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14. ABSTRACT

The goal of this study is to determine the prevalence of eating disorders (EDs) among military personnel and examine risk factors for their onset and recurrence, especially military-specific exposures. We additionally aim to describe the patterns of comorbidity between EDs and other mental health conditions (e.g. PTSD, depression, and problem drinking), particularly regarding order of onset. Finally, the study explores whether certain family system stressors as well as individual or relationship factors, are associated with EDs in military spouses. In the first year of the study all subtasks were completed on schedule. Preliminary estimates from self-report survey data from military personnel suggest that approximately 9-20% of men and 14-22% of women are either at risk for or meet the criteria for a probable eating disorders. Risk and protective factors as well as comorbid conditions were additionally calculated by survey cycle and eating disorder status (Table 2). Finally, when examining new onset EDs in military spouses using logistic regression, we found that spouse PTSD, body mass index (overweight or obese), social isolation, former smoker status, and financial problems were significant predictors of new onset Binge Eating Disorder. These findings have implications for the assessment and treatment of military personnel and spouses with eating disorders.

15. SUBJECT TERMS

Eating Disorders, Bulimia, Binge Eating Disorder, Anorexia Nervosa, Service Members, Military, Veterans, Mental Health, Family, Spouses, Stressors, Prevalence

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1. **INTRODUCTION:**

The prevalence of eating disorders (EDs) is higher in military personnel than in civilians. Despite the prevalence rates, estimates are inconsistent, risk factors for both military personnel and their families are not fully understood, and temporal patterns of comorbidity remain unclear. This research will determine the prevalence of EDs among military personnel and examine risk factors for their onset and recurrence, especially military-specific exposures. It will additionally describe the patterns of comorbidity between EDs and other mental health conditions (e.g. PTSD, depression, and problem drinking), particularly regarding order of onset. Finally, it will explore whether certain family system stressors, individual or relationship factors, are associated with EDs in military spouses. This study will provide important information for the future development of prevention and treatment of eating disorders that will be helpful for military leadership and commands as well as mental health clinicians who care for military personnel and their families.

2. **KEYWORDS:**

Eating Disorders, Bulimia, Binge Eating Disorder, Anorexia Nervosa, Service Members, Military, Veterans, Mental Health, Family, Spouses, Stressors, Prevalence

3. **ACCOMPLISHMENTS:**

What were the major goals of the project?

The main goal of this proposal is to use a longitudinal cohort design to better understand prevalence rates, risk factors, and associated comorbidities in military personnel.

The project work has been divided into 7 main tasks:

1.	Complete and submit study proposal to Millennium Cohort's Scientific Committee for review and approval	… 100% completed
2.	Build analytic dataset using all panels and waves of available data (N = ~202,00)	… 100% completed
3.	Conduct analyses to determine prevalence and risk factors for BN, BED, and OSFED	... 25%; Expected Year 2
4.	Conduct analyses to determine relationship between eating disorders and comorbid conditions	... Expected Year 2
5.	Create analytic dataset (N = ~9800)	… 100% completed
6.	Perform analyses on risk and protective factors for BED and OSFED in military spouses	… 50%; Expected Year 2
7.	Prepare reports and manuscripts to disseminate research findings to appropriate end users	... Expected Year 3

Progress on subtasks is described in detail in the following section.

<u>What was accomplished under these goals?</u>

SOW Major Task 2: *Build analytic dataset using all panels and waves of available data (N = ~202,000)*

- Subtask 1: Clean and merge Millennium Cohort and MDR data to create analytic dataset
- Subtask 2: Identify participants with probable eating disorders using self-reported data from the PRIME-MD Patient Health Questionnaire (PHQ) eating disorder questions on the Millennium Cohort and Family Cohort questionnaires for all available panels and waves of data, as well as the MDR using ICD-9 and IC9-10 ED codes.
- Subtask 3: Code all *a priori* risk and protective factors and add them to the analytic dataset.
- Subtask 4: Identify participants with comorbid mental health conditions identified using Millennium Cohort data

*Subtask 1***:** Eating disorder (ED) cases were identified using both self-reported survey data as well as the Department of Defense's (DoD) medical data repository (MDR). The MDR includes inpatient and outpatient encounters for DoD beneficiaries who seek care at a military treatment facility, or encounters from providers outside of the DoD system that bill the DoD. In order to obtain the most complete capture of ED cases, MDR inpatient and outpatient data were merged with the total responder dataset from the Cohort (N = 201,619), and any active duty (AD) participant who sought care for any reason during a given survey cycle were examined. The sample was for MDR case ascertainment was restricted to AD personnel since Reserve/Guard personnel and veterans may seek care outside of the DoD billing system (see Table 1 below for total and AD sample numbers at each survey cycle). For this study, an eating disorder case (see bulleted list of EDs listed below) was defined by the presence of any qualifying ICD-9 or ICD- 10 diagnosis code in the 1st or 2nd diagnostic position of an inpatient record or in the 1st diagnostic position of a record of an outpatient medical encounter. The following eating disorders were considered and then grouped as follows:

- Bulimia Nervosa (BN)
- Binge Eating Disorder (BED)
- Anorexia Nervosa (AN)
- All other EDs – Loss of appetite; other eating disorders; other unspecified eating disorders

Subtask 2: We used the merged dataset created in Subtask 1 to identify ED cases using survey responses among Millennium Cohort Study (MilCo) participants who responded at each survey cycle (see Table 1 below for the number of participants responding at each cycle). Survey data was used to ascertain probable BN and BED with eight questions from the PRIME-MD Patient Health Questionnaire (PHQ), self-reported height and weight (to calculate body mass index), and an item measuring dissatisfaction with weight/appearance. We were also able to identify low frequency and at-risk cases for EDs. The following EDs were coded:

- Bulimia Nervosa (BN)
- Low frequency BN
- Binge Eating disorder (BED)
- Probable BED
- Low frequency BED

- At-risk for BED

Table 1 below provides preliminary numbers of cases for EDs among the total sample and Active-Duty Millennium Cohort Study responders at each survey cycle, as well as those active-duty members who sought medical care for any reason during each survey cycle. These should be considered preliminary numbers, as final validation checks are still in progress. The study team is also creating statistical weights for sex, age, service branch, and race/ethnicity, such that prevalence estimates can be weighted back to the military population serving at the midpoint of each survey cycle to in order to provide estimates that are more generalizable to the active-duty military population.

Table 1. Eating Disorder Case Counts among Millennium Cohort Study Participants, Abstracted from Survey Data and the MDR

	Self-Reported Survey Data				Medical Record Data	
	Total Sample		**Active Duty**		**Active Duty**	
2001 CYCLE	**N = 76,520**		**N = 41,002**		**N = 40,435**	
	Male n=56,025	Female n=20,495	Male n=31,051	Female n=9,951	Male n=30,576	Female n=9,859
Bulimia Nervosa	340	241	239	126	0	19
Low frequency BN	358	224	204	130	-	-
Anorexia	-	-	-	-	0	0
Binge Eating Disorder	1,038	498	567	241	9	26
Probable BED	10	5	8	3	-	-
Low frequency BED	423	167	226	92	-	-
At risk for BED	5,016	2,424	2,876	1,201	-	-
Total ED Cases 2001 Cycle	7,185	3,559	**4,120**	**1,793**	**9**	**45**
2004 CYCLE	**N = 84,650**		**N = 44,172**		**N = 52,009**	
	Male n=58,532	Female n=26,118	Male n=30,987	Female n=13,185	Male n=36,951	Female n=15,058
Bulimia Nervosa	349	270	228	151	1	31
Low frequency BN	333	266	206	148	-	-
Anorexia	-	-	-	-	0	0
Binge Eating Disorder	1,264	627	624	293	2	33
Probable BED	16	5	11	3	-	-
Low frequency BED	402	201	202	104	-	-
At risk for BED	5,206	2,808	2,674	1,375	-	-
Total ED Cases 2004 Cycle	7,570	4,177	**3,945**	**2,074**	**3**	**64**
2007 CYCLE	**N = 114,313**		**N = 59,148**		**N = 68,438**	

	Male n=77,896	Female n=36,417	Male n=41,062	Female n=18,086	Male n=47,845	Female N=20,593
Bulimia Nervosa	471	330	282	176	3	53
Low frequency BN	456	270	261	136	-	-
Anorexia	-	-	-	-	0	0
Binge Eating Disorder	1,784	918	756	361	8	55
Probable BED	5	1	3	0	-	-
Low frequency BED	386	175	176	90	-	-
At risk for BED	7,008	3,431	3,639	1,519	-	-
Total ED Cases 2007 Cycle	10,110	5,125	**5,117**	**2,282**	**11**	**108**
2011 CYCLE	**N = 136,835**		**N = 59,718**		**N = 77,035**	
	Male n=95,996	Female n=40,839	Male N=43,989	Female n=15,729	Male n=56,364	Female N=20,671
Bulimia Nervosa	878	488	454	195	9	48
Low frequency BN	697	376	309	142	-	-
Anorexia	-	-	-	-	0	0
Binge Eating Disorder	2,761	1,200	397	188	13	62
Probable BED	3	1	2	0	-	-
Low frequency BED	517	222	182	83	-	-
At risk for BED	8,779	3,842	3,660	1,316	-	-
Total ED Cases 2011 Cycle	13,635	6,129	**5,004**	**1,924**	**22**	**110**
2014 CYCLE	**N = 100,660**		**N = 26,313**		**N = 48,954**	
	Male n=70,776	Female n=29,884	Male N=19,752	Female n=6,561	Male n=36,371	Female N=12,583
Bulimia Nervosa	*	*	*	*	3	25
Low frequency BN	*	*	*	*	-	-
Anorexia	-	-	-	-	0	7
Binge Eating Disorder	*	*	*	*	3	21
Probable BED	4,737	2,193	972	348	-	-
Low frequency BED	*	*	*	*	-	-
At risk for BED	9,683	4,420	2,507	885	-	-
Total ED Cases 2014 Cycle	14,420	6,613	**3,479**	**1,233**	**6**	**53**

- Anorexia is not assessed on the Millennium Cohort survey. For the MDR, not all eating disorders were captured using ICD-9 or ICD-10 codes.

* Unable to assess at this cycle due to removal of compensatory behavior items from 2014 survey.

Subtasks 3 and 4: The study team coded the risk and protective factors identified a priori, as well as several health conditions known to be comorbid with eating disorders (e.g. PTSD, depression, anxiety disorder, and problem drinking) for the study population responding at each survey cycle. The distribution of these characteristics as well as their significance by eating disorder status is shown in Table 2 below. These are preliminary numbers as final confirmatory checks are currently underway. Given the large sample size at each survey cycle, nearly all characteristics except for education level and height are significantly associated with the presence or absence of any ED.

Table 2. Risk and Protective Factors and Comorbid Conditions Among Millennium Cohort Participants with and without Any Eating Disorder, by Survey Cycle

Factors	2001 Cycle N = 76,520		2004 Cycle N = 84,650		2007 Cycle N = 114,313		2011 Cycle N = 136,835		2014 Cycle N = 100,660	
	No ED n = 65,776 n (%)	Any ED n = 10,744 n (%)	No ED n = 72,903 n (%)	Any ED n = 11,747 n (%)	No ED n = 99,078 n (%)	Any ED n = 15,235 n (%)	No ED n = 117,071 n (%)	Any ED n =19,764 n (%)	No ED n = 79,627 n (%)	Any ED n = 21,033 n (%)
Demographic characteristics										
Sex	$p < .0001$		$p < .0001$		$p < .0001$		$p < .001$		$p < .0001$	
Male	48,840 (74.3)	7,185 (66.9)	50,962 (69.9)	7,570 (64.4)	67,789 (68.4)	10,110 (66.4)	82,361 (70.4)	13,635 (69.0)	56,356 (70.8)	14,420 (68.6)
Female	16,936 (25.8)	3,559 (33.1)	21,941 (30.1)	4,177 (35.6)	31,292 (31.6)	5,125 (33.6)	34,710 (29.7)	6,129 (31.0)	23,271 (29.2)	6,613 (31.4)
Birth year	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
Before 1960	14,524 (22.1)	2,035 (18.9)	11,852 (16.3)	1,725 (14.7)	12,291 (12.4)	1,479 (9.7)	11,845 (10.1)	1,609 (8.1)	10,930 (13.7)	1,924 (9.2)
1960-1969	25,095 (38.2)	3,886 (36.2)	20,731 (28.4)	3,010 (25.6)	20,986 (21.2)	3,010 (19.8)	19,790 (16.9)	3,109 (15.7)	16,936 (21.3)	3,934 (18.7)
1970-1979	22,477 (34.2)	3,996 (37.2)	22,578 (31.0)	3,835 (32.7)	25,568 (25.8)	4,158 (27.3)	25,832 (22.1)	4,592 (23.2)	19,470 (24.5)	5,486 (26.1)
1980 and beyond	3,680 (5.6)	827 (7.7)	17,742 (24.3)	3,177 (27.1)	40,233 (40.6)	6,588 (43.2)	59,604 (50.9)	10,454 (52.9)	32,291 (40.6)	9,689 (46.1)
Race/ethnicity	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
White non-Hispanic	48,644 (74.0)	7,985 (74.3)	54,261 (74.4)	8,811 (75.0)	73,454 (74.1)	11,166 (73.3)	87,432 (74.7)	14,743 (74.6)	60,929 (76.5)	15,628 (74.3)
Black non-Hispanic	9,588 (14.6)	1,338 (12.5)	9,257 (12.7)	1,217 (10.4)	12,051 (12.2)	1,573 (10.3)	12,972 (11.1)	1,769 (9.0)	8,299 (10.4)	1,954 (9.3)
Other	7,499 (11.4)	1,411 (13.1)	9,310 (12.8)	1,711 (14.6)	13,523 (13.7)	2,480 (16.3)	16,616 (14.2)	3,243 (16.4)	10,346 (13.0)	3,445 (16.4)
Marital status	$p < .0001$		$p < .001$		$p < .0001$				$p < .0001$	
Never married	13,545 (20.6)	2,503 (23.3)	19,978 (27.4)	3,344 (28.5)	27,727 (28.0)	4,523 (29.7)	24,688 (21.1)	4,374 (22.1)	10,738 (13.5)	3,154 (15.0)
Married	43,390 (66.0)	6,691 (62.3)	44,332 (60.8)	6,904 (58.8)	59,154 (59.7)	8,767 (57.6)	75,658 (64.6)	12,226 (61.9)	56,259 (70.7)	13,972 (66.4)
Divorced/widowed/separated	8,836 (13.4)	1,550 (14.4)	8,591 (11.8)	1,498 (12.8)	12,197 (12.3)	1,945 (12.8)	16,725 (14.3)	3,164 (16.0)	12,630 (15.9)	3,907 (18.6)
Education level	$p < .05$		$p < .001$		$p = 0.147$		$p = 0.074$		$p < .001$	
High school or less	10,605 (16.1)	1,835 (17.1)	12,141 (16.7)	1,978 (16.8)	15,376 (15.5)	2,434 (16.0)	13,626 (11.3)	2,402 (12.2)	4,686 (5.9)	1,381 (6.6)
More than high school	55,162 (83.9)	8,907 (82.9)	60,758 (83.3)	9,763 (83.1)	83,702 (84.5)	12,801 (84.0)	103,443 (88.4)	17,361 (87.8)	74,941 (94.1)	19,652 (93.4)
Height, in.	$p < .0001$		$p = 0.084$		$p < .05$		$p < .001$		$p = 0.505$	
Mean $\pm$ SD	69.0 $\pm$ 3.7	68.7 $\pm$ 3.8	68.7 $\pm$ 3.8	68.6 $\pm$ 3.9	68.6 $\pm$ 3.8	68.7 $\pm$ 3.9	68.7 $\pm$ 3.8	68.8 $\pm$ 3.8	68.7 $\pm$ 3.8	68.7 $\pm$ 3.8
Weight, lbs.	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	

Mean ± SD	175.0 ± 30.7	185.6 ± 34.8	174.5 ± 32.3	186.8 ± 37.2	175.8 ± 33.4	189.6 ± 38.7	179.2 ± 34.3	196.0 ± 40.7	184.5 ± 36.3	204.0 ± 42.5
Current and former military characteristics										
Pay grade	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
Enlisted	50,158 (76.3)	8,733 (81.3)	55,797 (76.5)	9,491 (80.8)	77,252 (78.0)	12,443 (81.7)	89,684 (76.6)	16,016 (81.0)	55,974 (70.3)	16,417 (78.1)
Officer	15,618 (23.7)	2,011 (18.7)	17,106 (23.5)	2,256 (19.2)	21,826 (22.0)	2,792 (18.3)	27,386 (23.4)	3,748 (19.0)	23,653 (29.7)	4,616 (22.0)
Service branch	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
Army	30,706 (46.7)	5,476 (51.0)	34,600 (47.5)	6,019 (51.2)	41,472 (41.9)	7,284 (47.8)	51,087 (43.6)	10,058 (50.9)	34,418 (43.2)	10,560 (50.2)
Navy	11,388 (17.3)	1,975 (18.4)	12,043 (16.5)	2,068 (17.6)	16,149 (16.3)	2,627 (17.2)	18,355 (15.7)	3,362 (17.0)	12,863 (16.2)	3,680 (17.5)
Air Force	3,377 (5.13)	538 (5.0)	3,925 (5.4)	774 (6.6)	8,746 (8.8)	1,611 (10.6)	9,185 (7.9)	1,962 (9.9)	5,507 (6.9)	1,958 (9.3)
Marine Corps	19,596 (29.8)	2,636 (24.5)	21,572 (29.6)	2,759 (23.5)	30,981 (31.3)	3,426 (22.5)	36,165 (30.9)	4,044 (20.5)	25,337 (31.8)	4,509 (21.4)
Coast Guard	709 (1.1)	119 (1.1)	763 (1.1)	127 (1.1)	1,730 (1.8)	287 (1.9)	2,279 (2.0)	338 (1.7)	1,502 (1.9)	326 (1.6)
Military occupation	$p < .0001$				$p < .0001$		$p < .01$		$p = 0.405$	
Combat specialist	12,612 (19.2)	1,873 (17.4)	13,220 (18.1)	2,003 (17.1)	16,961 (17.1)	2,454 (16.1)	20,064 (17.1)	3,513 (17.8)	46,895 (58.9)	11,236 (53.4)
Healthcare specialist	6,950 (10.6)	1,270 (11.8)	8,484 (11.6)	1,502 (12.8)	11,400 (11.5)	1,959 (12.9)	13,895 (11.9)	2,460 (12.5)	22,532 (28.3)	6,757 (32.1)
Other	46,214 (70.3)	7,601 (70.8)	51,199 (70.2)	8,242 (70.2)	70,717 (71.4)	10,822 (71.0)	83,112 (71.0)	13,791 (69.8)	7,186 (9.0)	2,132 (10.1)
Service component	$p < .0001$		$p < .0001$		$p < .01$		$p < .0001$		$p < .001$	
Active Duty	37,157 (56.5)	6,425 (59.8)	37,154 (51.0)	6,286 (53.5)	59,877 (60.4)	9,001 (59.1)	68,855 (58.8)	11,302 (57.2)	39,149 (49.2)	10,054 (47.8)
Reserve/Guard	28,619 (43.5)	4,319 (40.2)	35,749 (49.0)	5,461 (46.5)	39,201 (39.6)	6,234 (40.9)	48,216 (41.2)	8,462 (42.8)	40,478 (50.8)	10,979 (52.2)
Service Status	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
Actively serving	59,706 (90.8)	9,526 (88.7)	59,760 (82.0)	9,045 (77.0)	75,234 (75.9)	10,834 (71.1)	75,811 (64.8)	11,059 (56.0)	34,270 (43.0)	7,283 (34.6)
Separated	6,070 (9.23)	1,218 (11.3)	13,143 (18.0)	2,702 (23.0)	23,844 (24.1)	4,401 (28.9)	41,260 (35.2)	8,705 (44.0)	45,357 (57.0)	13,750 (65.4)
Combat deployment experience	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
No deployment or combat	61,856 (94.0)	10,224 (95.2)	47,275 (64.9)	7,709 (65.6)	61,299 (61.9)	9,815 (64.4)	72,162 (61.6)	12,840 (65.0)	68,439 (86.0)	18,808 (89.4)
Deployed without combat	2,042 (3.1)	245 (2.3)	12,282 (16.9)	1,609 (13.7)	17,812 (18.0)	2,083 (13.7)	23,014 (19.7)	2,874 (14.5)	7,889 (9.9)	1,387 (6.6)
Deployed with combat	1,878 (2.9)	275 (2.6)	13,346 (18.3)	2,429 (20.7)	19,967 (20.2)	3,337 (21.9)	21,895 (18.7)	4,050 (20.5)	3,299 (4.1)	838 (4.0)
Behavioral and social characteristics										
Smoking status	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
Nonsmoker	37,533 (57.1)	5,740 (53.4)	41,784 (57.3)	6,203 (52.8)	57,520 (58.1)	8,240 (54.1)	68,339 (58.4)	10,461 (52.9)	46,895 (58.9)	11,236 (53.4)
Former smoker	15,730 (23.9)	2,880 (26.8)	17,514 (24.0)	3,258 (27.7)	23,662 (23.9)	4,215 (27.7)	29,961 (25.6)	5,773 (29.2)	22,755 (28.6)	6,819 (32.4)
Current smoker	11,446 (17.4)	1,924 (17.9)	12,663 (17.4)	2,144 (18.3)	16,848 (17.0)	2,611 (17.1)	15,966 (13.6)	2,988 (15.1)	7,256 (9.1)	2,151 (10.2)
Stressful life events	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
0 events	34,085 (51.8)	4,556 (42.4)	53,616 (73.5)	7,501 (63.9)	74,717 (75.4)	10,295 (67.6)	83,214 (71.1)	12,315 (62.3)	61,984 (77.8)	14,267 (67.8)
1 event	21,054 (32.0)	3,531 (32.9)	13,874 (19.0)	2,756 (23.5)	18,050 (18.2)	3,400 (22.3)	22,628 (19.3)	4,666 (23.6)	12,212 (15.3)	4,432 (21.1)
2 or more events	10,303 (15.7)	2,592 (24.1)	4,702 (6.5)	1,377 (11.7)	5,651 (5.7)	1,420 (9.3)	7,984 (6.8)	2,194 (11.1)	3,066 (3.9)	1,606 (7.6)
Lack of social support	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
No	54,743 (83.2)	6,493 (60.4)	60,352 (82.8)	7,279 (62.0)	81,047 (81.8)	9,646 (63.3)	92,380 (78.9)	11,363 (57.5)	60,533 (76.0)	10,849 (51.6)
Yes	10,679 (16.2)	4,194 (39.0)	12,187 (16.7)	4,422 (37.6)	17,590 (17.8)	5,526 (36.3)	23,864 (20.4)	8,267 (41.8)	18,412 (23.1)	10,016 (47.6)

Physical activity[a]	*		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
No	*	*	8,683 (11.9)	1,675 (14.3)	15,687 (15.8)	2,938 (19.3)	21,771 (18.6)	4,707 (23.8)	18,730 (23.5)	6,031 (28.7)
Yes	*	*	31,416 (43.1)	4,379 (37.3)	66,785 (67.4)	9,140 (60.0)	80,023 (68.4)	11,378 (57.6)	46,772 (58.7)	10,183 (48.4)
Fast food consumption[a]	*		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
None	*	*	8,032 (11.0)	845 (7.2)	18,606 (18.8)	2,084 (13.7)	23,276 (19.9)	2,697 (13.7)	19,103 (24.0)	3,434 (16.3)
Once/week	*	*	21,384 (29.3)	3,026 (25.8)	43,188 (43.6)	5,662 (37.2)	55,291 (47.2)	7,874 (39.8)	37,885 (47.6)	8,617 (41.0)
2-3 times/week	*	*	13,660 (18.7)	2,453 (20.9)	28,436 (28.7)	5,093 (33.4)	30,512 (26.1)	6,515 (33.0)	18,156 (22.8)	6,499 (30.9)
4-7 times/week	*	*	3,606 (5.0)	878 (7.5)	7,209 (7.3)	1,925 (12.6)	6,686 (5.7)	2,189 (11.1)	3,885 (4.9)	2,045 (9.7)
8-14 times/week	*	*	342 (0.5)	132 (1.1)	858 (0.9)	313 (2.1)	755 (0.6)	366 (1.9)	32 (0.5)	317 (1.5)
15+ times/week	*	*	51 (0.1)	25 (0.2)	163 (0.2)	92 (0.6)	90 (0.1)	82 (0.4)	59 (0.1)	79 (0.4)
Sexual assault	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
No	61,081 (92.9)	9,342 (87.0)	69,552 (95.4)	10,853 (92.4)	93,124 (94.0)	12,702 (83.4)	110,341 (94.3)	18,371 (93.0)	76,544 (96.1)	19,976 (95.0)
Yes	4,077 (6.2)	1,272 (11.8)	2,410 (3.3)	734 (6.3)	5,630 (5.7)	2,461 (16.2)	3,221 (2.8)	748 (3.8)	582 (0.7)	269 (1.3)
Childhood sexual abuse	*		*		*		*		$p < .0001$	
No	*	*	*	*	*	*	*	*	66,937 (84.1)	16,372 (77.8)
Yes	*	*	*	*	*	*	*	*	7,716 (9.7)	3,080 (14.6)
Prefer not to answer	*	*	*	*	*	*	*	*	2,136 (2.7)	738 (3.5)
Childhood physical abuse	*		*		*		*		$p < .0001$	
No	*	*	*	*	*	*	*	*	51,175 (64.3)	11,087 (52.7)
Yes	*	*	*	*	*	*	*	*	23,252 (29.2)	8,356 (39.7)
Prefer not to answer	*	*	*	*	*	*	*	*	2,492 (3.1)	779 (3.7)
Childhood verbal abuse	*		*		*		*		$p < .0001$	
No	*	*	*	*	*	*	*	*	57,489 (72.2)	12,440 (59.2)
Yes	*	*	*	*	*	*	*	*	17,437 (21.9)	7,157 (34.0)
Prefer not to answer	*	*	*	*	*	*	*	*	1,900 (2.4)	621 (3.0)
Childhood neglect	*		*		*		*		$p < .0001$	
No	*	*	*	*	*	*	*	*	68,483 (86.0)	16,624 (79.0)
Yes	*	*	*	*	*	*	*	*	6,804 (8.5)	2,996 (14.2)
Prefer not to answer	*	*	*	*	*	*	*	*	1,707 (2.1)	621 (3.0)
Comorbid conditions										
PTSD	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
No	62,754 (95.4)	9,130 (85.0)	68,120 (93.4)	9,699 (82.6)	93,124 (94.0)	12,702 (83.4)	106,141 (90.7)	15,069 (76.2)	71,023 (89.2)	15,196 (72.3)
Yes	1,897 (2.9)	1,372 (12.8)	3,059 (4.2)	1,791 (15.3)	5,630 (5.7)	2,461 (16.2)	10,064 (8.6)	4,512 (22.8)	7,145 (9.0)	5,341 (25.4)
Depression	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
No	64,199 (97.6)	9,605 (89.4)	70,128 (96.2)	10,290 (87.6)	95,235 (96.1)	13,318 (87.4)	111,366 (95.1)	16,803 (85.0)	74,565 (93.6)	16,828 (80.0)
Yes	1,290 (2.0	1,065 (9.9)	2,017 (2.8)	1,347 (11.5)	3,606 (3.6)	1,849 (12.1)	5,442 (4.7)	2,887 (14.6)	4,897 (6.2)	4,139 (19.7)
Anxiety disorder	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	

No	62,637 (95.2)	9,524 (88.6)	65,809 (90.3)	9,900 (84.3)	91,631 (92.5)	13,009 (85.4)	108,991 (93.1)	16,630 (84.1)	74,284 (93.3)	17,352 (82.5)
Yes	876 (1.3)	704 (6.6)	1,584 (2.2)	998 (8.5)	2,993 (3.0)	1,338 (8.8)	5,435 (4.6)	2,570 (13.0)	4,510 (5.7)	3.376 (16.1)
Problem drinking	$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$		$p < .0001$	
No	58,363 (88.7)	8,657 (80.6)	65,324 (89.6)	9,602 (81.7)	88,057 (88.9)	12,303 (80.8)	98,998 (84.6)	15,157 (76.7)	71,208 (89.4)	17,111 (81.4)
Yes	7,072 (10.8)	2,019 (18.8)	6,665 (9.1)	2,002 (17.0)	10,333 (10.4)	2,812 (18.5)	11,134 (9.5)	3,592 (18.2)	6,141 (7.7)	3,223 (15.3)

* Indicates that these items were not collected at this survey cycle

[a] Indicates that these items were not collected on the baseline surveys for Millennium Cohort Panel 1 and Panel 2 participants

SOW Major Task 6: Perform analyses on risk and protective factors for BED and OSFED in military spouses

- Subtask 1: Use logistic regression models to determine significant risk and protective factors for BED or OSFED among Family Study participants

Sample determined: The service members' spouses were initially recruited between 2011 and 2013 to complete the baseline assessment (n = 9,872) and participants were contacted again in 2014 and 2015 for the follow-up assessment (n = 6,618). For purposes of this study, we excluded spouses who were divorced or separated at baseline (n=63), paper survey responders (n=772) and those with missing outcomes at follow-up (n=238). The final analytic sample for the Exploratory Aim included 5,545 military spouses with data across the two time points.

Measures utilized: All spouse and service member measures were derived from self-reported survey data. Binge-eating was identified when the participant endorsed twice-weekly loss of control over eating and eating unusually large amounts of food. Risk and protective factors were assessed using baseline measures conceptualized as 1) individual factors - body-mass index, military status, PTSD, major depression, problem drinking, smoking, history of assault, and adverse childhood events, 2) group- and family level factors - social support, social isolation, number of children under 5, financial problems, 3) relationship factors - service member PTSD, major depression, problem drinking, and 4) military-stress factors - service member deployment, work-family conflict, military life stress. The following baseline demographics were used as covariates in our analyses: sex, race/ethnicity, age, educational attainment, and service member branch, rank, and component.

Analyses used: We used simple descriptive methods to characterize the sample at baseline. To identify factors associated with new onset binge eating disorder (BED), we regressed spouse BED at follow-up on these baseline factors, controlling for baseline BED to capture the change in BED status from baseline to follow-up.

Preliminary unweighted results: Table 3 shows the characteristics of the sample at baseline and BED bivariate analyses with P-values calculated using Pearson chi-square. To examine baseline risk and protective factors that may contribute to new onset BED, we conducted logistic regression. Preliminary results prior to weighting are shown in Table 4. We found that spouse PTSD, body mass index (overweight or obese), social isolation, former smoker status, and financial problems were significant predictors of new onset BED.

Table 3. Baseline Sample Characteristics by Probable Binge Eating Disorder

	All		Binge eating disorder				
			None		Probable		
	n	%	n	%	n	%	p-value
All	5,545	(100.0)	5,309	(95.7)	236	(4.3)	
Sex							0.63
Male	568	(10.2)	546	(96.1)	22	(3.9)	
Female	4,977	(89.8)	4,763	(95.7)	214	(4.3)	
Race/ethnicity							0.67
White, non-Hispanic	4,451	(80.3)	4,264	(95.8)	187	(4.2)	
Minorities	1,069	(19.3)	1,021	(95.5)	48	(4.5)	
Age							0.23
17 to 24 years old	1,100	(19.8)	1,043	(94.8)	57	(5.2)	
25 to 34 years old	3,740	(67.4)	3,587	(95.9)	153	(4.1)	
35 to 44 years old	561	(10.1)	538	(95.9)	23	(4.1)	
45 years and older	144	(2.6)	141	(97.9)	3	(2.1)	
Educational attainment							0.0003
High school or less	521	(9.4)	498	(95.6)	23	(4.4)	
Some college or associates degree	2,287	(41.2)	2,161	(94.5)	126	(5.5)	
Bachelor's degree or higher	2,732	(49.3)	2,645	(96.8)	87	(3.2)	
Body mass index							<.0001
Underweight	152	(2.7)	149	(98.0)	3	(2.0)	
Normal or Healthy Weight	2,758	(49.7)	2,703	(98.0)	55	(2.0)	
Overweight	1,470	(26.5)	1,394	(94.8)	76	(5.2)	

	All		Binge eating disorder				
			None		Probable		
	n	%	n	%	n	%	p-value
Above Obese	1,115	(20.1)	1,017	(91.2)	98	(8.8)	
Spouse Military Status							0.27
Civilian	4,676	(84.3)	4,473	(95.7)	203	(4.3)	
Veteran	417	(7.5)	398	(95.4)	19	(4.6)	
Dual Military	437	(7.9)	425	(97.3)	12	(2.7)	
SP PTSD							<.0001
No	5,132	(92.6)	4,941	(96.3)	191	(3.7)	
Yes	365	(6.6)	322	(88.2)	43	(11.8)	
SP Major depression							<.0001
No	5,254	(94.8)	5,049	(96.1)	205	(3.9)	
Yes	245	(4.4)	218	(89.0)	27	(11.0)	
SP Problem drinking							0.0001
No	5,123	(92.4)	4,921	(96.1)	202	(3.9)	
Yes	384	(6.9)	353	(91.9)	31	(8.1)	
History of assault							0.1
None	4,385	(79.1)	4,211	(96.0)	174	(4.0)	
Sexual assault only	379	(6.8)	357	(94.2)	22	(5.8)	
Sexual harassment only	256	(4.6)	248	(96.9)	8	(3.1)	
Violent assault only	82	(1.5)	76	(92.7)	6	(7.3)	
Combination of two or more	405	(7.3)	382	(94.3)	23	(5.7)	

	All		Binge eating disorder				
			None		Probable		
	n	%	n	%	n	%	p-value
Adverse Childhood Events							<.0001
No experiences	2,687	(48.5)	2,609	(97.1)	78	(2.9)	
1 experience	1,176	(21.2)	1,122	(95.4)	54	(4.6)	
2 or more experiences	1,642	(29.6)	1,540	(93.8)	102	(6.2)	
Smoking							<.0001
Non smoker	4,056	(73.1)	3,922	(96.7)	134	(3.3)	
Former smoker	680	(12.3)	636	(93.5)	44	(6.5)	
Current smoker	765	(13.8)	709	(92.7)	56	(7.3)	
High social support							<.0001
No	1,180	(21.3)	1,089	(92.3)	91	(7.7)	
Yes	4,323	(78.0)	4,180	(96.7)	143	(3.3)	
Social isolation							<.0001
No	4,061	(73.2)	3,942	(97.1)	119	(2.9)	
Yes	1,418	(25.6)	1,306	(92.1)	112	(7.9)	
Number of children under age 5							0.41
No children	2,658	(47.9)	2,551	(96.0)	107	(4.0)	
One child	1,760	(31.7)	1,687	(95.9)	73	(4.1)	
Two or more children	1,127	(20.3)	1,071	(95.0)	56	(5.0)	
Work Family Conflict							0.006
Low WFC	4,647	(83.8)	4,464	(96.1)	183	(3.9)	

	All		Binge eating disorder				
			None		Probable		
	n	%	n	%	n	%	p-value
High WFC	851	(15.3)	800	(94.0)	51	(6.0)	
Bothered by financial problems							<.0001
Not bothered	2,777	(50.1)	2,717	(97.8)	60	(2.2)	
Bothered a little or a lot	2,710	(48.9)	2,537	(93.6)	173	(6.4)	
Military life stress factors							0.0002
Never experienced or not stressful	2,433	(43.9)	2,358	(96.9)	75	(3.1)	
Slightly, moderately, or very stressful	3,031	(54.7)	2,876	(94.9)	155	(5.1)	
SM with combat deployment							0.18
No deployment	4,039	(72.8)	3,858	(95.5)	181	(4.5)	
Deployed without combat exposures	651	(11.7)	632	(97.1)	19	(2.9)	
Deployed with combat exposures	755	(13.6)	724	(95.9)	31	(4.1)	
SM PTSD							0.06
No	5,051	(91.1)	4,844	(95.9)	207	(4.1)	
Yes	433	(7.8)	407	(94.0)	26	(6.0)	
SM Major depression							0.87
No	5,293	(95.5)	5,069	(95.8)	224	(4.2)	
Yes	224	(4.0)	214	(95.5)	10	(4.5)	
SM Problem drinking							0.03
No	4,907	(88.5)	4,710	(96.0)	197	(4.0)	
Yes	472	(8.5)	443	(93.9)	29	(6.1)	

	All		Binge eating disorder				
			None		Probable		
	n	%	n	%	n	%	p-value
Rank							0.0005
Enlisted	3,848	(69.4)	3,660	(95.1)	188	(4.9)	
Warrant or Commissioned Officer	1,697	(30.6)	1,649	(97.2)	48	(2.8)	
Branch							0.07
Army	2,534	(45.7)	2,419	(95.5)	115	(4.5)	
Navy and Coast Guard	974	(17.6)	925	(95.0)	49	(5.0)	
Marine Corps	529	(9.5)	504	(95.3)	25	(4.7)	
Air Force	1,508	(27.2)	1,461	(96.9)	47	(3.1)	
Component							0.26
Reserve/Guard	1,222	(22.0)	1,163	(95.2)	59	(4.8)	
Regular Active	4,323	(78.0)	4,146	(95.9)	177	(4.1)	

Note. Frequencies and percentages presented are unweighted and may not sum to N =5,545 due to missing data. P-values were calculated using Pearson chi-square. Sp = item related to the spouse; SM = item related to the service member

Table 4. Logistic Regression Predicting Probable Binge Eating Disorder at Time 2

		95% CI	
Variable	OR	LLCI	ULCI
Sex			
Men	–	–	–
Women	1.03	0.51	2.13
Race/Ethnicity			
Person of color	–	–	–
White	0.97	0.63	1.51
Age			
17-24 years	–	–	–
25-34 years	0.91	0.59	1.41
35-44 years	0.61	0.30	1.24
Greater than 44 years	0.19	0.02	1.43
Educational Attainment			
High school diploma or less	–	–	–
Some college or Associate's degree	1.26	0.70	2.26
Bachelor's degree or higher	1.16	0.61	2.23
Body Mass Index			
Healthy	–	–	–
Underweight	0.68	0.16	2.88
Overweight	2.56***	1.66	3.94
Obese	2.82***	1.79	4.44
Military Status			
No military experience	–	–	–
Veteran	0.88	0.46	1.70
Dual-military	0.51	0.19	1.38
Posttraumatic Stress			
No	–	–	–
Yes	2.18**	1.23	3.86
Major Depression			
No	–	–	–
Yes	0.81	0.40	1.64
Problematic Drinking			
No	–	–	–

Yes	1.26	0.72	2.21
History of Assault			
None	–	–	–
Sexual assault only	0.98	0.53	1.79
Sexual harassment only	0.85	0.36	2.03
Violent assault only	1.10	0.40	3.02
More than one	0.67	0.36	1.26
Adverse Childhood Experiences			
None	–	–	–
One experience	1.46	0.92	2.32
Two or more experiences	1.43	0.92	2.21
Smoking			
Non-smoker	–	–	–
Former smoker	1.72*	1.06	2.78
Current smoker	1.33	0.84	2.12
High Social Support			
No	–	–	–
Yes	0.82	0.54	1.23
Social Isolation			
No	–	–	–
Yes	1.62*	1.07	2.46
Number of Children Under Five			
None	–	–	–
One	1.12	0.75	1.67
Two or more	1.19	0.75	1.87
Work-Family Conflict			
Low work-family conflict	–	–	–
High work-family conflict	1.04	0.67	1.62
Bothered by Financial Problems			
No	–	–	–
Yes	1.80**	1.18	2.77
Military-Life Stress			
No	–	–	–
Yes	1.42	0.95	2.12
SM Combat Deployment			
No deployment	–	–	–
Deployed without combat exposure	0.55	0.27	1.11
Deployed with combat exposure	1.19	0.73	1.95

SM Posttraumatic Stress			
No	–	–	–
Yes	1.08	0.57	2.03
SM Major Depression			
No	–	–	–
Yes	0.55	0.21	1.46
SM Problematic Drinking			
No	–	–	–
Yes	1.48	0.88	2.50
SM Rank			
Enlisted	–	–	–
Officer	1.03	0.62	1.71
SM Branch			
Army	–	–	–
Navy or Coast Guard	1.52	0.94	2.47
Marine Corps	0.96	0.50	1.83
Air Force	1.11	0.69	1.78
SM Component			
Reserve or National Guard	–	–	–
Active-duty	0.79	0.52	1.21

Note. The first variable of each category serves as the reference group. OR = Odds ratio. CI = Confidence interval. LLCI = Lower level confidence interval. ULCI = Upper level confidence interval. SM = Service member.

*$p < .05$ **$p < .01$ ***$p < .001$

What opportunities for training and professional development has the project provided?

Nothing to Report (not a goal of this study).

How were the results disseminated to communities of interest?

Nothing to Report (not yet at dissemination phase).

What do you plan to do during the next reporting period to accomplish the goals?

In the next reporting period, as stated in the SOW, we plan to complete major tasks 3, 4, and 6.

For major task 3 we will conduct analyses to determine prevalence and risk factors for BN, BED, and OSFED. We already completed subtask 1, which was to calculate the prevalence of BN, BED, and OSFED at each survey time point. This upcoming reporting period we will focus on subtask 2, which is to run complementary log-log models to determine significant risk and protective factors for the development and recurrence of ED. Upon completion of these subtasks we will have accomplished our first research aim.

In order to accomplish major task 4 we will conduct analyses to determine relationship between eating disorders and comorbid conditions. Subtask 1 will be to use non-linear mixed models to estimate prevalence of BN, BED, and OFSED conditional on the presence of comorbid conditions. Subtask 2 will be to use complementary log-log models to determine whether unique temporal patterns exist between the development of BN, BED, or OFSED and comorbid conditions. Upon completion of major task 4, we will reach the milestone of completing analyses for research aim 2.

Finally, for major task 6 we will perform analyses on risk and protective factors for BED and OSFED in military spouses. Subtask 1 will be to use logistic regression models to determine significant risk and protective factors for BED or OFSED among Family Study participants. Upon completion of this task we will reach the milestone of completing the analyses for our exploratory aim.

4. **IMPACT:**

What was the impact on the development of the principal discipline(s) of the project?

Nothing to report.

What was the impact on other disciplines?

Nothing to report.

What was the impact on technology transfer?

Nothing to report.

What was the impact on society beyond science and technology?

Nothing to report.

5. CHANGES/PROBLEMS:

Changes in approach and reasons for change

We did not encounter any problems thus far and all goals have been met on time. The team is in the process of adding one additional piece in order to strengthen our analysis, which is to weight our prevalence estimates for eating disorders back to some of the key characteristics (e.g. sex, age) of the active duty sample that was serving at the midpoint of each survey cycle.

Actual or anticipated problems or delays and actions or plans to resolve them

We did not encounter any problems thus far and all goals have been met on time.

Changes that had a significant impact on expenditures

Nothing to Report.

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Significant changes in use or care of human subjects

Nothing to Report.

Significant changes in use or care of vertebrate animals

Nothing to Report.

Significant changes in use of biohazards and/or select agents

Nothing to Report.

6. PRODUCTS:

- **Publications, conference papers, and presentations**
  Journal publications.

Nothing to report.

Books or other non-periodical, one-time publications.

Nothing to report.

Other publications, conference papers and presentations.

Nothing to report.

- **Website(s) or other Internet site(s)**

Nothing to report.

- **Technologies or techniques**

Nothing to report.

- **Inventions, patent applications, and/or licenses**

Nothing to report.

- **Other Products**

Nothing to report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Name: Shira Maguen

Project Role: Principal Investigator, San Francisco VAMC

Nearest person month worked: 1.8

Contribution to Project: Dr. Maguen has provided coordination, oversight, and management of all tasks outlined in the research plan, working closely with her co-investigators.

Name: Rudy Rull

Project Role: Principal Investigator of the Millennium Cohort Study, Naval Health Research Center

Nearest person month worked: 1.8

Contribution to Project: As PI of the Millennium Cohort Study, Dr. Rull is responsible implementation and compliance, ensuring that all NHRC personnel are properly trained and qualified, data interpretation, and the publication and dissemination of study findings

Name: Isabel Jacobson

Project Role: Co-Investigator

Nearest person month worked: 3.6

Contribution to Project: Ms. Jacobson is responsible for assisting with the design of the study, data interpretation, and scientific manuscript preparation, as well as assisting with the statistical analyses.

Name: Hope McMaster

Project Role: Co-Investigator

Nearest person month worked: 1.8

Contribution to Project: Dr. McMaster is responsible for overseeing the execution of the exploratory aim for this project, consisting of evaluating risk factors for the development of binge eating disorders in military spouses. In addition, she will be integral in drafting the manuscript related to the Family Study exploratory aim.

Name: Travis Ray

Project Role: Data Analyst

Nearest person month worked: 3

Contribution to Project: Mr. Ray provides analytic and writing support.

Name: Ben Porter

Project Role: Co-Investigator

Nearest person month worked: 1.8

Contribution to Project: Dr. Porter is responsible for overseeing the conduct of the statistical analyses for the project.

Name: Toni Rose Geronimo-Hara

Project Role: Data Analyst

Nearest person month worked: 6

Contribution to Project: Ms. Geronimo-Hara provides statistical and analytical support, assists in processing and maintenance of research databases; and will assist in writing of reports and scientific manuscripts for peer-reviewed professional journals and presentations.

Name: Alex Esquivel

Project Role: Data Analyst

Nearest person month worked: 4.2

Contribution to Project: Mr. Esquivel provides statistical and analytical support, assists in processing and maintenance of research databases; and assists in writing of reports and scientific manuscripts for peer-reviewed professional journals and presentations.

Name: Gia Gumbs

Project Role: Data Analyst/Study Coordinator

Nearest person month worked: 3

Contribution to Project: Ms. Gumbs is responsible for assisting with coordinating data management. In addition, she is responsible for arranging meetings, teleconferences, and other communication necessary for the project. She also assists with filing of documents and other files related to manuscript planning, writing, and submission.

Name: Haley Mehlman

Project Role: Study Coordinator

Nearest person month worked: 6

Contribution to Project: Ms. Mehlman is responsible for multiple administrative aspects of the project. She is responsible for arranging meetings, teleconferences, and other communication necessary for the project. She also assists with maintaining the IRB, assisting with reports, and tracking important project deadlines.

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Ben Porter transitioned off the study on January 15, 2021. We identified a replacement, Dr. Neika Sharifian, who will contribute time to the project during the next reporting period.

What other organizations were involved as partners?

Nothing to report.

8. SPECIAL REPORTING REQUIREMENTS

COLLABORATIVE AWARDS:

QUAD CHARTS:

9. APPENDICES: