



# Biological, psychological, social, and spiritual health of active duty women: An exploratory study

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## ABSTRACT

**Introduction:** Women make up more than 16% of the active duty military force in the United States; however, research that focuses solely on the health of these military members is very limited. The purpose of this study was to explore the ways in which biopsychosocial-spiritual (BPSS) domains of health influence active duty women and how these domains interact with one another to strengthen or challenge these women's health. **Methods:** Data were collected through self-report questionnaires that assessed participants' demographics, biological health, psychological health, physical and psychological trauma history, social support, sexual harassment, and spirituality. Participants were 76 active duty women with an average of 9.11 (SD = 6.27) years of service in the U.S. military. **Results:** Reports of sexual harassment were positively related to active duty women's waist circumference and reported pain level. A high level of intrinsic religious beliefs served as a protective factor between increased deployments and increased waist circumference. In addition, the more traumatic events women experienced, the more they were involved in organized and non-organized religious activities. **Discussion:** Experiences of sexual harassment, support from a significant other, and reports of feeling sexually coerced by supervisors or co-workers had moderating effects on length of time in the service and body mass index scores. This study highlights the unique challenges of women in the military in relation to BPSS factors and argues for the importance of developing BPSS-informed research designs and clinical practice.

**Key words:** active duty, biopsychosocial health, female, military, sexual harassment, spirituality, U.S.

## RÉSUMÉ

**Introduction :** Les femmes représentent plus de 16 % des forces militaires actives aux États-Unis, mais les recherches axées uniquement sur la santé de ces membres des forces armées sont très limitées. La présente étude visait à explorer l'influence des domaines biopsychosociaux et spirituels (BPSS) de la santé sur les femmes en service actif et l'interaction de ces domaines les uns avec les autres pour renforcer ou compromettre leur santé. **Méthodologie :** Les chercheurs ont colligé les données de questionnaires autodéclarés pour évaluer les caractéristiques démographiques, la santé biologique, la santé psychologique, les antécédents de traumatismes physiques et psychologiques, le soutien social, le harcèlement sexuel et la spiritualité des participantes. Ces participantes étaient 76 femmes en service actif dans les forces armées américaines depuis une moyenne de 9,11 ans (ÉT = 6,27). **Résultats :** Les déclarations de harcèlement sexuel étaient liées positivement au tour de taille des femmes en service actif et au taux de douleur déclaré. Les forts taux de croyances religieuses intrinsèques ont servi de facteur protecteur entre l'accroissement des déploiements et le tour de taille accru. Par ailleurs, plus les femmes vivaient des événements traumatiques, plus elles participaient à des activités religieuses organisées et non organisées. **Discussion :** Les expériences de harcèlement sexuel, le soutien d'un proche et le sentiment d'avoir été contraintes à avoir des relations sexuelles avec des superviseurs ou des collègues avaient des effets modérateurs sur la durée du service militaire et les indices de masse corporelle. La présente étude fait ressortir les difficultés particulières des femmes des forces armées à l'égard des facteurs de BPSS et souligne l'importance de mettre au point des méthodologies de recherche reposant sur les BPSS et la pratique clinique.

**Mots-clés :** États-Unis, harcèlement sexuel, militaire, santé biopsychosociale, service actif, sexe féminin, spiritualité

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## LAY SUMMARY

This study explored the physical, psychological, social, and spiritual health of active duty women, including how each of these dimensions of health is related to one another. In particular, this study addresses active duty women's health and experiences associated with trauma, sexual harassment, deployment, and physical health outcomes. A total of 76 active duty women completed a survey consisting of questions about demographics, physical health, psychological health, physical and psychological trauma history, social support, history of sexual harassment, and spirituality. Results showed that women with larger waist circumference had more physical pain and previous experiences with sexual harassment. Also, women who experienced more traumatic events in their lifetime were more involved in organized and non-organized religion or spiritual activities. Being in the military influences every service member's health; however, more attention is needed to understanding the ways in which biopsychosocial-spiritual assessments and treatment can be created and adopted by medical, mental health, social service, and spiritual health providers.

## INTRODUCTION

Women make up more than 16% of the active duty (AD) military force in the United States, and this number continues to increase.<sup>1</sup> Even though more women are serving in the military, research that focuses solely on their biological, psychological, social, and spiritual (BPSS) health is limited.<sup>2-4</sup> The BPSS framework recognizes BPSS health as dimensions that are distinct but that cannot be disaggregated. Thus, each BPSS dimension interacts with, and affects, each person differently.<sup>3,4</sup> Although some research exists on elements of AD women's health in relation to mission readiness,<sup>5</sup> most of what has been published has pertained to gynecological issues or reproductive health, intimate partner violence, harassment, disordered eating, and postpartum depression,<sup>2</sup> with a lack of recognition of the complex interactions of BPSS health.

AD women deserve to have their health considered in a more systemic nature. After all, the death rate for women is higher than that for men who deployed in Operation Enduring Freedom (35.9% and 17.0%, respectively) and Operation Iraqi Freedom (14.5% and 12.0%, respectively).<sup>6</sup> Deployment refers to any movement of armed forces from a military member's home station to somewhere outside the continental United States and its territories.<sup>7</sup> Attention to AD women's health is more salient now than ever. As women occupy more dangerous jobs and fulfil more complex missions, their BPSS health is influenced, as is retention for a longer career in the military.<sup>8,9</sup>

To address the gaps in research, this study aimed to: 1) provide a history of the literature that focuses on the BPSS of AD women, 2) share the study's design and results in relation to the BPSS health of AD women, and 3) extend a series of recommendations for providers and researchers on how to better meet the unique health needs of AD women on the basis of the outcomes of this study.

## BPSS health of AD women

The 1994 Direct Combat Exclusion Rule in the United States that once prohibited women from holding certain jobs (such as ground combat) was lifted in 2013, placing women in more complex and potentially dangerous positions.<sup>8</sup> Compared with other developed countries, including Israel (1985), Denmark (1988), and Canada (1989), the United States was relatively late to make this change. Although this policy has afforded women new opportunities, integrating into these new positions has resulted in changes in their BPSS health.

When considering the biological health of AD women, most researchers have simplified their health to issues pertaining to reproductive and sexual health experiences and how they impede mission readiness.<sup>2</sup> Other physical health concerns, such as musculoskeletal issues, traumatic brain injury (TBI), and osteoarthritis,<sup>10</sup> are commonly occur among AD men but have been given less attention among AD women. The intention of this article is not to diminish research on reproductive or sexual health but to amplify how BPSS health factors interface with one another and to capture a systemic perspective of women's experiences.

Past researchers have found that physical health factors influence AD women's psychological health, social roles as parent and partner, and relationships with other military members.<sup>11</sup> Researchers have predominantly focused on AD women's psychological health by looking at eating disorders and postpartum depression.<sup>2</sup> However, posttraumatic stress exacerbated by military sexual trauma has also received attention in recent research.<sup>12</sup> As for social relationships, whereas relational research for AD women historically centres on sexual partners or intimate partner violence,<sup>13</sup> little attention has been paid to the roles of healthy relationships or to considering AD service. This is particularly important, given that many AD women are in dual military marriages (i.e., both partners are AD), and one study found

that dual military women are likely to deploy more often than their non-dual military counterparts.<sup>14</sup>

Spiritual health has seldom been the focus of military research, and to date only a few studies have investigated the role of spirituality (as a health dimension in relation to biological, social, and spiritual health) of AD women.<sup>15,16</sup> One team of researchers found that spirituality played an important role in the relationship among deployment stress, depression, and anxiety for military members;<sup>15</sup> AD women made up 11.6% of the sample.

## Hypotheses

For this exploratory study, hypotheses included several relationships between the BPSS domains and military traits (e.g., number of deployments and length of time in service): 1) psychological health, social health, and spiritual health variables would act as mediators between number of deployments and biological health variables, 2) social support would act as a moderator between number of deployments and biological health variables, 3) spiritual health variables would act as a moderator between number of deployments and biological health variables, 4) psychological health variables would act as a mediator between length of service and biological health variables, 5) social support variables would act as moderators between length of service and biological health variables, and, last, 6) spiritual health variables would act as moderators between length of service and biological health variables.

## METHODS

To address the aims of this exploratory study, a cross-sectional, descriptive research design was used. An electronic self-report survey was disseminated through Qualtrics Survey Software (Qualtrics, Seattle, Washington), a web-based platform for creating and distributing surveys, to capture information from AD women from military bases all over the world.

## Participants

The inclusion criteria for this study were as follows: AD women who: 1) identified as female, 2) had AD status in the U.S. military at the time of the study, and 3) had access to the Internet. Women of all ranks were eligible to participate in this study; therefore, rank was the only variable controlled for in all analyses.

## Measures

The measures used in this study were selected to explore the BPSS health of AD women. Data were collected

through self-report questionnaires from 76 AD women. The measures included in this study assessed demographics, physical health (i.e., height and weight along with sex to determine a calculated body mass index [BMI], waist circumference [WC], pregnancies [i.e., number of live births, miscarriages, stillbirths, and abortions], list of current medical diagnoses), psychological health (i.e., the Alcohol Use Disorders Identification Test,<sup>17</sup> Generalized Anxiety Disorder-7,<sup>18</sup> Patient Health Questionnaire-9,<sup>19</sup> Primary Care-PTSD<sup>20</sup>), trauma history (i.e., Trauma Events Questionnaire<sup>21</sup>), social support (i.e., Multidimensional Scale of Perceived Social Support,<sup>22</sup> which consists of three subscales measuring support from a significant other, friends, and family), sexual harassment (i.e., Sexual Experiences Questionnaire-Department of Defense-s,<sup>23</sup> which consists of an overall summary score for sexual harassment, as well as four subscales measuring sexist hostility, sexual hostility, unwanted sexual attention, and sexual coercion), and religious and spiritual experiences (i.e., Duke University Religion Index,<sup>24</sup> which consists of three subscales — religious involvement, organizational activities, such as attending religious gatherings or private or non-organizational activities, such as prayer, and intrinsic religiosity (IR), which measures personal religious commitment). These measures have previously been used with military populations or were identified through previously published systematic reviews focused on AD women.<sup>2</sup> See [Table 1](#) for all measures and corresponding psychometrics.

## Procedure

The study was approved by the East Carolina University Institutional Review Board (15-001638) to ensure ethical research involving human subjects. AD women from different ranks and duty locations were recruited via social media sites, snowball sampling, professional resources (i.e., the Alliance of Military and Veteran Family Behavioral Health Providers), and relationships formed on military bases across the nation. Reminder emails were sent during the data collection window (nearly three months). De-identified data from the completed surveys were transferred from Qualtrics to IBM SPSS version 22 (IBM Corporation, Armonk, New York), and files were kept on a password-protected computer.

## Analyses

Descriptive statistics were run to capture the frequencies, means, and standard deviations from responses to the demographic questions (see [Table 2](#)).

**Table 1.** Psychosocial-spiritual assessments implemented, construct measured, historical use with military, and psychometrics

Assessment	Measure	Cited literature on use with military	Reliability or validity
Psychological health			
PHQ-9 <sup>19</sup>	Depression severity	25	Cronbach's $\alpha = 0.84$
GAD-7 <sup>18</sup>	Generalized anxiety disorder severity	26	Test-retest reliability $r = 0.85$
PC-PTSD <sup>20</sup>	Posttraumatic symptoms in a primary care setting	27,28	Sensitivity rate = 0.78, specificity rate = 0.87
AUDIT <sup>17</sup>	Alcohol use	29	Cronbach's $\alpha = 0.81$
TEQ <sup>21</sup>	Traumatic events	30	Not available for military populations
Social health			
SEQ-DoD-s <sup>23</sup>	Work-related sexual harassment	31	Cronbach's $\alpha = 0.92$
MSPSS <sup>22</sup>	Social support from family, friends, and significant others	32	Cronbach's $\alpha = 0.93$
Spiritual health			
DUREL <sup>24</sup>	Spirituality/religious involvement	33	Cronbach's $\alpha = 0.78-0.91$

PHQ-9 = Patient Health Questionnaire-9, GAD-7 = Generalized Anxiety Disorder-7, PC-PTSD = Primary Care-PTSD, AUDIT = Alcohol Use Disorders Identification Test, TEQ = Traumatic Events Questionnaire, SEQ-DoD-s = Sexual Experiences Questionnaire-Department of Defense-s, MSPSS = Multidimensional Scale of Perceived Social Support, DUREL = Duke University Religion Index.

The researchers examined the data for outliers (three standard deviations from the mean) for continuous and scaled variables, but no responses met the criteria or were removed from analysis. Next, Pearson correlations were used to explore the relationships within and between BPSS domains (see Table 3). Then, to better understand the relationships among BPSS domains (i.e., biological factors and psychological factors, psychological factors and spiritual factors) and military factors (e.g., number of deployments and length of time in the service), a series

of regression analyses were used to examine hypotheses 1-6. The SPSS PROCESS macro was used for the moderation and mediation analyses.<sup>34</sup> PROCESS uses an ordinary least squares or logistic-regression-based path analysis to estimate mediator and moderator models.<sup>34</sup>

Initially, the authors tested whether the psychological variables (see Table 1) mediated the relationship between the number of deployments and women's biological health variables (i.e., BMI, WC, level of current pain, number of medical diagnoses, and number of times medical treatment was sought in the past year). Then, the authors examined whether participants' psychological variables mediated the relationship between length of time in the service and biological health variables. Rank was controlled for in all analyses. No significant mediating relationships were found for these variables.

Finally, a series of models were run to examine whether the social (see Table 1) and spiritual (i.e., non-organized religious activities [NORA], organized religious activities, and IR) variables moderated their relationships with deployment, as well as length of time in service and biological health.

## RESULTS

A total of 76 AD women participated in this study. More than one-quarter of the sample (28.9%) identified as non-white, lower than the percentage of women who identify as a racial minority in the U.S. military (45.0%). The average length of time in the military was 9.11 (SD = 6.27) years, which is more than the average number of years for enlisted personnel in the military (i.e., 6.7 y, including men and women) and slightly less than for officers (i.e., 11 y, including men and women).<sup>35</sup> Four U.S. service branches and a reserve component were represented in the sample: air force (57.9%, compared with 30.2% of all U.S. AD women),<sup>36</sup> army (22.5%, compared with 32.8% of all U.S. AD women), Marine Corps (7.9%, compared with 7.4% of all U.S. AD women), navy (6.6%, compared with 29.7% of all U.S. AD women), and activated navy reserves (1.3%). Also, 44.3% of the participants were officers (women make up 18.0% of all U.S. AD officers) and 43.4% were in dual military relationships (i.e., both partners were in the military; overall, 44.6% of U.S. AD women are in dual military marriages).<sup>36</sup> In this sample, 12.8% of participants reported being single, never married, 61.8% were married or in a civil union, 5.3% were cohabitating with a partner, and 15.8% were divorced. More than 33% of participants had experienced at least

**Table 2.** Demographic information for active duty women (N = 76)

Indicators	n (%) <sup>*</sup>
Age, mean (SD)	30.25 (6.62)
Time in the service (y), mean (SD)	9.11 (6.27)
Race	
Non-Hispanic white	54 (71.1)
African American or Black	7 (9.2)
Biracial	7 (9.2)
Asian or Asian American	4 (5.3)
Hispanic or Latino	3 (3.9)
Hawaiian or other Pacific Islander	1 (1.3)
Education	
GED/HS diploma	5 (6.6)
Some college	29 (38.2)
College graduate	20 (26.3)
Graduate school	22 (28.9)
Religious affiliation	
Protestant	25 (33.3)
Catholic	15 (20.0)
Agnostic	9 (11.8)
Atheist	8 (10.5)
Mormon	1 (1.3)
Buddhist	1 (1.3)
Don't know	5 (6.7)
Other	12 (16)
Sexual orientation	
Heterosexual	64 (84.2)
Gay or lesbian	3 (3.9)
Bisexual	4 (5.3)
Asexual	1 (1.3)
Other	4 (5.3)
Relationship status	
Single, never married	9 (12.8)
Married or civil union	47 (61.8)
Cohabiting with partner	4 (5.3)
Divorced	12 (15.8)
Dual military	33 (43.4)
Service branch	
Air force	44 (57.9)
Army	17 (22.5)
Marine Corps	6 (7.9)
Navy	5 (6.6)

(Continued)

**Table 2.** (Continued)

Indicators	n (%) <sup>*</sup>
Activated navy reserves	1 (1.3)
Unknown	3 (3.9)
Rank	
Enlisted	40 (52.6)
Officer	33 (44.3)
Unknown	3 (3.9)
Deployment experience	
Combat	24 (33.3)
Non-combat	23 (30.3)
Never deployed	36 (47.4)

Note: For deployment experience, combat and non-combat frequencies may contain duplicates because participants could select more than one option.

\* Unless otherwise indicated.

GED/HS = General Educational Development/high school.

one combat-related deployment, and 30.3% had experienced at least one non-combat-related deployment; 47.4% of participants had never deployed. The deployment variable used in this article refers to the total number of deployments participants experienced. See [Table 2](#) for additional demographic information.

Generally, this sample was relatively healthy when each health variable is considered in isolation from all other variables. Regarding BMI and WC, these variables of biological health were less than the cut-off scores for overweight as determined by U.S. military fitness standards. The sample reported low levels of physical pain and few mental and physical health diagnoses. The mean scores for anxiety indicated less than mild anxiety, and the average scores for depression indicated mild levels of depressive symptoms. Moreover, the sample reported high levels of social support from friends, family, and significant others.

The previous paragraph must be considered in the context of other important and more concerning findings, particularly because variables are in the context of other health dynamics. Pearson correlations were run to explore the relationships between BPSS health variables. Several significant positive relationships emerged from the findings. Of concern was the significant relationship between participants' posttraumatic stress disorder (PTSD) responses and experiences with sexual hostility ( $r = 0.65, p < 0.01$ ) and sexist hostility ( $r = 0.55, p < 0.01$ ). Also concerning were the relationships between physical pain and symptoms of psychological depression ( $r = 0.40, p < 0.01$ ) (See [Table 3](#) for all correlations).

**Table 3.** Bivariate correlations for systemic variables of active duty women

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1. WC	—																		
2. MH Dx	-0.06	—																	
3. Med Tx	-0.08	0.21	—																
4. Pain	-0.02	0.18	0.21	—															
5. BMI	0.06†	0.16	0.00	0.06	—														
6. GAD	-0.01	0.36*	0.36†	0.27	-0.05	—													
7. TEQ	-0.15	0.00	0.52†	0.05	0.05	0.38*	—												
8. IR	0.04	-0.40	0.04	0.13	-0.06	-0.08	0.03	—											
9. ORA	0.05	-0.33	-0.06	0.07	-0.04	-0.02	-0.05	0.81†	—										
10. NORA	0.08	-0.16	0.09	-0.05	0.11	0.29	0.32*	0.66†	0.68†	—									
11. FAM	-0.13	-0.25	-0.02	-0.13	0.16	-0.18	0.18	0.27	0.38*	0.30	—								
12. PHQ	-0.02	0.41†	0.31*	0.40†	0.15	0.71†	0.29	-0.14	-0.13	0.07	-0.22	—							
13. SEQ	0.45†	0.28	0.17	0.62†	0.30	0.42†	0.23	-0.15	-0.06	-0.07	-0.15	0.55†	—						
14. COER	0.13	0.49†	0.25	0.38*	0.01	0.42†	0.11	-0.08	0.02	0.04	-0.02	0.40†	0.62†	—					
15. UNWAN	0.41*	0.02	0.19	0.25	0.08	0.08	0.45†	-0.21	-0.12	-0.06	-0.14	0.23	0.59†	0.28	—				
16. HOST	0.46†	0.31	0.16	0.59*	0.35*	0.46†	0.14	-0.06	0.06	-0.01	-0.06	0.54†	0.91†	0.64†	0.38*	—			
17. SEXIST	0.30	0.23	0.13	0.64†	0.23	0.39†	0.14	-0.07	-0.06	-0.10	-0.13	0.53†	0.92†	0.48†	0.37*	0.77†	—		
18. PTSD	0.01	0.47†	0.13	0.40†	0.19	0.57†	0.29	-0.13	-0.07	0.13	-0.20	0.59†	0.68†	0.54†	0.51†	0.65†	0.55†	—	

\* $p < 0.05$ . † $p < 0.01$ .

WC = waist circumference; MH Dx = mental health diagnoses; Med Tx = sought medical treatment; Pain = pain level; BMI = body mass index; GAD = Generalized Anxiety Disorder Scale; TEQ = Traumatic Events Questionnaire; IR = intrinsic religiosity; ORA = organized religious activities; NORA = non-organized religious activities; FAM = family support; PHQ = Patient Health Questionnaire; SEQ = Sexual Experiences Questionnaire; COER = sexual coercion; UNWAN = unwanted sexual attention; HOST = sexual hostility; SEXIST = sexist hostility; PTSD = Primary Care-PTSD.

### Moderation models with deployment

In the first model, IR (i.e., inner self is defined by religion) was tested as a moderating variable between number of deployments and WC. In the first step of the regression, participants' deployments were found to significantly predict WC,  $F_{4,32} = 2.66, p = 0.050$ . In this model, 25% of the variance in participants' WC was explained by the predictors (i.e., deployments and IR). The main effect for deployments significantly predicted participants' WC,  $b = 1.36, t_{32} = 0.45, p = .005$ , and the interaction coefficient was also significant and explained a 14% increase in variance in WC,  $b = -0.12, t_{32} = 0.05, p = 0.020$ . Conditional effects revealed that low levels of IR had a significant, positive relationship between WC and deployments,  $b = 0.78, t_{32} = 3.22, p = 0.002$ . For mean and high levels of IR, no significant moderation effects were found. Thus, high levels of IR served as a protective factor between increased deployments and increased WC.

In the next model, support from a significant other was tested as a moderator between deployments and participants' WC. In the first step of the regression, participants' number of deployments significantly predicted WC,  $F_{4,32} = 3.24, p = 0.020$ . In this model, 28% of the variance in participants' WC was explained by the predictors (i.e., deployments and support from a significant other). The main effect for deployments significantly predicted WC,  $b = 1.69, t_{32} = 0.54, p = 0.004$ , and the interaction coefficient was also significant and accounted for an additional 16% of variance,  $b = -0.24, t_{32} = 0.54, p = 0.004$ . The conditional effects were examined; for low levels of support, there was a significant, positive relationship between WC and deployments,  $b = 0.19, t_{32} = 3.25, p = 0.002$ . At a low level of support, having a high number of deployments was positively and significantly related to higher WC. There were no significant moderation effects at the mean or high levels.

In the third model, unwanted sexual attention from other military personnel was tested as a moderator between participants' number of deployments and WC. In the first step of the regression, participants' number of deployments significantly predicted WC,  $F_{4,31} = 3.92, p = 0.010$ . In this model, 33% of the variance in participants' WC was explained by the predictors (i.e., deployments and unwanted sexual attention). Moreover, for low and mean levels of unwanted sexual attention, there was no significant relationship between WC and deployments. At high levels of unwanted attention; there was a significant, positive effect,  $b = 0.49, t_{31} = 2.64, p = 0.010$ .

### Moderations with length of time in service

In this set of regressions, social and spiritual variables were tested as moderators between length of time in service and BMI. Overall, the model showed that participants' length of time in service significantly predicted BMI,  $F_{4,35} = 4.57, p = 0.004$ . Moreover, 34% of the variance in BMI was explained by time in service and sexual harassment. When the conditional effects were examined, mean and high levels of sexual harassment had significant positive relationships between BMI and time in the service,  $b = 0.16, t_{35} = 2.28, p = 0.020$ , and  $b = 0.34, t_{35} = 3.62, p = 0.009$ , respectively. At mean and high levels of reported sexual harassment, longer time in service significantly related to higher BMI, but this was not the case for low levels of reported sexual harassment.

In the next model, support from a significant other was tested as a moderator between length of time in the service and BMI. In the first step of the regression, participants' length of time in service significantly predicted BMI,  $F_{4,36} = 3.03, p = 0.020$ . In this model, 25% of the variance in BMI was explained by the predictors time in service and support from a significant other. Both of the main effects for support from a significant other and time in service significantly predicted BMI,  $b = 1.33, t_{36} = 0.65, p = 0.040$ , and  $b = 0.92, t_{36} = 0.37, p = 0.010$ . In addition, the interaction coefficient was significant and accounted for an additional 8% of variance,  $b = -0.12, t_{36} = 0.058, p = 0.050$ . The conditional effect was examined for low and mean levels of support, and significant interactions were found at those levels,  $b = 0.44, t_{36} = 3.15, p = 0.003$ , and  $b = 0.23, t_{36} = 3.19, p = 0.002$ . However, for high levels of support, there was no significant interaction. Thus, higher levels of support from a significant other served as a protective factor for BMI over length in service.

In the last model, reports of sexual coercion from supervisors or co-workers were tested as a moderator between length of time in service and BMI. In the first step of the regression, participants' length of time in service significantly predicted BMI,  $F_{4,35} = 3.34, p = 0.020$ . In this model, 27% of the variance in BMI was explained by the predictors time in service and sexual coercion. Although neither main effect was statistically significant, the interaction coefficient (sexual coercion) was significant and accounted for an additional 9% of variance,  $b = 0.31, t_{35} = 0.14, p = 0.030$ . For low, average, and high levels of sexual coercion, having been in the military longer was

significantly related to higher BMI,  $b = 0.19$ ,  $t_{35} = 2.56$ ,  $p = 0.010$ ,  $b = 0.23$ ,  $t_{35} = 3.11$ ,  $p = 0.003$ , and  $b = 0.40$ ,  $t_{35} = 3.53$ ,  $p = 0.001$ , respectively. It is concerning to see that all levels of sexual coercion influenced BMI.

## DISCUSSION

This is one of very few studies to examine the relationship within, and between, BPSS dimensions among AD women. Significant biological and social outcomes from this study include positive correlations of participants' reports of sexual harassment (as measured by sexual and sexist hostility) with both WC and pain. As reports of sexual harassment increased, so too did WC and reported pain levels. It does not appear that these findings have been reported with previous samples of AD women, but they do support previous research with Veterans in which women with a history of military sexual trauma were more likely to experience obesity, influencing overall mission readiness.<sup>37</sup>

Spiritual and psychological health variables were also found to be related (i.e., IR beliefs and number of mental health diagnoses). These findings add to previous research on the health of Veteran women, in which religiosity acted as a buffer for negative mental health experiences.<sup>38</sup> This study also found that the more traumatic events a participant experienced, the more they were involved in NORA (e.g., prayer). Past researchers have explored this relationship in non-military samples and found that low levels of NORA were related to fewer posttraumatic stress symptoms at moderate to high reports of traumatic exposure.<sup>39</sup> These contradictory findings could indicate that AD women have unique spiritual health needs compared with civilian populations, and perhaps NORA serves as a protective factor for mental health experiences for AD women.

IR, support from a significant other, and unwanted sexual attention from supervisors or co-workers had moderating effects on deployments and reported WC. These findings demonstrate the interconnectedness of biological, social, and spiritual health experiences. Moreover, experiences of sexual harassment, reports of feeling sexually coerced by supervisors or co-workers, and support from a significant other had moderating effects on length of time in service and BMI. These results appear to offer unique contributions to the current military literature. The relationships between these variables are especially important when considering potentially dangerous physical health outcomes that could

be exacerbated over length of time in service or as a side effect of physical or psychological trauma.

## Limitations

The method for this study was carefully considered, yet there are limitations worth noting. This survey took 30 minutes to complete, thus attrition was a concern. Fortunately, of the 83 people who activated the survey link, 76 participants completed nearly all 140 questions (a 92% response rate). The percentage who dropped out did not exceed the recommended percentage for indicating a fatal flaw in the survey.<sup>40</sup>

A second limitation pertained to representation of the sample in contrast to the population of U.S. women in the AD military. Women in air force and officer subgroups were overrepresented, whereas army and navy service members, as well as those of Hispanic ethnicity, were underrepresented.

A third limitation of this study was the use of a cross-sectional research design. This design made it difficult to assess BMI or WC measurements before or after a pregnancy; more than half (51.3%) of the women in this sample had at least one child. Research and clinical practice implications may lend themselves to future opportunities to address these limitations.

## Research implications

This study demonstrates the importance of acknowledging the relationships between BPSS dimensions while gaining a more complete understanding of AD women in the U.S. military. Health and illness do not occur in BPSS silos (e.g., the flu has social ramifications when one misses work); future researchers need to take each of these dimensions into context (simultaneously) to construct research that is more reflective of systemic health for AD women.

Given the volume of databases that exist on AD military (including electronic health records), more attention should be paid to the ways in which researchers measure, collect, and analyze BPSS variables and how they influence one another. Preferably, research teams should be interdisciplinary, with a capacity to simultaneously analyze numerous BPSS variables. Advanced analyses, conducted in partnership with clinicians and researchers, should rely on health informatics, machine learning, and predictive analytics to better attend to the complex health concerns of AD women. Such findings can then discern which BPSS factors predict health outcomes, enhance mission readiness, or decrease susceptibility to chronic medical or mental health conditions.



## Clinical implications

From this study, several clinical recommendations can be made to improve health care outcomes for AD women. Providers should assess patient health in relation to all four BPSS health dimensions, particularly because of the interconnectedness of findings among these dimensions. For example, a female AD member may present with a TBI (a physical injury), PTSD (a psychological injury), and moral injury (a soul or spiritual injury). Given co-occurrences of symptoms or diagnoses, it is important to understand the complexity of BPSS health and ensure that treatment is indicated on the basis of social locations (e.g., sex, gender identity) and presenting concerns.

A unique set of findings from this study is related to spiritual health. These findings suggest that IR and NORA are significant in relation to mental and physical health. Thus, it would be beneficial for assessments conducted by chaplains, as well as those conducted by health care providers, to extend beyond traditional questions (e.g., attending religious events) to include questions about belief systems or meaning-making. In tandem, medical facilities must work to reduce stigma by including spiritual health in BPSS assessments and treatment conversations. Moreover, mental health and family advocacy contexts must recognize the biological markers (e.g., physical pain) that enhance or exacerbate mental health conditions, personal or professional relationships, and spiritual well-being. Although ideally medical, mental health, and social services professionals and chaplains would collaborate in extending care all in one context (i.e., integrated care), offering a comprehensive and interdisciplinary BPSS assessment may afford a reduction in stigma for AD women and facilitate easier transitions from one type of provider (i.e., medical provider) to another (i.e., mental health provider). Ultimately, assessing and incorporating BPSS symptoms and protective factors into treatment is necessary to better honour AD women.

## Conclusion

With the growing opportunity for women to enter new job positions in the U.S. military, it is essential that the BPSS health of women be recognized. Women in the military deserve equity when being seen for their BPSS health symptoms and experiences. Gender socialization is often present and marginalizes the unique BPSS needs of women, which ultimately exacerbates physical health conditions, emotional and psychological concerns,

social relationships, and the ability for meaning-making as a military member as well as a partner or parent. Together, clinicians and researchers can improve BPSS readiness screeners and indicated treatments to better serve the women who serve their countries.

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## COMPETING INTERESTS

The authors have nothing to disclose.

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## ETHICS APPROVAL

This study was approved by the East Carolina University, University and Medical Center Institutional Review Board (15-001638), Greenville, North Carolina, United States, on Nov. 16, 2015, and the ethics certificate information is available from the author on request.

## INFORMED CONSENT

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