



# **2017 Workplace and Gender Relations Survey of Reserve Component Members**

**Statistical Methodology Report**

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## Acknowledgments

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Policy officials contributing to the development of this survey include Dr. Nathan Galbreath, Dr. Aubrey Hilbert, Dr. Dina Eliezer, and Mr. Zachary Gitlin (Office of the Under Secretary of Defense, Personnel and Readiness, Sexual Assault Prevention and Response Office) and Ms. Shirley Raguindin (Office of the Under Secretary of Defense, Personnel and Readiness, Office of Diversity Management and Equal Opportunity).

OPA's Statistical Methods Team, under the guidance of Mr. David McGrath, Branch Chief, is responsible for all statistical aspects of this survey, including, sampling, weighting, and the implementation of statistical hypothesis testing used in the survey program. Mr. Eric Falk, Team Lead of the Statistical Methods Team, was responsible for managing the *2017 WGRR*. Ms. Ada Harris, Mathematical Statistician, used the OPA Sampling Tool to design the sample and implemented the weighting methods. Ms. Sue Reinhold provided the data processing support. Data Recognition Corporation (DRC) performed data collection and editing.

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# 2017 WORKPLACE AND GENDER RELATIONS SURVEY OF RESERVE COMPONENT MEMBERS STATISTICAL METHODOLOGY REPORT

## Introduction

The Office of People Analytics' Center for Health and Resilience (OPA[H&R]) conducts both web-based and paper-and-pen surveys to support the personnel information needs of the Under Secretary of Defense for Personnel and Readiness (USD[P&R]).<sup>1</sup> These surveys assess the attitudes and opinions of the entire Department of Defense (DoD) community on a wide range of personnel issues. Health and Resilience (H&R) Surveys are in-depth studies on sensitive topics, which impact the health and well-being of military populations.

This report describes the statistical methodologies for the *2017 Workplace and Gender Relations Survey of Reserve Component Members (2017 WGRR)*. The survey fielded from August 16, 2017 through October 31, 2017. This report is divided into five sections: 1) sample design and selection, 2) weighting and variance estimation, 3) statistical tests used in analyses, 4) calculation of contact, cooperation, and response rates for the full sample and population subgroups, and 5) nonresponse bias analysis. Survey estimates for all questions are found in the *2017 Workplace and Gender Relations Survey of Reserve Component Members: Tabulations of Responses* (OPA, 2018a). Information about administration of the survey and detailed documentation of the survey dataset can be found in the *2017 Workplace and Gender Relations Survey of Reserve Component Members: Administration, datasets, and codebook* (OPA, 2018b).

## Sample Design and Selection

### Target Population

The *2017 WGRR* was designed to represent individuals meeting the following criteria:

- Members of the Army National Guard (ARNG), U.S. Army Reserve (USAR), U.S. Navy Reserve (USNR), U.S. Marine Corps Reserve (USMCR), Air National Guard (ANG), and U.S. Air Force Reserve (USAFR);
- Reserve component members from the Selected Reserve in Reserve Unit, Active Guard/Reserve (AGR/FTS/AR; Title 10 and Title 32), or Individual Mobilization Augmentee (IMA) programs;
- Paygrades E1-O6

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<sup>1</sup> Prior to 2016, the Health and Resilience (H&R) Research Center resided within the Defense Manpower Data Center (DMDC). In 2016, the Defense Human Resource Activity (DHRA) reorganized and moved H&R under the newly established Office of People Analytics (OPA).

## ***Sampling Frame***

The sampling frame consisted of 808,127 Reserve component members using the April 2017 Reserve Components Common Personnel Data System (RCCPDS) Master File. Auxiliary frame data was obtained from the following files:

- March 2017 Reserve Family Database File (contains the member's family information [e.g. marital status and children])
- April 2017 Contingency Tracking System (CTS) File (contains deployment information)
- April 2017 Defense Enrollment Eligibility Reporting System (DEERS) Medical Point-In-Time Extract (PITE) (contains personnel information)
- Active Service File, pulled June 2017 (contains activation information)

After selecting the sample, OPA performed an additional check to verify the sample member was still eligible. OPA identified 3,192 (1.3% percent unweighted) sample members as record ineligible that were no longer in the Reserve component in the May 2017 RCCPDS. Sample members who became ineligible during the field period were identified as self- or proxy-report ineligible. There were 716 (0.3%) sample members who were identified as being ineligible through either the survey instrument or other communications about the survey. OPA excluded ineligible sample members from further mailings and notifications (see Table 3).

## ***Sample Design***

The sample for the *2017 WGRR* survey used a single-stage stratified design. Table 1 shows the four variables and associated variable levels that were used for stratification.

**Table 1.**  
***Variables for Stratification***

Variable	Variable Name	Variable Levels
Reserve Component	RORG_CD	1. Army National Guard
		2. U.S. Army Reserve
		3. U.S. Navy Reserve
		4. U.S. Marine Corps Reserve
		5. Air National Guard
		6. U.S. Air Force Reserve
Gender	RSEX2	1. Male
		2. Female
Paygrade Grouping	RPAYGRP9	1. E1-E4
		2. E5-E9
		3. W1-W5
		4. O1-O3
		5. O4-O6
Reserve Program	RPROG1	1. TPU
		2. AGR
		3. MilTech
		4. IMA

OPA partitioned the population frame into 131 strata that were initially determined by the aforementioned four stratification variables. Levels (specific levels from Table 1 such as “IMA”) were collapsed when there were less than 200 in the stratum (e.g., collapsing “IMA” with “MilTech” to form a new stratification level). Reserve Component and gender were always preserved.

OPA selected individuals with equal probability and without replacement within each stratum. However, because allocation was not proportional to the size of the strata, selection probabilities varied among strata and individuals were not selected with equal probability overall. To achieve adequate sample sizes for all domains (reporting levels), OPA used a non-proportional allocation.

### ***Sample Allocation***

OPA based the total sample size on a 50 percent sample of females and 25 percent sample of males. The goal was to achieve reliable precision on estimates for outcomes associated with reporting a sexual assault (i.e., retaliation) and other measures that were only asked of a very small subset of members, especially for males. Given estimated variable survey costs and anticipated eligibility and response rates, OPA used an optimization algorithm to determine the minimum-cost allocation that simultaneously satisfied the domain precision requirements. Response rates from previous surveys were used to estimate eligibility and response rates for all strata. The *2015 Workplace and Gender Relations Survey of Reserve Component Members (2015 WGRR)*, the *2016 Status of Forces Survey of Reserve Component*

*Members (2016 SOFR)*, and the *2012 Workplace and Gender Relations Survey of Reserve Component Members (2012 WGRR)* were used to estimate these nonresponse rates.

OPA determined the sample allocation given the 50 percent of females and 25 percent of males by means of the OPA Sample Planning Tool (SPT), Version 2.1 (Dever & Mason, 2003). This application is based on the method originally developed by J. R. Chromy (1987) and described in Mason, Wheelless, George, Dever, Riemer, and Elig (1995). The SPT defines domain variance equations in terms of unknown stratum sample sizes and user-specified precision constraints. A cost function is defined in terms of the unknown stratum sample sizes and the per-unit cost of data collection, editing, and processing. The variance equations are solved simultaneously, subject to the constraints imposed, for the sample size that minimizes the cost function. Estimated eligibility rates are used and they modify the estimated prevalence rates used in the variance equations, thus affecting the allocation; response rates inflate the allocation, thus affecting the final sample size. Prevalence rates refer to a percentage that is used in determining the estimated variance used for the calculation of the sample size. OPA used a prevalence rate of 50 percent since it is most conservative and yields the largest estimated sample size.

There were 85 reporting domains (e.g., Male/E1-E4; see Appendix A for complete list) defined for the *2017 WGRR* and the initial goal was to achieve estimates of percentages with associated precisions of less than 5% based on the questions asked to all sampled members. The precision requirement for each domain was based on an estimated prevalence rate of 50% with a 95% confidence interval half-width no greater than  $\pm 5.0\%$ . However, given the rarity of events covered by many of the *2017 WGRR* questions, OPA ensured that a much tighter precision would be met for questions seen by all respondents, while making it likely that confidence interval half-widths of  $\pm 5.0\%$  could be met for questions that are relevant to only a small portion of respondents. Therefore, OPA tightened the precision constraints until the sample included 50 percent of all females and 25 percent of all males.

The *2017 WGRR* total sample size was 241,426. Table 2 shows the sample sizes by stratification variables. OPA and SAPRO agreed to a smaller sample size of 241,426 for *2017 WGRR* in comparison to the sample size of 485,774 for *2015 WGRR* mainly to alleviate survey burden every other survey administration.

**Table 2.**  
**Sample Size by Stratification Variables**

Stratification Variable	Total	Army National Guard	US Army Reserve	US Navy Reserve	US Marine Corps Reserve	Air National Guard	US Air Force Reserve
<b>Sample</b>	241,426	64,581	52,753	33,293	37,669	24,203	28,927
<b>Gender</b>							
Male	162,554	40,548	31,133	21,637	36,109	15,253	17,874
Female	78,872	24,033	21,620	11,656	1,560	8,950	11,053
<b>Paygrade Grouping</b>							
E1-E4	115,693	37,693	26,050	10,742	25,379	7,032	8,797
E5-E9	69,846	13,423	13,375	14,622	7,874	9,137	11,415
W1-W5	3,529	2,125	1,100	48	256	0	0
O1-O3	26,854	8,527	7,519	3,101	1,811	3,362	2,534
O4-O6	25,504	2,813	4,709	4,780	2,349	4,672	6,181
<b>Reserve Program</b>							
TPU	201,936	58,115	45,721	27,841	33,249	16,990	20,020
AGR	18,073	3,797	2,993	5,346	1,783	3,220	934
MilTech	11,162	2,669	2,083	0	0	3,993	2,417
IMA	10,255	0	1,956	106	2,637	0	5,556

### **Weighting**

OPA created analytical weights for the 2017 WGRR to account for unequal probabilities of selection and varying response rates among population subgroups. Sampling weights were computed as the inverse of the selection probabilities and then adjusted for nonresponse (eligibility and completion). The adjusted weights were forced to match population totals to reduce bias unaccounted for by the previous weighting steps using a technique called raking. Raking is an iterative process where current weights are forced to known totals for several variables one at a time until the sum of weights are sufficiently close to known marginal totals. More details about the weighting process can be found later in this document.

### **Case Dispositions**

As the first step in the weighting process, case dispositions were assigned based on eligibility for the survey and completion of the 2017 WGRR. Execution of the weighting process and computation of response rates both depend on this classification.

Final case dispositions for weighting were determined using information from personnel records, field operations (as recorded in the Survey Control System [SCS]), and returned questionnaires. No single source of information is entirely complete and correct for determining the case dispositions; inconsistencies among sources were resolved according to the order of precedence shown in Table 3. This order of execution is critical to resolving case dispositions. For example, a sample member refused the survey because it was “too long”; in the absence of any other information, the disposition would be “active refusal.” However, if a family member

of this same individual notified OPA that the sample member had left the military, the disposition of “Ineligible by self- or proxy-report” would override the former disposition, and OPA would code this individual as “ineligible” (SAMP\_DC = 2 in Table 3).

Case disposition counts for the 2017 WGRR are shown in Table 3. There were 41,099 eligible, complete respondents (SAMP\_DC = 4). Table 4 presents the number of eligible, complete respondents by several key domain variables.

**Table 3.**  
**Case Dispositions for Weighting**

Case Disposition (SAMP_DC)	Information Source	Conditions	Sample Size	Percent of Total
1. Record ineligible	Personnel record	OPA used the following criteria to identify eligible members (all others are record ineligible): 1) Member had to be alive in the June 30, 2017 DBE (DEERS Database Extract) and 2) member had to be in the Selected Reserve in the May 2017 RCCPDS	3,192	1.3%
2. Ineligible by self- or proxy-report	Survey Control System (SCS)	Self or proxy reported that member was “retired,” “no longer employed by DOD,” or “deceased.”	107	0.04%
3. Ineligible by survey self-report	Survey eligibility questions	The sampled member was determined to be ineligible based on their response to Question 1 of the survey: “Were you a member of the National Guard or a Reserve component on August 17, 2017?” Members who answered “No” were considered survey self-report ineligible.”	609	0.25%
4. Eligible, complete response	Item response rate	Respondents needed to answer one of the eight critical questions related to sexual assault.	41,099	17.0%
5. Eligible, incomplete response	Item response rate	Respondent answered some questions on the survey, but did not answer any of the critical sexual assault questions.	1,011	0.4%
8. Active refusal	SCS	Refused due to such reasons as “too long,” “too intrusive,” and “did not want additional communications,” etc.	365	0.15%
9. Blank return	SCS	Blank questionnaire with no reason given.	214	0.09%
10. Postal Non-Deliverable (PND)	SCS	Postal nondeliverable or address not-locatable.	24,425	10.1%
11. Nonrespondent	Remainder	Remaining sampled members who did not respond to survey.	170,404	70.6%
<b>Total</b>			<b>241,426</b>	<b>100%</b>

**Table 4.**  
**Complete Eligible Respondents by Stratification Variables**

Stratification Variable	Total	Army National Guard	US Army Reserve	US Navy Reserve	US Marine Corps Reserve	Air National Guard	US Air Force Reserve
<b>Sample</b>	41,099	8,439	9,227	6,374	2,890	7,092	7,077
<b>Gender</b>							
Male	26,046	5,110	5,436	4,255	2,663	4,319	4,263
Female	15,053	3,329	3,791	2,119	227	2,773	2,814
<b>Paygrade Grouping</b>							
E1-E4	7,982	1,964	1,848	801	1,073	1,162	1,134
E5-E9	15,498	2,587	3,075	2,790	956	3,093	2,997
W1-W5	1,341	767	473	18	83	0	0
O1-O3	6,612	1,909	1,883	894	260	997	669
O4-O6	9,666	1,212	1,948	1,871	518	1,840	2,277
<b>Reserve Program</b>							
TPU	27,591	5,810	6,438	5,250	1,930	4,025	4,138
AGR	6,185	1,626	1,284	1,075	402	1,441	357
MilTech	4,315	1,003	817	0	0	1,626	869
IMA	3,008	0	688	49	558	0	1,713

### **Nonresponse Adjustments and Final Weights**

After case dispositions were resolved, OPA adjusted the sampling weights for nonresponse. First, the sampling weights for cases of known eligibility (SAMP\_DC = 2, 3, 4, or 5) were adjusted to account for cases of unknown eligibility (SAMP\_DC = 8, 9, 10, or 11). Next, the eligibility adjusted weights for eligible respondents with complete questionnaires (SAMP\_DC = 4) were adjusted to account for eligible sample members who returned an incomplete survey (SAMP\_DC = 5). All weights for the record ineligible (SAMP\_DC=1) are set to 0, and this weight is transferred to the other cases during raking.

The eligibility and completion adjustment factors were computed as the inverse of model-predicted probabilities. OPA multiplies the sampling weight by the product of these two factors to create the eligibility and completion-adjusted weight. OPA changed the statistical models used to estimate propensities on the 2017 and 2015 surveys compared with the 2012 WGRR.

Little and Vartivarian (2005) argued only information related to key survey outcomes should be included in a nonresponse model, otherwise additional information will only increase the variance without reducing bias for the key outcomes. Following this logic, the 2017 WGRR nonresponse adjustment involved two steps, each of which produced a set of models. The first step used data from the eligible, complete respondents to develop XGBoost<sup>2</sup> (extreme gradient

<sup>2</sup> XGBoost is an R package function and stands for Extreme Gradient Boosting which is a machine-learning algorithm used to determine the best model fit.

boosting) models for three key outcome variables (sexual harassment, gender discrimination, and sexual assault). For each gender, OPA separately modeled the key outcome as a function of an extensive set of administrative variables (see Table 6) available for both respondents and nonrespondents, resulting in six separate models. Predicted values associated with experiencing the three behaviors were computed for both respondents and nonrespondents, and then these key outcome variables and a set of other predictors<sup>3</sup> were used in a second model to predict the probability of response. OPA weighted all XGBoost models; the first by the sampling weight and the second by the eligibility-adjusted weight resulting from multiplying the sampling weight by the eligibility status adjustment. The reciprocals of the predicted values from the second model were used as nonresponse adjustments and applied to the respondents. The nonresponse adjustment reduces nonresponse bias while limiting the increase in sampling variance.

Weighting the 2017 and 2015 WGRR was similar, but OPA reduced the number of key outcome variables for 2017 due to the smaller Reserve sample size (241,426 in 2017 and 485,774 in 2015). Table 5 shows the key outcome variables used in the XGBoost models for the 2015 and 2017 WGRR surveys.

**Table 5.**  
**Key Outcome Variables**

Variable	2015	2017
<b>Female</b>		
Gender Discrimination	X	X
Sexual Harassment	X	X
Sexual Assault Rate	X	X
Quid Pro Quo	X	
Non-Penetrative Sexual Assault	X	
Penetrative Sexual Assault	X	
<b>Male</b>		
Gender Discrimination	X	X
Sexual Harassment	X	X
Sexual Assault Rate	X	X

<sup>3</sup> In addition to the three sexual harassment/assault variables, OPA used gender, reserve component, paygrade, and survey form type (paper vs. web) in the second and third stage nonresponse models.

Table 6 provides a list of the candidate auxiliary variables considered for the XGBoost models.

**Table 6.**  
***Variables Used for the Eligibility and Completion Adjustments***

Variable	Variable Name	Variable Notes	Categories
Military Accession Program	ACC_SRC_CD2		See Appendix B
DEERS PITE Active Duty Status (PITE)	ACTVSOC	196,028 are missing	1=Active 2=Active Special Operations
Mailing Address Match Flag	ADDMATCH		N=Address is different; Y=Address is the same
Armed Forces Qualification Test score	AFQT_SCRR	Officers set to missing	0-99
Member Age at Field Open Date	AGE_FIELD	2 are missing	17-67
Assigned Unit Navy Ashore/Afloat Code	ASSGN_UIC_NV_ASHR_AFLT_CD		2=Sea Duty-CONUS Ships; 4=Non-rotated Sea Duty-Ships Homeported Overseas; 9=Unknown or not applicable
Assigned UIC Match Flag; Address is the Same	AUICMATCH		N=Assigned UIC is different; Y= Assigned UIC is the same
Number of People that are Female/Male at Base	BASEMALE_PCT	BASEMALE and BASESIZE were used to create percentage that were male	0-100
Base name of Member	BASENAMER	BASENAME was recoded; Any base with less than 50 complete eligible responses were combined into an "**** All Small Bases' group	
Number of People at Base	BASESIZE_CD	BASESIZE was recoded into subgroups	0=0; 1=1-99; 2=100-149; 3=150-199; 4=200-249; 5=250-299; 6=300-349; 7=350-399; 8=400-449; 9=450-499; 10=500-749; 11=750-999; 12=1,000-1,999; 13=2,000-2,999; 14=3,000-3,999; 15=4,000-4,999; 16=5,000-7,499; 17=7,500-9,999; 18=10,000-24,999; 19=25,000 and over
Email address purchase flag	BUYEMAIL		0=Do not buy email address, 1=Buy email address
Total Number of Children	CHILDCNT	2,294 are missing	0-13;
Organization Component code	COMP_CD		G=Guard; V=Reserve
Contacted	CONTACTED	5 are missing	0=Not Contacted 1=Contacted
Current Deployment	CUR	146,456 are missing	0= No; 1= Yes

Variable	Variable Name	Variable Notes	Categories
Status			
Number of Deployments	DCOUNT	146,456 are missing	1-42
Deployment flag in the last 12 months	DEPLOY12		1=Yes; 0= No
Deployment flag in the last 24 months	DEPLOY24		1=Yes; 0= No
Reserve Forces Initial Entry Date (RCCPDS)	DIERF_DT	9,862 are missing	Range from 3789-20939
Duty Service Occupation Code	DTY_DOD_OCC_CD		100000-290500
Education level	EDC_LVL		11 = Non-high school graduate 12 = Attending high school, junior or less 13 = Attending high school, senior 14 = Secondary school credential near completion 21 = Test-based equivalency diploma 22 = Occupational program certificate 23 = Correspondence school diploma 24 = High school certificate of attendance 25 = Home study diploma 26 = Adult education diploma 27 = ARNG Challenge Program GED Certificate 28 = Other Non-Traditional High School Credential 31 = High school diploma 32 = Completed High School-- No Diploma 41 = Completed one semester of college, no high school diploma 43 = 1-2 years of college, no degree 44 = Associate degree 45 = Professional nursing diploma 51 = Baccalaureate degree 61 = Master's degree 62 = Post master's degree 63 = First professional degree 64 = Doctorate degree 65 = Post doctorate degree 99 = Unknown
E-mail at Time of Sampling	EMAIL_FLD		Y=Have an e-mail ; N= no email
Email address flag	EMAILFLG		0 = No email address 1 = At least one email address
	EMAILSTAT		EMAILSTAT was recoded: '1=No email or all attempted email addresses invalid, 2=At least one attempted email address not invalid
Ethnic affinity code	ETHNICR		AA = Asian Indian AB = Chinese AC = Filipino AD = Guamanian AF = Japanese AG = Korean

Variable	Variable Name	Variable Notes	Categories
			AI = Vietnamese AJ = Other Asian descent AK = Mexican AL = Puerto Rican AM = Cuban AN = Latin American with Hispanic descent AO = Other Hispanic descent AP = Aleut AQ = Eskimo AR = US or Canadian Indian tribes AS = Melanesian AT = Micronesian AU = Polynesian AV = Other Pacific island descent BG = Other BH = None ZZ = N/A or Unknown
Family Status	FAMSTAT		0= Unknown marital status and/or child status, 1= Single with child(ren), 2= Single without child(ren), 3= Married with child(ren), 4=Married without child(ren)
Home Address Flag	HOMFLG		N=No home address; Y=Home address
Retired or Separated from Service Flag	LEFTSERV		N=No; Y=Yes
Mailing address available at the end of fielding	MAIL_FLD		N=No; Y=Yes
Marital Status Code	MARITALR		A = Annulled D = Divorced I = Interlocutory L = Legally separated M = Married N = Never married W = Widowed Z = N/A or Unknown
Home Address of Marine Corps Member is Midway	MIDWAYFLG		0=No, 1=Yes
Number of members in member's duty UIC	N_DUIC		1-2,209
Number of males in member's duty UIC	N_DUICMALE		0-1,698
Number of people within members' specific occupation code	N_OCC		1-47,206
Number of males in member's primary occupation	N_OCCMALE		0-47,195
Percent of males in member's duty UIC	P_DUICMALE		0-100%
Percent male within	P_OCCMALE		0-100%

Variable	Variable Name	Variable Notes	Categories
members' specific occupation			
Occupation Grouping	PDODOCCR	PDODOCC was recoded; There were 298 levels and this was formed by taking the first 2 characters	10-29
MILITARY LONGEVITY PAY SERVICE BASE CALENDAR DATE	PEBD_DT2		1971-2017
Paygrade of Member (20 level)	PG_CD		ME01-ME09, MW01-MW05, MO01-MO06
Postal Non-deliverable	POSTAL_ND		N=No, Y=Yes
Prior Regular Component Service Indicator Code (RCCPDS)	PRIOR_ASVC_IN DC_CD		N=No, Y=Yes, Z=Unknown
Race/Ethnic Category	RACE_ETH		A=AIAN, B=Asian, C=Black, D=White, E=Hispanic, F=NHPI, M=Multi Race, Z=Unknown
Ready Reserve Service Projected End Calendar Date	RDYV_SVC_PE_DT	56,529 are missing	20939-51134
Numeric Organizational Code	RORG_CD		1 = Army National Guard 2 = Army Reserve 3 = Navy Reserve 4 = Marine Corps Reserve 5 = Air National Guard 6 = Air Force Reserve
Reserve Category Programs	RPROG1		1=TPU/Unknown 2=AGR/TAR 3=Military Technicians 4=IMA
Numeric Service Code	RSERVICE		1=Army 2=Navy 3=Marine Corps 4=Air Force
Reserve Category Group Code	RSV_CATG		1 = Selected Reserve (not including AGR or MILTECH) 2 = Active Guard/ Reserve (AGR) 3 = Military Technicians (MILTECH)
Reserve Subcategory Code	RSV_SCAT		A = Drilling Unit Member B = Individual Mobilization Augmentees (IMA) D = Standby members on Active Status List E = Individual Ready Reserve (IRR) - Trained Members F = On Initial Active Duty For Training (IADT) G = Active Guard Reserve H = Untrained Members of the IRR in the DEP I = Inactive National Guard (ING)

Variable	Variable Name	Variable Notes	Categories
			J = IRR - Officers Training Program K = IRR - Health Professional Scholarship Program L = Standby with 20+ YOS & less than 30% Disabled M = IRR - Subject to Involuntary Activation N = Standby members on Inactive Status List O = Ready Reserve members, not in the Selres, as contracted ROTC P = Person awaiting IADT Q = Awaiting Second Part of IADT S = AGR Currently on or awaiting IADT T = Simultaneous Membership Program (SMP) U = Awaiting IADT - Not Authorized IDT or to Receive Pay V = FT members performing AD on FTNGD for >180, but exempt from X = SEL RES - Other Training Programs
Reserve Category Code	RSVCAT		S = Selected Reserve – Trained in Units T = Selected Reserve – Trained Individuals (non-unit) U = Selected Reserve – Training Pipeline
Total Days Activated (last year)	TOT_DAY_ACT		0-334
Total Number of Times Activated (last year)	TOT_NUM_ACT		0-117
All communications undelivered	UNDELIVERED		N=No, Y=Yes, NA=Not Applicable
US Citizen Citizenship Origin Code	US_CITZ_ORIG_CD		A='Born within the US, GU, PR or VI', B='US citizen, parent became a citizen by naturalization', C='Born outside US,GU,PR or VI to at least one citizen parent', D='US citizen by naturalization', Y='Not a US citizen', Z='Origin not determined'
US Citizenship Status Code	US_CITZ_STAT_CD		A=US national, C=US citizen, N=Non US citizen or national, Z=Unknown
Reserve Retirement Points Earned Career Quantity	VRET_PT_EARN_CRER_QY	There are 26,062 are 99999	0-12,696
Occupation was Closed to Females	WASCLOSED		0=No, 1=Yes
Active Federal Military Service	YOSR	34,982 are missing	0-36

To increase response to the 2017 WGRR, nonrespondents to the web version of the survey were sent a paper form of the questionnaire. The paper version included the key survey items, but it omitted many secondary items on the web questionnaire, presenting the recipient with 87 questions instead of the 185 on the web version. The primary set of weights was based

on responses from the full data set including both the web and paper versions. To support analysis of items only on the web version, a second set of weights was produced, following the same steps as the full data set including the paper questionnaire. For this weighting, all paper questionnaire respondents were treated as nonrespondents while fitting the XGBoost models. This second set of weights is intended solely for analysis of web-only items. The primary set of weights are used for estimating all survey items collected on both the web and paper versions of the questionnaire.

Finally, the nonresponse-adjusted weights were modified through a process called raking.<sup>4</sup> The purpose of raking is to use known information about the survey population to increase the precision of survey estimates. This information consists of totals for different levels of variables (such as demographic characteristics). During the raking process, sampled individuals are first categorized into the cells of a table defined by two or more variables—called raking dimensions. The goal of raking is to adjust the weights so that they add up to the known totals—called control totals—for the different levels within each raking dimension. Processing one dimension at a time, raking computes a proportional adjustment to the weights associated with each level of the raking dimension. After all dimensions are adjusted, the process is repeated until the totals for all levels of the raking dimensions are equal to the corresponding control totals (within a specified tolerance). For example, the level E1-E4 from the variable RPAYGRP9 had a population total of roughly 345,000. Suppose the weighted number of E1-E4 member after the eligibility and completion adjustments was 340,000. OPA computes the raking factor of 1.015 ( $345,000 / 340,000$ ) and multiplies this factor by the weight for E1-E4 members to ensure weighted estimates equal the target population. After raking, the sum of the weights for E1-E4 members will equal 345,000.

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<sup>4</sup> Raking, or iterative proportional fitting, is an algorithm for adjusting weights to match control totals

**Table 7.**  
***Variables and Levels (Raking Dimensions) Used for Raking***

Variable	Variable Name	Variable Levels
Reserve Component	RORG_CD	1. Army National Guard
		2. Army Reserve
		3. Navy Reserve
		4. Marine Corps Reserve
		5. Air National Guard
		6. Air Force Reserve
Paygrade Grouping	RPAYGRP9	1. E1-E4
		2. E5-E9
		3. W1-W5
		4. O1-O3
		5. O4-O6
Reserve Program	RPROG1	1. TPU/Unknown
		2. AGR/TAR
		3. Military Technicians
		4. IMA
Race/Ethnicity	RETHC4	1. Non-minority/Unknown
		2. Minority
Gender	RSEX2	1. Male/Unknown
		2. Female
Gender by Paygrade	GENPAY	1. Male E1-E4
		2. Male E5-E9
		3. Male W1-W5
		4. Male O1-O3
		5. Male O4-O6
		6. Female E1-E4
		7. Female E5-E9
		8. Female W1-W5
		9. Female O1-O3
		10. Female O4-O6
Gender by Program	GENPROG	1. Male TPU/Unknown
		2. Male AGR/TAR
		3. Male Military Technicians
		4. Male IMA
		5. Female TPU/Unknown
		6. Female AGR/TAR
		7. Female Military Technicians
		8. Female IMA
Gender by Race	GENRACE	1. Male Non-minority
		2. Male Minority
		3. Female Non-minority
		4. Female Minority
Gender by Service by Paygrade	GENORGPAY	1. Male ARNG Enlisted
		2. Male ARNG Officer

Variable	Variable Name	Variable Levels
		3. Male USAR Enlisted
		4. Male USAR Officer
		5. Male USNR Enlisted
		6. Male USNR Officer
		7. Male USMCR Enlisted
		8. Male USMCR Officer
		9. Male ANG Enlisted
		10. Male ANG Officer
		11. Male USAFR Enlisted
		12. Male USAFR Officer
		13. Female ARNG Enlisted
		14. Female ARNG Officer
		15. Female USAR Enlisted
		16. Female USAR Officer
		17. Female USNR Enlisted
		18. Female USNR Officer
		19. Female USMCR Enlisted
		20. Female USMCR Officer
		21. Female ANG Enlisted
		22. Female ANG Officer
		23. Female USAFR Enlisted
		24. Female USAFR Officer

Table 8 provides summaries of the distributions of the sampling weights, intermediate weights, final weights, and adjustment factors for eligible respondents. Eligible respondents are those individuals who were 1) eligible to participate in the survey and 2) completed one of the eight critical sexual assault items.

The mean sampling weights for the entire sample was 3.3 and the mean for the eligible respondents was 3.5. The nonresponse adjustment for eligibility status makes the biggest adjustment to the weights (mean is 5.3), in terms of increasing both the mean and the coefficient of variation (CV) of the weights. The two remaining adjustments for nonresponse among the eligible population and the final raking (mean is 1.0 and 1.0 respectively) have a modest effect on increasing the mean weight.

**Table 8.**  
*Distribution of Weights and Adjustment Factors*

Eligibility Status	Statistic	Sampling Weight	Eligibility Status Adjusted Weight	Complete Eligible Response Adjusted Weight	Final Weight With Non-response and Poststratification Adjustment	Eligibility Status Adjustment	Complete Eligible Response Adjustment	Raking Adjustment
Eligible Respondents	N	41,099	41,099	41,099	41,099	41,099	41,099	41,099
	MIN	1.0	1.5	1.5	1.5	1.0	1.0	0.9
	MAX	17.8	404.1	406.9	437.8	69.5	1.3	1.3
	MEAN	3.5	18.0	18.5	19.2	5.3	1.0	1.0
	STD	3.0	24.3	24.9	26.6	4.9	0.01	0.1

**Table 9.**  
*Sum of Weights by Eligibility Status*

Eligibility Category	Sum of Sampling Weights	Sum of Eligibility Status Adjusted Weights	Sum of Complete Eligible Response Adjusted Weights	Sum of Final Weights With Nonresponse and Raking Adjustments
1. Eligible respondent	145,523	741,479	759,545	790,637
2. Ineligible	2,174	16,558	16,558	17,490
3. Non-respondent	650,633	18,224	0	0
4. Record ineligible	9,797	9,797	9,797	0
<b>Total</b>	<b>808,127</b>	<b>786,057</b>	<b>785,899</b>	<b>808,127</b>

### **Variance Estimation**

Sampling error is the uncertainty associated with an estimate that is based on data gathered from a sample of the population rather than the full population. Note that sample-based estimates will vary depending on the particular sample selected from the population. Measures of the magnitude of sampling error, such as the variance and the standard error (the square root of the variance), reflect the variation in the estimates over all possible samples that could have been selected from the population using the same sampling methodology. Analysis of the 2017 WGRR data required a variance estimation procedure that accounted for the weighting procedures. The final step of the weighting process was to define strata for variance estimation

by Taylor series linearization. The 2017 WGRR variance estimation strata corresponded closely to the design strata; however, it was necessary to collapse some sampling strata containing fewer than 50 complete eligible responses with non-zero final weights with similar strata. There were 117 variance strata defined for the 2017 WGRR.

### ***Multiple Comparison Section***

To protect against erroneous statistically significant results due to large numbers of statistical tests, OPA used a p-value of 0.01 for its statistical tests in the 2017 WGRR. OPA decided this cut-off after using a method on several surveys to control for false discoveries known as the False Discovery Rate correction (FDR) developed by Benjamini and Hochberg (1995). FDR was defined as the expected percentage of erroneous rejections among all rejections. The idea is to control the false discovery rate which is the proportion of "discoveries" (significant results) that are actually false positives. Based on the FDR thresholds from several gender relations surveys, OPA determined that a p-value of 0.01 was a reasonable threshold. More details on performing multiple statistical tests follows.

When statistically comparing groups (e.g., Army vs. Navy estimates of the effectiveness of the sexual assault training), a statistical hypothesis whether there are no differences (null hypothesis) versus there are differences (alternative hypothesis) is tested. OPA mainly uses independent two sample t-tests and the conclusions are usually based on the p-value associated with the test-statistic. If the p-value is less than the critical value then the null hypothesis is rejected. Any time a null hypothesis is rejected (a conclusion that estimates are significantly different), it is possible this conclusion is incorrect. In reality, the null hypothesis may have been true, and the significant result may have been due to chance. A p-value of 0.01 means there is a one percent chance of finding a difference as large as the observed result if the null hypothesis were true.

In survey research there is interest in conducting multiple comparisons. For example, 1) testing whether the percentage of sexual assaults among senior officers is the same as the percentage of sexual assaults across enlisted members, and 2) testing that the percentage of sexual harassment for junior officers is the same as the percentage of sexual harassment for enlisted members and so on. When performing multiple independent comparisons on the same data the question becomes: "Does the interpretation of the p-value for a single statistical test hold for multiple comparisons?" If 200 independent statistical (significance) tests were conducted at the 0.01 significance level, and the null hypothesis is supported for all, 2 of the tests would be expected to be significant at the p-value < 0.01 level due to chance. These 2 tests would have incorrectly assumed to be statistically significant—known as false positives or false discoveries. Holding the significance level constant, the more tests that are conducted the greater the number of false discoveries.

This is known in statistical hypothesis testing as the multiple comparisons problem. Numerous techniques have been developed to reduce the false positives associated with conducting multiple statistical tests. It should be noted that there is no universally accepted approach for dealing with the problem of multiple comparisons.

## **Contact, Cooperation, and Response Rates**

Contact, cooperation, and response rates were calculated in accordance with the recommendations of the American Association for Public Opinion Research (AAPOR, 2016 Standard Definitions), which estimates the proportion of eligible respondents among cases of unknown eligibility (SAMP\_DC = 10 and 11).

The *contact rate* uses the concepts of AAPOR standard formula CON2 and is defined as

$$CON2 = \frac{(I + P) + R + O - e(O)}{(I + P) + R + O + NC - e(NC + O)} = \frac{\text{adjusted contacted sample}}{\text{adjusted eligible sample}} = \frac{N_C}{N_E}.$$

The *cooperation rate* uses the concepts of AAPOR standard formula COOP2 and is defined as

$$COOP2 = \frac{(I + P)}{(I + P) + R + O - e(O)} = \frac{\text{complete eligibles}}{\text{adjusted contacted sample}} = \frac{N_R}{N_C}.$$

The *response rate* uses the concepts of AAPOR standard formula RR4 and is defined as

$$RR4 = \frac{(I + P)}{(I + P) + R + O + NC - e(NC + O)} = \frac{\text{complete eligibles}}{\text{adjusted eligiblesample}} = \frac{N_R}{N_E}.$$

Where:

I = Fully complete responses according to RR4 are greater than 80% complete (SAMP\_DC=4).

P = Partially complete responses according to RR4 are between 50 – 80% complete (SAMP\_DC=4).

R = Refusal and break-off according to RR4 are less than 50% complete (SAMP\_DC=5, 8, and 9).<sup>5</sup>

NC = Non-contact (SAMP\_DC =10)

O = Other (SAMP\_DC = 11)<sup>6</sup>

e(O) = Estimated ineligible nonrespondents

e(NC) = Estimated ineligible PND

N<sub>C</sub> = Adjusted contacted sample

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<sup>5</sup> OPA considers these all cases of known eligibility.

<sup>6</sup> These are all nonrespondents which OPA considers cases of unknown eligibility.

$N_E$  = Adjusted eligible sample

$N_R$  = Complete eligibles<sup>7</sup>

Table 10 shows the corresponding sample disposition codes associated with the response categories.

**Table 10.**  
***Disposition Codes for Response Rates***

<b>Response Category</b>	<b>SAMP_DC Values</b>
Eligible Sample	4, 5, 8, 9, 10, 11
Contacted Sample	4, 5, 8, 9, 11
Complete Eligibles	4
Not Returned	11
Eligibility Determined	2, 3, 4, 5, 8, 9
Self-Report Ineligible	2, 3

### ***Ineligibility Rate***

The ineligibility rate (IR) is defined as the following and needs to be calculated both weighted and unweighted to be applied to Table 10:

$$IR = \text{Self-Report Ineligible} / \text{Eligibility Determined}.$$

### ***Estimated Ineligible Postal Non-Deliverable/Not Contacted Rate***

The estimated ineligible postal non-deliverable or not contacted (IPNDR) is defined as:

$$IPNDR = (\text{Eligible Sample} - \text{Contacted Sample}) * IR.$$

### ***Estimated Ineligible Nonresponse***

The estimated ineligible nonresponse (EINR) is defined as:

$$EINR = (\text{Not Returned}) * IR.$$

### ***Adjusted Contact Rate***

The adjusted contacted rate (ACR) is defined as:

$$ACR = (\text{Contacted Sample} - \text{EINR}) / (\text{Eligible Sample} - \text{IPNDR} - \text{EINR}).$$

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<sup>7</sup> Complete eligible is an OPA term that applies to self-administered surveys, which relates to the terms complete and partial interviews used by AAPOR.

### **Adjusted Cooperation Rate**

The adjusted cooperation rate (ACOR) is defined as:

$$\text{ACOR} = (\text{Complete Eligible})/(\text{Contacted Sample} - \text{EINR}).$$

### **Adjusted Response Rate**

The adjusted response rate (ARR) is defined as:

$$\text{ARR} = (\text{Complete Eligible})/(\text{Eligible Sample} - \text{IPNDR} - \text{EINR}).$$

The final response rate is the product of the contact rate and the cooperation rate. Table 11 shows both weighted and unweighted contact, cooperation, and response rates for the 2017 *WGRR*.

Finally, Table 12 shows weighted contact, cooperation, and response rates for the full sample by the stratification variables. The final weighted response rate for the survey was 18.5%.

**Table 11.**  
***Contacted, Cooperation, and Response Rates***

Type of Rate	Computation	Unweighted (percent)	Weighted (percent)
Contacted	Adjusted contacted sample/Adjusted eligible sample	89.7	90.6
Cooperation	Usable responses/Adjusted contacted sample	19.5	20.4
Response	Usable responses/Adjusted eligible sample	17.5	18.5

*Note.* Weighted response rates are the official reported rates. Unweighted response rates can be influenced by the sample design.

**Table 12.**  
**Rates for Full Sample and Stratification Level**

Variables	Variable Levels	Contact Rate (percent)	Cooperation Rate (percent)	Weighted Response Rate (percent)
Sample	<b>Sample</b>	90.6	20.4	18.5
Component	Army National Guard	89.6	16.1	14.4
	Army Reserve	90.5	20.4	18.5
	Navy Reserve	84.8	24.9	21.1
	Marine Corp Reserve	88.9	9.3	8.3
	Air National Guard	95.5	31.3	29.9
	Air Force Reserve	94.1	26.3	24.8
Gender	Male	90.7	20.1	18.2
	Female	89.9	21.9	19.7
Paygrade Grouping	E1-E4	86.3	8.3	7.1
	E5-E9	93.2	26.0	24.3
	W1-W5	96.7	39.4	38.1
	O1-O3	92.7	27.0	25.0
	O4-O6	96.9	42.2	40.9
Reserve Program	TPU	89.5	15.6	14.0
	AGR/TAR	93.4	42.1	39.3
	Military Technicians	96.8	39.4	38.1
	IMA	96.3	32.2	31.0

Note. Reported rates are weighted. Unweighted rates can be influenced by the sample design. This table was rounded for clarity.

### **Nonresponse Bias Analysis**

Survey nonresponse has the potential to introduce bias in the estimates of key outcomes. To the extent that nonrespondents and respondents differ on observed characteristics, OPA can use weights to adjust the sample so the weighted respondents match the full population on the most critical characteristics. This eliminates the portion of nonresponse bias (NRB) associated with those observed variables if these variables are strongly associated with the behaviors being estimated. When all NRB can be eliminated in this manner, the missingness is called *ignorable* or *missing at random* (Little & Rubin, 2002). The more observable demographic variables that are incorporated into the weights, the more plausible it is to assume that the weights eliminate any NRB.

Nonresponse bias occurs when survey respondents are systematically different from nonrespondents. Statistically, the bias in a respondent mean (e.g., sexual assault rate) is a function of the response rate and the relationship (covariance) between response propensities and the estimated statistics (i.e., sexual assault rate), and takes the following form:

$$\text{Bias}(\bar{y}_r) = \frac{\sigma_{yp}}{\bar{p}} = \left(\frac{\rho_{yp}}{\bar{p}}\right) \sigma_y \sigma_p, \text{ where:}$$

$\bar{y}_r$  = estimated sexual assault rate

$\sigma_{yp}$  = covariance between  $y$  and response propensity,

$\bar{p}$  = mean propensity over the sample,

$\rho_{yp}$  = correlation between  $y$  and  $p$ ,

$\sigma_y$  = standard deviation of  $y$ ,

$\sigma_p$  = standard deviation of  $p$ .

NRB can occur with high or low survey response rates, but the decrease in overall survey response rates within the Department, as well as in civilian studies, in the past decade has resulted in a greater focus on potential NRB. OPA conducted an extensive NRB study on the *2015 WGRR*. When the essential survey conditions (i.e., survey mode, contacts, response rates [including subgroups]) remain mostly constant, the level and direction of NRB should remain similar. Therefore, for this abbreviated NRB study, OPA attempts to confirm that the level and direction of NRB in *2017 WGRR* should be the same as *2015 WGRR* by comparing the sample composition with the survey respondents. If these comparisons are the same across survey iterations, OPA asserts that the NRB is similar and the *2017 WGRR* requires no further assessments. That result is confirmed in the following section.

Studies of NRB can be accomplished either by 1) conducting a follow-up survey of nonrespondents or 2) by using the survey responses and characteristics of the respondents to assess NRB. The latter is the approach that was used in this report. Two survey outcomes are critical in assessing NRB: response rates and the expected difference between respondents and nonrespondents on survey estimates.

It is common that survey quality is judged by response rates; they are the most visible measure of survey quality. However, response rates do not necessarily provide an accurate measure of survey bias. Low response rates are only indicative of the possibility of survey bias. A number of research studies have found little relationship between the level of nonresponse and bias (e.g., Keeter, Miller, Kohut, Groves, & Presser, 2000). Where bias is found, adjusting survey weights for nonresponse and raking using variables that are correlated with the response characteristics can significantly reduce that bias.

### ***Comparing Survey Respondents with Survey Nonrespondents***

The *2017 WGRR* NRB analysis compared the sample composition with the survey respondent composition and assessed whether the patterns matched the *2015 WGRR* results. The *2017 WGRR* sample composition demographically differs from the Reserve component member population distribution due to intentional sampling strategies that allow OPA to make precise estimates for small subgroups. The respondent composition differs from the sample distribution in predictable ways due to subgroups (e.g., junior enlisted members) responding at different rates. This analysis assesses whether survey respondents possess similar observable characteristics (e.g., gender, Component, and paygrade grouping) to survey non-respondents.

OPA draws optimized samples to reduce survey burden on members as well as produce high levels of precision for important domain estimates by using known information about the military population and their response propensity. It is important to note that OPA samples are often not proportional to their respective population. Depending on specific subgroups, OPA will over or under sample a specific group (e.g., E1-E4 US Army Reserve) to obtain enough expected responses to make statistically accurate estimates. Therefore, the sample composition is out of alignment with the population, and this is intentional. OPA is able to use its military personnel data to weight the respondents in order to make survey estimates representative of the entire Reserve component population. The demographics considered in this analysis include: gender, Reserve component, and paygrade grouping, which were directly controlled for in the raking stage and thus exactly match the known population values.

Table 13 shows the population, sample, and response breakdown by gender. OPA intentionally sampled 50 percent of females and 25 percent of males. The goal was to achieve reliable precision on estimates for outcomes conditional on reporting a sexual assault (i.e., retaliation) and other measures that were only asked of a very small subset of members, especially for males (Table 13: columns b and d). For example, females make up 20% of the Reserve population but 33% of the 2017 WGRR sample. The final weighted population pulls the respondents back into alignment with the gender composition in the Reserve components to ensure final weighted estimates do not over-represent females.

OPA performed a base-weighted Chi-square test of independence to examine the relationship between survey response and survey nonresponse. Survey respondents are defined as complete eligible (n=41,099) or self/proxy report ineligible (n=716). OPA defines survey nonrespondents as SAMP\_DC levels 5-11 (n=196,419; see Table 3). Record ineligible (n=3,192) are not included in the analysis. The relationship between gender and survey response was significant,  $\chi^2$  (df=1, n= 238,234) = 61.0<sup>8</sup>, p < 0.001. The results indicate that different genders respond at different rates and unweighted respondents are prone to nonresponse bias if not corrected for during weighting. For example, males (moved from 67 to 63 percent) and females (33 to 37 percent) have different sample and respondent percentages. Response patterns (e.g., females respond at higher rates) are the same across the 2015 and 2017 surveys, and therefore OPA concludes that NRB levels and direction will also be similar. Table 14 shows the effect in 2015 was more pronounced where males moved from 68 to 60 percent and females moved from 32 to 40 percent. Therefore, 2017 estimates are at less risk of NRB than 2015 survey estimates due to differences in response rates by gender.

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<sup>8</sup> The weighted Chi-square was generated using the PROC SURVEYFREQ with a weight statement within SAS 9.3 and SAS/STAT 12.1. The Rao-Scott correction to the Chi-square test was used since the data comes from a complex sample survey (Scott, 2015).

**Table 13.**  
*2017 WGRR Population, Sample Design, and Response Composition for Gender*

Gender	Population		Sample		Respondents		Weighted Estimates (Final Weights)	
	Frequency (a)	Percent (b)	Frequency (c)	Percent (d)	Frequency (e)	Percent (f)	Frequency (g)	Percent (h)
Male	650,440	80	162,554	67	26,546	63	650,440	80
Female	157,687	20	78,872	33	15,269	37	157,687	20
<b>Total</b>	<b>808,127</b>	<b>100</b>	<b>241,426</b>	<b>100</b>	<b>41,815</b>	<b>100</b>	<b>808,127</b>	<b>100</b>

**Table 14.**  
*2015 WGRR Population, Sample Design, and Response Composition for Gender*

Gender	Population		Sample		Respondents		Weighted Estimates (Final Weights)	
	Frequency (a)	Percent (b)	Frequency (c)	Percent (d)	Frequency (e)	Percent (f)	Frequency (g)	Percent (h)
Male	662,565	81	331,332	68	53,439	60	662,565	81
Female	154,442	19	154,442	32	35,229	40	154,442	19
<b>Total</b>	<b>817,007</b>	<b>100</b>	<b>485,774</b>	<b>100</b>	<b>88,668</b>	<b>100</b>	<b>817,007</b>	<b>100</b>

Table 15 shows the breakdown of the population, sample, and respondent distributions by Reserve component. Based on historically different response rates and the need to make estimates for each Component, OPA oversampled the US Marine Corps Reserves, and under sampled the Army National Guard (Table 15: columns b and d). For instance, Army National Guard is 42% of Reserve component members but since they are so large in comparison to other Components they were only 27% of the 2017 WGRR sample. There are fairly large differences between the unweighted sample size and unweighted respondents percentages, especially with Army National Guard (27% of the sample and only 20% of the respondents; Table 15: columns d and f), US Marine Corps Reserve (16 to 7 percent), Air National Guard (10 to 17 percent), and US Air Force Reserves (12 to 17 percent).<sup>9</sup> Similar results are found in 2015 WGRR where Army National Guard moved from 38 to 29 percent, Air National Guard moved from 13 to 22 percent, and US Air Force Reserve moved from 9 to 14 percent (Table 16).

Finally, OPA uses post-survey weighting procedures (described in the weighting section) to adjust the 20% of Army National Guard respondents to make them representative of the Army National Guard's true 42% proportion of the overall Reserve component members. The final weighting procedure (i.e., raking) aligns respondent proportions back with the military population for the Components (Table 15: columns b and h). Survey weighting reduces nonresponse bias for outcomes that are correlated with the raking variables.

<sup>9</sup> These observations are similar to those reported in the nonresponse bias analysis section of the Status of Forces of the Reserve Component 2016 survey (OPA, 2016-047).

OPA performed base weighted Chi-square test of independence on respondents and nonrespondents by Component. The relationship between Component and survey response was significant,  $\chi^2$  (df=5, n= 238,234) = 4579.5,  $p < 0.0001$ . The results indicate that different Components respond at different rates and unweighted respondents are prone to nonresponse bias if not adjusted. Response patterns (e.g., Air Force responds at higher rates) are the same across the 2015 and 2017 surveys, and therefore OPA concludes that NRB levels and direction will also be similar.

**Table 15.**  
*2017 WGRR Population, Sample Design, and Response Composition for Component*

Reserve Component	Population		Sample		Respondents		Weighted Estimates (Final Weights)	
	Frequency (a)	Percent (b)	Frequency (c)	Percent (d)	Frequency (e)	Percent (f)	Frequency (g)	Percent (h)
Army National Guard	341,374	42	64,581	27	8,562	20	341,374	42
US Army Reserve	198,250	25	52,753	22	9,390	22	198,250	25
US Naval Reserve	57,984	7	33,293	14	6,555	16	57,984	7
Marine Corps Reserve	38,202	5	37,669	16	2,998	7	38,202	5
Air National Guard	104,165	13	24,203	10	7,146	17	104,165	13
US Air Force Reserve	68,152	8	28,927	12	7,164	17	68,152	8
<b>Total</b>	<b>808,127</b>	<b>100</b>	<b>241,426</b>	<b>100</b>	<b>41,815</b>	<b>100</b>	<b>808,127</b>	<b>100</b>

**Table 16.**  
*2015 WGRR Population, Sample Design, and Response Composition for Component*

Reserve Component	Population		Sample		Respondents		Weighted Estimates (Final Weights)	
	Frequency (a)	Percent (b)	Frequency (c)	Percent (d)	Frequency (e)	Percent (f)	Frequency (g)	Percent (h)
Army National Guard	348,599	43	186,481	38	25,682	29	348,599	43%
US Army Reserve	197,698	24	121,036	25	19,008	21	197,698	24%
US Naval Reserve	58,227	7	36,245	7	8,261	9	58,227	7%
Marine Corps Reserve	38,468	5	36,364	7	4,111	5	38,468	5%
Air National Guard	104,818	13	61,695	13	19,423	22	104,818	13%
US Air Force Reserve	69,197	8	43,953	9	12,183	14	69,197	8%
<b>Total</b>	<b>817,007</b>	<b>100</b>	<b>485,774</b>	<b>100</b>	<b>88,668</b>	<b>100</b>	<b>817,007</b>	<b>100</b>

Table 17 shows the breakdown of the population, sample, and respondent percentage distributions by paygrade grouping. Based on historically different response rates and the need to make estimates for each paygrade, OPA only slightly oversampled the junior enlisted members and under sampled senior enlisted members (Table 17: columns b and d). For instance, senior enlisted members make up 42% of the Reserve component but only 29% of the 2017 WGRR sample. On the other hand, junior enlisted are slightly oversampled in proportion to their population (42% population, 48% sample). The basis for this approach is seen clearly in the differences between respondent percentages. The senior enlisted members, despite making up only 29% of the sample account for 38% of the respondents, while the junior enlisted members made up nearly half the sample (48%) of the sample, yet they represented only 20% of the respondents. Similar results are found in 2015 WGRR where E1-E4 moved from 49 to 22 percent, E5-E9 moved from 37 to 52 percent, and O4-O6 moved from 6 to 14 percent (Table 18). These differences are adjusted based on known characteristics in post-survey weighting procedures, which aligned the respondent proportions equal to the military population for paygrade (Table 17: columns b and h).

OPA performed base weighted Chi-square test of independence for paygrade grouping. The relationship between paygrade grouping and survey response was significant,  $\chi^2$  (df=4, n=238,234) = 15,403.9,  $p < 0.0001$ . The results indicate that different paygrade groupings respond at different rates and unweighted respondents are prone to nonresponse bias if not adjusted. Response patterns (e.g., junior enlisted respond at the lowest rates) are the same across the 2015 and 2017 surveys, and therefore OPA concludes that NRB levels and direction will also be similar.

**Table 17.**  
**2017 WGRR Population, Sample Design, and Response Composition for Paygrade**

Paygrade Grouping	Population		Sample		Respondents		Final Weighted Estimates	
	Frequency (a)	Percent (b)	Frequency (c)	Percent (d)	Frequency (e)	Percent (f)	Frequency (g)	Percent (h)
E1-E4	341,450	42	115,693	48	8,209	20	341,450	42
E5-E9	336,824	42	69,846	29	15,761	38	336,824	42
W1-W5	12,371	2	3,529	1	1,351	3	12,373	2
O1-O3	60,627	8	26,854	11	6,675	16	60,625	8
O4-O6	56,855	7	25,504	11	9,819	23	56,855	7
<b>Total</b>	<b>808,127</b>	<b>100</b>	<b>241,426</b>	<b>100</b>	<b>41,815</b>	<b>100</b>	<b>808,127</b>	<b>100</b>

**Table 18.**  
**2015 WGRR Population, Sample Design, and Response Composition for Paygrade**

Paygrade Grouping	Population		Sample		Respondents		Final Weighted Estimates	
	Frequency (a)	Percent (b)	Frequency (c)	Percent (d)	Frequency (e)	Percent (f)	Frequency (g)	Percent (h)
E1-E4	352,772	43	238,102	49	19,123	22	352,772	43%
E5-E9	336,347	41	179,140	37	45,867	52	336,347	41%
W1-W5	12,193	1	5,773	1	2,234	3	12,193	1%
O1-O3	59,524	7	33,684	7	9,216	10	59,524	7%
O4-O6	56,171	7	29,075	6	12,228	14	56,171	7%
<b>Total</b>	<b>817,007</b>	<b>100</b>	<b>485,774</b>	<b>100</b>	<b>88,668</b>	<b>100</b>	<b>817,007</b>	<b>100</b>

### **Summary**

The purpose of this NRB analysis was to determine whether there were differences between respondents and nonrespondents for three observable characteristics (gender, Reserve Component, and paygrade grouping). Similar to the 2015 WGRR, OPA found that the distribution of survey respondents was statistically significantly different from survey nonrespondents for all three characteristics analyzed.

Differences between respondents and nonrespondents on observable characteristics may suggest NRB. However, survey weighting effectively adjusts for these observable characteristics. Survey weighting also reduces any biases associated with unobservable characteristics (e.g., sexual assault rate) that are correlated with the observable characteristics.

Comparing survey respondents with the survey sample cannot definitively detect NRB. For example, if the respondents and nonrespondents look similar on observable characteristics, there is no evidence of NRB. However, if the respondents and nonrespondents look different on

observable characteristics, OPA reduces or eliminates this source of NRB during survey weighting. Therefore, neither of these two outcomes has the capability of detecting NRB. The relationship between observable and unobservable characteristics is unknown, and therefore the most desirable outcome would be where respondents and nonrespondents match on observable characteristics, something OPA does not find in either the *2015 WGRR* or *2017 WGRR*.

In this analysis, OPA observes that response patterns for the 2017 WGRR are nearly identical to patterns from the 2015 WGRR (DMDC, 2016), and concludes that the level of NRB should essentially be the same in both surveys. In the four NRB studies conducted in 2015 WGRR, OPA found little evidence of NRB and OPA draws that same conclusion here.



## References

- American Association for Public Opinion Research. (2016). *Standard definitions: Final dispositions of case codes and outcome rates for surveys* (9<sup>th</sup> Ed.). AAPOR. Retrieved from [http://www.aapor.org/AAPOR\\_Main/media/publications/Standard-Definitions20169theditionfinal.pdf](http://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf)
- Benjamini, Y. & Hochberg, Y. (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society. Series B (Methodological)*, 57. 289–300. Retrieved from <http://www.jstor.org/stable/2346101>
- Chen, T. (2016). xgboost: Extreme Gradient Boosting (Version 0.6-4) [Computer software]. Retrieved from <http://lib.stat.cmu.edu/R/CRAN/>
- Chromy, J. R. (1987). Design optimization with multiple objectives. In *Proceedings of the Section on Survey Research Methods, presented at the annual meeting of the American Statistical Association, San Francisco, CA, August 17-20, 1987* (pp. 194-199). Alexandria, VA: The Association.
- Dever, J. A., and Mason, R. E. (2003). *DMDC sample planning tool: Version 2.1*. Arlington, VA: DMDC.
- DMDC. (2016). *2015 Workplace and Gender Relations Survey of Reserve Component Members: Statistical Methodology Report* (Report No. 2016-004). Alexandria, VA: Author.
- Little, R.J., & Vartivarian, S. (2005). Does weighting for nonresponse increase the variance of survey means? *Survey Methodology* 31(2):161-168.
- Mason, R. E., Wheelless, S. C., George, B. J., Dever, J. A., Riemer, R. A., and Elig, T. W. (1995). Sample allocation for the Status of the Armed Forces Surveys. In *Proceedings of the Section on Survey Research Methods, Volume II, American Statistical Association* (pp. 769–774). Alexandria, VA: The Association.



# Appendix A. Reporting Domains

DATA  
DRIVEN  
SOLUTIONS  
FOR  
DECISION  
MAKERS



## Reporting Domains

Domain	Domain Level
1	All Domains
2	National Guard
3	Army National Guard
4	Air National Guard
5	Reserve
6	US Army Reserve
7	US Navy Reserve
8	US Marine Corps Reserve
9	US Air Force Reserve
10	Enlisted
11	E1-E4
12	E1-E3
13	E4
14	E5-E9
15	Officers
16	O1-O3
17	O4-O6
18	W1-W5
19	TPU
20	AGR
21	IMA
22	Non-Hispanic White
23	Total Minority
24	Females
25	Females*Enlisted
26	Females*E1-E4
27	Females*E5-E9
28	Females*Officers
29	Females*O1-O3
30	Females*O4-O6
31	Females*TPU
32	Females*AGR
33	Females*IMA
34	Females*Non-Hispanic White
35	Females*Total Minority
36	Females*National Guard
37	Females*Army National Guard
38	Females*Army National Guard*Enlisted
39	Females*Army National Guard*Officers
40	Females*Air National Guard

41	Females*Air National Guard*Enlisted
42	Females*Air National Guard*Officers
43	Females*Reserve
44	Females*US Army Reserve
45	Females*US Army Reserve*Enlisted
46	Females*US Army Reserve*Officers
47	Females*US Navy Reserve
48	Females*US Navy Reserve*Enlisted
49	Females*US Navy Reserve* Officers
50	Females*US Marine Corps Reserve
51	Females*US Air Force Reserve
52	Females*US Air Force Reserve*Enlisted
53	Females*US Air Force Reserve*Officers
54	Males
55	Males*Enlisted
56	Males*E1-E4
57	Males*E5-E9
58	Males*Officers
59	Males*O1-O3
60	Males*O4-O6
61	Males*TPU
62	Males*AGR
63	Males*IMA
64	Males*Non-Hispanic White
65	Males*Total Minority
66	Males*National Guard
67	Males*Army National Guard
68	Males*Army National Guard*Enlisted
69	Males*Army National Guard*Officers
70	Males*Air National Guard
71	Males*Air National Guard*Enlisted
72	Males*Air National Guard*Officers
73	Males*Reserve
74	Males*US Army Reserve
75	Males*US Army Reserve*Enlisted
76	Males*US Army Reserve*Officers
77	Males*US Navy Reserve
78	Males*US Navy Reserve*Enlisted
79	Males*US Navy Reserve* Officers
80	Males*US Marine Corps Reserve
81	Males* US Marine Corps Reserve*Enlisted
82	Males*US Marine Corps Reserve*Officers
83	Males*US Air Force Reserve
84	Males*US Air Force Reserve*Enlisted
85	Males*US Air Force Reserve*Officers

# Appendix B. Military Accession Program

DATA  
DRIVEN  
SOLUTIONS  
FOR  
DECISION  
MAKERS





## Military Accession Program

Military Accession Program
1=Induction
2=Voluntary enlistment in a Regular Component
3=Vol enlist - Rsv Comp for Reg DEP - 10 USC 12103/10 USC 513
4=Voluntary enlistment - Rsv Comp, Sec 511, ref(b). Excl DEP
A=U.S. Military Academy
B=U.S. Naval Academy
C=U.S. Air Force Academy
D=U.S. Coast Guard Academy
E=U.S. Merchant Marine Academy
F=Air National Guard Academy of Military Sciences
G=ROTC/NROTC scholarship program
H=ROTC/NROTC non-scholarship program
J=OCS, AOCS, OTS, or PLC
K=Aviation Cadet program
L=National Guard state OCS
M=Direct appointment authority, Commissioned Off, professional
N=Direct appointment authority, Commissioned Off, all other
P=Aviation training program other than OCS, AOCS, OTS, or PLC
R=Direct appointment authority, warrant officer
S=Direct appointment authority, commissioned warrant officer
T=Warrant Officer Aviation Training Program
X=Other
Z=Unknown or Not Applicable



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