 7/1/2013
DoD occupational group (20 categories)
Percentage male within members' specific occupation[b]
Number of people within members' specific occupation[b]
Percentage of recruitment emails unsendable or undeliverable
Number of changes in UIC/installation/MCC within the year

Table 2.2—Continued

Cluster characteristics[c]
Number of active-duty service members in cluster
Percentage of members within cluster who are male
Average age within cluster
Percentage of leaders within cluster who are male
Number of male respondents in cluster
Number of female respondents in cluster
Percentage of male respondents in cluster indicating sexual harassment[d]
Percentage of female respondents in cluster indicating sexual harassment[d]

[a] For these administrative variables, categories that comprise less than 0.5% of the population were combined into an "other" category when used as a predictor in the model. The number of categories after this recode is shown in parentheses.

[b] Derived from 302 DoD occupational categories.

[c] Each variable type was computed for three types of clusters: duty UIC, duty installation/postal code, and duty MCC. Each variable was computed for each month of FY 2014, and an individual service member's value was the average of his or her monthly values over the year.

[d] We included these variables only when predicting sexual assault. When predicting sexual harassment, cluster-level sexual harassment was replaced with cluster-level sexual assault.

and nonrespondents in the sample. The *percentage of recruitment emails unsendable or undeliverable* was taken from survey fielding records and was a factor previously found to be associated with both survey nonresponse and risk of sexual assault (see Morral, Gore, and Schell, 2015b).

The predictors listed under cluster characteristics were designed to capture characteristics of units, unit postal codes, and major commands that were hypothesized to be indicators of risk. To derive these variables, we took the following steps. First, we created a separate variable for each cluster characteristic at the unit, postal code, and major command levels; for example, one variable is *percentage of service members within a cluster who are male*. Thus, the eight rows in Table 2.2 labeled as cluster characteristics correspond to 24 predictor variables. Second, to account for the fact that individuals can move between units within the year and that units can move between postal codes or major commands within the year, we computed these variables separately for each service member in the sample for each month of FY 2014 and then took each member's average across months. Third, when defining the characteristics of a cluster for a given individual, that individual was excluded from the cluster. For example, in a unit with two individuals (one male, one female), the male in the unit would be assessed as being in a unit environment that is 0 percent male, while the female in the same unit would be assessed as being in a unit environment that is 100 percent male. Fourth, when an individual was the only member in a cluster in a given month, all characteristics of that cluster were missing for that month. The average for that individual over the year was the average of nonmissing values, unless all values were missing. In that case, the annual value was also missing. Finally, we recoded these variables into 20-quantile bins prior to being included as predictors. For example, individuals in the 95th to 100th percentile of the distribution on *percentage of members within UIC who are male* were recoded to have an identical value on the recoded variable, which was equal to their mean value prior to recoding. By recoding the variables into relatively large bins of individuals (N = 7,500 respondents), we can prevent unintentionally modeling cluster-specific effects in this first phase. Using these cluster characteristics as predictors in the model is designed to assess the association between regular features of clusters and sexual assault (i.e., how percentage male in the installation is predictive of sexual assault across installations). It should not assess the effects of specific installations. However, the nonlinear regression algorithm we used (discussed later) has the potential to detect individual installations in the data because individuals at those installations have nearly unique values on the predictors. The binning avoids this potential problem.

The regression models were estimated using GBM (Ridgeway, 2012). This is an R package that implements J. H. Friedman's Gradient Boost algorithm (Friedman, 2001, 2002). GBM is a general, automated, data-adaptive modeling algorithm that can estimate the relationship between an outcome of interest and a large number of covariates of mixed type while also allowing for flexible nonlinear relationships between the covariates and the outcome (Friedman, 2001; Ridgeway, 2012). During the GBM estimation, the complexity of each model was optimized using tenfold cross-validation. This procedure prevents overfitting the data while allowing a large number of nonlinear predictors and interactions. The GBM values were estimated using a logit link function, allowing four-way interactions among predictors (with a bagging-fraction of 0.5), and required at least 100 cases in each node. The shrinkage parameters were set low enough to require more than 5,000 iterations. The resulting model was used to create log-odds predicted values for each person in the full sample (both respondents and nonrespondents) on each outcome.

Individuals' predicted values from this modeling approach were subsequently included as an offset in the second-phase multilevel Bayesian model estimates and represent the fixed-effects portion of that multilevel model. However, the predicted values are point predictions (i.e., one prediction from each model per case). Such point estimates do not carry information about their uncertainty and are not proper posterior distributions for use in Bayesian modeling. While the uncertainty in these predictions is relatively small by conventional standards (due to having 150,000 cases on which to estimate the model), ignoring this variance could lead us to overstate the precision of our final installation estimates of sexual assault prevalence. For this reason, we used bootstrapping to assess the uncertainty in the GBM predicted values. Specifically, we created 40 random replicates of our respondent data by resampling with replacement and applied the GBM algorithm in each bootstrap replicate, running the model to the number of iterations that had been found to be optimal through prior cross-validation. For each bootstrap sample, we estimated a predicted value for each service member. The difference between the original estimate for each individual (based on the model run in the actual sample) and each of the 40 bootstrap estimates for that individual was used to estimate the distribution of sampling variability in the estimate for that individual. The process for incorporating this uncertainty into our overall estimates is described later, after we discuss the second-stage model.

Multilevel Model of Cluster-Level Effects

After estimating each individual's risk based on his or her personal characteristics and the broad characteristics of the unit or command in which the person served, the second phase of modeling added to the first risk model a series of effects to capture whether individual zip codes or major commands have higher or lower risk than was expected from just the predictors included in the first-stage model.

These additional effects for each zip code and major command are treated as "random" effects estimated in multilevel models, sometimes referred to as mixed models or hierarchical linear models (Raudenbush and Bryk, 2002; Gelman et al., 2013). The size of the random effect for a given cluster is determined by the following three things:

1. Whether the observed prevalence of sexual assaults among survey respondents was higher or lower in that cluster relative to what was predicted by the GBM algorithm. Zip codes or major commands with more sexual assaults than expected have positive random effects, while those with fewer sexual assaults than expected have negative random effects.
2. The number of observations in a cluster. Small clusters can have large deviations between the actual and expected number of sexual assaults due to chance; observing ten individuals from an installation provides a very imprecise estimate of whether the observed prevalence of sexual assault is higher or lower than expected, while observing 1,000 individuals provides a more precise estimate. As the sample size in a cluster gets larger, the predicted risk of sexual assault in the cluster converges on the observed prevalence of sexual assault in that cluster. On the other hand, as the sample size goes to zero, the predicted risk of sexual assault in that cluster is fully determined by the predicted risk from the first-stage GBM algorithm.
3. The extent to which, across installations and commands, sexual assaults are more clustered than would be expected from the GBM predicted values. When the observed risk of sexual assault is more similar for individuals within instal-

lations than across installations, the model will predict bigger differences in sexual assault risk across clusters. In contrast, if there is no correlation in sexual assault risk among the individuals who are in the same installation, all of the random effects across installations converge to zero because the data suggest that knowing a member's installation is, in general, not informative about sexual assault risk.

We wish to present estimates separately for women and men and for each service branch. Therefore, the multilevel models were run separately for each service branch by gender combination, and eight models were run for each outcome. The random effect associated with a given installation could be different for women and men at that installation, as well as for members from different services assigned to that installation.

The multilevel models we estimated had the following specification. Let Y_i be an indicator of the outcome, p_i the propensity for response on the RMWS survey, and GBM_i the log-odds risk prediction from the GBM for the *i*th service member. Further, let T_i denote the number of months the *i*th service member served in the active-component military in the 12 months from October 1, 2013, to September 30, 2014, and let M_{it} and Z_{it} denote the major command and unit zip code, respectively, of the *i*th service member in month *t*. We estimated the following model:

$$logit(\Pr(Y_i = 1)) = \alpha + GBM_i + g(p_i;\varphi) + \frac{1}{T_i}\sum_{t=1}^{T_i}\theta_{M_{it}} + \frac{1}{T_i}\sum_{t=1}^{T_i}\gamma_{Z_{it}},$$

where α is the intercept, θ is a random effect capturing clustering of service members in major commands, γ is a random effect capturing clustering of service members in unit zip codes, and $g(p_i;\varphi)$ is a spline function of the response propensity. We used a linear spline on the log-odds scale for $g(p_i;\varphi)$ with two knots defined by the 33rd and 67th percentiles of the distribution of the log-odds response propensity for the full sample of respondents and nonrespondents.

This response propensity term was included in the model to make the installation prevalence estimates more robust to possible nonresponse bias. This technique of conditioning on the response propensity when making estimates based on model predictions among nonrespondents is called the *penalized spline of propensity prediction method* (see Zhang and Little, 2009, 2011). The method offers estimates that are doubly robust to nonresponse bias. That is, bias is mitigated to the extent that either the other covariates in the prediction model or the response propensity is correctly specified. For these analyses, the response propensity variable is taken directly from the nonresponse model used to derive the nonresponse weights used in earlier reports in this series (for a detailed discussion of the characteristic of these weights, see Ghosh-Dastidar et al., 2016). Because these multilevel models were stratified by gender and service branch, the propensity spline coefficients were interacted with those factors, but they were not interacted with individual installations or major commands. We investigated including these propensity spline terms as random slopes associated with individual clusters, but such models assigned essentially zero variance to the random slopes and were inferior with respect to indicators of model quality—that is, the model WAIC (the Watanabe or widely applicable information criterion; see Watanabe, 2010) was better when the random slopes were excluded.

This model was fit using Stan, a probabilistic programming language that implements full Bayesian statistical inference using Hamiltonian Markov Chain Monte Carlo (MCMC) estimation (Stan Development Team, 2016). Prior distributions on the model parameters were specified as follows, including mean and standard deviation (SD):

- α ~ *Normal*(*mean* = α_0, *SD* = 1), where α_0 is set equal to the log-odds of the average response among respondents for each combination of gender and service branch. This centers the intercept at a reasonable value with a relatively flat (i.e., minimally informative) prior.
- φ ~ *Multivariate Normal*(*mean* = 0, *SD* = *I*), where *I* is the identity matrix. The coefficients of the linear spline $g(p_i;\varphi)$ are given independent standard normal priors.
- $\theta_j \mid \sigma$ ~ *Normal*(*mean* = 0, *SD* = σ) for each major command *j*. Conditional on a standard deviation parameter σ, the random effects for the major commands are independent and normally distributed.
- $\gamma_k \mid \tau$ ~ *Normal*(*mean* = 0, *SD* = τ) for each zip code *k*. Conditional on a standard deviation parameter τ, the random effects for the zip codes are independent and normally distributed.
- σ and τ are each distributed as *HalfNormal*(*mean* = 0, *SD* = 0.1)—that is, a normal distribution truncated to positive numbers. Making this prior distribution have a standard deviation equal to 0.1 is relatively informative and represents our expectations about the plausible variance in the random effects. This value was chosen based on the expectation that the vast majority of major commands and zip codes should have random effects that confer less than 20 percent increased or decreased odds of the outcome.[1] A nearly uninformative *Normal*(*mean* = 0, *SD* = 1) half-normal prior was also fit for comparison. With that flatter prior, the posterior dis-

[1] An odds ratio of 1.2 corresponds to a log-odds shift of 0.182. A value greater than 0.182 occurs in a half-normal distribution (*mean* = 0, *SD* = 0.1) with probability = 0.07. This prior is consistent with an expectation that only 7 percent of random effects across clusters could shift the odds of sexual assault more than 20 percent. As a practical matter, these particular model hyperparameters can be difficult to estimate in the available data. This is because the sexual assault outcomes are very sparse (e.g., a small number of Air Force sexual assaults on men divided over a large number of bases), making it hard to estimate the extent of interclass correlation and clustering. In light of this empirical ambiguity, we feel that it is prudent to use a regularizing prior (i.e., one with a substantial mass of density near zero) because it is preferable to err on the side of underestimating differences across installations or major commands rather than overestimating.

tributions of this parameter across the eight sexual assault models had a standard deviation of approximately 0.1. Thus, the prior we chose is similar to what one would observe if one pooled the estimate across our eight analytic strata. Using the more informative priors was relatively parsimonious, improving the model WAIC relative to the flat priors for 7 of 8 of our sexual assault models.
- The predicted log-odds of sexual assault from the GBM algorithm are included in the model as an offset. That is, the regression coefficient for these predicted values is constrained to be 1. Because the GBM algorithm uses shrinkage to avoid overfitting (with the amount of shrinkage determined through cross-validation), it should not be included in this second-stage model in a manner that would allow it to take on a β greater than 1.

Four Markov chains were run for 1,000 warm-up iterations and 1,000 sampling iterations, for a total of 4,000 usable MCMC samples. Convergence of the Markov chains was verified graphically and with the R-hat diagnostic statistic (Gelman and Rubin, 1992). Trace plots of the sampled parameter values versus iteration number showed good mixing and stationarity, and the R-hat statistics of all sampled parameters were very close to 1 (all rounded to 1.00), consistent with convergence to the stationary distribution. Effective sample sizes for sampled parameters ranged from 1,106 to 4,000 across the eight models.

Identifying Risk at Installations and Major Commands

To produce risk estimates for installations, we used the 4,000 MCMC iterations to estimate the posterior distribution of individual risk. This individual-level risk was then aggregated to produce posterior distributions for installation- or command-level risk. Before aggregating estimates to the cluster level, however, we needed to account for uncertainty in GBM_i that was estimated in the first-stage model and entered as an offset in the multilevel model. In other words, the posterior distributions from the Bayesian multilevel model ignored the uncertainty in the GBM risk estimate and thus underrepresent the true uncertainty in the predicted values for each individual. We accounted for this uncertainty by postprocessing the Bayesian posterior distributions to add in the uncertainty in the GBM predicted values. Specifically, the 40 bootstrap samples of the GBM were used to define the uncertainty in the GBM predicted value for each individual. A random draw from the 40 bootstrapped samples of GBM error for a given individual was added to each MCMC sample from the full Bayesian multilevel model for that individual. This implicitly assumes that the posterior distribution of the GBM predicted values is independent of the other model parameters. Note that the mth draw from the posterior distribution of the GBM predicted values used the same bootstrap sample for all service members, ensuring that the correlations among the predicted values were maintained. We denote the mth draw from the posterior distribution of the GBM predicted values for the ith service member as $GBM_i^{(m)}$. Then, predicted risk, $\hat{y}_i$, for the *m*th draw from the posterior distribution ($\alpha_0^{(m)}$, $\varphi^{(m)}$, $\theta^{(m)}$, $\gamma^{(m)}$, $GBM_i^{(m)}$) of risk for the *i*th service member is given by

$$logit(\hat{y}_i^{(m)}) = \alpha_0^{(m)} + GBM_i^{(m)} + g(p_i;\varphi^{(m)}) + \frac{1}{T_i}\sum_{t=1}^{T_i}\theta_{M_{it}}^{(m)} + \frac{1}{T_i}\sum_{t=1}^{T_i}\gamma_{Z_{it}}^{(m)}.$$

Note that these risk estimates were produced for the full sample of respondents and nonrespondents.

These posterior distributions of sexual assault risk at the individual level were then aggregated up to a given installation or cluster, using a weighted average based on the amount of time each individual spent at the installation in the survey year. Let

$$w_{ij} = \sum\nolimits_{t=1}^{T_i} \frac{I(M_{it} = j)}{T_i}$$

denote the fraction of time that the *i*th service member spent in the *j*th installation (where $I(M_{it} = j)$ is an indicator function equal to 1 if $M_{it} = j$ and 0 otherwise). The *m*th draw from the posterior distribution of the risk at the *j*th installation, $r_j^{(m)}$, is given by

$$r_j^{(m)} = \frac{\sum\nolimits_{i=1}^{N} w_{ij}\hat{y}_i^{(m)}}{\sum\nolimits_{i=1}^{N} w_{ij}}.$$

A similar strategy was used to estimate risk at commands.

In short, we estimated the distribution of the probability of sexual assault for each individual in the sample. This distribution takes into account all of the predictors in Table 2.2, as well as random effects for duty zip codes and major commands. To get estimates of the risk of sexual assault for any given cluster of individuals (e.g., a particular installation or major command), we averaged these posterior distributions for all individuals in that cluster, weighted by the proportion of the year they were in that cluster. This produces a posterior distribution for that cluster where the mean is the expected probability of sexual assault for all individuals in the cluster, and the variance represents the uncertainty in that estimated mean. When presenting these cluster means, we also present a 95-percent Bayesian credibility interval that corresponds to the 2.5th and 97.5th percentiles of the cluster's posterior distribution. These credibility intervals are generally interpreted in the same way as 95-percent confidence intervals; however, they are influenced by the data and any informative priors (discussed earlier). These credibility intervals may be asymmetric around the cluster mean when the uncertainty is asymmetric.

Identifying Installation-Specific and Command-Specific Risk

The total risk of sexual assault at the installations estimated in the previous section is strongly influenced by the characteristics of personnel at each installation. Installations associated with a high sexual assault risk for men or women typically have a large number of members who would have a high risk of sexual assault regardless of which installation they were assigned to (e.g., young, unmarried, and low-ranking personnel). To better understand the distribution of sexual assault, it may be useful to look beyond the average risk of sexual assault in a given cluster and estimate the extent to which assignment to a particular cluster alters individuals' risk estimates. Specifically, how much would the average estimated risk of sexual assault of service members at a particular installation change if they were assigned to an "average" installation for people with their characteristics rather than their actual installation? We refer to this as *installation-specific risk*.

Installation-specific risk is estimated by comparing two models of sexual assault risk:

1. our Bayesian multilevel risk model that takes into account each individual's specific installation or command over the year, as well as his or her personal characteristics (this is our model for assessing total sexual assault risk, described earlier)
2. a risk estimate that is based solely on personal characteristics, excluding all information about an individual's unit, installation, or command.

By comparing risk estimates from these two models, we can determine how much an individual's total risk estimate is increased or decreased relative to an estimate that assumes that each individual was assigned to a unit, installation, or command with average sexual assault risk.

Specifically, the reduced model included only the individual (not cluster) characteristics listed in Table 2.2 in a GBM regression model, referred to as the *reduced GBM*. The reduced GBM log-odds predicted values (GBM_i^{red}) were then included in a standard logistic regression to adjust the estimates for nonresponse propensity:

$$logit(\Pr(Y_i = 1)) = \alpha + GBM_i^{red} + g(p_i;\varphi),$$

where $g(p_i;\varphi)$ is the same spline function of the response propensity previously described. Predictions of sexual assault risk from this nonresponse-adjusted model are denoted as $\widetilde{GBM}_i$ and reflect our best prediction using just individual characteristics and ignoring cluster characteristics.

To compute the installation-specific risk, we compared the total sexual assault risk estimate (based on the Bayesian multilevel model that includes individual characteristics and information about unit, installation, and command) to this reduced model risk estimate (based only on individual characteristics). For RMWS respondents, we could have compared these two risk estimates by simply looking at the difference between them. The estimates are comparable because both models have the same average predicted probability of sexual assault among respondents. This is because the models use the same data and differ only in how they allocate risk across individuals. For nonrespondents, however, it is more difficult to compare the two estimates of sexual assault risk. These two predicted values are, essentially, two different imputed values based on different models. To the extent that the additional predictors in the full model are associated with both sexual assault and nonresponse, the two different estimates could have substantially different means. In that case, the difference between the estimates will not have the desired interpretation (e.g., all of the installations could have positive values, suggesting that all installations are worse than average). Furthermore, the estimates from the reduced model may be substantially biased because that model fails to account for information about how nonresponse and sexual assault risk are clustered by installation.

Rather than compute the simple difference between these two model estimates, we predicted the risk estimate from the full model using the risk estimate from the reduced model. The prediction resulting from this procedure effectively recalibrates the predicted values from the reduced model to have the same mean as the risk estimates of the full model among nonrespondents. Specifically, we used the following model:

$$logit(\hat{y}_i^{(m)}) = \alpha + \widetilde{GBM}_i + \beta H_i + \gamma H_i \widetilde{GBM}_i,$$

where $\hat{y}_i^{(m)}$ is the predicted probability of sexual assault from the full Bayesian multilevel model for the *m*th draw from the posterior distribution, H_i is an indicator of nonresponse, and $\widetilde{GBM}_i$ is the predicted risk of sexual assault for that individual from the reduced GBM. Predictions from this model, denoted as $\tilde{y}_i^{(m)}$, reflect the portion of the total risk estimate, $\hat{y}_i^{(m)}$, that is explainable by the reduced model within a given sample of the posterior from the total risk model. The $\tilde{y}_i^{(m)}$ values are used as the posterior distribution of the risk explained by individual personnel characteristics.[2] The form of this recalibration model allows the relationship to differ between respondents and nonrespondents and ensures that the population posterior mean of risk from the reduced model is identical to the population posterior mean of the total risk. The *m*th draw from the posterior distribution of the expected risk from the reduced model at the *j*th installation, $\tilde{r}_j^{(m)}$, is given by:

---

2 This procedure can be seen as projecting the posterior distribution from the full Bayesian multilevel model of sexual assault risk onto a reduced model that used only individual respondent characteristics as predictors. This procedure identifies the portion of our total risk estimate that is predictable from the reduced model in each MCMC sample of the posterior.

$$\tilde{r}_j^{(m)} = \frac{\sum_{i=1}^{N} w_{ij} \tilde{y}_i^{(m)}}{\sum_{i=1}^{N} w_{ij}}.$$

The installation-specific risk at the *j*th installation is then estimated as

$$R_j^{(m)} = r_j^{(m)} - \tilde{r}_j^{(m)}.$$

The distribution of R_j is taken as the posterior distribution of installation-specific risk for the *j*th installation. The mean of that distribution is our point estimate, and the 2.5th and 97.5th percentiles of the distribution are the upper and lower bounds of the 95-percent credibility interval.

In short, our estimates of installation-specific risk are derived from our total risk estimates at each installation; however, any variability in the total risk estimates that is predictable by the individual characteristics of personnel assigned to that installation has been removed. These installation-specific risk estimates average to zero within each service branch by gender combination. Thus, for example, if one installation has high (positive) installation-specific sexual assault risk for Navy men, then another installation must have low (negative) installation-specific risk. This facilitates comparisons of sexual assault risk across installations while controlling for differences in the individual characteristics of personnel assigned to each installation.

Overall Fit for Models Predicting Sexual Assault

Our final estimates of risk were derived from predictive models. The accuracy of these risk estimates is related to how well these models fit the data. To assess the quality of the fit, as well as how model fit changes across the sequence of models used in the report, we generated two indices of absolute model fit (i.e., predictive accuracy): Tjur's R^2 and cross-entropy. Tjur's R^2 is a pseudo-R^2 for use with dichotomous outcomes (see Tjur, 2009). It also has a straightforward interpretation as the difference between (1) the mean predicted probability for those who experienced the outcome and (2) the mean predicted probability for those who did not experience the outcome. That is, the Tjur's R^2 index indicates how effectively the model differentiates the expected risks of those who were sexually assaulted from those who were not, with larger values indicating better separation. Cross-entropy (Rubinstein, 1999) is an error metric from information theory that assesses the distance between the actual values of the outcome variable and the predicted values from the model in units of information lost, with lower values indicating better fit.

These fit indices are presented in Table 2.3 for both the sexual assault and sexual harassment outcomes by each analytic stratum (service branch by gender combination). The table compares fit across three models: the reduced GBM, which includes as predictors only the individual characteristic variables from Table 2.2; the full

Table 2.3
Model Fit Indices Across Model Types, by Outcome, Gender, and Service Branch

	Pseudo-R^2			Cross-Entropy		
	Reduced GBM	Full GBM	Bayesian Multilevel	Reduced GBM	Full GBM	Bayesian Multilevel
Sexual assault						
Female						
Army	0.038	0.090	0.099	0.175	0.154	0.152
Navy	0.052	0.127	0.138	0.213	0.182	0.178
Air Force	0.019	0.040	0.046	0.118	0.110	0.109
Marine Corps	0.048	0.109	0.120	0.254	0.223	0.218
Male						
Army	0.008	0.018	0.027	0.055	0.051	0.050
Navy	0.020	0.060	0.074	0.071	0.062	0.060
Air Force	0.004	0.007	0.006	0.021	0.020	0.020
Marine Corps	0.007	0.016	0.026	0.055	0.051	0.049
Sexual harassment						
Female						
Army	0.069	0.084	0.084	0.504	0.493	0.492
Navy	0.108	0.135	0.135	0.518	0.497	0.496
Air Force	0.043	0.049	0.050	0.363	0.359	0.358
Marine Corps	0.070	0.083	0.084	0.538	0.525	0.523
Male						
Army	0.033	0.045	0.048	0.228	0.223	0.222
Navy	0.052	0.070	0.074	0.239	0.232	0.231
Air Force	0.010	0.013	0.014	0.122	0.121	0.120
Marine Corps	0.025	0.037	0.040	0.187	0.180	0.179

GBM, which adds to the reduced model the cluster characteristics from Table 2.2; and the Bayesian multilevel model, which adds to the full GBM random effects for postal codes and commands.

These fit indices show that the model fit generally improves with increasing model complexity. In most cases, there was a substantial jump in predictive accuracy when cluster characteristics were added to the reduced GBM and a relatively small additional improvement when adding the random effects to the full GBM. Averaged over strata and the two outcomes, the R^2 values were 0.038, 0.061, and 0.067 for the reduced GBM, full GBM, and Bayesian multilevel model, respectively. The averaged cross-entropy values were 0.229, 0.218, and 0.216 for the reduced GBM, full GBM, and Bayesian multilevel model, respectively. This suggests that the primary means by which differential risk across installations and commands is being identified is through the cluster characteristics that were included in the full GBM. These characteristics—such as the percentage of individuals at an installation who indicated sexual harassment on the RMWS (included only when predicting sexual assault), the percentage of personnel at each installation who were male, and the average age of personnel at each installation—are predictors. Further investigation of the full GBM suggests that the predictive benefit of adding these cluster characteristics is largely due to the inclusion of information about ambient sexual harassment (when predicting sexual assault) and ambient sexual assault (when predicting sexual harassment). For example, the proportion of other RMWS respondents indicating sexual harassment in a given individual's unit, postal code, or command is predictive of that individual's risk of sexual assault, and this risk is shared with others at the installation or command. Consequently, it plays an important role in assessing the overall risk of sexual assault in a given installation or command.

It is difficult to compare the fits of the sexual assault and sexual harassment models, or even the fits of either model, across strata, because values of R^2 and cross-entropy are sensitive to the prevalence of the outcome being modeled. That is, a given model will typically have higher R^2 values and cross-entropy values in samples as the prevalence of the outcome approaches 50 percent. Predictably, therefore, these values are higher among Navy women than Air Force women and higher among Air Force women than Air Force men. This may simply reflect the fact that the prevalence of the outcomes is highest for Navy women and lowest for Air Force men. Thus, neither fit index is well-suited to comparisons across subpopulations with different prevalence rates. However, there is some indication that the sexual assault model may be better than the sexual harassment model. For example, averaged over the strata, the R^2 value for the final sexual assault model (0.067) is actually slightly higher than the comparable model predicting sexual harassment (0.066) despite the fact that harassment is much more prevalent.

CHAPTER THREE

The Distribution of Sexual Assault Risk

The primary purpose of these analyses is to document how estimated sexual assault risk varies throughout the military as a function of duty installation and duty major command. As discussed in Chapter Two, we linked RMWS survey respondents to specific installations and major commands using DMDC records. When respondents were counted as having been sexually assaulted over the one-year period corresponding to FY 2014, their assaults were also linked to the installation and major command of their duty unit(s) during the period of time covered by the survey.

These estimates should be interpreted as the estimated one-year (FY 2014) prevalence of sexual assault for active-duty personnel who are assigned to duties at that installation. These estimates do not provide direct information about where the assaults occurred. They may have occurred in the local community, in off-base housing, during off-base training exercises, or on the installation. For example, when referring to rates of sexual assault for personnel assigned to the USS *George Washington*, we do not infer that all such assaults occurred while sailors were on that ship. Assaults could also have occurred in the ship's home port in Norfolk, Virginia; while on liberty at a foreign port; or even while the member was on leave in his or her hometown. Similarly, the estimates do not provide direct information about the perpetrator. Sexual assaults of members assigned to an installation or major command are counted regardless of whether the perpetrator was civilian or military or whether the perpetrator was assigned to that same installation or major command. In short, the estimates document the one-year prevalence of sexual assault for groups of personnel defined by their duty installation and duty major command; they do not document where the sexual assaults occurred or who committed the assaults.

Because the estimates reported here are based on survey data collected in FY 2014, there is no guarantee that the patterns of higher- and lower-risk installations or commands persist in later years. It is possible that whatever factors produced high or low prevalence of sexual assault at that time have changed in the intervening years. Personnel may have moved; commanders may have changed; policies, procedures, and training programs may have evolved. The estimates provided may not represent the distribution of risk today. Further research would be required to determine how stable these estimates are over time.

Finally, total sexual assault risk differs across installations or commands, but those differences do not necessarily suggest that something about the installations or commands causes these differences. An installation can have high or low risk because individuals whose personal characteristics put them at high or low risk are more likely to be assigned there. For example, individuals assigned to duty at the Pentagon have low risk of sexual assault, but those service members would have low risk no matter where they served because, collectively, they are older and higher ranking than the rest of the force. (Later in this chapter, we examine the portion of total sexual assault risk that cannot be explained by the individual characteristics of the personnel assigned to the installation or command.) The one-year rates of sexual assault estimated for each installation should be interpreted descriptively, not as evidence that something about the installation or command is causing or preventing sexual assault.

Total Installation Risk

In this chapter, we present sexual assault risk results only for the large installations (as defined in Chapter Two) that are found to have the highest and lowest risk estimates. Complete tabular results for the installation level of analysis are presented in the annex to this report for all clusters that meet our minimum installation size requirements.

Table 3.1 provides the gender and service branch distributions of the 270 installations, or clusters of units.

Average One-Year Sexual Assault Risk

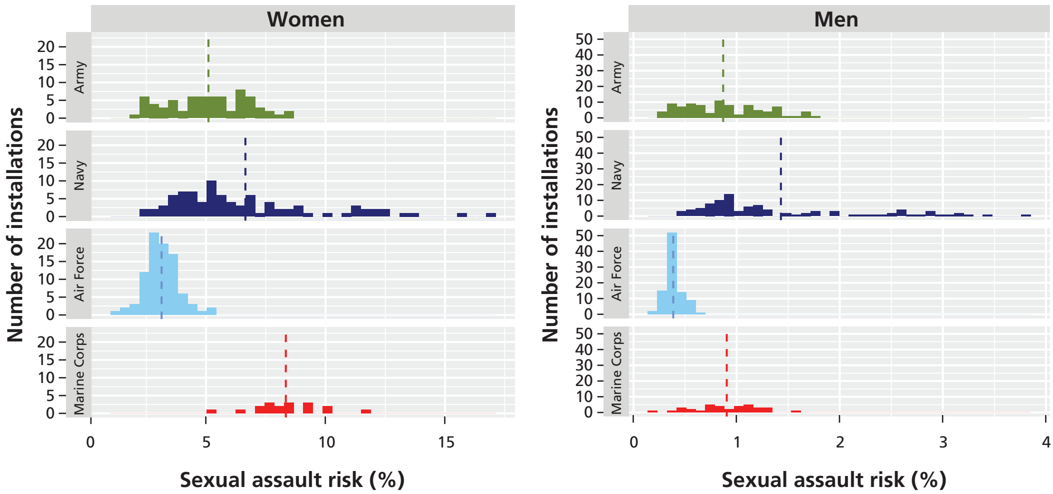
Assessing total sexual assault risk at the installation level clarifies where sexual assault prevention and training resources may be most needed, as well as where sexual assault reporting may be higher or lower than expected based just on the size of the installation. Figure 3.1 illustrates the distribution of one-year sexual assault risk at large installations for women and men. The dashed lines correspond to the average risk to women and men in each service.[1] Clearly, there is considerable variation in sexual assault risk within and across service branches. For women, the Navy and Marine Corps have some

Table 3.1
Number of Large Installations, by Gender and Service Branch

Gender	Army	Navy	Air Force	Marine Corps
Women	69	88	90	18
Men	92	97	93	35

[1] "Average" risk here is the average across all large installations, which differs slightly from average risk estimates published in the main report on sexual assault in the military (Morral, Gore, and Schell, 2015a). In addition to being calculated across large bases rather than individuals, estimates of sexual assault in this report will differ

Figure 3.1
Distribution of Estimated Total Sexual Assault Risk Across All Large Installations, by Gender and Service Branch



NOTES: The dashed lines correspond to the average large installation risk to women or men in each service. The figures for women and men are on different vertical and horizontal scales.
RAND *RR870/7-3.1*

large installations where risk is more than 10 percent. Indeed, the highest-risk installation has an estimated one-year sexual assault risk of 17.1 percent (credibility interval: 9.7–24.9) for women in the Navy. That is, our model estimates that more than one in six women assigned to duty at that installation were sexually assaulted in FY 2014.

Sexual assault risk for women in the Air Force is, on average, lower than for women in other services. Nevertheless, the highest-risk Air Force installation presents a one-year risk of 5.2 percent (credibility interval: 4.3–5.6), which is 1.7 times greater than the Air Force average risk for women of 3.1 percent.

The distribution of risk across installations for men is similar to that of women, although the risk estimates are considerably smaller. Specifically, the Navy has a much wider distribution of risk scores than do other services, with some large installations having more than twice the average risk faced by men in the Navy.

Sexual assault risk across installations is correlated for women and men. For the Army, the correlation is 0.80; for the Navy, it is 0.91; for the Air Force, it is 0.77. For the Marine Corps, the correlation is lower but not negligible at 0.43.

because (1) here, we include cases of unwanted sexual contact on the prior form as sexual assaults; (2) we include late respondents; and (3) we use a different approach to nonresponse adjustment. Differences between service average sexual assault rates estimated using the methods described in Chapter Two and rates estimated in Morral, Gore, and Schell (2015a) are all less than 0.25 percentage points for men and 0.5 percentage points for women.

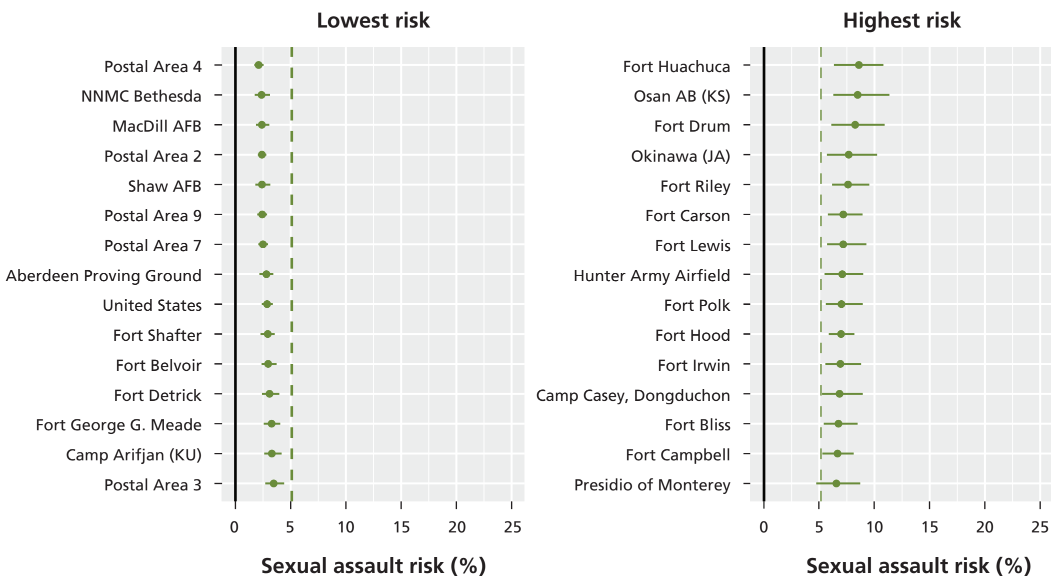
Interpreting Credibility Intervals

The credibility intervals around each risk estimate describe the uncertainty in that estimate, given the data, the model, and the priors (each of which are discussed in Chapter Two). For each estimate, there is a 2.5-percent chance that the true risk for sexual assault in FY 2014 was lower than the low end of the bar and a 2.5-percent chance that the true risk for sexual assault was higher than the high end of the bar. Pairwise comparisons between installations using these credibility intervals do not directly correspond to claims about statistically significant differences in risk between those installations.

Figures 3.2 through 3.7 list the 15 large installations with the lowest and highest one-year sexual assault risk according to our model for each gender in the Army, Navy, and Air Force. Figures 3.8 and 3.9 list the five large installations with the lowest and highest risk for each gender in the Marine Corps.

For Army women, presented in Figure 3.2, several of the lowest-risk installations are found in the National Capital Region. This could result from differences in the seniority or profession of soldiers assigned to Washington-area jobs. The lower-risk installations for Army women also include two Air Force bases, two medical centers, and five postal areas that aggregate service members who were not stationed at large installations. Here, as elsewhere in this report, per-

Figure 3.2
Estimated Sexual Assault Risk for the 15 Lowest- and Highest-Risk Installations, Army Women



NOTES: The dashed lines represent the mean one-year risk of sexual assault for the service. Each point plots total risk, and the lines on either side indicate the 95% credibility intervals. AB = Air Base; JA = Japan; KS = South Korea; KU = Kuwait; NNMC = National Naval Medical Center.

RAND *RR870/7-3.2*

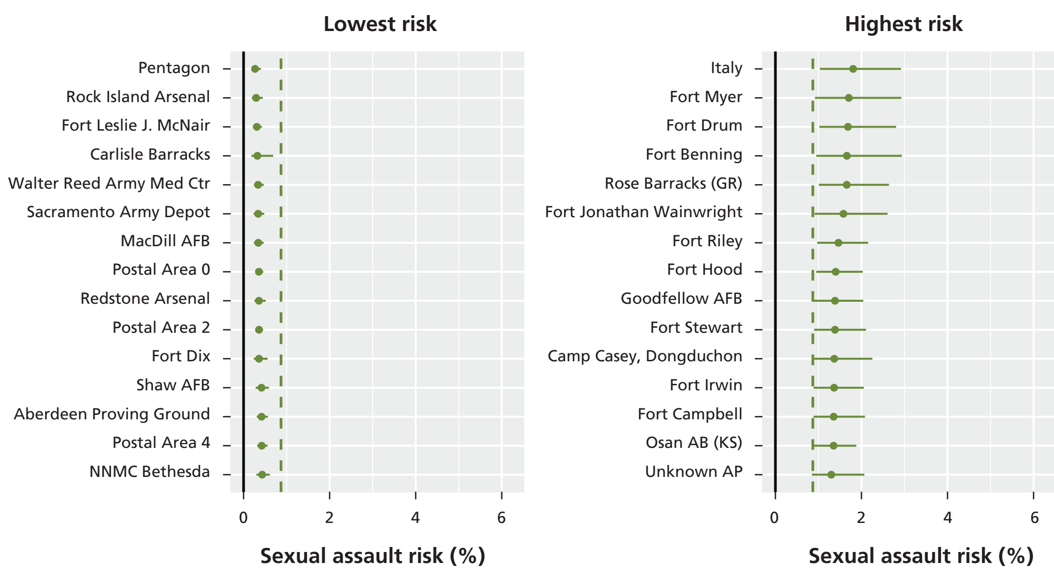
sonnel whose unit address listed a country but no postal code were clustered with others whose only location code was that country. Thus, Army women whose only location information was that they were in the United States are listed in Figure 3.2 as in the "United States" installation.

All of the highest-risk bases for women in the Army are associated with higher risk of sexual assault than the average for women at large Army installations (the vertical dashed line in the figure). These installations include large U.S., Japanese, and South Korean bases and at least two installations with large training programs (Fort Huachuca and the Presidio of Monterey).

Similarly, several of the lowest-risk facilities for Army men are in the National Capital Region (Figure 3.3). As was the case for women, Shaw AFB and MacDill AFB are associated with particularly low risk for Army men, as is Aberdeen Proving Ground, NNMC Bethesda, and small installations aggregated in postal areas 0, 2, and 4.

While the lowest-risk installations for men are dominated by small, command, or support installations, the highest-risk list includes many installations with a more prominent combat unit presence. Almost half of these highest-risk installations are identical to those found for women. Five of the 15 highest-risk installations are foreign. As was the case for women, no small installations aggregated at the postal area appear on the high-risk list.

Figure 3.3
Estimated Sexual Assault Risk for the 15 Lowest- and Highest-Risk Installations, Army Men



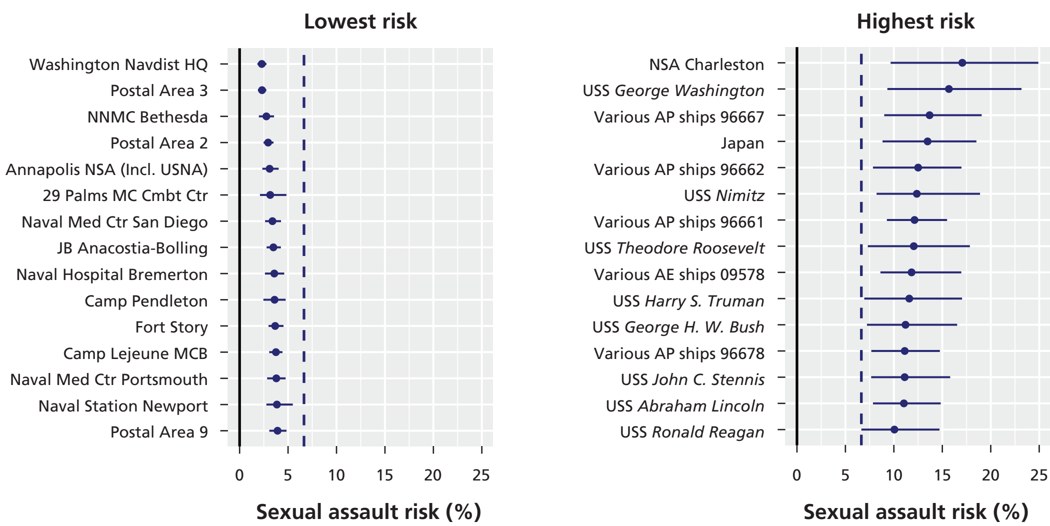
NOTES: The dashed lines represent the mean one-year risk of sexual assault for the service. Each point plots total risk, and the lines on either side indicate the 95% credibility intervals. The estimate for Fort Benning is based on a subset of personnel who served there and may not accurately describe the experiences of soldiers receiving basic military training there. See discussion in Chapter Two.
GR = Germany.
RAND *RR870/7-3.3*

The 15 lowest- and highest-risk installations for Navy women are presented in Figure 3.4. As was the case for women and men in the Army, the lowest-risk installations for women sailors include medical centers, National Capital Region installations, and smaller installations aggregated in postal areas. The U.S. Naval Academy is also a low-risk facility relative to the rest of the Navy; however, this estimate is for staff other than midshipmen.

While there are no ships among the lowest-risk installations for women in the Navy, ships dominate the highest-risk installations. Of the 15 highest-risk installations for Navy women, 13 are ships or clusters of ships, including eight of the ten aircraft carriers. Our model estimates that more than 10 percent of all women experienced a sexual assault at each of these high-risk installations over a one-year period, and more than 15 percent of all women were assaulted at two of them.

Clusters of ships in such FPO addresses as "Various AP Ships 96667" do not represent coherent strike groups, geographic locations, ship types, or other functional or administrative characteristics, although this clustering does result in ships from the same fleet being grouped together, and these clusters never include an aircraft carrier. It is perhaps surprising, therefore, that several such clusters of ships appear to have especially high risk. This may simply reflect the fact that sailors on ships face higher than average risk, or it could be that these higher-risk clusters of ships include some ships of a type or in a command that is associated with especially high risk. In future

Figure 3.4
Estimated Sexual Assault Risk for the 15 Lowest- and Highest-Risk Installations, Navy Women



NOTES: The dashed lines represent the mean one-year risk of sexual assault for the service. Each point plots total risk, and the lines on either side indicate the 95% credibility intervals. HQ = headquarters; JB = Joint Base; MC = Marine Corps; MCB = Marine Corps Base; NAVDIST = Naval District; NSA = Naval Support Activity; USNA = U.S. Naval Academy.
RAND *RR870/7-3.4*

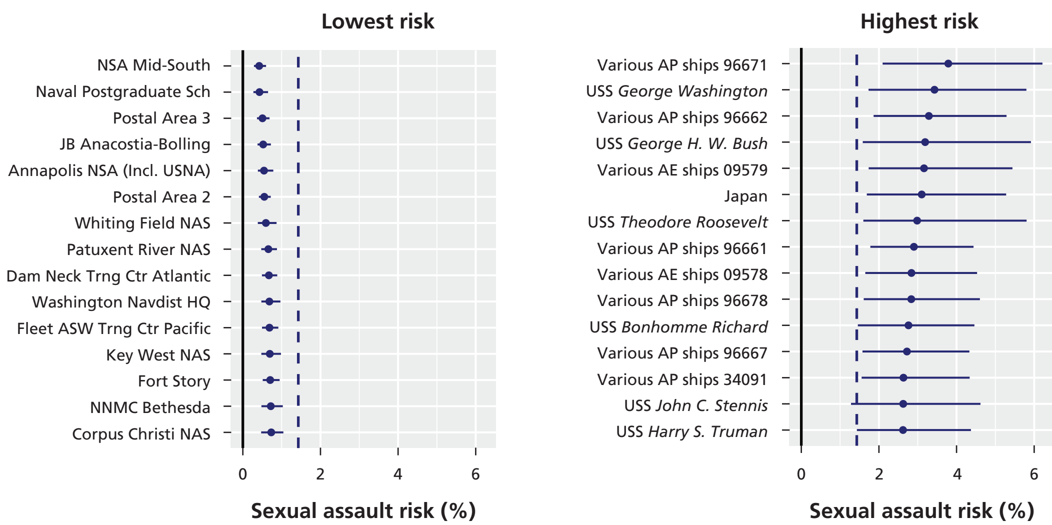
research, it would be valuable to cluster ships in different ways that could highlight which of their specific characteristics are most associated with risk. For instance, they might be clustered by ship class, home port, strike group, mission type, or ports of call.

Seven of the 15 lowest-risk installations for Navy men are the same as those of women sailors (Figure 3.5). The low-risk installations do not include any ships but do include National Capital Region installations, small installations aggregated in postal areas, and the U.S. Naval Academy.

All but one of Navy men's highest-risk installations are ships or clusters of ships, including five aircraft carriers. More than two-thirds of these high-risk installations are also among the 15 with the highest risk for women. On one of these ships, we estimate that close to one in every 25 men was sexually assaulted in FY 2014, and more than 2.5 percent of men were assaulted on all of the ships in the highest-risk list. The single non-ship installation on the list is "Japan," referring to sailors in units with no address listed in the DMDC personnel records other than the country code for Japan, which was also estimated to be a high-risk location for women.

Average sexual assault risk to women across the Air Force is low relative to the other services, and few installations appear to have total sexual assault risk that diverges greatly from the service averages at large installations (Figure 3.6). Nevertheless, the 15 installations with the lowest risk have features in common with those in the Army and Navy. Specifically, the list includes National Capital Region installations, a medical center, and small installations aggregated in postal areas.

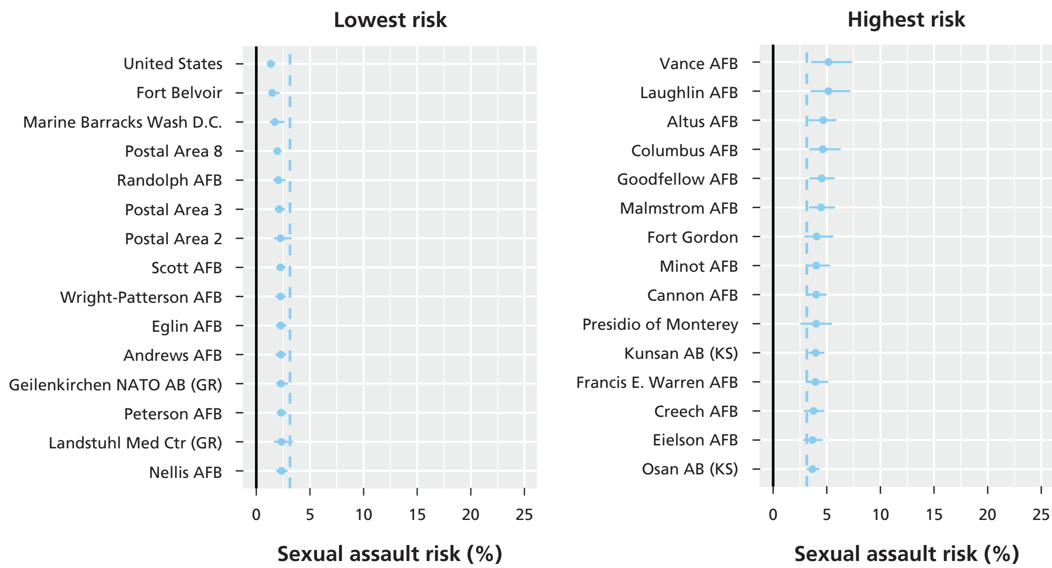
Figure 3.5
Estimated Sexual Assault Risk for the 15 Lowest- and Highest-Risk Installations, Navy Men



NOTES: The dashed lines represent the mean one-year risk of sexual assault for the service. Each point plots total risk, and the lines on either side indicate the 95% credibility intervals. ASW = anti-submarine warfare; NAS = Naval Air Station.

RAND *RR870/7-3.5*

Figure 3.6
Estimated Sexual Assault Risk for the 15 Lowest- and Highest-Risk Installations, Air Force Women



NOTES: The dashed lines represent the mean one-year risk of sexual assault for the service. Each point plots total risk, and the lines on either side indicate the 95% credibility intervals. NATO = North Atlantic Treaty Organization.
RAND *RR870/7-3.6*

The five highest-risk bases for Air Force women are all Air Education and Training Command bases, with the top three focused on undergraduate pilot training. As with Army women, the Presidio of Monterey is on the highest-risk list.

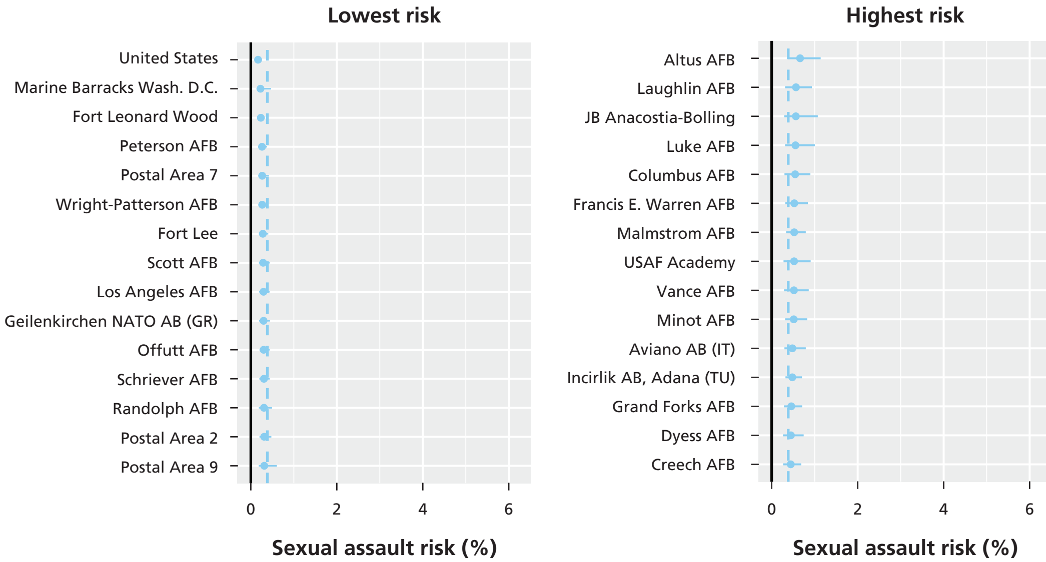
Total sexual assault risk for Air Force men at the lowest-risk installations barely differs from service average risk to men at large installations (Figure 3.7). More than half of the installations are in common with the low-risk installations for women in the Air Force. Unlike low-risk lists seen for the Army and Navy, no medical centers appear explicitly. As with other services, small installations aggregated to postal areas are among the lowest-risk locations.

More than half of the highest-risk list for Air Force men is shared with the high-risk list for women, including the three undergraduate pilot training bases. Small installations aggregated to postal area again do not appear on the high-risk list.

Only 37 Marine Corps installations met our criteria for large installations. Therefore, we restrict our lists of lowest- and highest-risk installations for the Marine Corps to just five each (Figure 3.8). Two installations, MCB Quantico and U.S. Marine Corps (USMC) Mobile 3rd Marine Expeditionary Force (MEF), appear to be associated with lower risk of sexual assault for women than the service average at large installations.

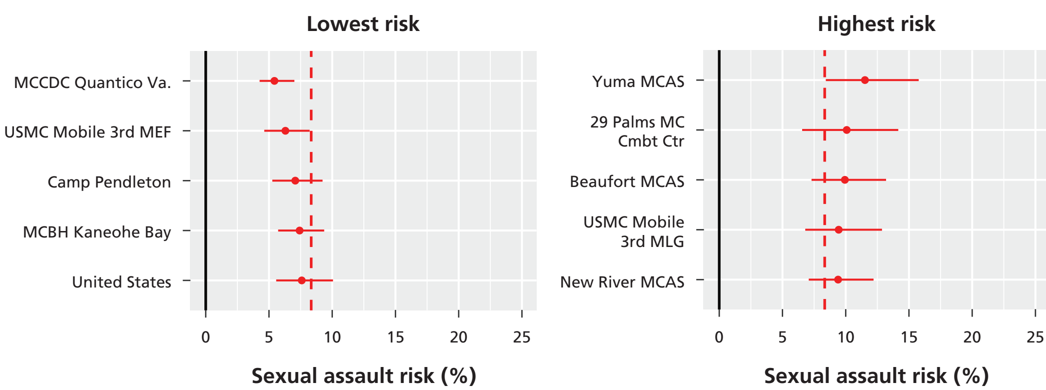
One of the five lowest-risk installations for Marine Corps men is in common with those of Marine Corps women (Figure 3.9). The list for men includes National Capital

Figure 3.7
Estimated Sexual Assault Risk for the 15 Lowest- and Highest-Risk Installations, Air Force Men



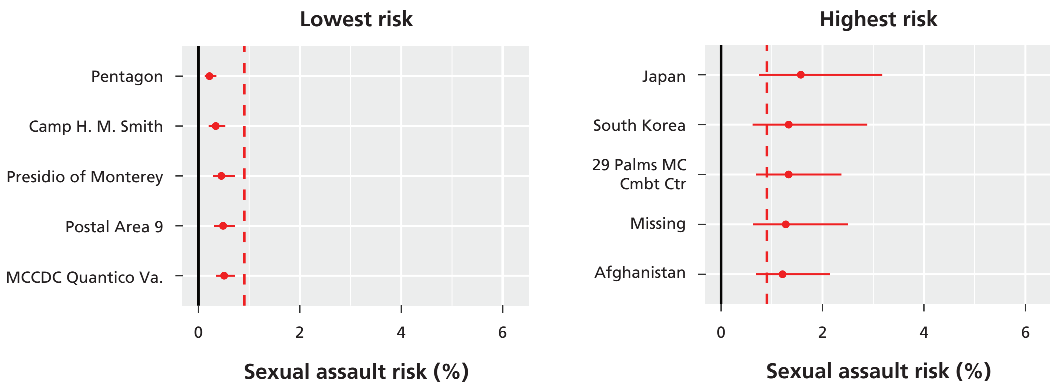
NOTES: The dashed lines represent the mean one-year risk of sexual assault for the service. Each point plots total risk, and the lines on either side indicate the 95% credibility intervals. The estimate for Fort Leonard Wood is based on a subset of personnel who served there and may not accurately describe the experiences of soldiers receiving basic military training there. See discussion in Chapter Two. IT = Italy; TU = Turkey; USAF = U.S. Air Force.
RAND *RR870/7-3.7*

Figure 3.8
Estimated Sexual Assault Risk for the Five Lowest- and Highest-Risk Installations, Marine Corps Women



NOTES: The dashed lines represent the mean one-year risk of sexual assault for the service. Each point plots total risk, and the lines on either side indicate the 95% credibility intervals. MCAS = Marine Corps Air Station; MCBH = Marine Corps Base Hawaii; MCCDC = Marine Corps Combat Development Command; MLG = Marine Logistics Group.
RAND *RR870/7-3.8*

Figure 3.9
Estimated Sexual Assault Risk for the Five Lowest- and Highest-Risk Installations, Marine Corps Men



NOTES: The dashed lines represent the mean one-year risk of sexual assault for the service. Each point plots total risk, and the lines on either side indicate the 95% credibility intervals.
RAND *RR870/7-3.9*

Region installations and small installations aggregated in postal area 9. Although the Presidio of Monterey is a high-risk installation for Army and Air Force women, it is a low-risk installation for men in the Marine Corps.

Among high-risk installations for Marine Corps men, one (29 Palms Marine Corps Combat Center) is in common with Marine Corps women. Only one of the highest-risk installations for men is clearly in the United States. Others are foreign or missing.

Estimated Number of Personnel Sexually Assaulted in One Year

The total sexual assault risk estimates for installations can be converted into estimates for the number of women and men at each facility who were sexually assaulted during the year of study. Specifically, the estimate risk is a prevalence rate, which can be applied to the number of men or women serving at the installation in an average month during FY 2014.

If sexual assault risks were equal across installations, we would expect the largest installations to have the greatest number of sexual assaults. With a few exceptions, this is what we find. Table 3.2 lists the ten installations for each service with the highest total estimated numbers of women and men sexually assaulted in FY 2014. The ten Army installations with the highest estimated number of personnel sexually assaulted are also the ten largest Army installations when using our procedures for aggregating units into installations. For the Navy, only four of the ten installations with the highest estimated number of assaulted sailors are among the ten largest installations. In

Table 3.2
Ten Installations with the Highest Estimated Number of Women and Men Sexually Assaulted During FY 2014, by Service Branch

Service Branch	*N* Assaulted	Service Branch	*N* Assaulted
Army		**Navy**	
Fort Hood	885	United States	474
Fort Bragg	836	Norfolk NB	248
Fort Lewis	609	NSA Charleston	223
Fort Campbell	579	USS *George Washington*	181
Fort Bliss	539	USS *Theodore Roosevelt*	153
Fort Carson	475	USS *George H. W. Bush*	152
Fort Drum	395	Japan	150
Fort Riley	375	USS *Harry S. Truman*	142
Fort Stewart	359	USS *Nimitz*	132
Schofield Barracks	254	San Diego NAVSTA	121
Air Force		**Marine Corps**	
Ramstein AB (GR)	76	Camp Lejeune MCB	514
Langley AFB	71	Camp Pendleton	465
Hurlburt Field	67	29 Palms MC Cmbt Ctr	171
Travis AFB	59	Cherry Point MCAS	115
Minot AFB	54	MCAS Miramar	111
Nellis AFB	53	United States	104
Okinawa (JA)	50	Afghanistan	92
Elmendorf AFB	49	New River MCAS	90
Davis-Monthan AFB	48	Okinawa (JA)	76
Osan AB (KS)	47	Japan	71

NOTES: "United States" and "Afghanistan" describe the assault experiences of personnel whose location codes did not specify where in each country the person was stationed (see Chapter Two for details). Installations where basic military training is conducted have been omitted from this table because our estimates are likely to undercount the number of men and women sexually assaulted during FY 2014 (see Chapter Two). Specifically, Fort Benning, Naval Station Great Lakes, Lackland AFB, and Parris Island Marine Corps Recruit Depot (MCRD) were removed because of this imprecision, although a corrected estimate would necessarily place them among the ten installations with the highest number of sexual assaults for the Army, Navy, Air Force, and Marine Corps, respectively. NAVSTA = Naval Station; NB = Naval Base.

particular, the five aircraft carriers on the list had considerably fewer personnel. None of the five appears among the largest 20 Navy installations. For the Air Force and Marine Corps, the ten installations with the greatest number of service members who were assaulted in the one-year period are all among the 13 largest installations for each service.

The Army and Marine Corps have bases estimated to have more than 500 service members sexually assaulted during the year covered by the survey. This is largely, though not exclusively, associated with the installations' size. For the Army, 54 percent of all soldiers were stationed at the ten installations, but 60 percent of all soldiers who were sexually assaulted were stationed at one of them. For the Navy, the ten installations account for 26 percent of all active-component sailors but 32 percent of all who were assaulted. Airmen who served at the ten installations in Table 3.2 account for 25 percent of all active-component airmen and contain 26 percent of those who were estimated to have been sexually assaulted. Finally, for the Marine Corps, the ten installations account for approximately 71 percent of all Marines but 74 percent of all in the Marine Corps who were assaulted during the year.

Installation-Specific Risk

In many cases, installations with high sexual assault risk are those with high concentrations of young and junior-ranking personnel. That is, installations with many higher-risk service members are usually estimated to have higher average risk. We can, however, examine whether installations' total risk includes some portion of risk that is not simply a reflection of the risk factors of its personnel. To do so, we define two classes of risk factors:

1. *Individual risk factors* are individual-level characteristics of each service member. These characteristics, such as age, rank, and marital status, stay relatively stable even if the service member is moved to a new unit, installation, or command.
2. In contrast, *duty-assignment risk factors* are characteristics of each service member's duty environment, and such factors will change as a member is moved to a new unit, installation, or command.

The variables defined as individual risk factors in the statistical models are listed in the top of Table 2.2 (e.g., age, gender, service branch, pay grade, and occupation). The duty-assignment risk factors include all of the cluster characteristics listed in the bottom of Table 2.2, as well as the random effects for postal code and major command discussed in Chapter Two.

In the first part of this chapter, we presented total sexual assault risk estimates for installations. As discussed in Chapter Two, we produced these estimates by averaging estimates of individual risk of sexual assault that took into account service members' individual risk factors and all of their duty-assignment risk factors. We can compare that estimate of total sexual assault risk to an estimate based solely on the individual risk factors. Specifically, we can modify our total sexual assault risk estimates for each individual by removing any variability that can be explained by individual risk factors. This creates a measure of how much each individual's risk is higher or lower than would be expected had he or she been assigned to an average-risk duty assignment for service members with similar personnel characteristics. This divides each service member's total risk into a measure of his or her *individual risk* and a measure of his or her *duty-specific risk*, which represents how much the person's individual risk estimate is modified when taking into account the specific duty assignment to a given unit, installation, or command.

Two installations may have different sexual assault risk either because they have personnel assigned to them who have, on average, different individual risk factors or because they have different duty-assignment risk factors. For instance, based solely on the individual risk factors, we estimate that 17 percent of Navy women assigned to NSA Charleston were sexually assaulted in FY 2014, whereas only about 2 percent of women working at the Washington NAVDIST HQ were assaulted. These estimates differ primarily because of the individual risk factors of the personnel who have been stationed at each installation, with women at Washington NAVDIST HQ being, among other differences, older and higher ranking relative to women serving at NSA Charleston.

However, personnel assigned to duty at two installations could still differ substantially in sexual assault risk even if the two installations have very similar personnel characteristics. That is, some duty assignments may be associated with higher or lower risk for individuals stationed there even while controlling for their individual risk factors. Our measure of installation-specific risk assesses only that portion of sexual assault risk that cannot be explained by these individual risk factors. This can be interpreted as the extent to which the average risk of sexual assault for personnel assigned to a given installation is higher or lower than expected based on the individual risk factors of those personnel.

These estimates of installation-specific risk compare each installation with a hypothetical installation with "average risk" for personnel with similar characteristics. These estimates average to zero within each service branch and gender. For example, among Navy women, the installation-specific effects must average out to zero. If there are some installations with high (positive) installation-specific risk for Navy women, other installations must show low (negative) installation-specific risk for this same group. Thus, these estimates are all inherently relative, assessing whether risk at a given installation is higher or lower relative to risk for similar individuals at other installations.

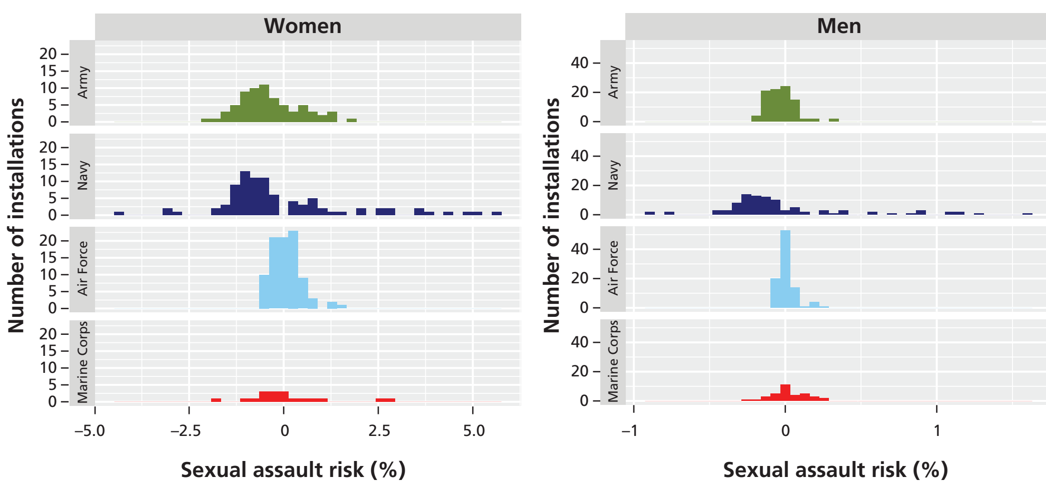
Although we compute the additional risk associated with assignment to a particular installation, the study does not identify what causes a given installation to have high installation-specific risk. Many factors across military organizations could contribute to installation-specific or command-specific risk, including local culture, discipline, physical environment, training, operational tempo, command climate, and personnel characteristics that were not captured in the available data, among others. Although installation-specific risk does associate sexual assault risk more directly with the installation by controlling for differences in personnel characteristics, installations should still be interpreted as associated with sexual assault risk, not with the causes of risk.

Figure 3.10 illustrates the distribution of installation-specific risk for all large installations. Positive values indicate that personnel have sexual assault risk at that duty assignment that is higher than at an average duty assignment for people with similar characteristics. Across members of a service branch, the average installation-specific risk is zero.

A noteworthy observation from Figure 3.10 is that for women and men, the Navy has the greatest dispersion of installation-specific risk: Some installations are associated with elevations in sexual assault risk greater than that found in other services, and some are associated with reductions in sexual assault risk greater than that in other services. Indeed, the standard deviation of installation-specific risk for women in the Navy (SD = 0.012) is greater than in other services (Army SD = 0.008; Air Force SD = 0.004; and Marine Corps SD = 0.011). Similarly, the standard deviation of installation-specific risk for men in the Navy (SD = 0.005) is five times greater than for the Army, Air Force, and Marine Corps (SD = 0.001 for all three services).

Moreover, the magnitude of these associations is considerable. Navy women in the installation with the highest installation-specific risk have risk that is, on average,

Figure 3.10
Distribution of Estimated Installation-Specific Sexual Assault Risk Across All Large Installations, by Gender and Service Branch



NOTE: The figures for women and men are on different vertical and horizontal scales.
RAND *RR870/7-3.10*

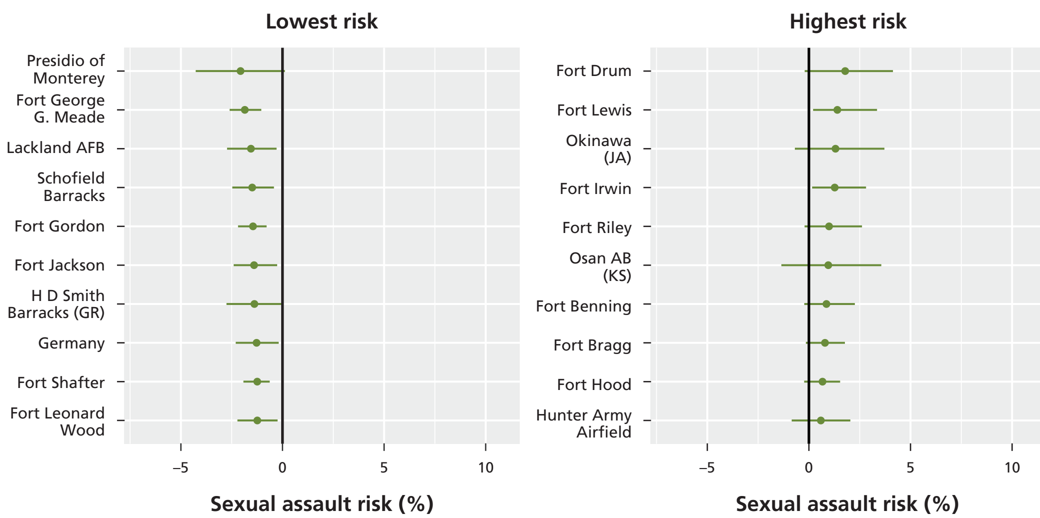
6.6 percentage points higher than expected from the personnel characteristics of those serving at the installation. For the Army and Marine Corps, the largest installation-specific risk adds up to 1.8 and 2.7 percentage points, respectively, to individual risk. The highest installation-specific risk in the Air Force adds an average of 1.4 percentage points to the individual risk of women serving at the installation. For men, the highest installation-specific risk among Navy installations is 1.6 percentage points higher than would be expected based on the personnel characteristics at that installation. Considering that the Navy average installation sexual assault risk for men is 1.4 percent, an installation-specific effect of 1.7 percent more than doubles risk to men at that installation.

For installation-specific risk, as for total risk, the correlation across installations for women and men is high for all services. The correlation is 0.77 for the Army, 0.88 for the Navy, 0.82 for the Air Force, and 0.80 for the Marine Corps. Therefore, the installations associated with higher installation-specific risk for women tend also to have higher installation-specific risk for men.

Installations with the Lowest and Highest Installation-Specific Sexual Assault Risk

In this section, we highlight the ten lowest and highest installation-specific risk estimates for women and men of each service. The complete set of installation-specific

Figure 3.11
Estimated Installation-Specific Sexual Assault Risk for the Ten Lowest- and Highest-Risk Installations, Army Women



NOTE: Each point plots installation-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimates for Fort Benning, Fort Jackson, Fort Leonard Wood, and Lackland AFB are based on a subset of personnel who served at those installations and may not accurately describe the experiences of soldiers receiving basic military training at each. See discussion in Chapter Two.

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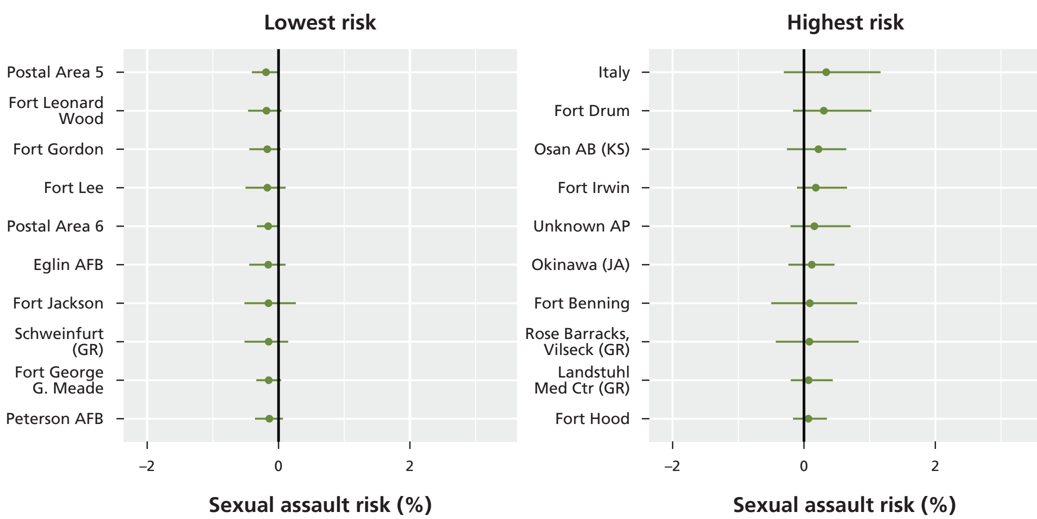
risk estimates is provided in Part A of the annex to this report. Figure 3.11 exhibits the lowest and highest installation-specific risk estimates for Army women. This figure illustrates the portion of each installation's total sexual assault risk that cannot be explained by the demographic characteristics or other individual risk factors of personnel serving at the installation. At the extremes, this figure shows that those serving at the Presidio of Monterey have total risk scores more than 2 percentage points lower than would be expected based on the demographics of those serving there, and women at Fort Drum have a risk of sexual assault that is approximately 2 percentage points higher than expected.

Eight of the ten installations with the highest installation-specific risk in this figure are also among the installations with the highest total risk. In contrast, only two of the bases with the lowest installation-specific risk also appear among the installations with the lowest total risk (Fort Shafter and Fort Meade). Many of the lowest total risk installations are small units aggregated in postal zones. The fact that these installations have low total risk of sexual assault but these postal zone aggregations do not appear among the lowest installation-specific risk locations suggests that they have low total risk primarily because the personnel assigned to small units unaffiliated with large bases tend to have individual characteristics associated with low risk of sexual assault (e.g., the soldiers are older and more senior ranking).

Figure 3.12
Estimated Installation-Specific Sexual Assault Risk for the Ten Lowest- and Highest-Risk Installations, Army Men



NOTE: Each point plots installation-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimates for Fort Benning, Fort Jackson, and Fort Leonard Wood are based on a subset of personnel who served at those installations and may not accurately describe the experiences of soldiers receiving basic military training at each. See discussion in Chapter Two.

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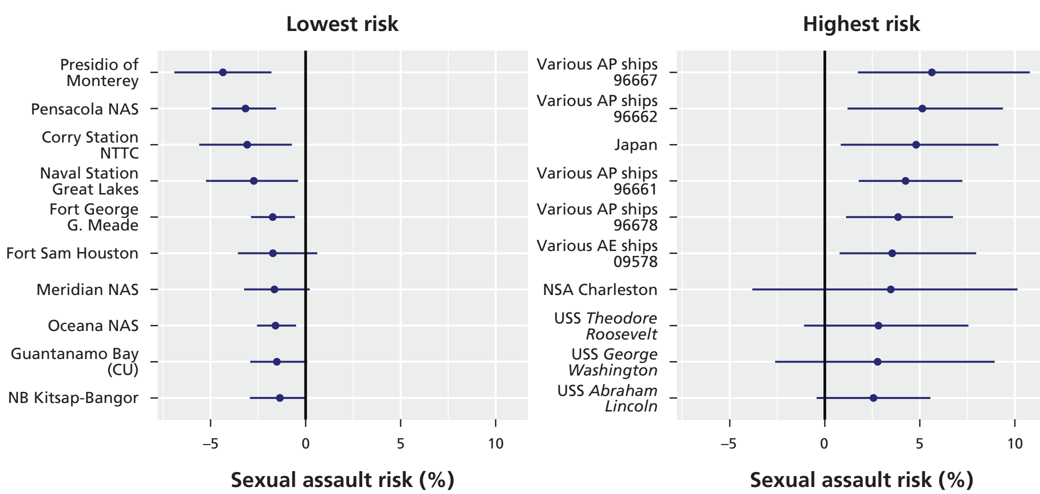
Figure 3.12 shows the ten lowest and highest installation-specific risk scores for men in the Army. The scale on the figures for men is substantially narrower than for women. For men, no installation is associated with even a half percentage point higher or lower risk than expected based on individual characteristics. In contrast to women soldiers, two of the locations associated with the lowest installation-specific risk are postal areas, and none is among the installations with the lowest total risk to men. Among the locations with the highest installation-specific risk, most (8 of 10) are also among the locations with the highest total risk for men in the Army.

As expected based on Figure 3.10, 8 of the 10 installations with the lowest installation-specific risk for women and 9 of the 10 with the highest such risk across all services are in the Navy. Several of the installations with the lowest total risk for Navy women were medical centers, but the absence of medical centers on the lowest-risk panel of Figure 3.13 suggests that this is not because medical centers have a large protective effect. Instead, those serving at medical centers may have demographic profiles that place them at lower risk.

All but two of the ten installations with the highest installation-specific risk are ships or groups of ships, including three aircraft carriers. The only exceptions are the

Figure 3.13
Estimated Installation-Specific Sexual Assault Risk for the Ten Lowest- and Highest-Risk Installations, Navy Women



NOTES: Each point plots installation-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimate for Naval Station Great Lakes is based on a subset of personnel who served there and may not accurately describe the experiences of sailors receiving basic military training there. See discussion in Chapter Two. CU = Cuba; NTTC = Naval Technical Training Center.

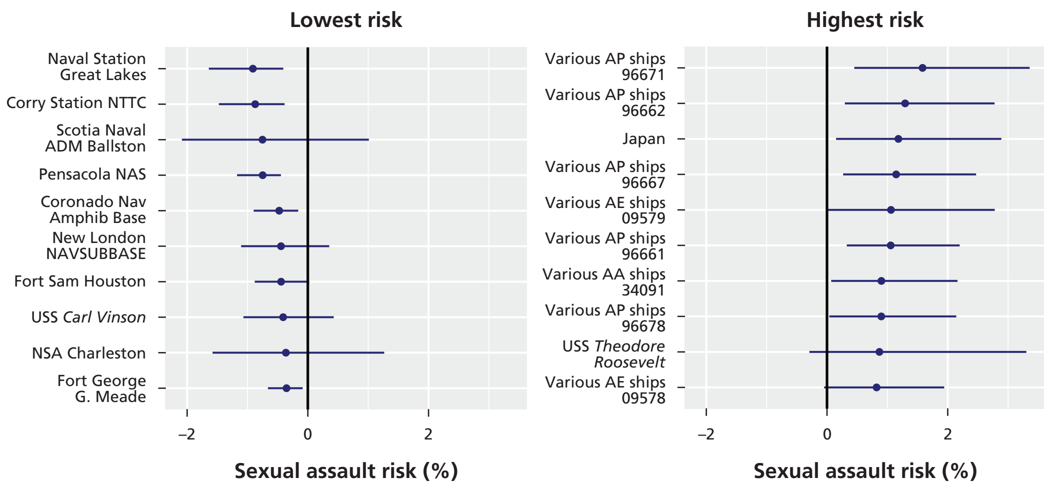
RAND *RR870/7-3.13*

unspecified "Japan" unit location and NSA Charleston. In contrast, no ship is among the locations with the lowest installation-specific risk.

The ten lowest and the ten highest installation-specific risk scores for men are all found in the Navy (Figure 3.14). As was the case for women, most of the highest-risk locations for men are ships, or the unspecified "Japan" location, and the lowest-risk locations include only a single ship. Half of the locations with the lowest installation-specific risk for men are also among the ten lowest for women. The installation with the highest risk, comprising ships with the 96671 FPO address, has a risk of sexual assault that is 1.6 percentage points higher than expected based on the individual characteristics of personnel assigned there. By comparison, the men's average installation-specific risk of sexual assault in the Navy is 1.4 percent. Thus, ships in the 96671 FPO address are associated with risk more than 100 percent greater than the average installation-specific risk in the Navy.

Installation-specific risk for women in the Air Force spans a narrow range compared with other services, running from a low at Nellis AFB of –0.6 percent to a high at Vance AFB of 1.4 percent (Figure 3.15). For men, the range is even narrower: Instal-

Figure 3.14
Estimated Installation-Specific Sexual Assault Risk for the Ten Lowest- and Highest-Risk Installations, Navy Men



NOTES: Each point plots installation-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimate for Naval Station Great Lakes is based on a subset of personnel who served there and may not accurately describe the experiences of sailors receiving basic military training there. See discussion in Chapter Two. ADM = administrative; NAVSUBBASE = Naval Submarine Base.

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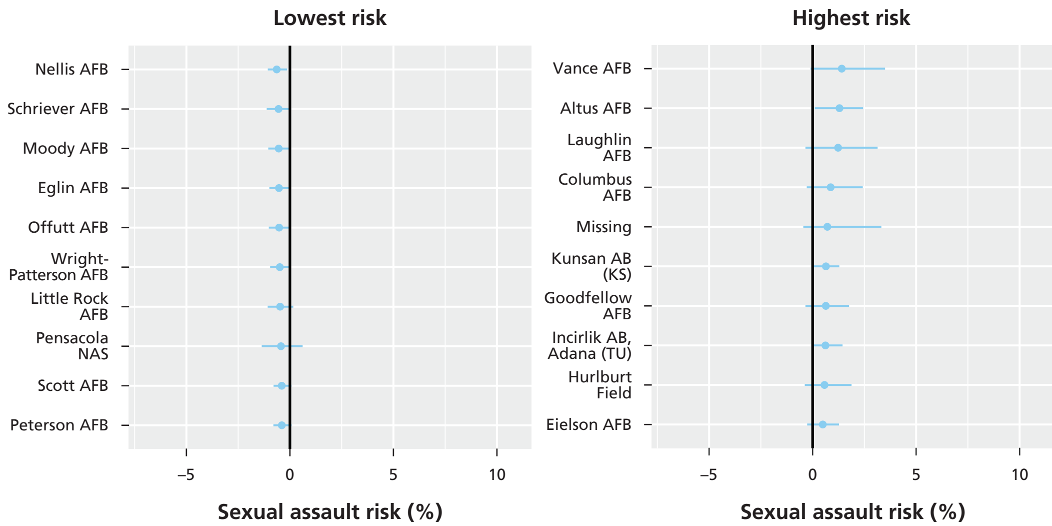
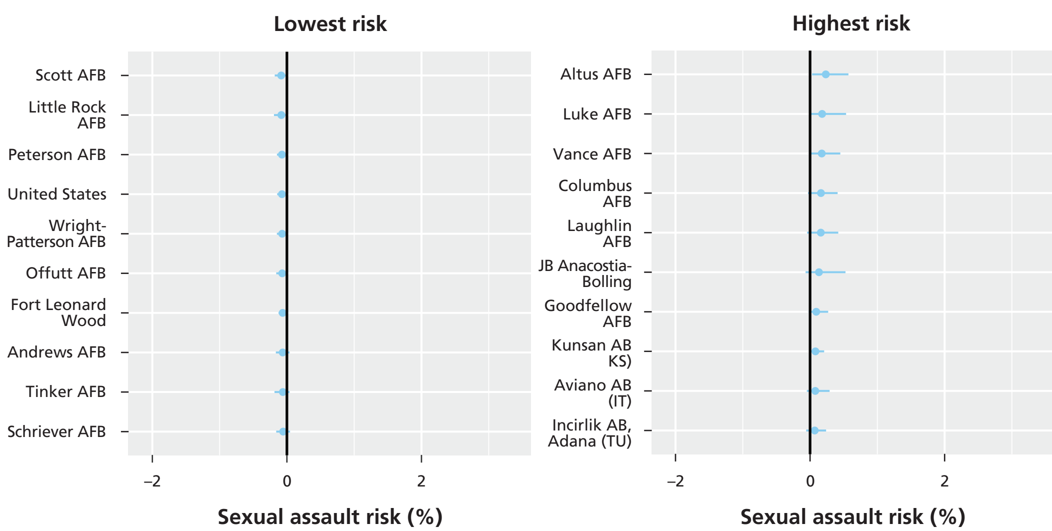
Figure 3.15
Estimated Installation-Specific Sexual Assault Risk for the Ten Lowest- and Highest-Risk Installations, Air Force Women



NOTE: Each point plots installation-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-3.15*

Figure 3.16
Estimated Installation-Specific Sexual Assault Risk for the Ten Lowest- and Highest-Risk Installations, Air Force Men



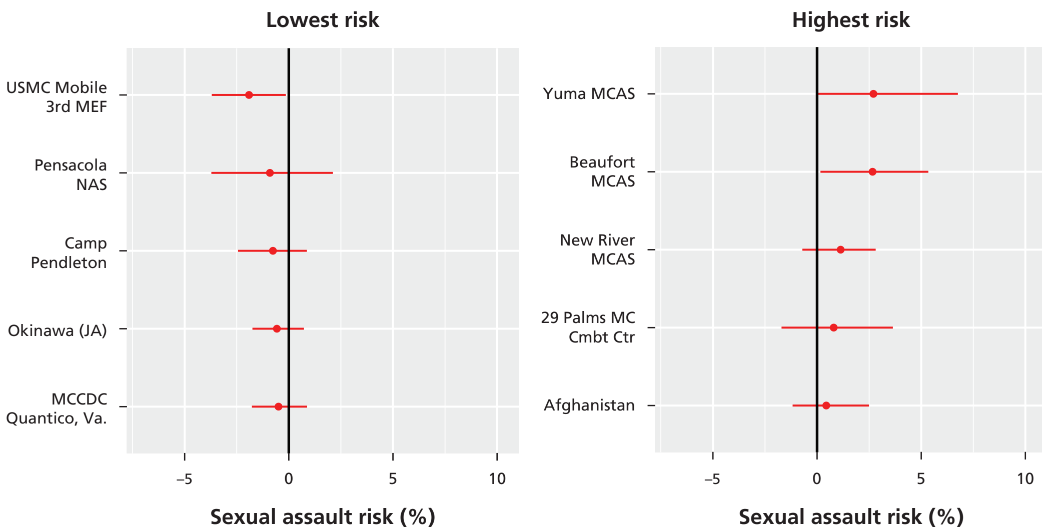
NOTE: Each point plots installation-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimate for Fort Leonard Wood is based on a subset of personnel who served there and may not accurately describe the experiences of soldiers receiving basic military training there. See discussion in Chapter Two.

RAND *RR870/7-3.16*

lation-specific risk alters individuals' demographic risk by less than a few tenths of a percentage point in either direction (Figure 3.16).

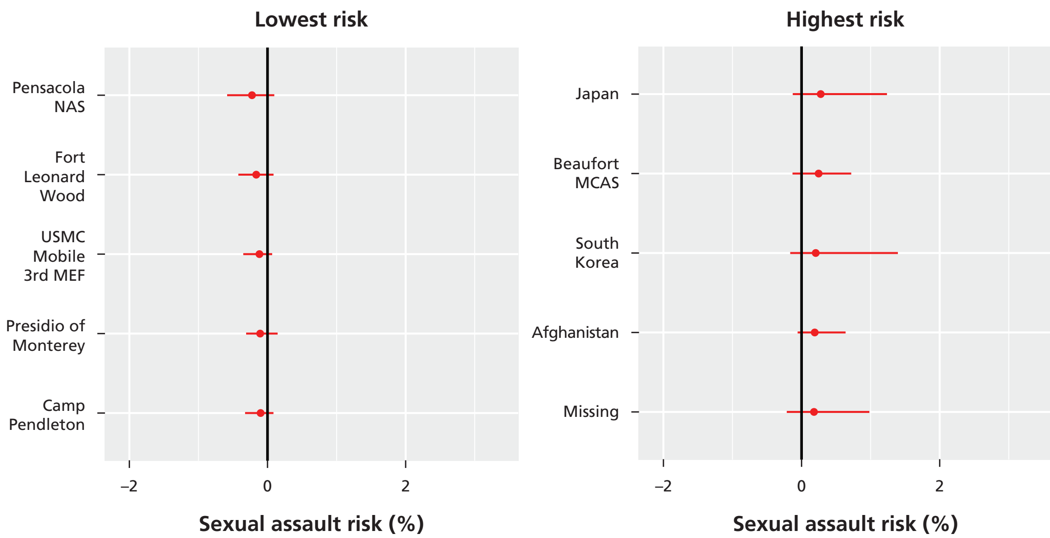
For women in the Marine Corps, Yuma MCAS and Beaufort MCAS are both associated with high installation-specific risk, with each estimated to add more than 2.5 percentage points of risk above that expected based on the individual characteristics of the women at those installations (Figure 3.17). In contrast, the location associated with the 3rd Mobile MEF is associated with a lower risk of more than 1 percentage point.

Figure 3.17
Estimated Installation-Specific Sexual Assault Risk for the Five Lowest- and Highest-Risk Installations, Marine Corps Women



NOTE: Each point plots installation-specific risk, and the lines on either side indicate the 95% credibility intervals.
RAND *RR870/7-3.17*

Figure 3.18
Estimated Installation-Specific Sexual Assault Risk for the Five Lowest- and Highest-Risk Installations, Marine Corps Men



NOTE: Each point plots installation-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimate for Fort Leonard Wood is based on a subset of personnel who served there and may not accurately describe the experiences of soldiers receiving basic military training there. See discussion in Chapter Two.

RAND *RR870/7-3.18*

For men in the Marine Corps, the location associated with the highest installation-specific risk is the unspecified Japan location, which was also among the highest installation-specific risk locations for men and women in the Navy (Figure 3.18).

Installation-Specific Risk and the Number of Individuals Sexually Assaulted

Installation-specific risk may be especially valuable for understanding the nature and distribution of sexual assault risk in the services; however, it may not be the most relevant metric for SAPRO and other sexual assault prevention and response offices interested in focusing training and prevention resources where they might do the most good. This is because a location with high installation-specific risk but few personnel may have few sexual assaults in a given year (or none at all). Targeted prevention efforts may be most efficient when focused on installations where there are large numbers of service members being sexually assaulted, particularly in places where the numbers substantially exceed those that would be expected based on the individual characteristics of the service members assigned there.

Table 3.3 describes the five bases with the greatest number of sexual assaults above or below the number that would be expected based on the individual characteristics of personnel assigned there. At the extremes, Table 3.3 shows that the

Table 3.3
Installations with the Five Lowest and Highest Numbers of Sexual Assaults Estimated to Be Associated with the Installation-Specific Risk Portion of Total Installation Risk

Lowest		Highest	
Installation	Sexual Assault Difference[a]	Installation	Sexual Assault Difference[a]
Army			
Schofield Barracks	–48	Fort Drum	76
Fort Gordon	–36	Fort Lewis	68
Fort Lee	–23	Fort Hood	62
Fort George G. Meade	–18	Fort Bragg	51
Fort Sam Houston	–15	Fort Riley	29
Navy			
Pensacola NAS	–67	Japan	56
Norfolk NB	–64	Various AP ships 96662	44
San Diego NAVSTA	–26	Various AP ships 96667	41
Corry Station NTTC	–25	USS *Theodore Roosevelt*	39
Coronado Nav Amphib Base	–24	Various AP ships 96678	35
Air Force			
Nellis AFB	–12	Hurlburt Field	8
Wright-Patterson AFB	–9	Luke AFB	7
Eglin AFB	–8	Ramstein AB (GR)	6
Offutt AFB	–8	Altus AFB	6
Scott AFB	–7	Laughlin AFB	4
Marine Corps			
Camp Pendleton	–47	Japan	12
Pensacola NAS	–8	Beaufort MCAS	12
Okinawa (JA)	–6	Afghanistan	12
MCCDC Quantico VA	–6	Yuma MCAS	12
USMC Mobile 3rd MEF	–5	29 Palms MC CMBT CTR	11

[a] *Sexual assault difference* refers to the number of sexual assaults above or below the number that would be predicted based only on the demographics of personnel serving at the installation. Installations where basic military training is conducted have been omitted from this table because of the possible imprecision of these estimates (see Chapter Two).

installation-specific risk component of installations' total risk accounts for as many as 76 additional sexual assaults per year (at Fort Drum) or 67 fewer than would be expected (at Pensacola NAS).

Large Command Sexual Assault Risk

In addition to examining risk at the installation level, we also looked at risk by duty unit major command using MCCs supplied by DMDC. As discussed in Chapter Two, the MCCs required substantial processing to make them useful for the current purposes. In particular, the MCCs provided by DMDC represented a smaller organizational unit for the Marine Corps than for the other services. As a result, we grouped Marine Corps MCC clusters into a higher level of aggregation. Unlike with the other services, we do not present descriptive labels for command codes in the Marine Corps because we lack a definite list of such labels for these codes.

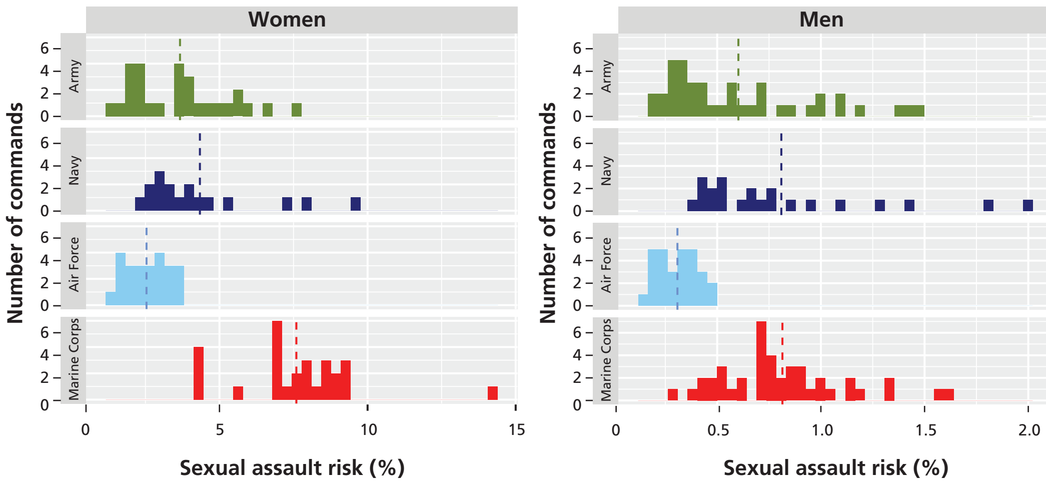
Table 3.4 lists the numbers of large commands that we analyzed for this report by gender and service branch. We do not provide estimates for small commands because they have poor reliability, and we must protect the privacy of service members from those commands who responded to the RMWS survey.

Figure 3.19 shows the distribution of total sexual assault risk across the large commands. There is a single command in the Marine Corps with an estimated one-year prevalence of sexual assault of 14 percent for women, which is substantially higher than found for any other large command. Nevertheless, the Marine Corps commands analyzed here are smaller than those for other services and do not represent the Marine Corps' major commands, the unit of analysis for the other three services (see Chapter Two for discussion of this difference). Tables in Part A of the annex to this report provide complete data on the total sexual assault risk of all large commands.

Table 3.4
Number of Large Commands, by Gender and Service Branch

Gender	Army	Navy	Air Force	Marine Corps
Female	28	17	24	27
Male	41	22	29	42

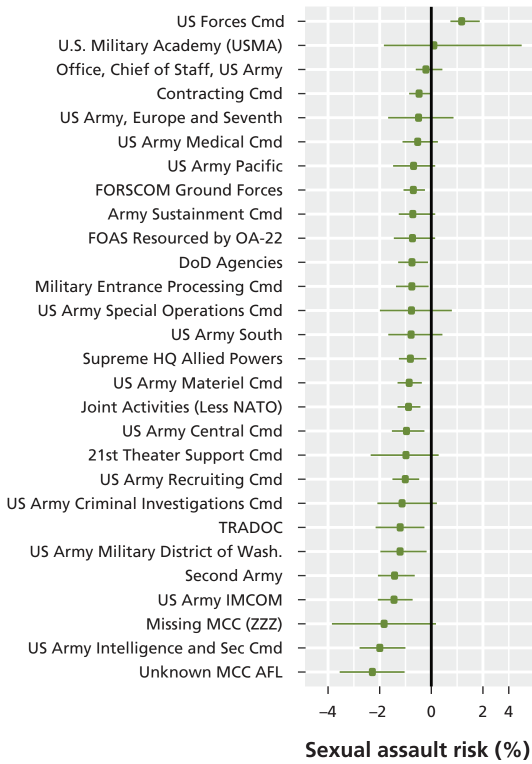
Figure 3.19
Distribution of Total Estimated Sexual Assault Risk Across All Large Commands, by Gender and Service Branch



NOTES: The dashed lines correspond to average large command risk to women or men in each service. The figures for women and men are on different horizontal scales.
RAND *RR870/7-3.19*

Having introduced the distinctions between total risk and installation-specific risk in the previous section, here we focus on command-specific risk of sexual assault. This represents the extent to which risk is lower or higher than expected for members in that command while controlling for the individual characteristics of personnel assigned there.

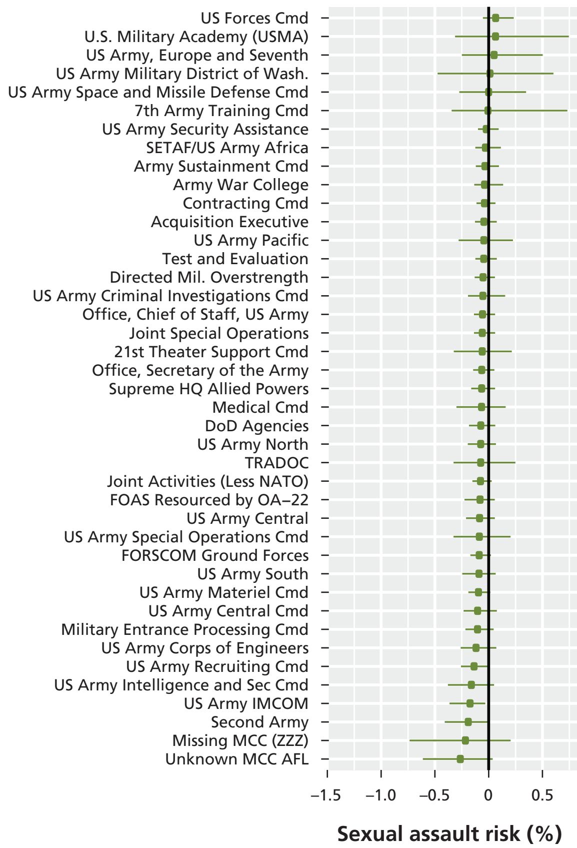
Figure 3.20
Estimated Command-Specific Sexual Assault Risk for All Large Commands, Army Women



NOTES: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. AFL = Armed Forces of Liberia; FOAS = Field Operating Agencies of the Army Staff; FORSCOM = U.S. Army Forces Command; IMCOM = Installation and Management Command; OA = operating agency; TRADOC = U.S. Army Training and Doctrine Command.

RAND *RR870/7-3.20*

Figure 3.21
Estimated Command-Specific Sexual Assault Risk for All Large Commands, Army Men



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. SETAF = Southern European Task Force.

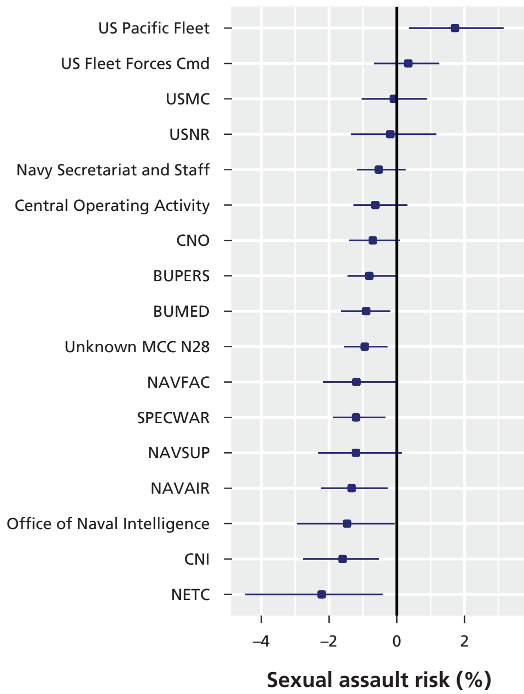
RAND *RR870/7-3.21*

Figure 3.20 displays command-specific risk estimates for Army women. All but two of these estimates fall below zero, meaning the command is associated with a lower-than-expected risk. The outlier is U.S. Forces Command, the largest Army command, where risk to women is elevated by an average of 1.2 percentage points.

For men in the Army, the range of command-specific risks is small, and few commands are associated with an effect that is clearly different from zero (Figure 3.21).

Of the 17 large Navy commands (fleets, shore and headquarters commands, and defense agencies where large numbers of sailors worked) for women, only two fleets (U.S. Pacific Fleet and U.S. Fleet Forces Command) were found to be associated with elevated risks of sexual assault (Figure 3.22). Several other commands were associated with lower risk than expected based on the risk factors of their personnel, including

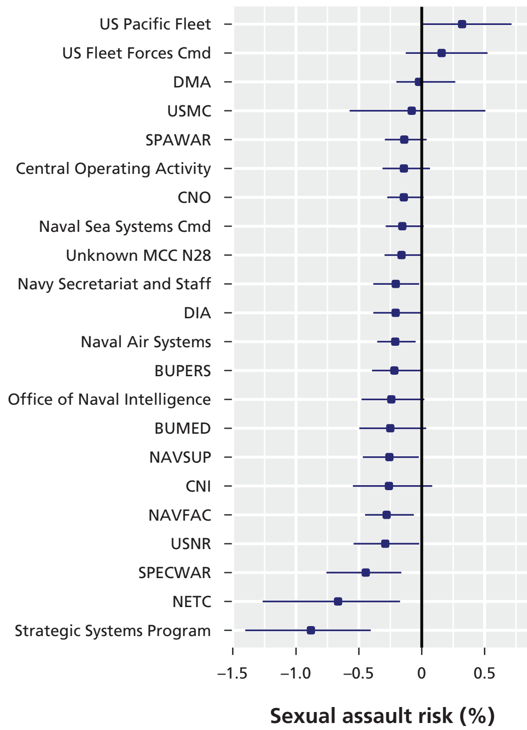
Figure 3.22
Estimated Command-Specific Sexual Assault Risk for All Large Commands, Navy Women



NOTES: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. BUMED = Bureau of Medicine and Surgery; BUPERS = Bureau of Navy Personnel; CNI = Commander, Naval Installations; CNO = Chief of Naval Operations; NAVAIR = Naval Air Systems Command; NAVFAC = Naval Facilities Engineering Command; NAVSUP = Naval Supply Systems Command; NETC = Naval Education and Training Command; SPECWAR = Special Warfare Command; USNR = U.S. Navy Reserve.

RAND *RR870/7-3.22*

Figure 3.23
Estimated Command-Specific Sexual Assault Risk for All Large Commands, Navy Men

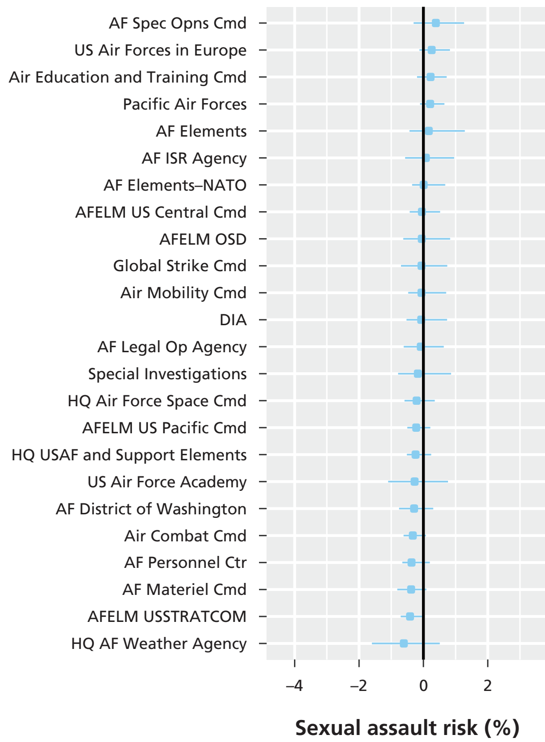


NOTES: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. DIA = Defense Intelligence Agency; DMA = Defense Media Activity; SPAWAR = Space and Naval Warfare Systems Command.

RAND *RR870/7-3.23*

several associated with a 1– to 2–percentage point reduction in risk (e.g., Personnel Command, Bureau of Medicine, Facilities Engineering Command, Special Warfare Command, Supply Systems Command, Air Systems Command, the Office of Naval Intelligence, Installations Command, and the Education and Training Command). Similarly, of the 22 large Navy commands for men, the only two associated with elevated risk were Pacific Fleet and Fleet Forces Command (Figure 3.23).

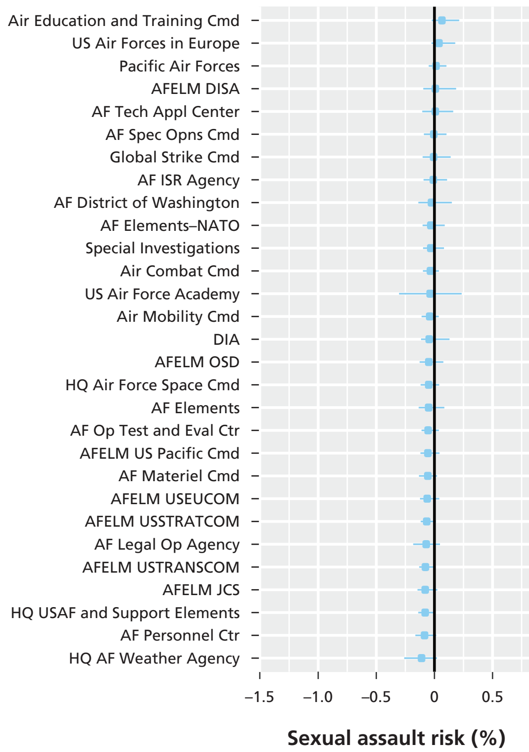
Figure 3.24
Estimated Command-Specific Sexual Assault Risk for All Large Commands, Air Force Women



NOTES: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. AF = Air Force; AFELM = Air Force Element; ISR = intelligence, surveillance, and reconnaissance; USSTRATCOM = U.S. Strategic Command.

RAND *RR870/7-3.24*

Figure 3.25
Estimated Command-Specific Sexual Assault Risk for All Large Commands, Air Force Men



NOTES: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. DISA = Defense Information Systems Agency; JCS = Joint Chiefs of Staff; USEUCOM = U.S. European Command; USTRANSCOM = U.S. Transportation Command.

RAND *RR870/7-3.25*

For Air Force women, Figure 3.24 shows that command-specific risk makes up a small part of total sexual assault risk. The largest such effect, at Special Operations Command, is associated with a 0.4-percentage-point increase in risk.

Similarly, for Air Force men, command-specific risk plays a small role in total risk (Figure 3.25). For men, Air Education and Training Command is associated with just a 0.1-percentage-point increase in risk, which is the largest command-specific risk estimate for men in the Air Force.

As discussed in Chapter Two, we were unable to group Marine Corps personnel into major command groups. Although we were able to cluster them by Monitored Command Codes and CMCCs, the interpretability of these clusters is limited, both because we do not have labels for these commands and because they may not correspond to the Marine Corps' conventional command structures. For this reason, we have put the Marine Corps results in the appendix of this report, and we do not discuss them here.

Total Number of Assaults Associated with Command-Specific Risk

We also combine information on command-specific risk with the size of the population affected by that risk during FY 2014 to assess the number of sexual assaults higher or lower than the number expected based on the individual characteristics of personnel in the command. Because several of the commands with the highest command-specific risk are also the largest commands, the number of sexual assaults associated with just command-specific risk is sometimes large. For instance, U.S. Forces Command is large and has the highest command-specific risk for Army women and men. The number of sexual assaults at this command over the number expected based on its personnel's individual characteristics is 357 (credibility interval: 218–554) for women and 153 (–112–486) for men. Fleet Forces Command and Pacific Fleet are associated with 56 (–100–186) and 268 (55–480) more sexual assaults of Navy women, respectively, and 117 (–89–364) and 277 (0–598) more sexual assaults of Navy men, respectively, than expected based on the individual characteristics of personnel assigned there. Air Education and Training Command is associated with 25 (–19–70) more assaults of Air Force women and 27 (–8–77) more sexual assaults of Air Force men than would be expected based on its personnel's individual characteristics.

CHAPTER FOUR
The Distribution of Sexual Harassment Risk

All of the large installations available for estimating rates of sexual assault were also available for estimating rates of sexual harassment. Across these installations, the correlations between our estimate of total risk of sexual harassment and sexual assault are high. For women, the Army (0.89) and Navy (0.93) have very high correlations between sexual assault and harassment risks across installations; the Air Force (0.69) and Marine Corps (0.58) have lower, but still quite high, correlations. For men, correlations are high in the Army, Navy, and Marine Corps, ranging from 0.91 to 0.94, and somewhat lower in the Air Force at 0.67. This means that the patterns of findings for total risk across installations and commands of sexual harassment are quite similar to those of sexual assault. To avoid duplication, we do not present the estimates of the overall rate of sexual harassment by installation or major command in the body of this report. Tables showing the distribution of total sexual harassment risk by large installations and commands can be found in Part B of the annex to this report.

The high correlation in our estimates of the risk of sexual assault and of sexual harassment across installations reflects the fact that these outcomes have similar or correlated predictors in our statistical models. For example, both outcomes are much more common among younger enlisted personnel, so installations with a higher-than-average proportion of such personnel will have high estimated rates of both sexual assault and sexual harassment. However, it is not just the personnel characteristics that lead to the correlated estimates for sexual assault and harassment across installations. The installation-specific risks of sexual assault and sexual harassment are also correlated across installations. Correlations for women in the Army, Navy, Air Force, and Marine Corps are 0.76, 0.77, 0.19, and 0.63, respectively; for men they are 0.48, 0.70, 0.30, and 0.25, respectively. The markedly lower correlation for women in the Air Force (and, to a lesser extent, men in the Air Force) suggests that installation-level risk factors may be less important in the Air Force. Relatedly, it may be that the rates of installation-specific sexual assault and sexual harassment are so comparatively low in the Air Force that chance factors play a greater role in determining which Air Force installations have the highest or lowest risk, reducing correlations.

The high correlations for all services in total risk of sexual assault and sexual harassment suggest that the important predictors for these two outcomes are quite similar whether predictions are based on the individual characteristics of personnel at the installation or on installation characteristics (measured from either the official records or the survey).

As discussed in Chapter Two, the statistical models used to estimate installation risk of sexual assault leverage the high correlation between sexual assault and sexual harassment to improve the precision of our estimates. Indeed, one of the key predictors for installation-specific risk of sexual assault is the proportion of respondents from that installation who indicated experiencing sexual harassment on the survey. Similarly, the proportion of respondents who indicated a sexual assault at the installation is a key predictor of sexual harassment risk at that installation. While this method improves our installation estimates of both sexual assault and sexual harassment, it also means that these two estimates are correlated for purely methodological reasons.

We have greater statistical precision in many of the sexual harassment estimates at any given cluster size because many more people experience sexual harassment than sexual assault.[1] This means that the credibility intervals on most estimates are smaller for sexual harassment than sexual assault, and we can more often confidently conclude that rates are higher or lower than service averages. Thus, although the estimates are highly correlated, we can identify installations with unusually high or low rates of sexual harassment more accurately than with sexual assault.

Figure 4.1 describes the distribution of total sexual harassment risk by gender and service branch. Compared with sexual assault risk, estimated harassment risk is much greater for all groups. It also spans a wider range, running for women from less than 10-percent risk at several Air Force installations to more than 55 percent at one Navy installation. For men, estimated sexual harassment risk ranges from just more than 1 percent to more than 20 percent.

The correlation of total sexual harassment risk for women and men is large and generally higher than found for sexual assault risk. For the Army, Navy, Air Force, and Marine Corps, those correlations are 0.89, 0.91, 0.68, and 0.59, respectively. Therefore, the installations where risk of sexual harassment is lowest or highest for women tend to also be the ones where risk is lowest or highest for men, although this association is smaller for the Air Force and Marine Corps.

In this section, we highlight only the installations with the ten lowest or highest installation-specific sexual harassment risk. Estimates of total and installation-specific sexual harassment risks for all installations are presented in Part B of the annex to this report.

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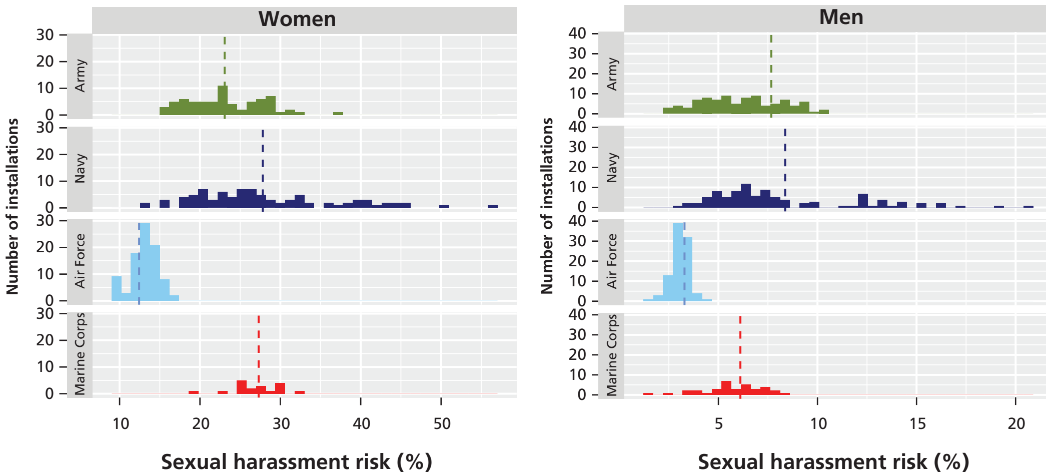
[1] More specifically, the absolute range of the credibility interval is wider for estimates of sexual harassment prevalence than sexual assault prevalence. However, when that range is expressed as a fraction of the estimate itself, estimates of the prevalence of sexual harassment have much greater precision. This allows for increased statistical power to detect differences across installations when looking at a higher prevalence outcome like sexual harassment relative to sexual assault.

Figure 4.1
Distribution of Total Estimated Sexual Harassment Risk Across All Large Installations, by Gender and Service Branch



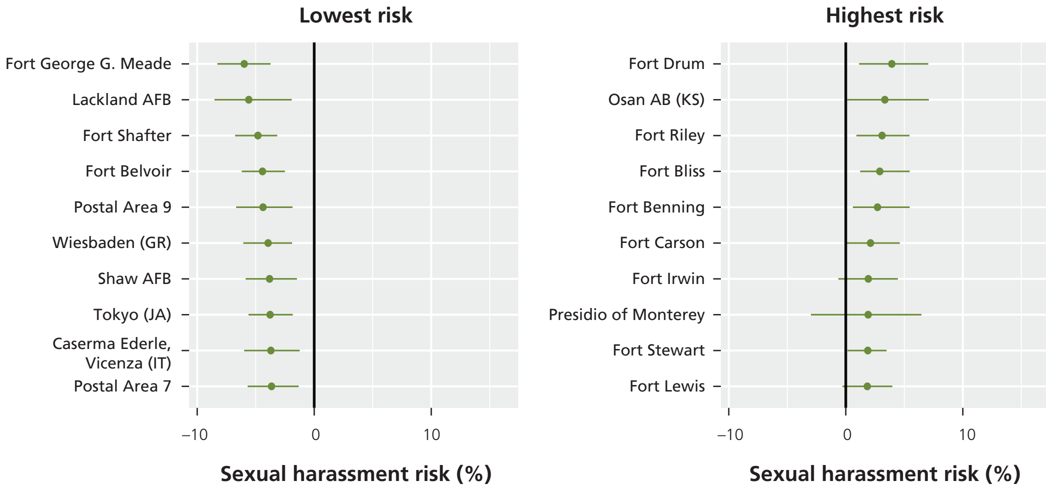
NOTES: The dashed lines correspond to the average large installation risk to women or men in each service. The figures for women and men are on different vertical and horizontal scales.
RAND *RR870/7-4.1*

Figure 4.2 illustrates the ten bases with the lowest and highest estimated installation-specific risk of sexual harassment of Army women. These figures suggest that installation-specific risk can have a considerable effect on women's risk of sexual harassment. At Fort George G. Meade, for instance, women face an average sexual harassment risk that is about 6 percentage points lower than would be expected based on the individual characteristics of personnel assigned there. The total estimated risk of sexual harassment to Army women at Fort Meade is 19.8 percent (see Table B.9 of the annex to this report). If the installation effect there is to reduce women's risk by 6.0 percent, this means that assignment to Fort Meade reduced these women's risk of sexual harassment by almost one-quarter.

At Fort Drum, women's risk of sexual harassment is higher than expected by an average of 3.9 percentage points. Total risk of sexual harassment for women at this installation is 32.3 percent, which means that assignment there is associated with a rate of sexual harassment that is 14 percent higher than expected based on the individual characteristics of the base's personnel. The Presidio of Monterey is interesting because it has the lowest estimated installation-specific risk of sexual assault but has the eighth-highest installation-specific risk of sexual harassment. This estimate is imprecise, however, as indicated by the wide credibility interval.

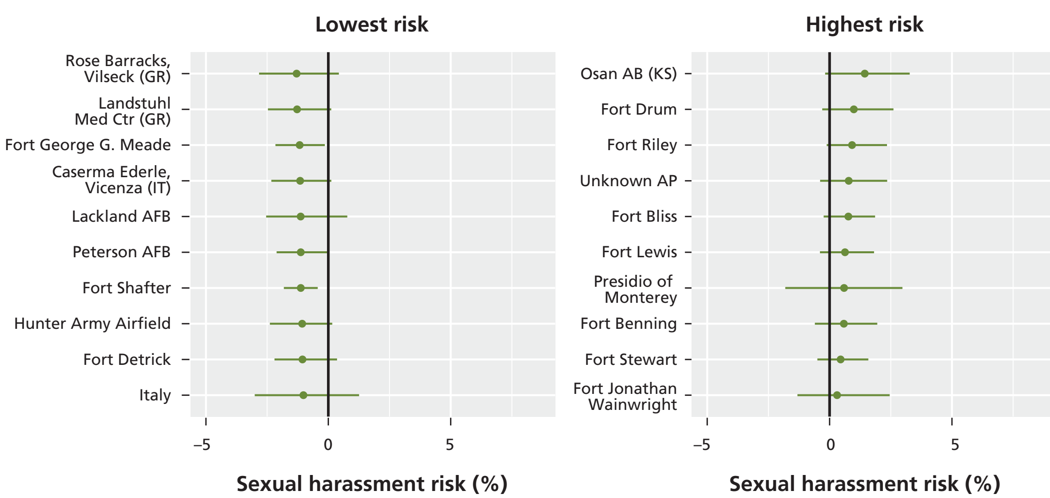
Figure 4.3 presents the same information for men in the Army. Many of the same installations with low or high installation-specific risk for women are also low or high for men.

Figure 4.2
Estimated Installation-Specific Sexual Harassment Risk for the Ten Lowest- and Highest-Risk Installations, Army Women



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimates for Fort Benning and Lackland AFB are based on a subset of personnel who served at those installations and may not accurately describe the experiences of soldiers receiving basic military training at each. See discussion in Chapter Two.
RAND *RR870/7-4.2*

Figure 4.3
Estimated Installation-Specific Sexual Harassment Risk for the Ten Lowest- and Highest-Risk Installations, Army Men



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimates for Fort Benning and Lackland AFB are based on a subset of personnel who served at those installations and may not accurately describe the experiences of soldiers receiving basic military training at each. See discussion in Chapter Two.
RAND *RR870/7-4.3*

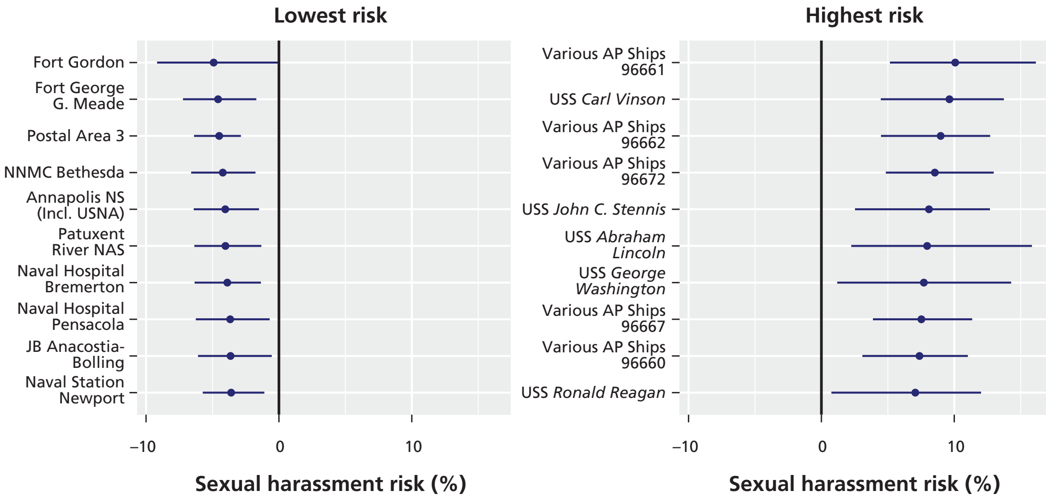
For Navy women (Figure 4.4), the locations with the lowest installation-specific risk of sexual harassment include medical centers and Fort Meade. The highest-risk locations are all ships, including five aircraft carriers. Ships in the 96661 FPO, for instance, have an average estimated total sexual harassment risk of about 44 percent for women. Ten percentage points of this risk is estimated to be associated with installation-specific risk.

For Navy men, many of the same locations identified for Navy women are also associated with especially low or high installation-specific risk of sexual harassment (Figure 4.5). Among the lower-risk locations are medical centers and Fort Meade. Similarly, the highest estimated installation-specific risk is found exclusively among ships, including five aircraft carriers. At the extreme (ships in the 96661 FPO address), about one-quarter of the total risk of sexual harassment is associated with installation-specific risk, meaning it cannot be explained by the individual characteristics of the personnel at the installation.

The locations with the lowest and highest estimated installation-specific risk of sexual harassment for women in the Air Force are listed in Figure 4.6 and for men in Figure 4.7. The magnitude of the installation-specific risks are comparatively small for women and men.

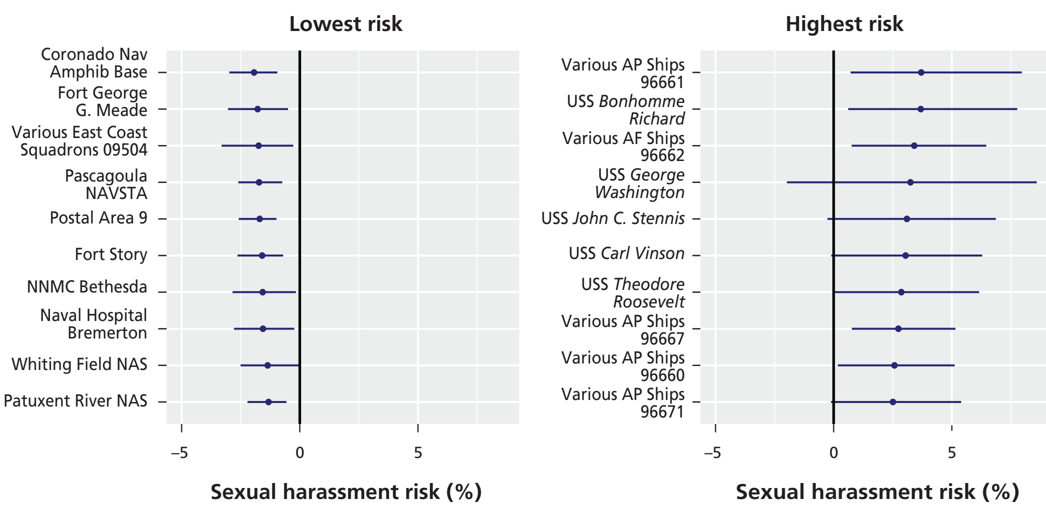
Figure 4.8 shows the five installations with the lowest and highest installation-specific risks of sexual harassment of women in the Marine Corps, and Figure 4.9 shows the installations for men.

Figure 4.4
Estimated Installation-Specific Sexual Harassment Risk for the Ten Lowest- and Highest-Risk Installations, Navy Women



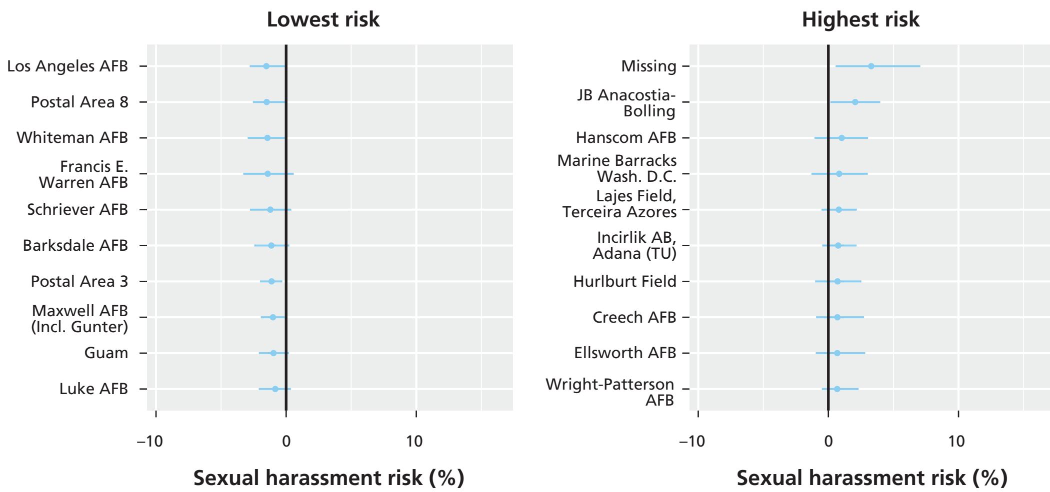
NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.
RAND *RR870/7-4.4*

Figure 4.5
Estimated Installation-Specific Sexual Harassment Risk for the Ten Lowest- and Highest-Risk Installations, Navy Men



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.
RAND *RR870/7-4.5*

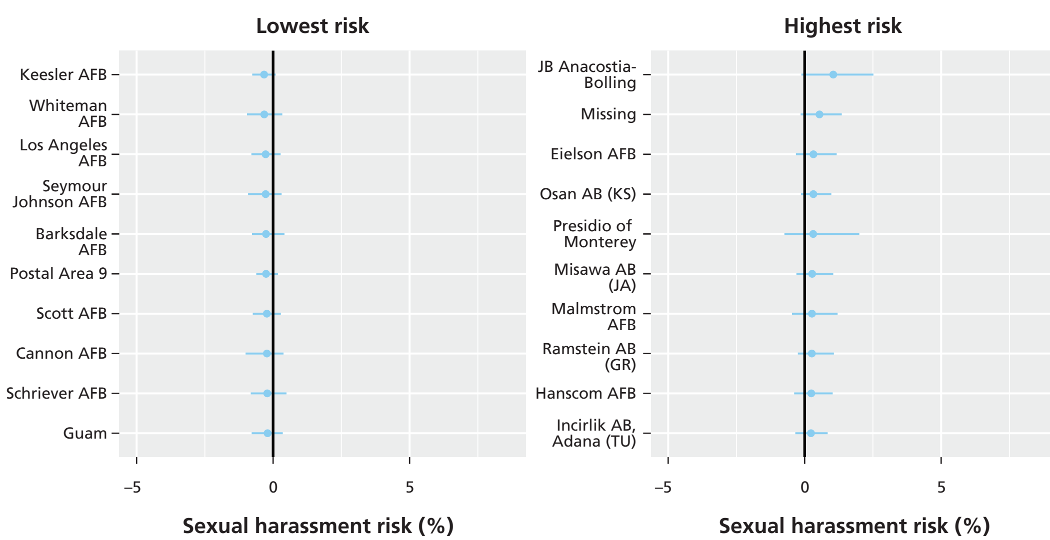
Figure 4.6
Estimated Installation-Specific Sexual Harassment Risk for the Ten Lowest- and Highest-Risk Installations, Air Force Women



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-4.6*

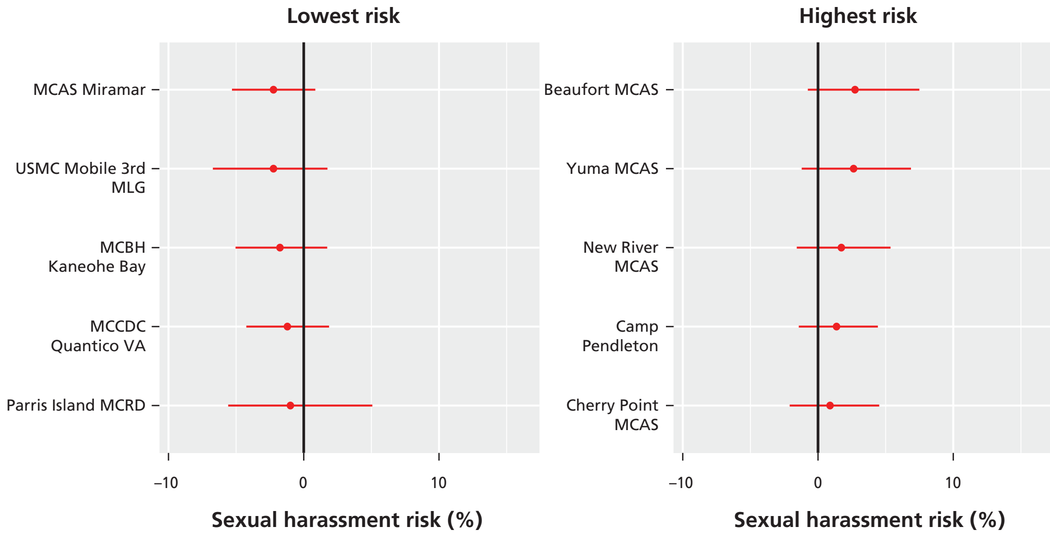
Figure 4.7
Estimated Installation-Specific Sexual Harassment Risk for the Ten Lowest- and Highest-Risk Installations, Air Force Men



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

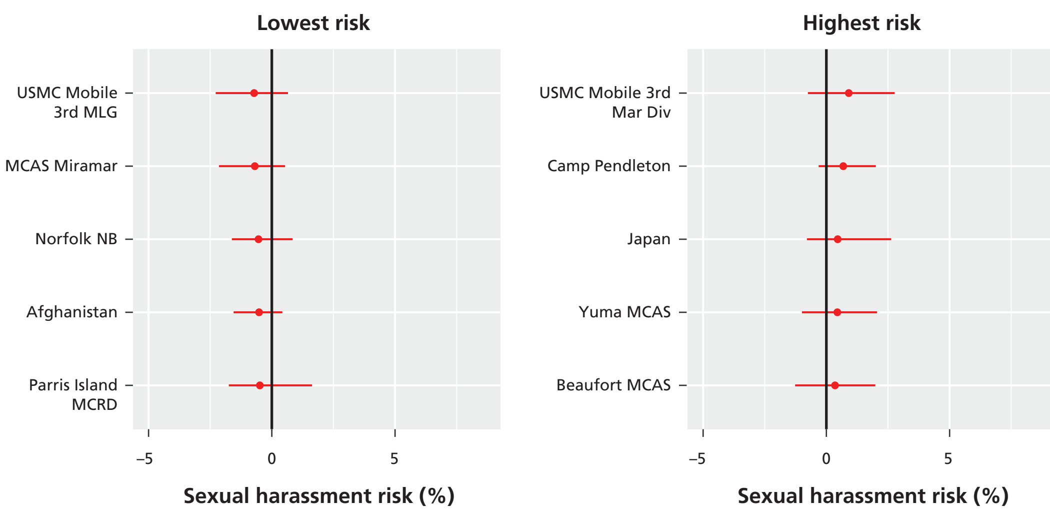
RAND *RR870/7-4.7*

Figure 4.8
Estimated Installation-Specific Sexual Harassment Risk for the Five Lowest- and Highest-Risk Installations, Marine Corps Women



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimate for Parris Island MCRD is based on a subset of personnel who served there and may not accurately describe the experiences of soldiers receiving basic military training there. See discussion in Chapter Two.
RAND *RR870/7-4.8*

Figure 4.9
Estimated Installation-Specific Sexual Harassment Risk for the Five Lowest- and Highest-Risk Installations, Marine Corps Men



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals. The estimate for Parris Island MCRD is based on a subset of personnel who served there and may not accurately describe the experiences of soldiers receiving basic military training there. See discussion in Chapter Two.
RAND *RR870/7-4.9*

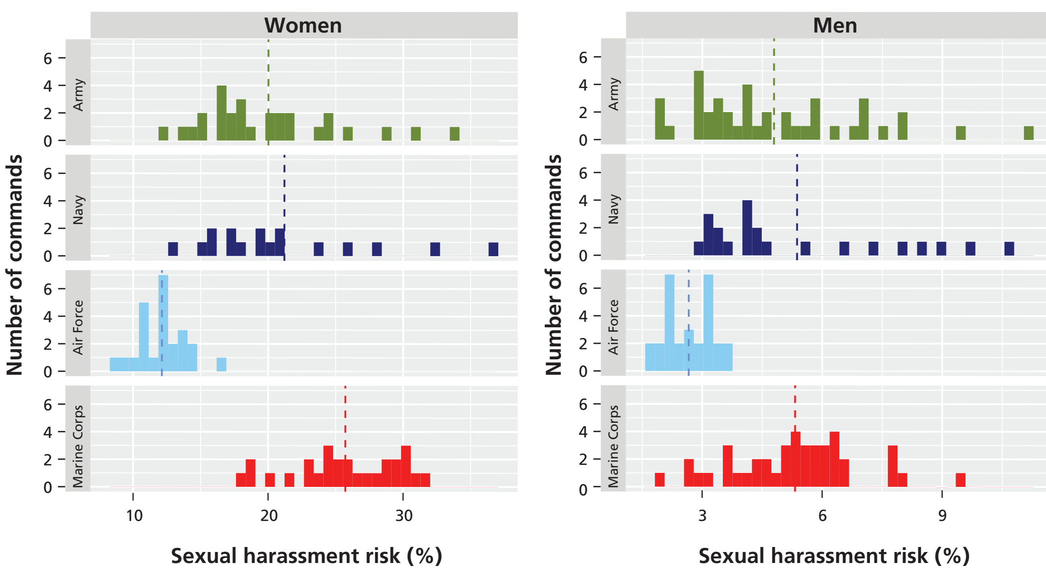
Large Command Sexual Harassment Risk

In this section, we discuss the risk of sexual harassment among the large commands. The range of sexual harassment risk found among the 135 large commands we analyzed is substantially lower than found for installation-specific risk of sexual harassment. Whereas the range of values for installations spans more than 40 percentage points for women and close to 20 percentage points for men, among commands, the range for women is less than 30 points and for men is less than 10 points (Figure 4.10).

Because of the similarities in total sexual harassment risk and total sexual assault risk, we do not present figures for the total sexual harassment risk by major command; however, the data are available in Part B of the annex to this report. Here, we discuss the commands with the lowest and highest command-specific risk of sexual harassment—that is, the average portion of risk at each command that is not explained by the individual characteristics of personnel in that command.

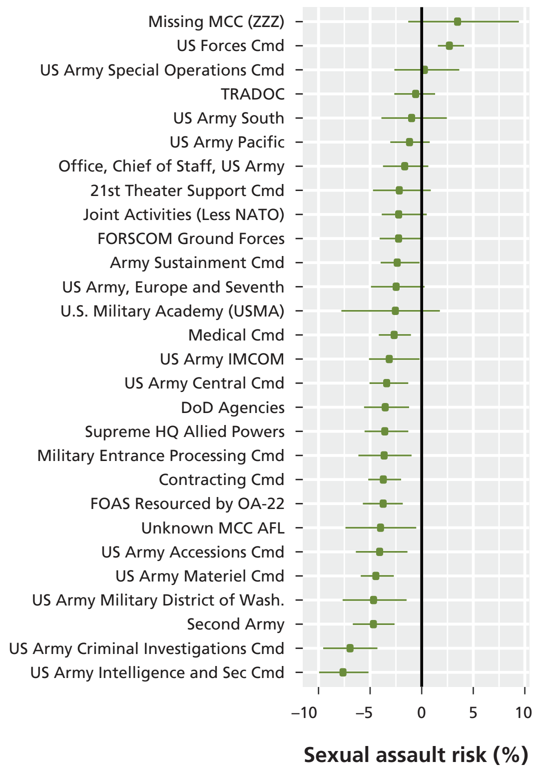
As seen in Figure 4.11, the Army commands with the lowest command-specific risk of sexual harassment are associated with markedly lower risk of sexual harassment to women than would be expected, on average, across Army commands. Many of these lowest-risk commands are support activities, such as the Materiel, Accessions, and Contracting Commands. Two commands have estimated command-specific risk associated with elevations in women's risk of sexual harassment over their individual risk. A

Figure 4.10
Distribution of Estimated Sexual Harassment Risk Across All Large Commands, by Gender and Service Branch



NOTES: The dashed lines correspond to average large command risk to women or men in each service. The figures for women and men are on different horizontal scales.
RAND *RR870/7-4.10*

Figure 4.11
Estimated Command-Specific Sexual Harassment Risk for All Large Commands, Army Women

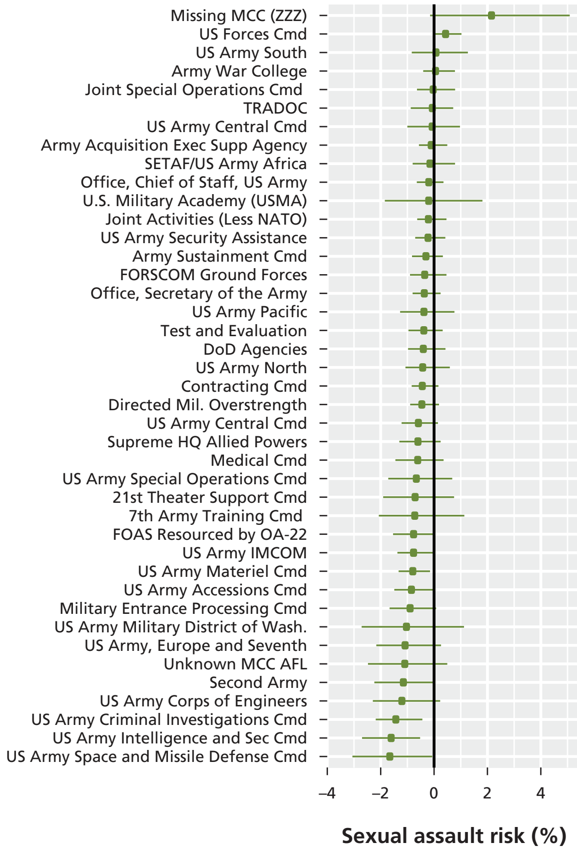


NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.
RAND *RR870/7-4.11*

third identified command with the highest risk is not a real command but instead the cluster of soldiers who had missing MCCs in the DMDC personnel records. It would be useful to investigate the circumstances that result in MCCs being missing, because these appear to be associated with especially high command-specific risk.

For Army men (Figure 4.12), again, U.S. Forces Command and those with missing MCCs are associated with the highest estimated command-specific risk. Similarly, many of the commands associated with the lowest risk for women are also present among the lowest command-specific risk of sexual harassment for men.

Figure 4.12
Estimated Command-Specific Sexual Harassment Risk for All Large Commands, Army Men

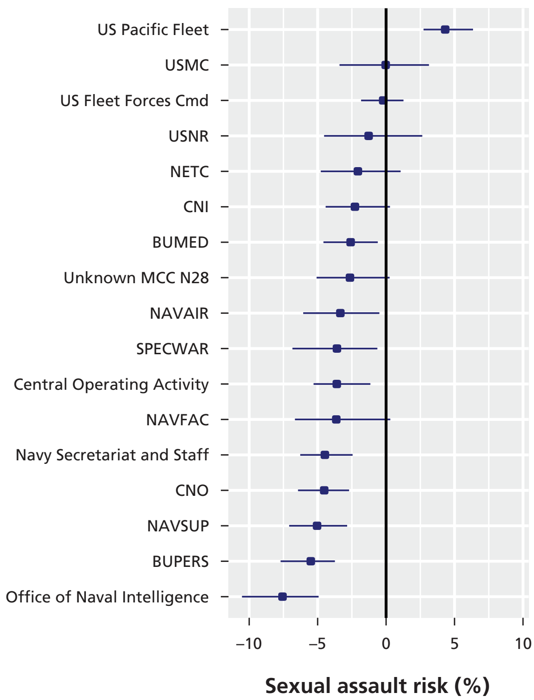


NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-4.12*

For Navy women and men (Figures 4.13 and 4.14), only the Pacific Fleet stands out as having especially elevated command-specific risk of sexual harassment. As was the case for soldiers, the lowest estimated command-specific risks are associated with support activities and intelligence activities.

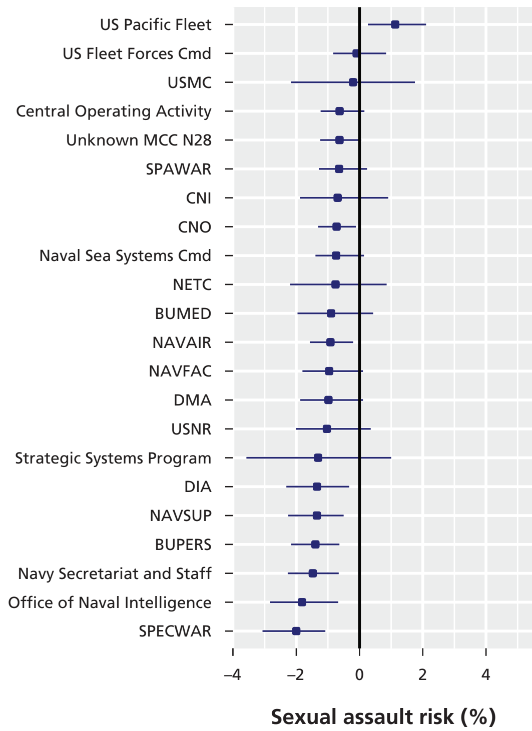
Figure 4.13
Estimated Command-Specific Sexual Harassment Risk for All Large Commands, Navy Women



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-4.13*

Figure 4.14
Estimated Command-Specific Sexual Harassment Risk for All Large Commands, Navy Men

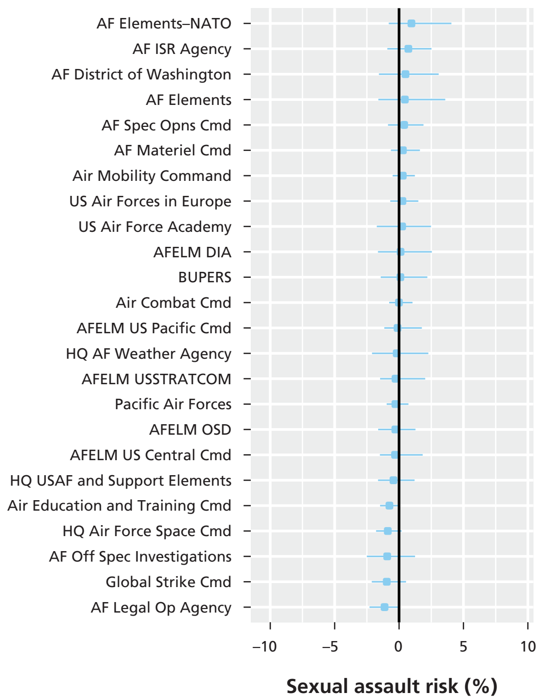


NOTES: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-4.14*

Most Air Force commands for women and men have command-specific risks of sexual harassment that are not clearly positive or negative, meaning that substantial portions of the credibility interval fall on either side of zero (Figures 4.15 and 4.16). Surprisingly, Air Education and Training Command is associated with lower-than-expected risk of sexual harassment for women even though it is associated with elevated risk of sexual assault for them.

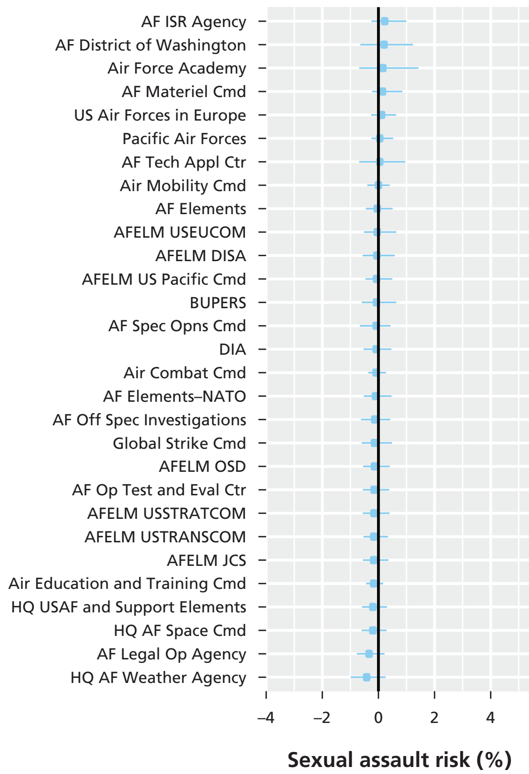
Figure 4.15
Estimated Command-Specific Sexual Harassment Risk for All Large Commands, Air Force Women



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-4.15*

Figure 4.16
Estimated Command-Specific Sexual Harassment Risk for All Large Commands, Air Force Men



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-4.16*

As discussed in Chapter Two, we were unable to group Marine Corps personnel into major command groups. Although we were able to cluster them by Monitored Command Codes and CMCCs, the interpretability of these clusters is limited, both because we do not have labels for these commands and because they may not correspond to the Marine Corps' conventional command structures. For this reason, we have put the Marine Corps results in the appendix of this report, and we do not discuss them here.

CHAPTER FIVE

Conclusions and Recommendations

This study was a proof of concept designed to evaluate whether small-area estimation techniques could be used to identify differences in sexual assault and sexual harassment risk at the installation or command levels that are useful in characterizing differences between installations with high and low risk. We find that such techniques can be used to identify differences in sexual assault and harassment risk across installations and commands with good precision and that these differences are sometimes large. Our results may offer important insights into the distribution of risk across the services. The results may also provide clues about the conditions that contribute to sexual assault risk and about strategies that could be used to prevent sexual assault and harassment. In this chapter, we highlight some of these implications and suggest new steps that could be taken to combat sexual assaults against service members.

Patterns in Sexual Assault Risk Suggest Consistent Sources of Risk

The RMWS described sexual assault and sexual harassment experiences of military personnel at a point in time—FY 2014—so it is reasonable to ask whether the distributions of risk we observe in this report have any bearing on risk as it currently exists (now a few years later). Could it not be the case, for instance, that some of the installations with the highest total or installation-specific risk in FY 2014 are now among the safest environments for service members to work, perhaps because the command climate has changed or a cohort of predators has moved on? In some cases, this is certainly possible. But we suspect that the broad patterns we observe across installations and commands may reflect structural characteristics of risk that are not likely to change rapidly. For instance, the fact that it is not just one or two ships that top the Navy's lists of total and installation-specific risk of sexual assault and sexual harassment suggests that there may be something about assignment to ships that elevates risk for women and men. However, the current, cross-sectional data do not allow us to conclude that these are stable characteristics of installations, and testing this speculation would require additional data.

There were several such patterns—some of which are consistent for women and men and across services—that may reflect structural or stable characteristics of sexual assault risk. These patterns may provide clues about the mechanisms driving installation risk. Here, we highlight several of these patterns and consider their implications.

Consistency in Which Installations Are Associated with Risk to Women and Men

First, there is striking consistency between the installations with the lowest and highest risk of sexual assault for women and men. Across three services, the correlation between installations' total risk scores for women and men are high, ranging from 0.77 to 0.91, while the scores for the Marine Corps have a lower correlation of 0.43. Similarly, installation-specific risk estimates for women and men have high correlations ranging from 0.77 to 0.88 across services. These observations suggest that some of the same installation characteristics associated with risk of sexual assault for women are also associated with risk for men.

Patterns Among the Lowest-Risk Installations

Assignment to installations in the National Capital Region appears to present especially low risk to service members. Much of this association can be explained by the individual characteristics of the personnel assigned to these locations. Similar observations might be made for medical centers, many of which appear among the 15 locations with the lowest total sexual assault risk, but none appears among the ten locations with the lowest installation-specific sexual assault risk. However, for women and men, medical centers do appear as among the locations with the lowest installation-specific risk of sexual harassment, which is highly correlated with risk of sexual assault.

Finally, we note that the ten synthetic installations we created by combining many small units in postal areas emerged as among the lowest-risk assignments. Aggregated units at the postal area appeared among the lowest-risk installations for each service branch and for women and men. Postal areas also were associated with reduced installation-specific risk for men in the Army, but not for others. Therefore, the lower total risk associated with postal areas may partially reflect differences in the individual risk factors of personnel assigned to those locations.

We know little about these small installations other than their zip codes and the fact that few active-component members serve there. The personnel may include service members working in industry, academia, research institutes, defense agencies, state government, recruiting, or other primarily civilian settings.

Patterns Among the Highest-Risk Installations

The clearest pattern of high risk we recognize is that women and men on many ships face the greatest total and installation-specific risk. On the basis of this study, we cannot say what it is about these duty assignments that leads to their association with the highest risk of sexual assault and harassment. There may be evidence, however, that it is not exclusively due to life at sea or the cycles of shore leave experienced by deployed sailors. In particular, we know that the USS *Abraham Lincoln* was undergoing a refueling complex overhaul during the period covered by the RMWS. Therefore, the ship's crew was not at sea, and most were not living on the ship. Some would have been living on land in the adjacent community and others on a nearby barge with quarters comparable to those on the carrier. Nevertheless, one-year risk of sexual assault for women assigned to the USS *Abraham Lincoln* was high and comparable to that found with other aircraft carriers, and it was among the assignments with the highest installation-specific risk for women across all service branches.

More generally, it may be that many of the highest-risk installations had a large combat unit presence. Similarly, such commands as U.S. Pacific Fleet, U.S. Fleet Forces Command, U.S. Forces Command, Pacific Air Forces, and others with direct combat roles were among the commands with the highest total and command-specific risk. The reasons for this pattern cannot be inferred from the current analyses. It is possible that there is a mindset, ethos, or culture common to combat units that is associated with sexual assault risk. However, these installations and commands differ from the lowest-risk locations in many ways that are not assessed in this study. For instance, combat units may have lower officer-to-enlisted ratios. They may have a higher proportion of personnel living on base or ship than do installations with a greater proportion of support than combat occupations. These environments may include a smaller proportion of civilians. Any such differences could be relevant to explaining why some installations have higher or lower risk.

The Distribution of Risk Is Uneven Across Installations and Commands

A large proportion of all sexual assaults occur at a relatively few large installations for each of the services. The Army and Marine Corps, for instance, each have installations where we estimate that there were more than 500 sexual assaults of women and men in FY 2014 (Fort Hood, Fort Bragg, Fort Lewis, Fort Campbell, Fort Bliss, and Camp Lejeune). By targeting prevention, training, and other interventions at the largest and highest-risk installations, the services might efficiently make important reductions in their sexual assault rates.

For instance, if the Marine Corps reduced sexual assault risk for women at the ten installations with the most assaults by one-third (e.g., from 7.9 percent to 5.3 percent), this could reduce risk to women across the entire Corps by more than 20 percent. The Army could achieve the same level of across-the-board reductions in risk for women by reducing risk by one-third at the 15 installations with the largest number of sexually assaulted individuals. If the Navy could reduce sexual assaults of women by one-third at its 38 installations with the greatest number of such assaults, it could bring down its service average risk to the average of all DoD services in FY 2014 (i.e., from 6.5 percent to 4.9 percent).

The uneven concentration of risk across installations and commands also has implications for how SAPRO and the services evaluate rates of official reporting of sexual assaults. In particular, service average sexual assault rates cannot be assumed to apply to each unit, facility, or command. Each service branch has some installations and commands that face quite low risks of sexual assault and others that can have risks substantially greater. Among large installations, the lowest risk and highest risk to women differ by a factor of two for the Marine Corps, four for the Army and the Air Force, and more than seven for the Navy. With this much variability in installation risk, the expected number of official reports of assault at any base are not well estimated by considering only the number of personnel serving there. Instead, to establish whether some installations or commands have unexpected rates of official reporting, it is necessary to compare those reporting rates with estimates of the number of assaults at those installations, such as we developed in this report.

Installation- and Command-Specific Risk Account for Many Sexual Assaults

Each service member's estimated risk of being sexually assaulted in the next year depends, to a surprising extent, on his or her duty assignment to a particular unit, command, and installation. For example, estimated sexual assault risk for women assigned to ships in the 96667 FPO address is 70 percent higher than expected based on similar Navy women with other duty assignments; 24 of the estimated 59 sexual assaults of these women in FY 2014 are associated with this installation-specific risk. Conversely, sexual assault risk for Navy women at the Presidio of Monterey is more than 35 percent lower than expected relative to similar Navy women with other duty assignments; the 15 sexual assaults of women that we estimate occurred there in FY 2014 are actually nine fewer than would be expected had women been assigned to other Navy installations where similar women serve.

At large bases, installation-specific risk is sometimes associated with many more sexual assault victims than would be expected based on similar individuals with other duty assignments. Across Fort Drum, Fort Lewis, Fort Hood, and Fort Bragg, we estimate that more than 257 of the female assault victims in FY 2014, or about 17 percent of all women estimated to have been sexually assaulted at these bases, were associated with the installation-specific component of risk—that is, risk above what those women would have experienced at a typical Army duty assignment. Similarly, of the estimated 2,262 women sexually assaulted while serving in the Army's U.S. Forces Command during FY 2014, 357 (or about 16 percent) of these assaults were above what would be expected based on assault rates against women with similar individual characteristics assigned to other Army installations.

But to make progress reducing the installation-specific component of risk, it would be useful to better understand the conditions that contribute to it. Unfortunately, although the current study clarifies where to look for factors causing higher or lower installation-specific risk, it does not provide information on what those factors are. The difference in risk could be associated with characteristics of the type of work performed at the installation, the command climate, discipline, training procedures, local sexual predators, the prevalence of sexual harassment, the mix of combat forces, the proportion of officers to enlisted personnel, or even features of the physical environment (such as how sleeping or bathing quarters are arranged).

To better understand the nature of installation-specific risk, SAPRO could conduct studies of otherwise similar installations—one that is associated with elevated installation-specific risk and one that is not or that is associated with reduced risk. Differences in conditions across these installations could point to sources of installation risk. Similarly, longitudinal studies that examine how installation risk changes as different units and tenant agencies move in or out could also help specify the sources of this risk.

Sexual Assault and Sexual Harassment Risk Are Highly Correlated

Our estimates of sexual assault and sexual harassment risk are highly correlated across installations. While this correlation may partially be due to the methods we used to estimate these rates, there is strong evidence that the predictors of these two problems are very similar, at the levels of both individuals and installations. This is an important finding with implications for how the services track, investigate, and prevent sexual assaults and sexual harassment. Some of this association is driven by differences among organizational units in the age of their personnel, their ranks, occupations, and other individual risk factors.

These strong associations suggest that sexual assault and sexual harassment have similar or correlated predictors at both the individual and installation levels. Knowing that there is a strong and shared underlying risk could help investigate what those common factors are and improve targeting of prevention efforts.

Regardless of the cause of the association, the high correlation of risk between sexual harassment and sexual assault highlights the need to carefully monitor sexual harassment across the force. However, additional research is needed to determine how well an existing sexual harassment measure, such as the assessment that all units already receive as part of the DEOCS, could serve to identify units with high risk of both sexual assault and harassment. If the DEOCS can be used to accurately identify units where sexual harassment risk is high, this may also identify the units where DoD and the services could focus investigative, training, and preventive resources for countering sexual assault.

We have no direct evidence that sexual harassment causes sexual assault risk. It may be that some other feature of the installation or command environment drives risk of both sexual harassment and sexual assault. For instance, features of the command climate, physical work and living environments, organizational structure and makeup, training procedures, discipline practices, operational tempo, and unit or installation purpose or function could all, in theory, contribute to the risk of sexual harassment and sexual assault.

Whether sexual assault is caused by ambient sexual harassment or by some other unit characteristic that causes sexual assaults and harassment, interventions to reduce sexual harassment could address the same risk factors that contribute to sexual assault. For instance, interventions designed to correct workplace norms and standards that are permissive of sexual harassment could equally address the pathology of order and discipline that produces sexual assaults.

Different Aggregations of Risk Could Be Useful

For this proof-of-concept analysis, we did not explore the full array of alternative clusterings of personnel that might be especially revealing of the nature and distribution of risk. For instance, more useful than the high-level commands we examined in the Army, Navy, and Air Force might be their subordinate commands. Knowing that U.S. Forces Command is the major command associated with the largest command-specific risk of sexual assault and sexual harassment is useful—but perhaps not as useful as looking at its subordinate commands to understand whether there are subcommands that explain this risk. By identifying the subordinate commands with the highest risk, it may be possible to further refine our understanding of risk by looking at particular units, occupations, locations, missions, activities (e.g., training or deployment), or other characteristics.

The value of clustering personnel in different ways to better understand risk may be especially valuable for the Navy. Although the analyses we conducted indicated that risk may be especially high on ships, the aggregation methods we used were able to specify only aircraft carriers as a class of ships with especially high risk. Other classes of ships were placed in clusters organized by their postal addresses, which do not represent coherent classes of ship or mission. Surprisingly, even some of these clusters were found to have especially elevated risk relative to the Navy as a whole. In ongoing work for the Navy, we are examining alternative approaches to clustering ships that may highlight the features of ships most associated with risk. For instance, the ships might be clustered by ship class, home port, strike group, mission type, or port of call.

Similarly, the information we had to work with did not allow us to cluster Marines into major commands in the same way members of other services were clustered. With information on the hierarchy of commands in the Marine Corps, more-accurate and

-interpretable estimates could be produced on the risk associated with major commands. Before considering recommendations supported by the analyses reported here, we first highlight some of the limitations of our work that affect how our results should be understood.

Caveats and Limitations

There are important limitations to the estimates of installation and command risk we present in this report. Some of the key limitations include the following:

- *Estimates for sexual assault and sexual harassment risk in this report are for FY 2014, and risk may be different today.* It is possible that some factors contributing to risk in some installations or commands in FY 2014 are no longer present today, in which case the estimates provided in this report would not accurately describe current risks.
- *The risk estimates in this report are just for active-component personnel.* Many bases have reserve-component personnel on active-duty status, civilian employees, contractors, and others. This report provides estimates for the rates of sexual assault experienced only by active-component members assigned to the installation or ship.
- *The estimates describe the risk of sexual assault to service members assigned to specific installations or commands, not the risk of assaults occurring at the installation or while on duty in a command.* We are estimating the total number of personnel assigned to each installation who were sexually assaulted at any point during the year, whether or not the assault happened on the installation. In some cases, this means that assaults occurred when the member was home on leave or on temporary duty elsewhere.
- *This report does not reveal why risk is higher or lower at different installations, and there is a wide range of possible explanations for these differences.* This report describes the distribution of sexual assault and sexual harassment risk, not why some installations have higher or lower risk. There are many possible causes for the observed differences in risk across installations. For example, the differences may result from differences in command climate, alcohol availability and price, crime rates in the surrounding civilian community, or the transitory presence of one or more sexual predators. Although the current study cannot identify the causal role of these or other factors, ongoing research may help answer these questions.
- *Estimates for eight installations where basic military training occurs exclude the experiences of roughly half of those locations' FY 2014 trainees.* Because the RMWS, like U.S. Department of Defense surveys of sexual assault risk, did not sample service members with fewer than six months of active-duty service at the time of

survey administration, roughly half of the trainees at installations providing basic military training were omitted from the sample. The affected installations were Fort Benning, Fort Jackson, Fort Leonard Wood, Fort Sill, Naval Station Great Lakes, Lackland AFB, and the Marine Corps Recruit Depots at Parris Island and San Diego. Our risk estimates are representative of service members in the sample frame, but because these installations have a significant proportion of individuals who are not in the sample frame, our estimates are not representative of all service members at these installations. For these eight installations, our estimates of sexual assault risk overemphasize the experiences of personnel with lengthier military careers, such as trainers and administrators. We cannot say whether this emphasis raises or lowers these installations' risk estimates, so the reported rates should be interpreted with caution. Estimates of the total number of assaults, which are derived from the total number of personnel in the sample frame, are sufficiently inaccurate for those eight installations that we have omitted them from this report.

- *Service academy estimates exclude the experiences of cadets and midshipmen.* Estimates for Army Garrison West Point (which includes the U.S. Military Academy), the Naval Support Activity Annapolis (which includes the U.S. Naval Academy), and the U.S. Air Force Academy all exclude the experiences of cadets and midshipmen because they were not included in the 2014 RMWS.
- *We were not able to produce estimates for Marine Corps major commands.* We did not receive access to major command information for the Marine Corps. Instead, we had unit-monitored command codes and parent-monitored command codes, which allow for aggregation of units typically well below the major command level. Moreover, we did not have access to labels describing these lower-level aggregations of commands. Therefore, our Marine Corps command risk estimates are not directly comparable to the major command estimates we produced for the other services, and they are difficult to interpret for anyone who does not know what the commands are that correspond to the monitored command codes. For this reason, the Marine Corps command estimates appear only in the appendix at the end of this report.
- *We provide risk estimates only for the largest installations and ships.* To protect the confidentiality of RMWS survey respondents, no estimates are provided for men or women at an installation or ship unless at least 50 members of the same sex who were assigned to the installation or ship completed the RMWS survey. Units or installations with fewer respondents were typically aggregated with other smaller clusters of personnel in the same city, country, or postal zone. Smaller ships were typically aggregated with other smaller ships by their mailing addresses, so these smaller ships were clustered with other units typically in the same fleet and from the same home port.

- *Our estimates assume that risk to individuals is relatively constant over a service member's tenure at any particular installation or ship.* When members served at more than one installation during FY 2014, we attributed their calculated sexual assault risk to each installation they served at during the year in proportion to the time they spent at each. This procedure will produce unbiased estimates of risk for each of the installations where an individual served, unless risk varies with the length of time the member served at a location. If, for instance, risk is high in the first month a member serves at a new installation but is low thereafter, then our assumption that risk at each installation is constant over a service member's time there would be violated and could lead to some bias in our procedure.

Recommendations

This study demonstrates that the method of estimating risk of sexual assault and sexual harassment developed here produces useful information about the distribution of risk. The small-area estimation techniques used for producing risk estimates within installations and commands successfully produced reasonably precise estimates even for reasonably small subpopulations. Even in clusters with between 50 and 100 survey respondents, we could often achieve 95-percent credibility intervals for our risk estimates that were only a couple of percentage points wide. While this method of estimation requires a large survey sample on which to estimate the model, when such data exist (as with the recently completed 2016 WGRA), they can be leveraged to provide informative risk estimates for groups as small as 50 respondents. These more-localized estimates can improve the overall utility of the WGRA for guiding sexual assault prevention and training programs, monitoring DoD progress in addressing sexual assault and harassment, and informing policymakers about key risk factors for these outcomes. Similar small-area estimation methods should also be considered for producing the DEOCS estimates of organizational climate in units or clusters of units. Relative to a simple average of respondents—the method currently being used for DEOCS estimates—small-area estimates offer several advantages, including lower measurement error (particularly for units with a smaller numbers of respondents), the ability to correct for nonresponse biases, the ability to provide estimates that control for the personnel mix in the unit, and increased confidentiality to respondents.

These risk estimates should be disseminated to military leaders to make them more aware of problems in their commands and to identify progress on command objectives. Military leaders play several important roles in preventing and reporting sexual assault, in setting the workplace climate in which sexual harassment occurs, and even in making administrative and judicial decisions that affect both perpetrators and victims. Despite these substantial responsibilities, there has not been any regular way for military leaders to get data on the rate of sexual assault in their commands, nor any way of knowing whether the rates of sexual assault and harassment in their commands are high relative to similar commands. In short, these leaders are considered to be the most important military personnel for bringing about the desired reductions in sexual assault and harassment, but they lack visibility into potential problems in their commands and lack metrics that could be used to identify progress on their command objectives. Installation- and command-level estimates of risk of sexual assault and harassment should be disseminated to military leaders in a format that allows them to more effectively lead in the military's efforts to combat sexual assault and harassment.

The concentration of large numbers of sexual assault victims at a relatively small number of installations suggests that specialized training, prevention, and response interventions may be efficiently deployed to those locations. The Army and the Marine Corps each have installations where we estimate that more than 500 women and men were sexually assaulted in one year. Installations with comparatively large numbers of sexual assault victims may offer ideal locations for focused sexual assault prevention and response interventions of a type that may be infeasible or inefficient to deploy to all installations.

Services should investigate the conditions leading to patterns of sexual assault risk. Patterns like the high total and installation-specific risk found on ships or in training commands may reflect ongoing structural or organizational risk factors for sexual assault. A study of the conditions in these types of organizational units could provide important insights on the causes of and remedies for sexual assault and harassment risk.

For example, other data collected from service members on morale, command climate, psychiatric distress, leadership responsiveness to sexual harassment or sexual assault complaints, or other attitudes and experiences may prove to be associated with risk of sexual assault or sexual harassment. If so, such associations could suggest new prevention or training strategies that could help mitigate sexual assault risk. For instance, if sexual assault risk were found to be closely associated with leadership attitudes toward sexual harassment, this would suggest the possible benefits of special training for leaders rated as having such attitudes. Because the military regularly moves large units because of deployments, base closures, or unit relocations, it may be possible to track changes in installation risk longitudinally in ways that would detect or suggest which of several possible causal mechanisms most contributes to risk. For instance, if a unit relocation changes the proportion of combat personnel at an installation and this, in turn, predicts a change in sexual assault risk there, this would provide some evidence that combat units per se may be associated with risk.

To clarify features of military life, personnel, or organization that are most closely related to risk, the services should aggregate sexual assault risk in different ways. This study was designed as a proof of concept to explore the feasibility of constructing small-group estimates of risk. This report aggregates responses using the organizational clusters that were available to us, but those may not represent the best organizational units to assess risk using these estimates. A systematic investigation of the small groups most closely associated with risk has not yet been performed. Moreover, in some cases, the groups we analyzed—such as the clusters of ships in FPO addresses or the CMCC or MCC organizations in which we combined Marine Corps personnel for the command-level analyses—may not correspond to meaningful subgroupings of service personnel. A more useful analysis might examine whether risk differs by class of ship (e.g., submarines, destroyers), operational characteristics (e.g., home ports, time at sea, ports of call), carrier group, or the duties to which the ship is assigned. For instance, personnel serving in the submarine fleet could be aggregated to compare risk on fast-attack submarines with risk on ballistic or cruise missile submarines if the Navy believed the cultures associated with these sets of ships differ in ways that could be associated with risk. The current statistical methods are well suited to such analyses but would require data that are not available to RAND.

By clarifying the subgroupings of personnel most closely associated with higher and lower risk, service branches will be better able to target training, prevention, and response resources. In addition, such patterns of risk may suggest factors that are causing elevated (or reduced) risk. Insights into the causes of risk can be used to disrupt root causes of risk or to promote protective factors.

When examining installation-level data on sexual assault reporting, the services should compare observed rates of official reporting with installation-level risk. SAPRO collects information on the numbers of restricted and unrestricted reports of sexual assaults filed at many military installations. These raw numbers may not provide a good measure of sexual assaults at these installations for the following reasons:

- The rate of official reporting at an installation reflects both the rate at which sexual assaults occur and the rate at which victims of assaults are willing to come forward with an official report. A high rate of reporting cannot be easily interpreted because it could reflect either a good thing (e.g., victims have confidence in the reporting process at the installation) or a bad thing (e.g., there is a high prevalence of sexual assault at the installation).
- Some installations collect reports of sexual assaults for other installations in their catchment areas. In the past, most ships have had their sexual assault reports associated with their home ports or other ports where they stopped, meaning those port stations will be associated with more sexual assault reports than just those filed by their own personnel.
- The sexual assaults reported may have occurred before the service member joined the military, and such nonmilitary assaults are likely to be distributed unevenly across reporting bases.
- Differences in installation size would lead to different numbers of reported sexual assaults, even if the rates of sexual assault and the proportion of victims reporting were identical. It is surprisingly difficult to get an accurate population size

of many installations, and conclusions may depend on how one normalizes the number of reports by population size.
- Installations differ in the makeup and individual characteristics of their personnel. For instance, an installation with a high concentration of young people could have higher rates of reported sexual assault than a headquarters installation with many older service members. This would not indicate that the installation with many young people was doing a worse job preventing sexual assault than the headquarters installation. Indeed, the opposite could be true. To establish whether an installation has higher or lower rates of sexual assault than would be expected based on the characteristics of its personnel, it is necessary to evaluate the sexual assault rates after adjusting for those personnel characteristics, as we have done with our installation-specific risk estimates.

Each of these considerations demonstrates that the raw numbers of official reports associated with each installation or command are not themselves a useful indicator of problems. Instead, rates of sexual assault reporting in any catchment area should be compared with estimates of the rate of sexual assaults against members in that catchment. The current estimates should be useful for this purpose when trying to interpret the number of official reports in installations and commands. Where the proportion of sexual assaults that result in an official report is low, this might suggest that there are unusually severe barriers to reporting in that area.

Also for the reasons described in the bullets, official reports of sexual assault should never be used to establish whether an installation or command has an unusually small or great problem with sexual assaults. Instead, such measures as the installation-specific sexual assault rates we calculate in this report should be used. These explicitly examine whether sexual assaults at an installation or command are lower or higher than average for service members serving elsewhere with individual characteristics like those at the installation or command. If the installation-specific risk is low, the installation does not have a bigger problem than average among all installations in the service, after accounting for individual risk characteristics. If it has high installation-specific risk, the installation is indeed an outlier and something about it is associated with unusually elevated risk of sexual assault, even after accounting for the individual characteristics of its personnel.

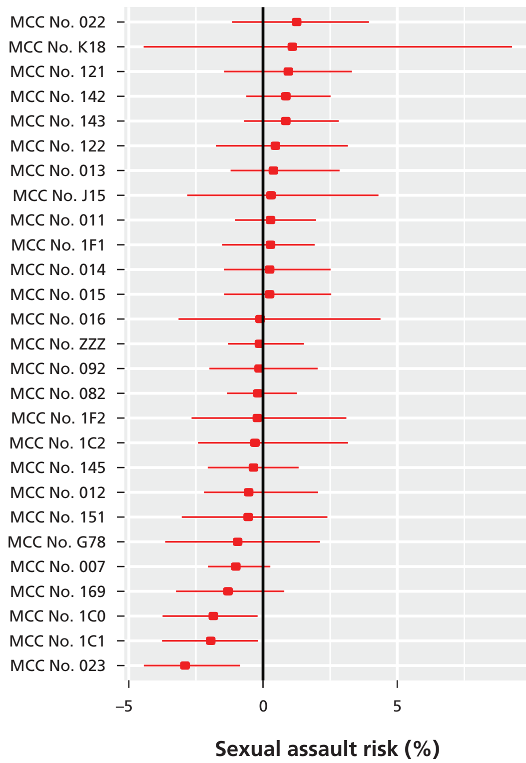
Researchers should evaluate the use of the DEOCS to identify units and installations where sexual harassment risk is greatest and where high rates of sexual assault are likely. The DEOCS is conducted regularly in all military units. Hundreds of thousands of surveys are collected per year. The DEOCS has recently added a short sexual harassment scale derived from the full RMWS sexual harassment assessment. Based on the findings reported here, the DEOCS sexual harassment estimates for units may provide important information about sexual assault risk and sexual harassment risk. Moreover, because the DEOCS may be conducted with units more frequently than the WGRA, it might provide a valuable source of information about the time course of risk at the unit level. For instance, it could provide sexual assault prevention and response programs with information about where risk has increased substantially over a short period, providing responders with new opportunities to intervene to reduce risk or to better understand the factors leading to changes in risk. On the other hand, the DEOCS is quite different from the RMWS and may have limitations for these uses. Relative to the WGRA, the DEOCS uses a different sampling method, does not make corrections for nonresponse biases, and uses a slightly different measure to assess sexual harassment, so we do not know exactly how well the DEOCS might work to highlight installations or units with high rates of sexual assault or sexual harassment. Additional research would be needed to investigate how accurately the DEOCS could identify units, installations, or commands that are at high risk of sexual assault.

APPENDIX

Marine Corps Command-Specific Risk

As discussed in Chapter Two, we were unable to group Marine Corps personnel into major command groups. Although we were able to cluster them by Monitored Command Codes and CMCCs, the interpretability of these clusters is limited, both because we do not have labels for these commands and because they may not correspond to the Marine Corps' conventional command structures. For this reason, we have not discussed command-specific risk for the Marine Corps in the main report. Instead, in this appendix, we provide figures displaying Marine Corps command-specific risk for sexual assault and sexual harassment using the unlabeled command groupings we identified.

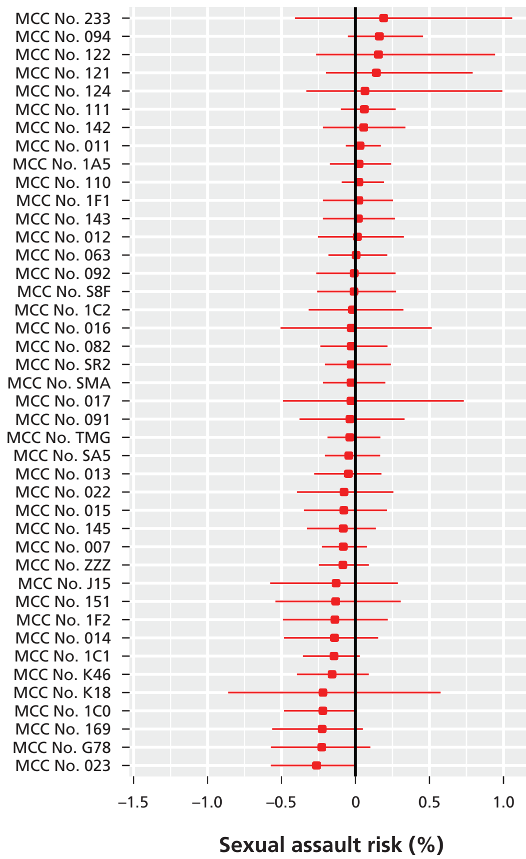
Figure A.1
Estimated Command-Specific Sexual Assault Risk for All Large Commands, Marine Corps Women



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-A.1*

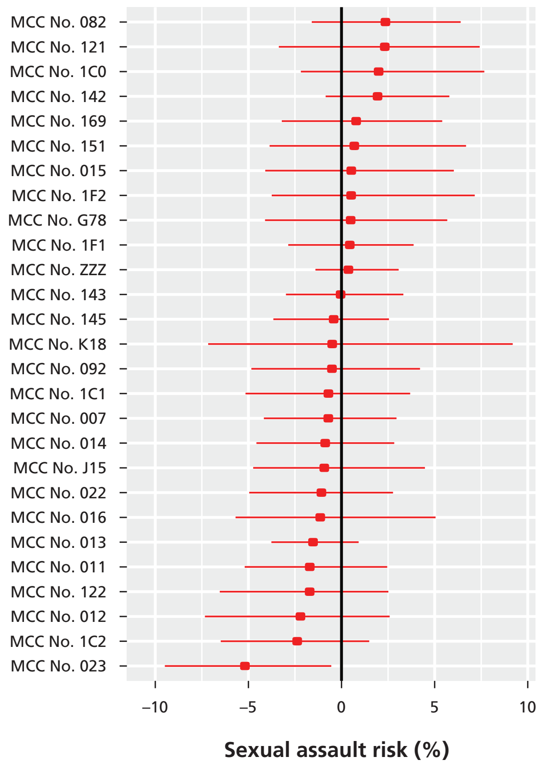
Figure A.2
Estimated Command-Specific Sexual Assault Risk for All Large Commands, Marine Corps Men



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-A.2*

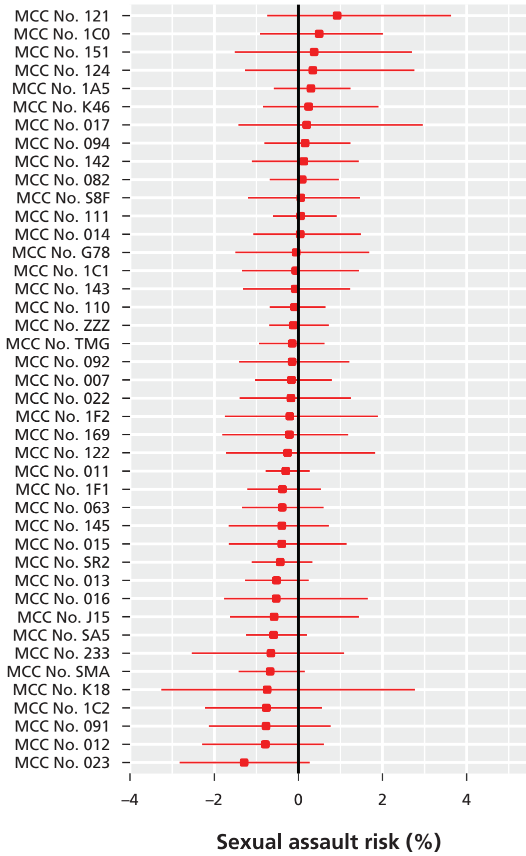
Figure A.3
Estimated Command-Specific Sexual Harassment Risk for All Large Commands, Marine Corps Women



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-A.3*

Figure A.4
Estimated Command-Specific Sexual Harassment Risk for All Large Commands, Marine Corps Men



NOTE: Each point plots command-specific risk, and the lines on either side indicate the 95% credibility intervals.

RAND *RR870/7-A.4*

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