Published in final edited form as:

Res Hum Dev. 2012 ; 9(3): 210–228. doi:10.1080/15427609.2012.705553.

Women Vietnam Veterans: Do PTSD Symptoms Mediate Effects of Warzone Service on Health?

Anica Pless Kaiser,

VA National Center for PTSD and the Massachusetts Veterans Epidemiology Research and Information Center, VA Boston Healthcare System, and the Department of Psychiatry, Boston University School of Medicine

Avron Spiro III,

Massachusetts Veterans Epidemiology Research and Information Center and the VA National Center for PTSD, VA Boston Healthcare System; the Department of Epidemiology, Boston University School of Public Health; and the Department of Psychiatry, Boston University School of Medicine

Lewina Onyi Lee, and

VA Boston Healthcare System and the Department of Epidemiology, Boston University School of Public Health

Jeanne Mager Stellman

Department of Health Policy and Management, Mailman School of Public Health, Columbia University

Abstract

We assessed the impact of warzone stress on the physical and mental health functioning and well-being of 975 female nurse veterans who had been deployed to Vietnam, and examined whether PTSD symptoms at the time of the survey mediated these relations. A questionnaire was mailed to the Women's Vietnam Memorial Project members, approximately 25 – 30 years after their wartime service. We examined current physical and mental health functioning in relation to several measures of warzone stress and PTSD symptoms, adjusting for age, length of military service, and current physical health problems. Using regression models, we evaluated whether current PTSD symptoms mediated the effects of warzone stress on mental and physical health. Findings suggested that PTSD symptoms did mediate the relationship between warzone stress and mental, but not physical, health functioning in later life. These findings suggest that among women nurses deployed to Vietnam, the effects of warzone stress many years earlier on current functioning and well-being are both direct and indirect, mediated by PTSD symptoms. The legacy of wartime deployment remains, although muted in its expression, in military nurses nearly 30 years after their return.

Keywords

Nursing; stress; chronic disease; mental health; Vietnam War

Between 1962 and 1973 (West, n.d.), a number of women, mostly nurses, served in the US military and were stationed in Vietnam. The precise number is unknown, but estimates range from 7,500 to 11,000 (Walker, 1985). Anecdotal reports and individual interviews (e.g.,

Norman, 1990) provide snapshots of the nursing experience in Vietnam. However, relatively little research has examined the effects of warzone experiences on women's subsequent health and well-being. Adopting a lifespan perspective, we conducted a cross-sectional retrospective study using data collected approximately 25 to 30 years post-deployment, to ask whether current PTSD symptoms mediated the consequences of warzone exposures on women's current physical and mental health functioning and well-being.

When investigating the health and well-being of women veterans, especially those who served in the healthcare professions, it is important to consider the influence of multiple deployment-related stresses other than combat, such as stressful working conditions and exposure to the consequences of war (Gibbons, Hickling, & Watts, 2011). Stressful experiences reported by nurses who served in Vietnam included being overwhelmed by the volume of casualties, the severity of injuries, and the youth of the patients. Additional sources of stress included having to learn new skills quickly, the threat of danger, sleep deprivation, sexual harassment, and the difficult living and working conditions (Paul, 1985). Stanton and colleagues (1996) interviewed 22 female nurses from various war eras and uncovered common themes, including the physical and professional hardships of living (e.g., extreme temperatures) and working (e.g. long hours, lack of necessary medical supplies) conditions. Warzone nursing was described by all as very different from noncombat nursing – dangers varied from managing unfamiliar tropical diseases and the threat of chemical warfare to being wounded by enemy fire (Stanton, Dittmar, Jezewski, & Dickerson, 1996). Many of the nurses sent to Vietnam were fairly inexperienced, but even those with more nursing experience were faced with a steep learning curve during their deployment.

Exposure to the effects of war contributed to the likelihood of developing posttraumatic stress disorder (PTSD) among nurses who served in Vietnam (Fontana, Spoonster-Schwartz, & Rosenheck, 1997). Schnaier (1982) studied 94 female medical personnel who served in Vietnam, and reported that 25% of them demonstrated PTSD symptomatology. Ravella (1995) investigated prevalence of PTSD, use of coping skills, and war experiences in 20 Vietnam Air Force flight nurses and found that 60% described exposure to dangerous events such as rocket attacks and being in aircraft that were fired upon; 25% reported PTSD symptoms.

One pathway through which warzone stress can be translated into health problems is mediation by PTSD. This idea has been examined in several studies of women Vietnam veterans (Taft, Stern, King, & King, 1999; Wolfe et al., 1994), and of male veterans from World War II and Korea (Schnurr & Spiro, 1999). The Taft et al. (1999) study examined the associations between combat exposure, PTSD, and physical health among 1,632 male and female Vietnam veterans. For men, PTSD mediated the relationship between combat exposure and both physical health conditions and physical health functioning. For women, PTSD mediated the relationship between combat exposure and physical health conditions only (Taft et al., 1999). Schnurr and Spiro (1999) used a sample of 921 older male veterans from the Normative Aging Study to examine the effects of combat exposure on physical health. Combat exposure only had an indirect effect on physical health functioning through its association with PTSD symptoms. Schnurr and Green (2004) provided a review of this model and its implications.

In the aftermath of trauma exposure, it is essential to assess consequences on both emotional and physical health function. General physical symptoms are commonly a component of trauma reactions (McFarlane, Atchison, Rafalowicz, & Papay, 1994). In a sample of women veterans, Wolfe and colleagues (1994) found that severity of warzone exposures was related to physical symptoms. Further, PTSD symptoms predicted physical symptoms after accounting for warzone exposures, suggesting that physical symptoms play a significant role

in trauma reactions and are important to consider when investigating the physical and mental health of veterans.

Further, posttraumatic stress symptomatology has been negatively associated with quality of life among women veterans in general (e.g., Dobie et al., 2004) and specifically for women who served in Vietnam (e.g., Zatzick et al., 1997). War-related PTSD could mediate the relationship between trauma exposure and current functioning, such that people who were exposed to trauma and developed PTSD symptoms subsequently experience increased health problems. Such an indirect effect of trauma through its association with PTSD has been reported in studies of male combat veterans (e.g., Schnurr & Spiro, 1999). Among women, one study found that 8–20% of a sample of Army nurses who served in Vietnam reported increases in relationship problems, flashbacks, feeling numb, and difficulty coping with stress in the two years following deployment (Baker, Menard, & Johns, 1989). Kimerling, Clum, and Wolfe (2000) assessed background characteristics, warzone exposure, PTSD symptomatology, comorbid psychiatric disorders, war-related and other traumatic lifetime events, and medical conditions of 52 women Vietnam veterans. They found that PTSD symptomatology mediated the relationship between stressor exposure and self-reported physical symptoms.

A broader understanding of the long-term consequences of warzone experiences for women nurses in Vietnam includes consideration of warzone exposures, but should also consider individual factors that varied among nurses, such as age and experience in the military. As demonstrated in King et al. (2011), active duty experience and age contribute to maturity and serve a buffering function against the potentially negative consequences of stressful experiences. Further support for the protective effects of age and experience is revealed by studies reporting that younger age is a risk factor for the development of PTSD (Brewin, Andrews, & Valentine, 2000). Although physical health often declines with age, characteristics that contribute to maturity may be inversely related to mental health problems; in contrast to physical health, mental health functioning may be influenced more by psychological factors than by age.

We sought to understand whether warzone stress (recalled from deployment to Vietnam) influenced mental and physical health 25–30 years later. We were also curious about whether the presence of current PTSD symptoms could explain this relationship. Thus, in this study we tested the direct and indirect (through PTSD symptoms) effects of warzone stress on mental and physical health functioning, as measured by the SF-36. We also measured health status by assessing the extent of current health-related problems, using a symptom checklist previously developed for a study of male Vietnam veterans. We controlled for several covariates in our models that were likely related to mental and physical functioning and well-being, including age, length of military service, as well as for the current health problems elicited from the checklist. We hypothesized that warzone stress would be associated with worse physical and mental health, and that current PTSD symptoms would mediate this relation.

Methods

Participants and Procedure

In 1998 and 1999, a detailed questionnaire was sent to women on the mailing list of the Women's Vietnam Memorial Project, Inc. Three rounds of surveys were mailed, with the surveys re-sent to those who had not yet returned it. Of those mailed, 2,446 were returned, for a response rate of 70%.

The present study is on the 975 female veterans who reported serving in Vietnam as military nurses during the Vietnam War. The study was approved by the Institutional Review Boards of Columbia University and VA Boston Healthcare System.

Measures

Demographic characteristics—Age was assessed in years. Dates of military service were used to compute length of service, and two dummy variables were created to distinguish short-term (up to four years) and long-term (20 years or more) from medium-term service (four -19 years) as the reference group. The first dummy-coded variable, LOW, assigned short-term a value of 1 and medium and long-term were coded together as 0. A second dummy-coded service length variable, HIGH, coded long-term as 1 and short and medium-term together as 0.

Warzone Stress—Two measures were used to assess recollections of warzone stress. Military stress used a single item that asked how stressful participants perceived their time in Vietnam to have been. Response options were 1 = *not at all*, 2 = *somewhat*, 3 = *not sure*, 4 = *stressful* and 5 = *highly stressful*. Work stress during Vietnam service was assessed by a seven-item scale adapted from measures of burnout and work stress (Kulka et al., 1990; Wolfe, Brown, Furey, & Levin, 1993). This scale included questions about work role stress, excessive fatigue, and problems associated with work positions. Sample items include, “Have to perform at a level significantly exceeding your level of training” and “How often did you make critical or life threatening errors in your work because of excessive fatigue or workload?” Items were rated on a five-point Likert scale, with response options ranging from 1 = *never* to 5 = *often*. A total score was used (Cronbach’s alpha = 0.77).

Health problems—Current health problems associated with enervation and aches were assessed with scales developed through factor analyses of a 28-item rating measure used in earlier studies of male veterans (Stellman, Stellman, & Sommer, 1988). The *enervation* scale consisted of five items related to physical exhaustion and emotional tiredness. The *aches* scale consisted of two items focused on physical aches and pains. Sample items include, “Becoming very tired in a short period” (enervation), and “Neck and shoulder pain” (aches). Items were rated on a four-point Likert scale on which participants indicated to what extent the particular symptom was a current problem (1 = *not a problem* to 4 = *really a major problem*). There were no missing data for these scales, and a total score was used. Cronbach’s alpha was 0.82 (enervation), 0.57 (aches), respectively.

PTSD symptoms—Current PTSD symptoms were assessed using an 18-item scale (Snow, Stellman, Stellman, & Sommer, 1988) based on work by Foy and colleagues (Foy, Sippelle, Rueger & Carroll, 1984; Lund, Foy, Sippelle & Strachan, 1984), which followed the *Diagnostic and Statistical Manual for Mental Disorders – Version III – Revised* criteria for PTSD (DSM-III-R; APA, 1987). Participants were asked to rate the severity of their symptoms in the past three months. Items were rated on a five-point scale with response options ranging from 1 = *never* to 5 = *very often*. Sample items include, “Had dreams or nightmares about your service” and “Found you were unable to feel emotions.” Only cases with complete data were used. A total score was calculated. Cronbach’s alpha was 0.95.

Functioning and well-being—Physical and mental health functioning and well-being were measured using the SF-36 (Ware, Kosinski, & Keller, 1994), a scale designed to assess perceived functioning and how symptoms affect well-being in physical and mental health domains. It yields eight scales, which are then used to create two scores summarizing physical (PCS) and mental (MCS) health. The PCS score includes physical functioning, role-physical, bodily pain, and general health scales. The MCS score includes vitality, social

functioning, role-emotional, and mental health scales. Response options vary by item; sample items include, “During the past four weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health...Accomplished less than you would like?” (role-physical; response options 0 = *yes* 1 = *no*) and “How much of the time during the past four weeks have you been a very nervous person?” (mental health; response options 0 = *all of the time* to 5 = *none of the time*). These scores are standardized to a US national population with a mean of 50 and standard deviation of 10; higher scores indicate better health.

In the standard scoring (Ware et al., 1994), these summaries can only be computed if all eight scales have valid data. Because 11.4% of respondents had missing data on the SF-36, we obtained maximum likelihood estimates of missing items based on participants’ responses to the items present and to the other measures used in the current study. This approach is based on the assumption that data were missing at random (MAR). We also created a dummy variable to indicate whether a participant’s SF-36 scores involved any imputed items.

Analyses

Descriptive statistics and bivariate correlations among study variables were examined. Initial examination of these data showed an unexpected distribution of length of service among these women, so we undertook a preliminary exploration of how this variable was related to the other variables in our study. (Twenty years of service represents the minimum term required to attain full retirement benefits for military personnel.) A three-level (up to four years, four – 19 years, and 20 or more years) length of service variable was created and a set of one-way analyses of variance was conducted, followed by Scheffé’s tests, to examine whether and how these three groups differed.

Two sets of regression analyses were conducted to examine the associations of warzone stress on physical and mental health. First, age, length of service, and current health symptoms (enervation and aches) were included as covariates. An additional covariate, “imputation,” was added to indicate whether any SF-36 items had been imputed. The second regression analysis examined the incremental effect of PTSD symptoms on the health outcomes. We evaluated PTSD as a potential mediator of the effects of warzone stress on health by testing the significance of the indirect effect (i.e., of military or work stress through PTSD on physical or mental health), examining the 95% Monte Carlo confidence intervals (CI) for the indirect effects replicated over 10,000 samples using a bootstrap method (Preacher & Hayes, 2008).

Results

Descriptive Statistics

Sample demographics and service characteristics are given in Table 1. Age ranged from 50 to 88 ($M = 60.0$, $SD = 7.6$). Most of the women were in their fifties, but 13% were 70 years or older and two were more than 80 years old. A majority of the sample was Caucasian, had a college or professional degree, and lived in households with total income of more than \$60,000 a year (although many were unmarried). A little over one-third (39%) never married, 44% were married, and 17% were divorced or widowed. About one-half (43.8%) of the women served four years or less in the military; a little more than one-third (35.7%) served 20 years or more.

Descriptive information and bivariate correlations for study variables are shown in Table 2. On average, these women served in the military for about 11 years ($M = 11.3$, $SD = 10.1$), with a range from less than one year to 36 years. The veteran nurses reported experiencing a

wide range of work-related stresses; the average response was 3.3 (between “somewhat” and “stressful”) on a five-point scale. Most individual items were typically rated as rare occurrences during deployment. The majority of participants did not indicate experiencing much of a problem with aches and enervation. Similarly, while there was a range of responses to questions about PTSD symptoms experienced, on average, women rated PTSD symptoms as occurring “rarely.” Respondents scored close to general population means for both physical ($M = 45.9$, $SD = 11.2$) and mental ($M = 49.7$, $SD = 11.2$) health functioning and well-being, as measured by the PCS and MCS. About a quarter of the sample (27%) fell into the range that is considered to reflect poor physical health functioning ($T < 40$), and 19% scored within this range on mental health functioning. At the bivariate level, warzone stressors were related to current PTSD symptoms, as well as to physical and mental health functioning and well-being.

Explorations of Length of Service

For most variables considered in this study (except education and aches), there were notable differences among the length-of-service groups: career women were older during deployment and at survey, had lower incomes; were more enervated; reported lower levels of military and work stress during deployment, had lower levels of current PTSD symptoms and physical health, but better mental health. In general, nurses with four or fewer years of military service were younger, had higher income, greater deployment stress and PTSD, better physical health and lower mental health. The results are shown in Table 3.

Regression Analyses

Physical health—Multiple regression analyses showed both military stress and work stress to be related to PTSD ($b = 2.36$, $p < .001$, $b = .72$, $p < .001$, respectively, see Table 4), adjusting for age, length of service, and health problems. PTSD was also related to physical health functioning ($b = -.20$, $p < .001$; results not shown). We examined the association between the warzone stress measures (military, work) and physical health functioning and well-being using linear regression, adjusting for covariates. We found work stress to be a weak but significant predictor (see Model 1 in left panel of Table 5). The model accounted for 31% of the variance in PCS scores. When the PTSD symptom variable was added to the model, it was not significant (see Model 2, in left panel of Table 5). In both models, age was negatively associated with PCS score, as were current aches and enervation; neither length of service nor the variable representing imputation of SF-36 scores were significantly related to PCS scores.

PTSD was next examined as a potential mediator between warzone (military and work stress) stress and physical health functioning. When military stress, work stress, and PTSD were jointly included in the model with physical health as the dependent variable, the relationship between warzone stress and physical health did not change. Additionally, the confidence intervals for the indirect effects included zero, which indicates that PTSD did not mediate the effects of the warzone stressors on physical health (see left panel of Table 6).

Mental health—Multiple regression analyses demonstrated that both stressors were significantly related to PTSD symptoms ($b = 2.36$, $p < .001$ for military stress, $b = .72$, $p < .001$ for work stress; see Table 4), and that PTSD symptoms were significantly related to mental health ($b = -.51$, $p = .001$; results not shown). Military stress was a significant predictor of mental health (see Model 1 in the right panel of Table 5), adjusting for the covariates. This model explained 46% of the variance in MCS scores. When PTSD was added in Model 2, the effect of military stress was no longer significant, but PTSD was significant and negatively associated with MCS. The explained variance increased to 54% (see Model 2 in right panel of Table 5). Among the covariates, age was positively associated

with MCS scores, as was aches, while enervation was negatively related. Women whose SF-36 data were imputed had somewhat lower MCS scores.

Finally, we considered current PTSD as a mediator between warzone (military and work) stress and mental health. In contrast to physical health, when military stress, work stress, and PTSD were entered together in the model with mental health as the dependent variable, the relationship between warzone stress and mental health was no longer significant (b changed from $-.78$ to $.02$, ns), but the relationship between PTSD and mental health remained significant, indicating PTSD was an intermediate factor in the relationship. The true indirect effect of military stress through PTSD was estimated as -0.81 (95% CI -0.58 , -1.06) and that of work stress through PTSD as -0.25 (95% CI -0.18 , -0.32). Because these confidence intervals do not include zero, we conclude that the indirect effects of war zone stress were mediated through current PTSD symptoms (see the right panel of Table 6).

Discussion

This study describes various characteristics of a large group of women who served in Vietnam as military nurses during the Vietnam War. We examined the impact of warzone stress (as recalled 25–30 years later) on their current mental and physical health, and whether the effects of such stress were mediated through PTSD symptoms. We also explored the variations in demographic and health-related characteristics as a function of length of service in the military.

Our findings suggest that current PTSD symptoms play an intermediate role between exposure to warzone stress (feeling stressed, experiencing heavy workload demands, and being exposed to enemy fire and casualties during service in Vietnam) and mental health functioning in later life. It is important to note that, on average, women in our sample reported low levels of PTSD symptoms. Additionally, findings are relevant to PTSD symptoms, not diagnosis. The results also indicated that being older, having experienced more work-related stress during Vietnam deployment, and reporting more current enervation and aches, are associated with poorer physical health functioning among these women. These direct effects support literature that details the negative effects of age and current health problems (e.g., Spirduso, Francis, & MacRae, 2005) and warzone stress (e.g., Eisen, Goldberg, True, & Henderson, 1991) on physical health functioning and well-being. As expected, age and current health problems were strongly related to physical health functioning in this sample, but after adjusting for their effects, reports of work stress during deployment continued to have negative effects.

Mental health functioning and well-being was worse (lower MCS scores) among those who were younger, reported more enervation and aches, and experienced more current PTSD symptoms, suggesting a positive effect of being older and more experienced when exposed to the stressors of warzone service. It is possible that being older was associated with lower current PTSD symptoms for many reasons, including postwar experience of social support, ability to adjust to civilian life, and occupational success. Examining these factors is beyond the scope of the present study but they are ripe areas for future research. Additionally, having missing data on SF-36 items was also associated with poorer mental health functioning. This finding suggests that women veterans who reported more mental health difficulties were also more likely to leave items blank. We also found that PTSD symptoms were negatively related to mental health functioning and that PTSD mediated the effects of warzone exposure on mental health.

Our finding that current PTSD symptoms were a mediator of the effects of warzone stress on mental health functioning extends the findings of Kimerling et al. (2000) with women and

Schnurr and Spiro (1999) with men, and supports the model, proposed by Schnurr and Green (2004), of PTSD as mediator of stress effects on health. As documented in the literature, it may not be solely the experience of stress or trauma that leads to poorer functioning over time, but also the consequences of these distal exposures on more proximal aspects, such as development of mental health problems (e.g., PTSD; O'Toole & Catts, 2008). Additionally, having PTSD symptoms, and related difficulties, may affect an individual's health-related decisions (such as social isolation, failing to seek treatment, or engaging in risky behaviors), which could increase the risk of developing more mental health-related problems, such as major depression, and subsequent impairment (Breslau, Davis, Peterson, & Schultz, 2000). In this manner, PTSD symptoms may serve a maintaining role in mental health problems over time.

We also found that women for whom the military was a career, and served for twenty years or longer, exhibited better mental health 25 to 30 years after their Vietnam deployment than did women who served for shorter periods of time, although this effect was eliminated when PTSD was included in the model. One possible explanation for this difference relates to social support - nurses who stayed in the military tended to have more opportunities to talk about their experiences and receive support from knowledgeable others than those who left the military after their overseas service (Stanton et al., 1996). Social support has consistently been found to buffer against the negative consequences of stress and trauma exposure among veterans across war eras (e.g., King, King, Fairbank, Keane & Adams, 1998; Pietrzak et al., 2010). Another possible explanation for the positive effect of career service can be found by examining social norms within the military during the Vietnam era. For example, women who became pregnant were discharged from the military; it is possible that some women who had planned on pursuing a military career were not allowed to continue, and thus had to change their occupational plans. Such a major life transition may have negatively affected their emotional health in the immediate and long-term. In addition, it is possible that women who served for a shorter amount of time had more difficulty adapting to the male-dominated military culture or had negative experiences in the military (e.g., sexual harassment or assault) that influenced their future mental health functioning. Another possible explanation is that these women had difficulty adapting to civilian life and careers. Conversely, it is also possible that women who stayed for longer in the military tended to have resources (personal and professional) that helped them to maintain employment more easily.

Why might current PTSD symptomatology mediate the relationship between warzone stress and mental, but not physical, health functioning and well being in this sample? This finding may be related to the population surveyed in this study. These were female nurses who worked in field hospitals, within medical units, and on medical transport planes. Although they experienced threats of physical danger, such as exposure to incoming fire or threat from patients, these nurses did not serve in combat roles. Thus, for the majority of nurses serving in Vietnam, the risks of physical injury, and its consequences, were much different than they would be for a sample of combat theater veterans. However, this distinction may not be as clear with current women veterans; in the multiple conflicts since the Vietnam War (especially Operation Enduring Freedom/Operation Iraqi Freedom), women have served in combat support positions with increasing levels of physical danger (Hoge, Clark, & Castro, 2007). Thus, it will be important to consider the potential role of PTSD when examining the effects of warzone stress on both physical and mental health in the future. Additional research may shed more light on this question by considering a broader array of background characteristics and warzone exposures, and by examining more objective measures of both physical and mental health (e.g., physician-rated medical or psychiatric diagnoses).

It should be noted that this study sampled women from the Vietnam Era, during which women served in fewer capacities within the armed services, and were primarily nurses in the war zone. In addition, the situation of women in society has changed substantially in the half-century that has followed the Vietnam Era. Our findings thus cannot be generalized easily to women who are deployed in non-nursing roles or to women who are deployed during more recent conflicts. Despite these problems in generalization, our observations of the enduring nature of exposures to warzone stressors, as well as the positive effects associated with career military service and maturity, may be helpful to consider for promoting positive mental and physical health of women serving in today's military. Others examining the implications of the Vietnam experience for modern women warriors have concluded that a pro-active role is needed to prepare women both for the emotional and the professional demands of war zone service (Scannell-Desch, 1996). Our results support such advice. In addition, our findings might be relevant to women nurses who serve in highly stressful conditions, such as disaster zones, where the experience of caring for casualties on a mass scale can be stressful.

This study is not without limitations. The cross-sectional and retrospective nature of the data limits our ability to discuss causality or examine changes in health over time. Given the retrospective reporting of warzone factors, participants' current psychological and physical states could have influenced their reporting of past exposures. One of the indices of warzone stress was a single-item measure. A multidimensional scale would serve to capture more fully the complexities of stress in military service and be a more reliable measure. Such scales should be developed, particularly as more and more women are entering into military service and combat situations.

Despite the limitations, this study of a large sample of female nurse Vietnam veterans adds to the comparatively sparse literature on women Vietnam veterans. Much more is known about the men who served in Vietnam. Our testing of the mediating role of current PTSD symptoms in the relation between warzone stress and health furthers knowledge of potential pathways between stress and health, and suggests that while we may not be able to eliminate stress from war, reducing the prevalence and severity of resulting PTSD may lead to improved health among our veterans. Long-term effects of deployment remain among many of those who survive, and we should be relentless in our efforts to reduce the possible lingering effects on those who serve. A lifespan perspective is a useful approach for examining long-term physical and mental health and there remains much to be understood about the effects of deployment on women who served in support roles in this and other conflicts.

Acknowledgments

Study design and data collection were supported by the National Academy of Sciences Subcontract NAS-VA-5124-98-001. Support for this study was also provided by the National Center for PTSD and the Massachusetts Veterans Epidemiology Research and Information Center, VA Boston Healthcare System, by NIA grant R24-AG039343 and by a VA Research Career Scientist Award. The authors express appreciation to Margaret Keleher and Karestan Koenen for contributions to study design and data collection, to the Women's Vietnam Memorial Project, Inc, for its collaboration and to their colleagues in the Stress, Health, and Aging Research Program (SHARP), VA Boston Healthcare System.

References

- American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 3. Washington, DC: 1987. Revised (DSM-III-R)
- Baker RR, Menard SW, Johns LA. The military nurse experience in Vietnam: Stress and impact. *Journal of Clinical Psychology*. 1989; 45:736–744. [PubMed: 2808729]

- Breslau N, Davis G, Peterson E, Schultz L. A second look at comorbidity in victims of trauma: The posttraumatic stress disorder-major depression connection. *Biological Psychiatry*. 2000; 48:902–909. [PubMed: 11074228]
- Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology*. 2000; 68:748–766. [PubMed: 11068961]
- Dobie D, Kivlahan D, Maynard C, Bush K, Davis T, Bradley K. Posttraumatic stress disorder in female veterans: Association with self-reported health problems and functional impairment. *Archives of Internal Medicine*. 2004; 164:394–400. [PubMed: 14980990]
- Eisen S, Goldberg J, True W, Henderson W. A co-twin control study of the effects of the Vietnam War on the self-reported physical health of veterans. *American Journal of Epidemiology*. 1991; 134:49–58. [PubMed: 1853860]
- Fontana A, Spoonster-Swartz L, Rosenheck R. Posttraumatic stress disorder among female Vietnam veterans: A causal model of etiology. *American Journal of Public Health*. 1997; 87:169–175. [PubMed: 9103092]
- Foy D, Sippelle R, Rueger D, Carroll E. Etiology of posttraumatic stress disorder in Vietnam veterans: Analysis of premilitary, military, and combat exposure influences. *Journal of Consulting and Clinical Psychology*. 1984; 52:79–87. [PubMed: 6699251]
- Gibbons SW, Hickling EJ, Watts DD. Combat stressors and post-traumatic stress in deployed military healthcare professionals: An integrative review. *Journal of Advanced Nursing*. 2011; 68:3–21. [PubMed: 21635285]
- Hoge C, Clark J, Castro C. Commentary: Women in combat and the risk of post-traumatic stress disorder and depression. *International Journal of Epidemiology*. 2007; 36:327–329. [PubMed: 17376800]
- Kimerling R, Clum G, Wolfe J. Relationships among trauma exposure, chronic posttraumatic stress disorder symptoms, and self-reported health in women: Replication and extension. *Journal of Traumatic Stress*. 2000; 13:115–128. [PubMed: 10761178]
- King D, King L, Fairbank J, Keane T, Adams G. Resilience-recovery factors in posttraumatic stress disorder among female and male Vietnam veterans: Hardiness, postwar social support, and additional stressful life events. *Journal of Personality and Social Psychology*. 1998; 74:420–434. [PubMed: 9491585]
- King L, King D, Schuster J, Park C, Moore J, Kaloupek D, Keane T. Captivity stressors and mental health consequences among repatriated U.S. Navy, Army, and Marine Vietnam-era prisoners of war. *Psychological Trauma: Theory, Research, Practice, and Policy*. 2011; 3:412–420.
- Kulka, R.; Schlenger, W.; Fairbank, J.; Hough, R.; Jordan, B.; Marmar, C.; Weiss, D. *Trauma and the Vietnam war generation: Report of findings from the National Vietnam Veterans Readjustment Study*. New York: Brunner/Mazel; 1990.
- Lund M, Fry D, Sippelle C, Stachan A. The combat exposure scale: A systematic assessment of trauma in the Vietnam war. *Journal of Clinical Psychology*. 1984; 40:1323–1328. [PubMed: 6511942]
- McFarlane A, Atchison M, Rafalowicz E, Papay P. Physical symptoms in post-traumatic stress disorder. *Journal of Psychosomatic Research*. 1994; 38:715–726. [PubMed: 7877126]
- Norman, E. *Women at War: The Story of Fifty Military Nurses who Served in Vietnam*. Philadelphia, PA: University of Pennsylvania Press; 1990.
- O'Toole B, Catts S. Trauma, PTSD, and physical health: An epidemiological study of Australian Vietnam veterans. *Journal of Psychosomatic Research*. 2008; 64:33–40. [PubMed: 18157997]
- Paul E. Wounded healers: A summary of the Vietnam nurse veteran project. *Military Medicine*. 1985; 150:571–576. [PubMed: 3935950]
- Pietrzak R, Johnston D, Goldstein M, Malley J, Rivers A, Morgan C, Southwick S. Psychosocial buffers of traumatic stress, depressive symptoms, and psychosocial difficulties in veterans of Operations Enduring Freedom and Iraqi Freedom: The role of resilience, unit support, and postdeployment social support. *Journal of Affective Disorders*. 2010; 120:188–192. [PubMed: 19443043]

- Preacher K, Hayes A. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*. 2008; 40:879–891. [PubMed: 18697684]
- Ravella P. A survey of U.S. Air Force flight nurses' adaptation to service in Vietnam. *Aviation, Space, and Environmental Medicine*. 1995; 95:80–83.
- Scannell-Desch EA. The lived experience of women military nurses in Vietnam during the Vietnam war. *Journal of Nursing Scholarship*. 1996; 28:119–124.
- Schnaier, J. Unpublished master's thesis. University of Maryland; College Park: 1982. Women Vietnam veterans and mental health adjustment: A study of their experiences and posttraumatic stress.
- Schnurr, PP.; Green, BL. Understanding relationships among trauma, post-traumatic stress disorder, and health outcomes. In: Schnurr, PP.; Green, BL., editors. *Trauma and health: Physical health consequences of exposure to extreme stress*. Washington DC: American Psychological Association; 2004. p. 247-75.
- Schnurr PP, Spiro A. Combat exposure, posttraumatic stress disorder symptoms, and health behaviors as predictors of self-reported physical health in older veterans. *Journal of Nervous and Mental Disease*. 1999; 187:353–359. [PubMed: 10379722]
- Snow BR, Stellman JM, Stellman SD, Sommer JF. Post-traumatic stress disorder among American Legionnaires in relation to combat experience in Vietnam: Associated and contributing factors. *Environmental Research*. 1988; 47:175–192. [PubMed: 3181093]
- Spirduso, W.; Francis, K.; MacRae, P. *Physical dimensions of aging*. 2. Champaign, IL: Human Kinetics; 2005.
- Stanton M, Dittmar S, Jezewski M, Dickerson S. Shared experiences and meanings of military nurse veterans. *IMAGE: Journal of Nursing Scholarship*. 1996; 28:343–347.
- Stellman S, Stellman J, Sommer J. Health and reproductive outcomes among American Legionnaires in relation to combat and herbicide exposure in Vietnam. *Environmental Research*. 1988; 47:150–174. [PubMed: 3263269]
- Taft CT, Stern AS, King LA, King DW. Modeling physical health and functional health status: The role of combat exposure, posttraumatic stress disorder, and personal resource attributes. *Journal of Traumatic Stress*. 1999; 12:3–23. [PubMed: 10027139]
- Walker, K. *A Piece of My Heart: The Stories of Twenty-Six American Women who Served in Vietnam*. Novato: Presidio Press; 1985.
- Ware, JE.; Kosinski, M.; Keller, SK. *SF-36® Physical and Mental Health Summary Scales: A User's Manual*. Boston, MA: The Health Institute; 1994.
- West, II. [accessed March 22, 2012] The women of the Army Nurse Corps during the Vietnam War. nd. <http://www.vietnamwomensmemorial.org/pdf/iwest.pdf>
- Wolfe J, Brown P, Furey L, Levin K. Development of a war-time stressor scale for women. *Psychological Assessment: A journal of Consulting and Clinical Psychology*. 1993; 65:330–335.
- Wolfe J, Schnurr P, Brown P, Furey J. Posttraumatic stress disorder and war-zone exposure as correlates of perceived health in female Vietnam War veterans. *Journal of Consulting and Clinical Psychology*. 1994; 62:1235–1240. [PubMed: 7860822]
- Zatzick D, Weiss D, Marmar C, Metzler T, Wells K, Golding J, Stewart A, Schlenger W, Browner S. Post-traumatic stress disorder and functioning and quality of life outcomes in female Vietnam veterans. *Military Medicine*. 1997; 162:661–665. [PubMed: 9339077]

Table 1

Characteristics of Female Military Nurses Deployed to Vietnam (N=975)

	N	Percent
Age at Survey	969	
50–59		63.2
60–69		22.1
70- and older		14.7
Ethnicity %	963	
White		96.6
Non-White		3.4
Education	968	
Some college or less		19.9
College Grad		38.7
Professional Degree		41.3
Household Income	925	
Under 40,000		19.4
\$40,000–59,999		30.7
\$60,000 or more		49.9
Marital Status	968	
Never married		38.5
Married		44.1
Divorced/Widowed		17.4
Length of Service (years)	898	
Short-term (< 4)		43.8
Medium-term (4–19)		20.5
Long-term (≥ 20)		35.7

Table 2

Descriptive Statistics and Bivariate Correlations for Study Variables

Variable	M	SD	Range	1	2	3	4	5	6	7	8	9
Demographics												
1. Age at survey	60.0	7.6	50 – 88	--								
2. Length of service	11.3	10.1	0 – 36	.59***	--							
Current health problems												
3. Enervation	7.6	3.1	5 – 20	-.17***	-.16***	--						
4. Aches	3.6	1.6	2 – 8	-.07*	.00	.39***	--					
Warzone stressors												
5. Military stress	3.3	1.3	1 – 5	-.21***	-.20***	.39***	.17***	--				
6. Work stress	12.9	4.3	6 – 30	-.28***	-.15***	.36***	.18***	.48***	--			
Current functioning												
7. PTSD symptoms	35.8	13.9	17.0 – 90.0	-.23***	-.18***	.62***	.23***	.51***	.50***	--		
8. Physical health	45.9	11.2	11.8 – 69.2	-.22***	-.15***	-.36***	-.41***	-.10**	-.11***	-.16***	--	
9. Mental health	49.7	11.2	6.2 – 68.6	.23***	.24***	-.64***	-.19***	-.36***	-.32***	-.66***	.01	--

Note. PTSD = Posttraumatic stress disorder; M = Mean, SD = Standard deviation;

* $p < .05$;

** $p < .01$;

*** $p < .001$.

Table 3

Characteristics of Population by Length of Service in Military

Length of Service	Short-Term (S)		Medium-Term (M)		Long-Term (L)		Comparisons
	SD	Mean	SD	Mean	SD	F	
Age at Deployment	24.12	3.93	26.31	5.22	33.24	7.59	F (2,857) = 220.8*** S < M < L
Age at Survey	56.03	4.47	58.51	5.89	65.50	7.86	F (2,889) = 213.35*** S < M < L
Education	6.04	1.05	6.04	1.06	6.08	1.15	F (2,889) = .13 --
Household Income	9.16	1.31	8.82	1.66	8.53	1.43	F (2,846) = 16.35*** S > M; S > L
Enervation	8.12	3.37	7.64	3.24	6.94	2.55	F (2,895) = 13.09*** S > L; M > L
Aches	3.64	1.56	3.59	1.56	3.64	1.69	F (2,895) = .08 --
Military Stress	3.53	1.27	3.39	1.19	2.93	1.26	F (2,867) = 20.03*** S > L; M > L
Work Stress	13.65	4.49	13.03	4.15	12.00	3.77	F (2,895) = 13.84*** S > L; M > L
PTSD Symptoms	37.97	14.08	37.09	14.61	32.22	12.28	F (2,894) = 16.97*** S > L; M > L
Physical Health	47.44	10.54	46.06	11.41	43.80	11.66	F (2,892) = 9.43*** S > L
Mental Health	47.47	11.63	48.84	11.74	53.31	9.14	F (2,892) = 26.50*** S < L; M < L

Note. PTSD = Posttraumatic Stress Disorder; For Physical and Mental Health, general population means are approximately 50 for each scale. For all *post hoc* comparisons, $p < .05$ based on Scheffe's test.
***
 $p < .001$.

Table 4

Hierarchical Regression Model of the Relationship between PTSD and Selected Study Variables

Variable	<i>b</i>	<i>SE</i>	<i>Beta</i>
Intercept	36.33	.72	
Age	-.08	.05	-.04 ***
Length (High)	-1.24	.97	-.04 ***
Length (Low)	-1.13	.87	-.04 ***
Imputation	3.00	1.09	.07 **
Enervation	2.05	.12	.47 ***
Aches	-.16	.22	-.02 ***
Military Stress	2.36	.30	.22 ***
Work Stress	.72	.09	.22 ***
$R^2 = .53, F(8,854) = 119.00 ***$			

Note. Age = Age at time of survey; N = 861; High: Long-term=1, Short-Medium=0,; Low: Short-term=1, medium-long-term=0;

*
 $p < .05$;

**
 $p < .01$;

***
 $p < .001$.

Table 5
Hierarchical Regression Models of the Relationship between Physical Health and Mental Health and Selected Study Variables

Variable	Physical Health						Mental Health					
	Model 1			Model 2			Model 1			Model 2		
	<i>b</i>	<i>SE</i>	<i>Beta</i>	<i>b</i>	<i>SE</i>	<i>Beta</i>	<i>b</i>	<i>SE</i>	<i>Beta</i>	<i>b</i>	<i>SE</i>	<i>Beta</i>
Intercept	45.43	.71		45.40	.71		49.51	.63		49.70	.58	
Age	-.41	.05	-.27***	-.41	.05	-.27***	.13	.05	.09**	.11	.04	.07*
Length (High)	.15	.96	-.01	-.21	.96	-.01	1.70	.84	-.07*	1.29	.78	.06
Length (Low)	1.08	.86	.05	1.14	.86	.05	.13	.76	.01	-.25	.70	-.01
Imputation	-1.27	1.08	-.03	-1.44	1.09	-.04	-3.07	.96	-.08***	-2.02	.88	-.05*
Enervation	-1.01	.12	-.28***	-1.12	.14	-.31***	-2.12	.11	-.60***	-1.42	.11	-.40***
Aches	-2.20	.22	-.31***	-2.19	.22	-.31***	.52	.19	.07**	.46	.18	.07**
Military Stress	.25	.30	.03	.12	.31	.01	-.78	.26	-.09**	.02	.25	.00
Work Stress	-.18	.09	-.07*	-.21	.09	-.08*	-.12	.08	-.05	.12	.08	.05
PTSD Symptoms	--	--	--	.05	.03	.07	--	--	---	-.34	.03	-.42***
<i>R</i> ²		.31			.31			.46			.54	
<i>F</i> (<i>df</i>)		<i>F</i> (8, 852)=46.80***			<i>F</i> (9, 851)=41.96***			<i>F</i> (8, 852)=89.88***			<i>F</i> (9, 851)=111.74***	
ΔR^2 , ΔF (<i>df</i>)					.00, $\Delta F(1, 851) = 2.57$					.08, $\Delta F(1, 851) = 155.89***$		

Note. Age = Age at time of survey; N = 861. High: Long-term=1, Short-Medium=0, Low: Short-term=1, medium-long-term=0;

* $p < .05$;

** $p < .01$;

*** $p < .001$.

Table 6
Indirect Effect of Warzone Stress on Health Functioning Mediated by PTSD (with CI)

	Monte Carlo – 95% CI			Monte Carlo – 95% CI		
	Effect	Lower	Upper	Effect	Lower	Upper
Military Stress	0.13	-0.02	0.29	-0.81	-1.06	-0.58
Work Stress	0.04	-0.01	0.09	-0.25	-0.32	-0.18
R ²		0.31	***		0.54	***

Note. Monte Carlo confidence intervals (CI) used to test indirect effects; 10,000 samples, 95% CI;

***
p < .001.