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Development and Implementation of the Women's Health Addendum: Program Evaluation Among Women Veterans with Military Environmental Exposures

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Abstract

Background: The number of women in the armed forces has steadily increased across all branches, even as the overall size of the military remains stable. The population of women Veterans (WVs) is also expanding. The existing literature has extensively reported the impact of military environmental exposures (MEE) on adverse physical and mental health outcomes in service members and Veterans; however, most of these studies focus on the experiences of men. In response to the growing need to address women-specific health care concerns, particularly women with MEE, the Women's Operational Military Exposure Network Center of Excellent (WOMEN CoE) developed the Women's Health Addendum (WHA).

Objective: The primary objective of this project is to: (1) describe the development and implementation of a comprehensive health questionnaire for WVs; (2) systematically describe and characterize the health conditions of women seeking care for MEE-related health concerns; and (3) utilize findings to inform clinic policies and develop targeted programs.

Methods: The WHA was introduced by the WOMEN CoE to assess the prevalence of health conditions that are female-specific, or disproportionally impact WVs, examine the relationship between these health conditions and MEEs; and utilize findings to improve care. The WHA was developed through an iterative process, incorporating literature review, Veteran and clinician feedback, and clinical expertise. It consists of 81 questions across seven categories related to health conditions across the life span. The WHA was implemented in two phases and descriptive findings are presented here.

Results: A total of 63 WVs participated in the program evaluation from October 2022 – April 2024. Several women's health conditions were reported, with approximately 97% of women reporting at least one health condition and 87% reporting three or more. Among respondents, the most prevalent conditions included sexual dysfunction (69.70%), urinary incontinence (58.93%), pelvic floor dysfunction (52.40%), and pregnancy loss (44.44%). Overall, more than 40% of conditions were related to urinary health and pelvic floor dysfunction.

Conclusions: Findings highlight the need for services related to women's health, especially for this cohort of WVs with MEE concerns seen at a tertiary care center. Future efforts to evaluate further are underway. Clinical Trial: NA

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INTRODUCTION

Women Veterans

With over 2 million U.S. women Veterans (WVs), women are the fastest-growing segment of the Veteran population and are projected to be 18% of the population by 2040 [1]. According to the Department of Veterans Affairs (VA), WVs are also increasingly using VA services [1]. At various fiscal year timepoints, the number of WVs using VA services nearly tripled or doubled, while the number of men grew substantially slower over the same period [2, 3]. This increase represents a more than 300% growth among women using VA primary care [3], yet despite these improvements, women are still a minoritized group with less than 30% of all WVs enrolled in VA services [2].

Within the VA, women are more likely to have higher outpatient utilization, be younger, and represent a more racially/ethnically diverse group compared to men [2]. For women VA patients, the most prevalent health conditions are endocrine/metabolic/nutritional, musculoskeletal, mental health/substance use disorders, reproductive health, neurologic, sense organ, cardiovascular, and gastrointestinal [3]. For reproductive and sexual health conditions, the most frequent diagnoses include: urinary disorders; breast conditions and reproductive organ disorders; menstrual and menopausal disorders; contraceptive care management; and sexually transmitted diseases [4]. As VA projects the resources needed for the future care of the expanding WV population, clinical and educational efforts must consider the health problems faced by WVs.

Military Service and Military Environmental Exposures

Although women have served in the U.S. armed forces for over 200 years, it wasn't until 1948 that women were made permanent members of all branches of the armed forces, and

2013 when women were allowed to serve in combat roles [5]. As the role of women in the military has changed over time, so has their exposure to military environmental exposures (MEEs). Examples of MEEs that women may have been exposed to during military service include air pollutants, chemicals, radiation, occupational hazards, and chemical warfare agents.[6] For women, exposures during military service have been increasing since the 1990s due to changes in policy, length of conflicts, and expanded roles in the military [5, 7].

A growing body of literature indicates that an association between MEEs and adverse health problems exists. For example, research on MEEs and physical and mental health conditions include chronic multisymptom illness or Gulf War Illness (GWI) [8, 9]; impairments in activities of daily living and physical functioning [10]; peripheral neuropathy and widespread pain [11]; cognitive functioning [12, 13]; depression [14]; anxiety and post-traumatic stress disorder (PTSD) symptoms [14, 15]; and quality of life [14]. However, most of the MEE literature is based on men, and often studied in Vietnam-era or Gulf War I-era service members and Veterans [16]. Although studies have highlighted differences in military service and deployment effects between men and women, more studies are needed to better understand the post-deployment health of WVs [17-21]. As women transition from service members to Veterans, their risk for health concerns that are female-specific or disproportionately impact women may increase, yet few studies have been conducted with WVs, and even fewer have focused on their reproductive health [22].

Current Status and Gaps

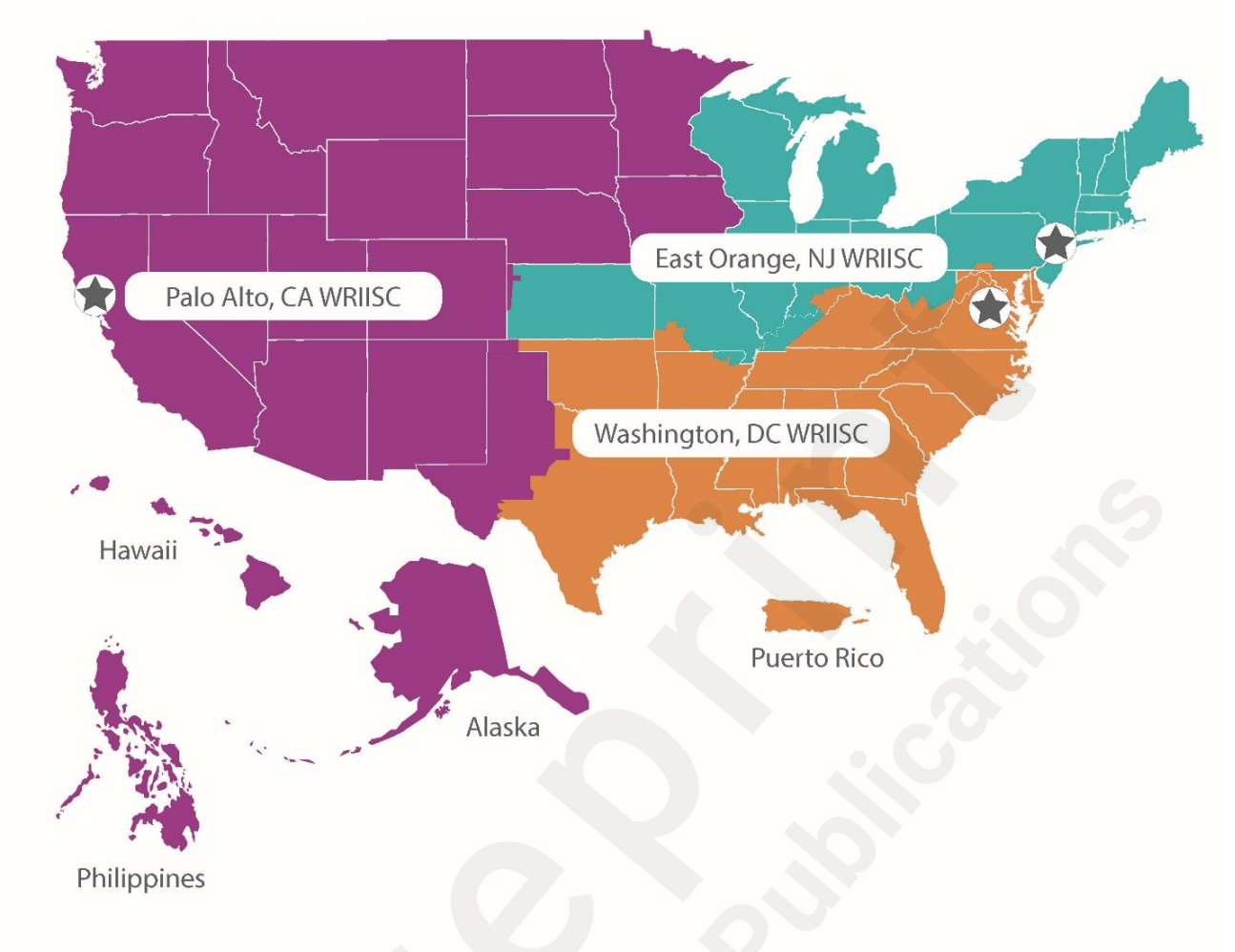
Most of the research conducted among WVs, or examining sex differences among Veterans from the Gulf War and post-9/11 eras, have been observational studies focused on mental

health, such as PTSD, military sexual trauma (MST), and substance use disorders (SUD) [19, 23]. While the number of studies on WVs is growing, several reviews have reported that gaps in the extant literature on WV's health remain and have highlighted the lack of sex-specific results from studies on all Veterans [18, 23-25]. Many of the reproductive health studies among WVs utilized clinical records or qualitative interviews (versus self-reported questionnaires) or examined specific age-related reproductive health issues such as contraception or pregnancy (versus multiple conditions across the life span) [22, 23]. Topics such as infertility and menopause have been identified as key knowledge gaps in the reproductive health literature, and the need to assess reproductive health outcomes using standardized measures has been highlighted [22]. To our knowledge, there are no standardized women's health questionnaires for WVs.

WRIISC & WOMEN CoE

Established in 2001, the War Related Illness and Injury Study Center (WRIISC) is a national tertiary care center at VA utilizing a multidisciplinary translational approach to the care of Veterans with MEE concerns [6, 26, 27]. There are three sites across the U.S. (California, New Jersey, and Washington, District of Columbia) that provide post-deployment health services for the Veterans in their catchment areas (see Figure 1), including clinical care, education, and research [6, 26].

Figure 1. WRIISC | WOMEN CoE Clinical Service Areas.

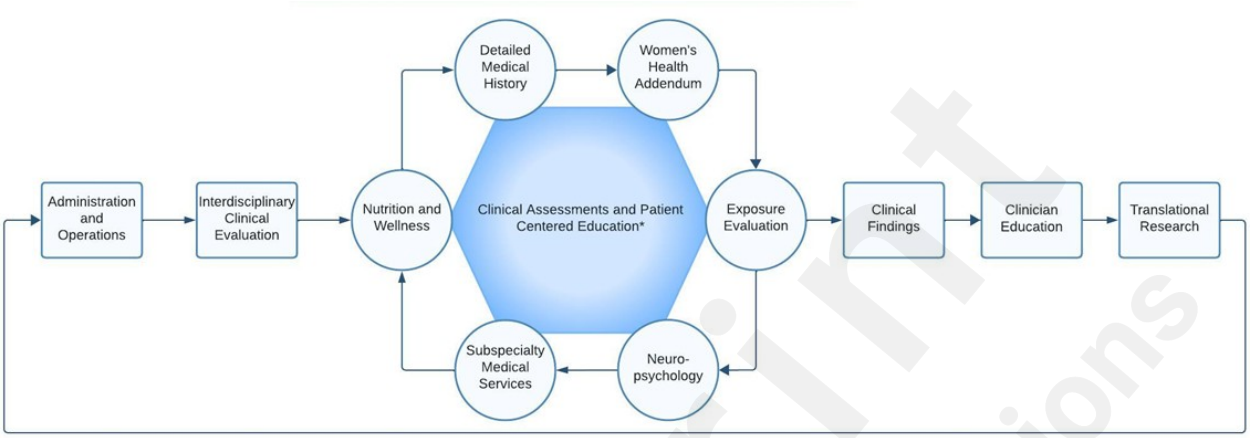


Note: Clinical services for Women's Operational Military Exposure Network Center of Excellence (WOMEN CoE) are provided by the War Related Illness and Injury Study Centers (WRIISC).

In 2022, VA established the Women's Operational Military Exposure Network (WOMEN) to address the growing health concerns of WVs with MEEs, and in 2024 designated it a Center of Excellence (CoE) [28, 29]. In alignment with WRIISC, WOMEN CoE provides a multipronged approach to the care of WVs with the goal of evaluating the health of women with MEE concerns, investigating the impact of MEEs, and offering resources to providers, patients, and key stakeholders [28]. In this report, we describe the activities of the clinical care pillar (see Figure 2), which has been described elsewhere [28]. Briefly, WOMEN CoE clinical services are provided by CA WRIISC clinicians during week-long virtual appointments. The Women's Health Addendum (WHA), a clinical tool designed to assess

health conditions that are female-specific or disproportionately impact women, was developed and implement by WOMEN CoE.

Figure 2. WOMEN CoE Clinical Process Flow Chart



This clinical process flow chart shows the different components that make up the Women's Operational Military Exposure Network Center of Excellence (WOMEN CoE) clinical services. Except for the Women's Health Addendum (WHA), clinical services are provided by the War Related Illness and Injury Study Center (WRIISC).

Objective

The primary objective of this project is to: (1) describe the development and implementation of a comprehensive health questionnaire for WVs; (2) systematically describe and characterize the health conditions of women seeking care for MEE-related health concerns; and (3) utilize findings to inform clinic policies and develop targeted programs to address the most common health concerns among women seen at the WRIISC.

METHODS

Women's Health Addendum

The WRIISC intake packet was created in 2012 and contains questions on demographics, health concerns, military and deployment information, MEE history, and standardized

questionnaires to assess cognitive difficulties, mental health, and physical functioning. The primary purpose of this tool is to aid WRIISC clinicians in their assessment of Veterans assigned to a comprehensive, one week evaluation. When this questionnaire was originally designed, the target population was primarily men. Since then, the number of women accessing VA services and seeking treatment at the WRIISC has been steadily increasing. While the WRIISC intake packet addressed a wide range of topics, gaps in topics related to women's health existed. Furthermore, WVs across different ages and deployment eras voiced their concerns about MEEs and how it impacts their reproductive and sexual health. To effectively address these concerns, the WHA was introduced.

Development of WHA

Development of the WHA began in summer 2022. Led by the nurse practitioner, a small group at WOMEN CoE began assessing what was missing from the WRIISC intake packet regarding women's health. Following the initial assessment, an extensive literature review was conducted to examine what questionnaires on women's health, deployment, and MEEs already existed. The literature review included studies of WVs from the Gulf War and post-9/11 eras as more than 70% of the women seen at WRIISC have served during one of these eras.

Studies with a reproductive health focus were reviewed to assess the scope of problem and identify the health issues most frequently reported among WVs [30]. Studies that utilized questionnaires to assess self-reported women's health were examined to either: (1) identify a standardized questionnaire, or (2) generate a list of topics covered or questions asked to include in the WHA [17, 31]. In studies that utilized questionnaires to assess WVs'

reproductive health, standardized assessments were not used.

In addition to the literature review, the preliminary version of the WHA included conditions added by the clinical team that were deemed clinically relevant (e.g., miscarriages and reproductive cancers) or were frequently discussed during comprehensive visits (e.g., incontinence and sexual function).

During pilot testing, the preliminary version of the WHA was administered via video appointments to CA WRIISC WVs who were attending the week-long telehealth comprehensive appointments. The addendum was administered by the nurse practitioner or the clinical director, and consent was obtained prior to administration. Veteran and clinician feedback was solicited at the end of each appointment. Additional edits were made to the WHA to improve comprehension, ensure comprehensiveness, and maintain a reasonable length.

Based on findings from the literature, feedback from WVs and clinicians, and clinical expertise, the WHA was developed through an iterative process and designed to work in conjunction with the WRIISC intake packet. The purpose of the WHA is to: (1) assess the prevalence of health conditions that are female-specific or disproportionally impact WVs across the tri-WRIISC; (2) to examine the relationship between these health conditions and MEEs; and (3) utilize findings to inform clinic policies and develop targeted programs to address the most common health concerns among women seen at the WRIISC.

Questions in WHA

Currently, the WHA questionnaire consists of 81 adaptive multiple choice, yes-no, and fill-in-

the-blank questions across seven categories including: sexual health, endocrine health, reproductive health, pregnancy, urinary health, mental health, and menopause. The questions are related to health concerns that are female-specific, or that disproportionately impact women across the life span. For example, there are questions on age-related conditions (e.g., infertility or menopause) and questions on health conditions that can occur at any age (e.g., urinary health or sexual health). A description of the categories and sample questions for each are available in Table 1.

Table 1. Categories and Sample Questions from the Women's Health Addendum Questionnaire

Categories	Description	Sample Question
Sexual Health	Questions related to sexual functioning and pelvic floor dysfunction	Have you experienced pelvic floor dysfunction such as chronic pelvic pain or pain with intercourse?
Endocrine Health	Questions related to endocrine complications such as endometriosis and polycystic ovary syndrome (PCOS)?	Have you been diagnosed with polycystic ovary syndrome (PCOS)?
Reproductive Health	Questions related to infertility and cancers	Have you experienced issues with fertility?
Pregnancy	Questions related to pregnancy and pregnancy-related complications	Did you experience gestational diabetes?
Urinary Health	Questions related to urinary health such as urinary incontinence and urinary tract infections	Did you experience urinary tract infections (UTIs) during your deployment?
Mental Health	Questions related to mental health during pregnancy and menstruation	Have you experienced prenatal depression?
Menopause	Questions related to menopause and post-pregnancy including menopause diagnosis and treatments, and major surgical procedures such as hysterectomy	Have you used, or are you currently using, hormone replacement therapy?

The WHA is organized by category and employs branching logic to improve questionnaire flow and display relevant questions. Due to the sensitive nature of the topics covered,

participants can skip questions that are triggering or elicit an unwanted reaction. As a note, because this is an addendum to the WRIISC intake packet, questions on exposures, military history, and other health conditions are not included.

Population

WOMEN CoE Participants

Participants in the WOMEN CoE program evaluation project are WRIISC clinical patients who had a referral to one of three WRIISC sites. Specifically, eligible WVs are those with medically unexplained symptoms lasting for more than six months, difficult-to-diagnose post-deployment health concerns, an overseas deployment, and concerns about MEEs [6, 28]. Additional requirements include a completed WRIISC intake packet. WOMEN CoE participants are more likely to be older (over 50 years old), enlisted, Army, non-Hispanic white, and post-9/11 Veterans. Additionally, as a tertiary care clinic, WRIISC clinical patients have more complex health problems and are more likely to use VA services than the general Veteran population.

Procedures

Implementation of WHA

The WHA was implemented in two phases (see Figure 3). In Phase 1, WOMEN CoE staff sent introductory letters to former CA WRIISC patients who had completed the WRIISC intake packet announcing the newly established WOMEN CoE, describing the WHA, and explaining its purpose. The letter was signed by the CA WRIISC clinical director and sent via the Veteran's patient portal. Following the letter, WOMEN CoE staff invited Veterans via phone to complete the WHA. For Veterans who agreed to participate, the questionnaire was administered by phone with WOMEN CoE staff and responses were entered into Qualtrics.

Due to the sensitive topics covered in the WHA, women were also provided the option to complete the questionnaire online via Qualtrics.

At the end of Phase 1, a thorough review of the WHA was conducted to assess survey flow, number and type of questions, and ease of comprehension. Additional edits to the survey were incorporated based on patient and staff feedback. Examples of changes made include rearranging questions within categories, adding questions to the reproductive health section to include surrogacy, and language adjustments to improve comprehension. Due to the positive Veteran feedback, and interest from NJ and DC WRIISC leadership, Phase 2 was implemented.

In Phase 2, the WHA was administered online via Qualtrics to former DC and NJ WRIISC patients who had completed the WRIISC intake packet. This option was also used for former CA WRIISC patients who were not successfully reached by phone, and for current CA WRIISC patients. To improve response rates for NJ and DC, introductory letters were accompanied by messages from the respective clinical directors. Phase 2 is ongoing, and modifications will be made based on feedback from Phase 2.

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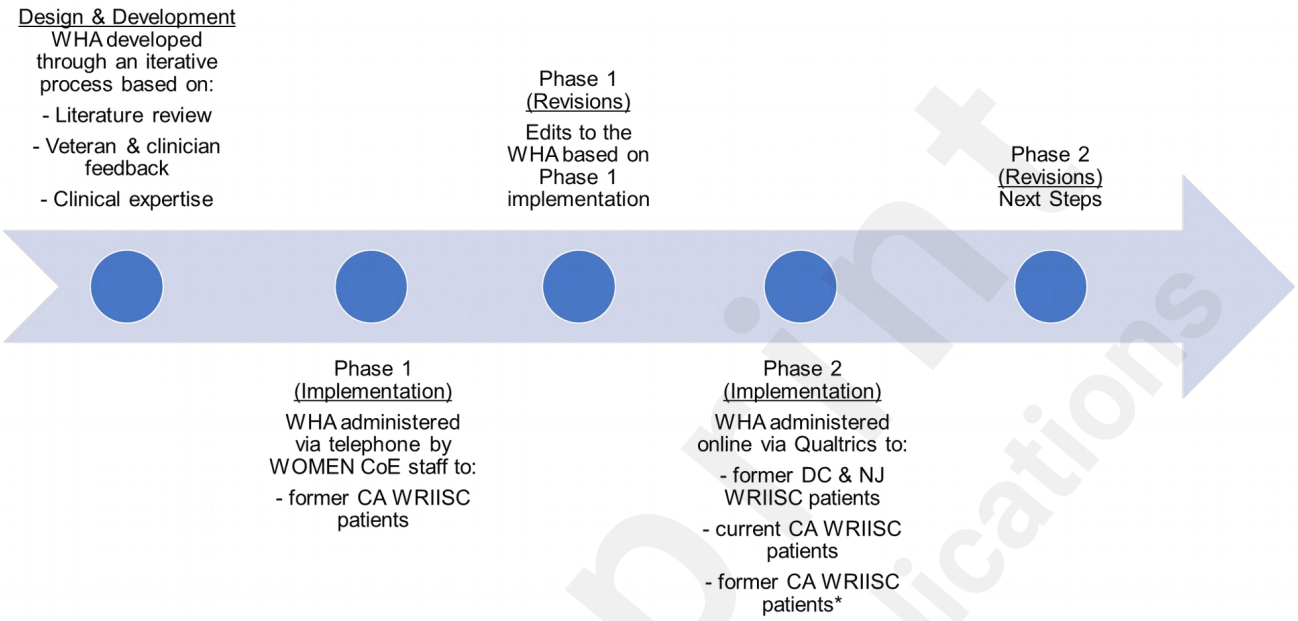
Figure 3. Implementation of the Women's Health Addendum, 2022 – 2024



Note: * Former CA WRIISC patients who were not successfully reached during Phase 1; WHA = Women's Health Addendum; CA = California; DC = Washington, DC; NJ = New Jersey

Ethics

The Stanford Institutional Review Board (IRB) has reviewed and determined that this project does not meet the definition of human subject research as defined in federal regulations 45 CFR 46.102 or 21 CFR 50.3.

Data Analysis

Findings from the WHA are based on data that were collected as part of a larger program evaluation project to improve care among WVs seen at the WRIISC. Descriptive statistics are presented for selected results. Data were analyzed using IBM SPSS Statistics Version 29 [32].

RESULTS

From October 2022 to April 2024, a total of 63 WVs completed the WHA. In Phase 1, 75 women who had a completed WRIISC intake packet were invited to participate. Of these, 38.7% responded. In Phase 2, 34 of the 325 invited Veterans (10.46%) responded.

Table 2 presents self-reported demographic and military characteristics of the sample. More than half (62%) of respondents were from the CA WRIISC catchment area, followed by NJ (22%) and DC (16%) WRIISC sites. The average age was 51.75 years, with nearly 40% of women between the ages of 50 – 59 years old. Most identified as non-Hispanic white (80.36%) and reported being married (49.15%). Nearly 70% served during post-9/11 (38.16%) or Gulf War I (28.95%) eras. All women in this sample had at least one deployment (range = 1–5), with an average deployment length of 10.08 months. The majority served in enlisted ranks (81.36%) and on active duty (79.37%) across all branches, but primarily Army (53.70%) and Air Force (33.33%). Overall, length in service was an average of 10.55 years, ranging from 0.33–28.08 years.

Table 2. Demographic and Military Characteristics of Women Veteran Respondents, 2022 - 2024

Characteristic	Women (n=63)
Age, mean years (SD)[a]	51.75 (9.32)
Age, year	
30-39	9 (14.29)
40-49	14 (22.22)
50-59	25 (39.68)
60+	15 (23.81)
Race/Ethnicity,[b] n (%)	
American Indian or Alaskan Native	3 (5.36)
Black, non-Hispanic	3 (5.36)
Hispanic/Latino	5 (8.93)
White, non-Hispanic	45 (80.36)
Marital Status,[c] n (%)	
Currently married	29 (49.15)
Divorced/widowed	13 (22.03)
Never married	11 (18.64)
Other [d]	6 (10.17)
Branch of Service,[e] n (%)	
Air Force	18 (33.33)
Army	29 (53.70)
Marines	3 (5.56)
Navy	4 (7.41)
Military Service Component, n (%)	
Active Duty	50 (79.37)
Reserves/Guard	28 (44.44)
Both	20 (31.75)
Service Era,[f] n (%)	
Gulf War I	22 (28.95)
Post-9/11	29 (38.16)
Other combat deployments [g]	9 (11.84)
Non-combat deployments	16 (31.75)
Rank,[h] n (%)	
Enlisted	48 (81.36)
Officers	11 (18.64)
Number of Deployments,[i] mean (SD)	1.39 (1.02)
Deployment Length,[j] mean months (SD)	13.8 (17.16)
Service Length, mean years (SD)	10.55 (7.57)
WRIISC Site, n (%)	
California	39 (61.90)
New Jersey	14 (22.20)
Washington, DC	10 (15.90)

Note: Includes self-identified demographic and military characteristics. [a] SD = standard deviation; [b] n=7 missing; [c] n=4 missing, [d] Other marital status includes living with a partner, separated; [e] n=9 missing; [f] n=7 missing; [g] Other combat deployments includes e.g., Somalia, Bosnia, etc., with some participants serving across multiple eras; [h] n=4 missing; [i] n=12 missing; [j] n=16 missing

Several health conditions that are female-specific or more prevalent in women were reported (Figure 4). Approximately 97% of reported at least one health condition and 87% reported three or more. Among those who responded, the most prevalent conditions included sexual dysfunction (69.7%), urinary incontinency (58.93%), pelvic floor dysfunction

(52.40%), pregnancy loss (44.44%), urinary tract infections (UTIs) (41.82%), uterine fibroids (40.32%), and hysterectomy (35.48%). Overall, 43% of these concerns were related to urinary health and pelvic floor dysfunction.

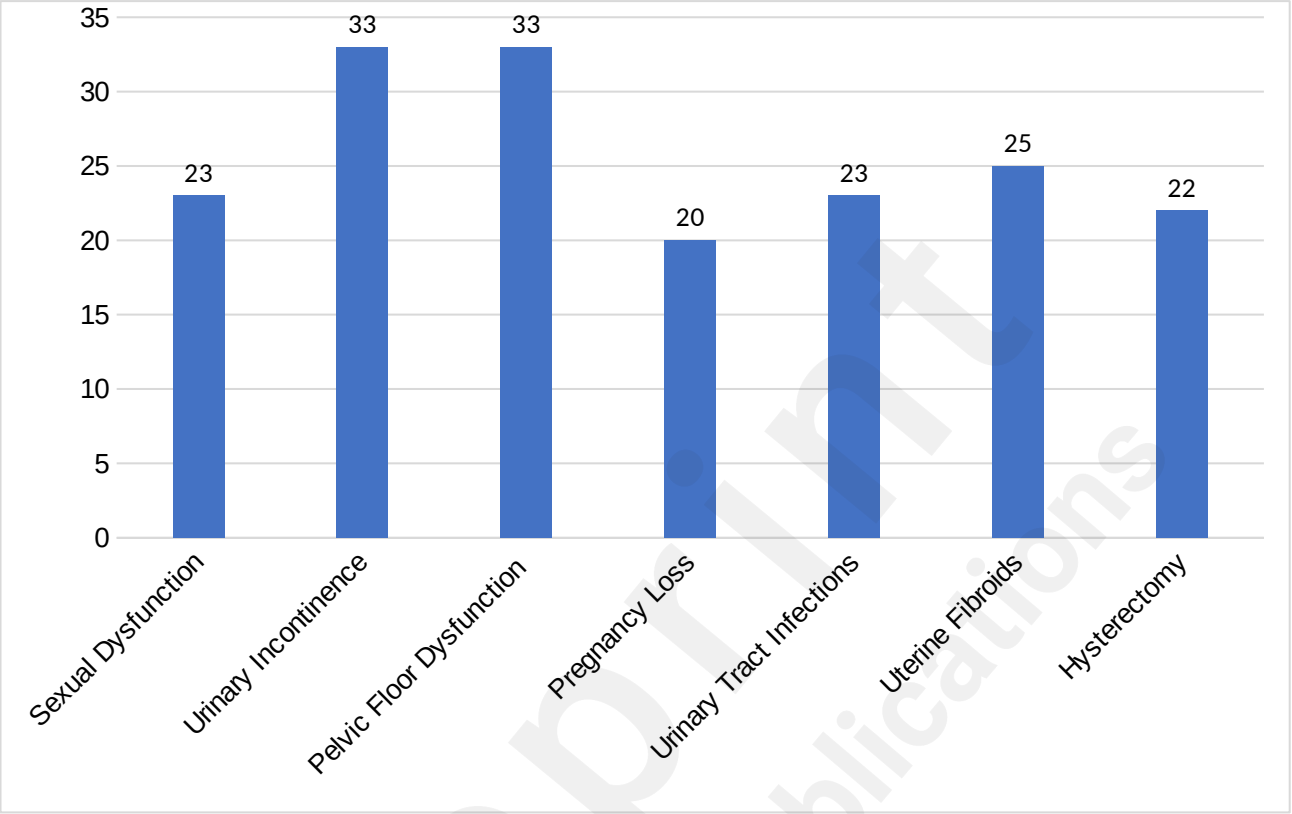


Figure 4. Number of Most Frequently Reported Women's Health Conditions Among Women Veteran Respondents 2022 – 2024 (n=63)*

Note: *n=63 is the total number of women in the sample. [a] Response totals are noted in parenthesis at the top of each condition. This figure depicts the total number of women who reported having at least one of the health conditions listed. The most frequently reported conditions are based on the number of total responses for each health condition.

DISCUSSION

With the number of WVs on the rise, understanding their health and MEE concerns is important to address their needs. This comprehensive report captures the self-reported health problems of WVs with exposure histories. As part of a larger program evaluation project, a new women's health questionnaire was developed by WOMEN CoE to serve as an addendum to the tri-WRIISC intake packet for WVs. The WHA was developed through an iterative process, incorporating literature review, Veteran and clinician feedback, and

clinical expertise. Implementation of the WHA is currently in Phase 2 and results have been presented here. The respondents are women with MEE concerns seen at a tertiary VA care center, who primarily served during Gulf War I and/or post-9/11 eras across all branches as active-duty service members in enlisted ranks. Respondents reported several health concerns that are unique to female physiology or disproportionately impact women that were previously absent from the WRIISC intake packet. Of the nearly 97% of women who reported at least one health condition, more than half were related to urinary health, pelvic floor dysfunction, and sexual dysfunction. Given the critical role that the pelvic floor plays in urinary and sexual health, it is not surprising that these are collectively the top health concerns. However, other concerns such as pregnancy loss and uterine fibroids were also frequently reported. Findings from this program evaluation project highlight areas of need for this patient populations, ensure that women's health issues are adequately addressed and studied, and improve healthcare equity for deployed veterans with MEE.

Overall, research examining the health of WVs from the Gulf War and post-9/11 eras have increased in recent years, many of which have focused on mental health [23-25]. For studies among Gulf War Veterans, most have highlighted the physical and mental health status of Gulf War Veterans, reported on health challenges facing Gulf War Veterans such as GWI and chronic diseases, and have described the prevalence of health conditions and military exposures [17-19, 25, 33-36]. However, health outcomes specific to WVs and related to reproductive health or women's life course events have been poorly studied [18]. For studies among post-9/11 Veterans, most have focused on various mental health topics (e.g., PTDS, MST, and SUD), assessed barriers and facilitators to healthcare access and utilization (e.g., delayed care, financial concerns, attrition), examined military exposures and combat-related stressors, and described post-deployment health (e.g., chronic

multisymptom illness, pain, and traumatic brain injury) [20, 21, 23, 24, 37-40]. Studies on the reproductive health of post-9/11 WVs are also limited [22].

The results of this descriptive program evaluation project on women's health conditions were consistent with findings from the literature. For example, Katon et al also reported high prevalence of reproductive health conditions [30]. Although the percentage was considerably higher among WHA respondents, Katon et al found that 43% of VA users had at least one reproductive health diagnosis [30]. Moreover, among women with a diagnosis, urinary conditions (including incontinence) were the most common diagnosis across all age groups; however, sexual dysfunction and pregnancy-related conditions were also among the top diagnoses [30]. Other studies among Gulf War and post-9/11 Veterans have also reported urinary conditions as top diagnoses [41, 42]. In Gaffey et al, 26.5% of post-9/11 WVs reported pelvic pain [37]. Results from studies on pregnancy-related outcomes have been mixed [43]. However, Araneta et al found similar adverse pregnancy outcomes among Gulf War postwar conceptions, including 22.8% spontaneous abortions, 0.7% stillbirth, and 10.7% ectopic pregnancy [44]. In another study among Gulf War Veterans, pregnancies ending in miscarriage/stillbirth was 25.7% for all respondents, with rates higher among Gulf War Veterans compared to Gulf War era Veterans [45]. Although VA hysterectomy rates appear to be decreasing, elevated risk of early hysterectomy was found in one study among Veterans under age 65 compared to non-Veterans [22]. Among WHA respondents, 35.48% reported a hysterectomy. Uterine fibroids were also among the most frequently reported health conditions among this WHA sample. Even at 40.32%, this is likely an underestimate as many women are asymptomatic [46].

Clinical Implications/Applications

In this clinical program evaluation, nearly 70% of respondents stated that women's health was important. This is not surprising given that concerns raised by WVs was one of the many drivers of the development and implementation of the WHA. Additionally, the high percentage of women that endorsed three or more health conditions highlights the need for services related to women's health, especially for this cohort of WVs with exposure histories. Furthermore, studies have shown that women with at least one reproductive health diagnosis are more likely to have concomitant medical/mental health diagnoses and have more VA outpatient encounters compared to those without a reproductive health diagnosis [22]. Although conclusions from this initial assessment are limited, future efforts to evaluate further are underway.

Strengths and Limitations

This clinical program evaluation has several strengths. First, WOMEN CoE was able to identify a gap in the current WRIISC intake packet and take steps to address it by implementing a questionnaire to assess health outcomes that impact women. WOMEN CoE clinical staff were able to incorporate Veteran and clinician feedback, literature review, and clinical expertise in its development and implementation. Second, this addendum has gone through several iterations to improve flow, length, comprehension, and coverage of important topics. At each implementation phase, changes have been identified, and modifications implemented, to improve the WHA and its response rates. Third, although these are descriptive findings and further examination is warranted, the WHA results highlight the clinical needs of WVs with MEE concerns seen at a WRIISC/WOMEN CoE, and the clinical team can address these by prioritizing services and resources based on these findings.

There are also limitations. One limitation is the small sample size. The sample size was not large enough to assess differences by sociodemographic, military, clinical, or other factors. With a larger sample size, we hope to conduct additional analyses to better understand our patient population. Furthermore, a larger sample size will improve future studies that aim to explore the association between MEEs reported in the WRIISC intake packet and reproductive health conditions reported in the WHA. The small sample size is driven in part by the small number of women seen at WRIISC (n = 799). While the proportion of WVs at WRIISC (18%) is higher than that of WVs across VA at large (9.2%)[2], as a tertiary care center, the total number of WRIISC Veterans (men and women) is still small. The low response rate in Phase 2, also contributes to the small sample size. At the end of Phase 1, the response rate was moderate (38.7%); however, the current response rate for Phase 2 is low (10.46%). Phase 2 is still ongoing, so the response rate might increase. Possible explanations for the low response rate include differences in survey administration, lack of familiarity with WOMEN CoE staff, and greater time since WRIISC visit. Changes to the survey modality were necessitated by the large number of WVs in Phase 2. While WOMEN CoE staff were able to schedule appointments with former CA WRIISC patients in Phase 1, by expanding roll-out to include former DC and NJ WRIISC patients, WOMEN CoE staff needed to transition to an online questionnaire to ensure proper scale-up. In addition, because of some overlap between CA WRIISC and WOMEN CoE clinicians, CA WRIISC patients might have been familiar with WOMEN CoE staff, which may also account for improved response rates in Phase 1. Furthermore, because DC and NJ WRIISC sites were established earlier, former patients may not have had contact with WRIISC in over 23 years, which may have contributed to greater reluctance or a disinclination to respond to the invitations. Next steps include working closely with DC and NJ WRIISC staff to improve response rates among former patients and addressing barriers when expanding to new DC

and NJ WRIISC patients.

Another limitation is that results from this program evaluation may not be generalizable to the typical WV population. At present, the WHA is specific to WOMEN CoE Veterans seeking care at a tertiary care center with complex medical histories and exposure concerns. Furthermore, the WHA is an addendum and therefore, extensive information on lifetime and military exposures, military service, and other physical and mental health histories, are not available without the WRIISC intake packet. However, plans to link WHA to the WRIISC intake packet are currently underway, which would allow clinicians to work closely with researchers to explore potential associations with MEEs.

Lastly, the data from this program evaluation is based on self-report, which may have introduced bias. However, several studies related to reproductive health have used patient surveys [22]. Furthermore, the WRIISC intake packet is also based on self-report and studies have shown that self-report can be an important aspect of assessing health [47]. Given the complex medical histories of WOMEN CoE patients, it is not unreasonable to expect higher rates of self-reported health conditions compared to the general Veteran population. Additional evaluation efforts include validating self-report with electronic medical records.

Future Direction and Next Steps

Future modifications have already been proposed based on preliminary findings from Phase 2, including changing the question format for most fill-in-the-blank questions to forced multiple choice. These results have shown that fill-in-the-blank questions have

poorer response rates and often include responses that are difficult to interpret and analyze. For example, a question on number of pregnancies will include “multiple” but not specify the number. In this example, the proposed change would include adding multiple choice response options (e.g., 1, 2, 3, 4, and 5 or more). Another proposed change includes adding additional identifier questions (e.g., last 4 SSN) to improve linking to the WRIISC intake packet. Although the WHA currently includes identifier questions such as name and date of birth, changes in names due to life events (e.g., marriage or divorce), typos, or variations (e.g., nicknames), may pose a challenge when linking the WHA to the WRIISC intake packet, especially for former patients who completed the WRIISC intake packet many years ago.

Additional next steps include implementation of WHA for current DC and NJ WRIISC patients. This step requires further coordination with DC and NJ centers to ensure that the questionnaire is sent within seven days of a patient's week-long appointment, and additional staffing to ensure timely delivery of the invitation letter and questionnaire. While these implementation barriers have delayed Phase 3 roll-out, both WRIISC centers are working closely with WOMEN CoE to address them and identify facilitators for this and future next steps. Next steps also include the dissemination/expansion of the WHA to others. Several VA programs and centers have signaled interest in using the WHA for their patient/participant populations. This and future publications on the WHA are part of an effort to expand access beyond VA.

Conclusion

As part of a program evaluation, WOMEN CoE clinical staff developed and implemented an addendum to the WRIISC intake packet to address the unique health concerns of WVs.

Initial findings highlight the reproductive health care needs of women with MEE concerns. As more women complete the WHA, WOMEN CoE will be able to assess prevalence of health concerns, identify unmet health needs to prioritize, improve clinical care, evaluate protentional associations of health concerns with MEEs, and disseminate findings to Veterans and providers.

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CONFLICTS OF INTEREST

None Declared

ABBREVIATIONS

CA: California

DC: Washington, District of Columbia

GWI: Gulf War Illness

MEE: Military environmental exposures

MST: military sexual trauma

NJ: New Jersey

PTSD: Post-traumatic stress disorder

SSN: Social security number

SUD: substance use disorders

UTI: urinary tract infections

VA: Department of Veteran Affairs

WHA: Women’s Health Addendum

WOMEN CoE: Women’s Operational Military Exposure Network Center of Excellence

WRIISC: War Related Illness and Injury Study Center

WVs: Women Veterans

Preprint JMIR Publications

REFERENCES

1. Women Veterans Health Care. *Women Veterans in Focus*. 2022 [cited 2023; Available from: https://www.womenshealth.va.gov/materials-and-resources/facts-and-statistics.asp.
2. Breland JY, F.S., Saechao F, Gujral K, Vashi AA, Shaw JG, Gray KM, Illarmo SS, Urech T, Grant N, Berg E, Offer C, Veldanda S, Schoemaker L, Dalton AL, Esmaeili A, Phibbs CS, Hayes PM, Haskell S., *Sourcebook: Women Veterans in the Veterans Health Administration. Volume 5: Longitudinal Trends in Sociodemographics and Utilization, Including Type, Modality, and Source of Care*. , O.o.W.s.H. Women's Health Evaluation Initiative, Editor. 2024, Veterans Health Administration, Department of Veterans Affairs: Washington DC. .
3. Frayne, S.M., et al., *Sourcebook: Women Veterans in the Veterans Health Administration. Volume 4: Longitudinal Trends in Sociodemographics, Utilization, Health Profile, and Geographic Distribution*, W.s.H.S. Women's Health Evaluation Initative, Editor. 2018, Veterans Health Administration, Department of Veterans Affairs: Washington DC.
4. Katon JG, T.E., Eleazer JR, Frayne SM, Haeger KO, Luo S, Schule AKR, Offer C, Phibbs CS, Rose D, Saechao F, Shankar M, Shaw J, Vinekar KS, Yano EM, Christy AY, Johnson AM., *State of Reproductive Health Volume II: VA Reproductive Health Diagnoses and Organization of Care*, V.H.A. Office of Women's Health, Editor. 2023 Department of Veterans Affairs.
5. Kamarck, K.N., *Women in combat: Issues for Congress*. 2016, Congressional Research Service: Washington, DC.
6. War Related Injury and Illness Center. *War Related Injury and Illness Center (WRIISC)*. 2023 [cited 2023; Available from: https://www.warrelatedillness.va.gov/WARRELATEDILLNESS/index.asp.
7. Patten, E.P., Kim. *Women in the U.S. Military: Growing Share, Distinctive Profile*. Pew Social & Demographic Trends 2011; Available from: https://www.pewresearch.org/social-trends/2011/12/22/women-in-the-u-s-military-growing-share-distinctive-profile/.
8. DeBeer, B.B., et al., *The Association Between Toxic Exposures and Chronic Multisymptom Illness in Veterans of the Wars of Iraq and Afghanistan*. J Occup Environ Med, 2017. **59**(1): p. 54-60.
9. White, R.F., et al., *Recent research on Gulf War illness and other health problems in veterans of the 1991 Gulf War: Effects of toxicant exposures during deployment*. Cortex, 2016. **74**: p. 449-75.
10. Taylor, M.G., S. Ureña, and B.L. Kail, *Service-Related Exposures and Physical Health Trajectories Among Aging Veteran Men*. Gerontologist, 2016. **56**(1): p. 92-103.
11. Cherry, N., et al., *Health and exposures of United Kingdom Gulf war veterans. Part II: The relation of health to exposure*. Occup Environ Med, 2001. **58**(5): p. 299-306.
12. Jeffrey, M.G., et al., *Neuropsychological Findings in Gulf War Illness: A Review*. Front Psychol, 2019. **10**: p. 2088.
13. Vasterling, J.J., et al., *Neuropsychological outcomes of army personnel following deployment to the Iraq war*. JAMA, 2006. **296**(5): p. 519-29.
14. Toomey, R., et al., *Neuropsychological functioning of U.S. Gulf War veterans 10 years after the war*. J Int Neuropsychol Soc, 2009. **15**(5): p. 717-29.
15. King, L.A., et al., *Risk factors for mental, physical, and functional health in Gulf War veterans*. J Rehabil Res Dev, 2008. **45**(3): p. 395-407.
16. Schultz, D., et al., *Improving Support for Veteran Women: Veterans' Issues in Focus*. Rand Health Q, 2023. **10**(2): p. 10.

17. Ansa, B.E., et al., *The Gulf War Women's Health Cohort: Study Design and Protocol.* Int J Environ Res Public Health, 2020. **17**(7).
18. Coughlin, S.S., et al., *A Review of Epidemiologic Studies of the Health of Gulf War Women Veterans.* J Environ Health Sci, 2017. **3**(2).
19. Dursa, E.K., et al., *Health Status of Female and Male Gulf War and Gulf Era Veterans: A Population-Based Study.* Womens Health Issues, 2019. **29 Suppl 1**: p. S39-S46.
20. Street, A.E., et al., *Gender differences among veterans deployed in support of the wars in Afghanistan and Iraq.* J Gen Intern Med, 2013. **28 Suppl 2**(Suppl 2): p. S556-62.
21. Street, A.E., D. Vogt, and L. Dutra, *A new generation of women veterans: stressors faced by women deployed to Iraq and Afghanistan.* Clin Psychol Rev, 2009. **29**(8): p. 685-94.
22. Katon, J.G., et al., *Reproductive Health of Women Veterans: A Systematic Review of the Literature from 2008 to 2017.* Semin Reprod Med, 2018. **36**(6): p. 315-322.
23. Danan, E.R., et al., *An Evidence Map of the Women Veterans' Health Research Literature (2008-2015).* J Gen Intern Med, 2017. **32**(12): p. 1359-1376.
24. Bean-Mayberry, B., et al., *Systematic review of women veterans' health: update on successes and gaps.* Womens Health Issues, 2011. **21**(4 Suppl): p. S84-97.
25. Goldzweig, C.L., et al., *The state of women veterans' health research. Results of a systematic literature review.* J Gen Intern Med, 2006. **21 Suppl 3**(Suppl 3): p. S82-92.
26. Lange, G., et al., *War Related Illness and Injury Study Center (WRIISC): a multidisciplinary translational approach to the care of Veterans with chronic multisymptom illness.* Mil Med, 2013. **178**(7): p. 705-7.
27. Lincoln, A.E., et al., *The war-related illness and injury study centers: a resource for deployment-related health concerns.* Mil Med, 2006. **171**(7): p. 577-85.
28. Assefa, M.T., et al., *A Multipronged Approach to Caring for Women Veterans With Military Environmental Exposures.* Womens Health Issues, 2024. **34**(4): p. 325-330.
29. Women's Operational Military Network CoE. *Women's Operational Military Exposure Network Center of Excellence (WOMEN CoE)*. 2024 [cited 2024; Available from: https://www.warrelatedillness.va.gov/WARRELATEDILLNESS/WRIISC-WOMEN/ww-about-us.asp.
30. Katon, J.G., et al., *Prenatal Care for Women Veterans Who Use Department of Veterans Affairs Health Care.* Womens Health Issues, 2015. **25**(4): p. 377-81.
31. Miller, L.J. and N.Y. Ghadiali, *Gender-specific mental health care needs of women veterans treated for psychiatric disorders in a Veterans Administration Women's Health Clinic.* Med Care, 2015. **53**(4 Suppl 1): p. S93-6.
32. IBM, C., *IBM SPSS Statistics for Windows*. 2023, IBM Corp.: Armonk, NY.
33. Abou-Donia, M.B., et al., *Sex-Based Differences in Plasma Autoantibodies to Central Nervous System Proteins in Gulf War Veterans versus Healthy and Symptomatic Controls.* Brain Sci, 2021. **11**(2).
34. Heboyan, V., et al., *Sex Differences in Gulf War Illness: A Reanalysis of Data From the CDC Air Force Study Using CDC and Modified Kansas Case Definitions.* J Occup Environ Med, 2019. **61**(7): p. 610-616.
35. Krengel, M., et al., *Neurotoxicant exposures and rates of Chronic Multisymptom Illness and Kansas Gulf War Illness criteria in Gulf War deployed women veterans.* Life Sci, 2021. **280**: p. 119623.
36. Sullivan, K., et al., *Prevalence and Patterns of Symptoms Among Female Veterans of the 1991 Gulf War Era: 25 Years Later.* Journal of women's health, 2020.
37. Gaffey, A.E., et al., *Baseline Characteristics from the Women Veterans Cohort Study: Gender*

Differences and Similarities in Health and Healthcare Utilization. J Womens Health (Larchmt), 2021. **30**(7): p. 944-955.
38. Haskell, S.G., et al., *Gender differences in rates of depression, PTSD, pain, obesity, and military sexual trauma among Connecticut War Veterans of Iraq and Afghanistan*. J Womens Health (Larchmt), 2010. **19**(2): p. 267-71.
39. Mohanty, A.F., et al., *Chronic Multisymptom Illness Among Iraq/Afghanistan-Deployed US Veterans and Their Healthcare Utilization Within the Veterans Health Administration*. J Gen Intern Med, 2018. **33**(9): p. 1419-1422.
40. Vogt, D., et al., *Gender differences in combat-related stressors and their association with postdeployment mental health in a nationally representative sample of U.S. OEF/OIF veterans*. J Abnorm Psychol, 2011. **120**(4): p. 797-806.
41. Cohen, B.E., et al., *Reproductive and other health outcomes in Iraq and Afghanistan women veterans using VA health care: association with mental health diagnoses*. Womens Health Issues, 2012. **22**(5): p. e461-71.
42. Dursa, E.K., et al., *Comparison of Health Outcomes Over Time Among Women 1990-1991 Gulf War Veterans, Women 1990-1991 Gulf Era Veterans, and Women in the U.S. General Population*. Womens Health Issues, 2023. **33**(6): p. 643-651.
43. Gawron, L.M., et al., *Impact of Deployment on Reproductive Health in U.S. Active-Duty Servicewomen and Veterans*. Semin Reprod Med, 2018. **36**(6): p. 361-370.
44. Araneta, M.R., et al., *Conception and pregnancy during the Persian Gulf War: the risk to women veterans*. Ann Epidemiol, 2004. **14**(2): p. 109-16.
45. Friedman, A., et al., *Preliminary Findings from the Gulf War Women's Cohort: Reproductive and Children's Health Outcomes among Women Veterans*. Int J Environ Res Public Health, 2022. **19**(14).
46. De La Cruz, M.S. and E.M. Buchanan, *Uterine Fibroids: Diagnosis and Treatment*. Am Fam Physician, 2017. **95**(2): p. 100-107.
47. Haws, K., et al., *A Virtual Functional Medicine-Based Interdisciplinary and Integrative Intervention for Gulf War Illness*. Mil Med, 2024. **189**(Suppl 3): p. 99-105.