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Lifetime Sexual Assault and Sexually Transmitted Infections Among Women Veterans

Vinita Goyal, MD, MPH,[1] Michelle A. Mengeling, PhD, MS,[2–4] Brenda M. Booth, PhD,[5,6] James C. Torner, PhD,[7,8] Craig H. Syrop, MD,[9] and Anne G. Sadler, PhD, RN[2,10]

Abstract

Objective: Women veterans report a high prevalence of sexual assault. Unfortunately, there are limited data on the reproductive health sequelae faced by these women. Our objective was to evaluate the association between completed lifetime sexual assault (LSA) and sexually transmitted infections (STIs) among a cohort of women veterans, adjusting for sexual risk behaviors.

Materials and Methods: We conducted a retrospective study among women veterans aged 51 years or younger who enrolled for care at two Veterans Administration (VA) healthcare sites between 2000 and 2008. Participants completed a telephone interview assessing reproductive health and sexual violence history. We compared the frequencies of past STI diagnoses among those who had and had not experienced LSA. We used logistic regression to assess the effect of sexual assault with history of an STI diagnosis after adjusting for age, sexual risk behaviors, and substance abuse treatment.

Results: Among 996 women veterans, a history of STIs was reported by 32%, including a lifetime history of gonorrhea (5%), chlamydia (15%), genital herpes infection (8%), and human papillomavirus infection (15%), not mutually exclusive; 51% reported LSA. Women with a history of LSA were significantly more likely to report a history of STIs (unadjusted odds ratio [OR] 1.91, 95% confidence interval [CI] 1.45–2.50; adjusted OR 1.49, 95% CI 1.07–2.08).

Conclusions: Women veterans who have experienced LSA are at increased risk for lifetime STI diagnoses. To adequately address the reproductive health needs of the growing population of women veterans, STI risk assessments should include queries of military service and LSA histories.

Keywords: sexual risk veteran, sexual assault, sexually transmitted infection

Introduction

THE POPULATION OF WOMEN who are veterans of the U.S. military is steadily increasing. In fact, the fastest growing group of U.S. military veterans are women. In 2011, there were ~1.8 million women veterans in the United States and this is projected to increase to more than 2 million by 2020.[1,2] Despite the large and increasing population of women veterans in the United States, little is known about their reproductive healthcare needs.[3]

One public health concern that may place veteran women at risk for adverse reproductive health outcomes is the high

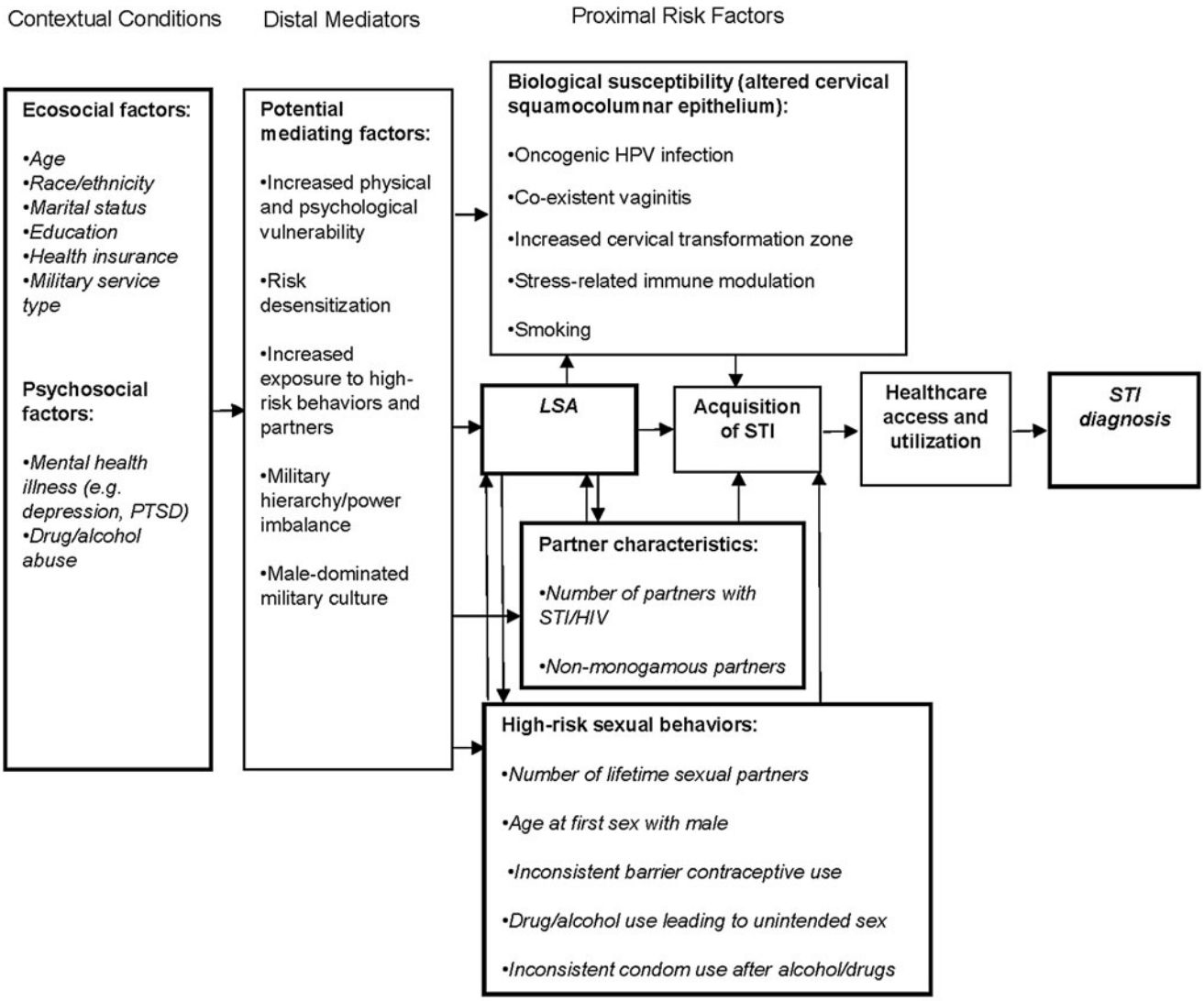
[1]South Texas Veterans Health Care System, San Antonio, Texas.
[2]Comprehensive Access & Delivery Research and Evaluation (CADRE), Iowa City Veterans Health Care System, Iowa City, Iowa.
[3]VA Office of Rural Health, Veteran Rural Health Resource Center, Iowa City, Iowa.
[4]Department of Internal Medicine, University of Iowa Carver College of Medicine, Iowa City, Iowa.
[5]Center for Mental Healthcare Outcomes and Research, Central Arkansas Veterans Healthcare System, Little Rock, Arkansas.
[6]Department of Psychiatry, University of Arkansas for Medical Sciences, Little Rock, Arkansas.
[7]Department of Epidemiology, University of Iowa College of Public Health, Iowa City, Iowa.
Departments of [8]Neurosurgery and Surgery and [9]Obstetrics and Gynecology, University of Iowa Carver College of Medicine, Iowa City, Iowa.
[10]Department of Psychiatry, University of Iowa Carver College of Medicine, Iowa City, Iowa.

prevalence of lifetime sexual assault (LSA). Approximately 18% of women in the U.S. general population report LSA[4] (also referred to as sexual violence). However, women veterans have a higher prevalence of LSA and report greater assault severity and frequency than their civilian counterparts.[5] Women veterans have nearly twofold greater odds of experiencing childhood sexual assault than nonveteran women,[6,7] suggesting that, for some, enlisting in the military serves as an escape from adverse childhood experiences.[6,8] However, violence often extends into military service, as 23%–30% of women veterans report experiencing sexual assault while in the military (SAIM).[9,10]

For many women veterans, sexual violence is not isolated to one period in life, but instead occurs across the lifespan.[11] Military women who are sexually assaulted as children are more likely to also be sexually assaulted during military service.[8–12] Furthermore, women veterans who experience military sexual assault are more likely to be in abusive relationships and to experience sexual violence after leaving the military.[12,13]

Civilian women who have experienced sexual assault appear to have a higher lifetime risk of sexually transmitted infections (STIs),[14,15] yet there are no data evaluating this relationship among veteran women. Consequently, we seek to better understand the relationship between sexual assault and STIs for this cohort of women by using the constructs of ecosocial theory (Fig. 1) as a heuristic model.[16,17] This model takes into account the contextual conditions, as well as mediating and proximal risk factors among military women that may heighten the relationship between sexual assault and STIs beyond what is seen in civilian women.

Demographic (or ecosocial) and psychosocial factors associated with increased risk for sexual assault and STI risk are more common among women veterans than civilian women. Compared with nonveteran women, women veterans are more likely to be unmarried and belong to racial and ethnic minority groups.[18] Both of these demographic factors are associated with an increased risk of STIs.[14,19,20] Similarly, women veterans who



Note: Conceptual model adapted from Buffardi, et al.[17] Variables measured in our analysis are noted in italics in boxes formed by thick lines.

FIG. 1. Conceptual model based on ecosocial theory describing contextual, mediating, and proximal risk factors that may influence the association between LSA and STIs. LSA, lifetime sexual assault; STI, sexually transmitted infection.

report military sexual trauma (MST), defined by the Veterans Administration (VA) as severe or threatening forms of sexual harassment and sexual assault that occur during military service, tend to be unmarried.[21] However, compared with their minority counterparts, white women veterans are more likely to report MST.[21] Type of military service may portend a differential risk for STI, as active duty military women are more likely to report MST[21] and those who experienced SAIM are more likely to report an abnormal pap smear (which may be a proxy for STI) than Reserve or National Guard personnel.[22] In addition, insured women veterans who experienced SAIM are more likely to report an abnormal pap smear result[22] and 20% report a history of MST.[21] The high prevalence of depression and post-traumatic stress disorder (PTSD) among military women may result from extraordinary work-related stressors, including combat exposure, MST, and family separation. Women who experience depression or PTSD as a result of SAIM are more likely to engage in high-risk sexual behaviors and have increased risk for STIs.[23]

Unlike most civilian women, women in the military often live and work in an environment with pervasive mediating factors for STI, such as exposure to high-risk behaviors and partners with STIs, a male-dominated military culture, and increased risk of sexual assault. Military service members may frequently engage in high-risk sexual behaviors, including using condoms inconsistently, having multiple sexual partners, having new partners, or having sex while under the influence of alcohol or drugs,[23,24] which may lead military women to have higher risk desensitization and a greater likelihood of engaging in these high-risk behaviors than civilian women.[25,26] At the same time, in a male-dominated field, military women may feel stigmatized as promiscuous if they request condoms to protect against STIs.[27] This stigmatization, as well as the fear of unemployment or thwarted job advancement, may prohibit women from reporting military sexual assault when it occurs,[28,29] contributing to repeated sexual assault and continued exposure to STIs.[30]

Proximal risk factors that may explain the link between sexual assault and STI acquisition include infection as a direct result of sexual assault, involvement in high-risk sexual behaviors that increase the exposure to an infected partner, and increased susceptibility to STI because of impaired biological defenses. Although the incidence of STI as a direct result of sexual assault varies,[31] the risk is high enough that STI prophylaxis is recommended for sexual assault victims seeking immediate medical care.[32] Among nonveteran women who have been sexually assaulted, the long-term risk of STIs may be attributed to increased vulnerability of engaging in high-risk sexual behaviors and continued exposure to sexual assault.[33] Studies among civilian women who are young or who have experienced intimate partner violence demonstrate an association between LSA and involvement in risky sexual behaviors such as having sexual partners who have multiple partners or who have an STI, having unprotected sex because of alcohol or drug use during sexual activity, difficulty negotiating condom use, and feeling unable to refuse to engage in unwanted sexual activity.[34–41] Veteran women who have experienced sexual assault may also engage in these high-risk sexual behaviors, leading to increased STI risk. In addition, women veterans who have experienced sexual assault may have increased biological susceptibility to STI acquisition upon exposure to an infected partner. Even when accounting for high-risk behaviors, STI risk among civilian women may be independently linked to changes in cervical epithelial defense related to increased cervical transformation zone surface area particularly among young women,[42] coexistent vaginitis,[43] oncogenic human papillomavirus (HPV) infection, smoking, and substance use.[44] Stress-related changes in immune system biomarkers that are linked to disease development[45] may also contribute to increased susceptibility of STI acquisition among women veterans who have experienced LSA, although this has not yet been studied.

There are limited data on STI risk among women veterans, including one study that demonstrates higher self-reported STI diagnoses among veteran women than among nonveteran women.[25,46] Yet, there are no studies that examine the association between LSA and STI risk among women veterans and none that look at this relationship within the context of ecosocial, psychosocial, mediating, and proximal risk factors, which may be more prevalent among women veterans than among civilian women. The purpose of our study was to evaluate the association between LSA and STIs among a cohort of women veterans, adjusting for these risk factors.

Materials and Methods

In this retrospective cohort study, data from 1004 women veterans 51 years of age or younger who enrolled for care at the Iowa City or Des Moines Veterans Administration Medical Centers or community-based outpatient clinics between 2000 and 2008 were analyzed to investigate the association between LSA and STIs. Study participants may have enrolled within the VA to receive healthcare, completed a disability claim, enrolled in a registry, or responded to veteran outreach. An introductory letter providing a toll-free number to call and schedule an interview and consents with postage-paid, preaddressed return envelopes was sent to potential study participants. Eligible participants who had not scheduled an interview within 2 weeks of receiving the introductory letter were contacted by telephone. Mail and phone protocols were repeated until contact was made or participants were deemed unreachable. Among a sample of 2414 women veterans, 1670 (69%) were reached by study investigators and met criteria for participation and 1055 (63%) consented to participate (Fig. 2). Reasons for declining to participate in the study included being too busy (36%), lack of interest (33%), and not wishing to discuss personal gynecological care (7%). Among the 615 eligible participants who declined to participate, 391 agreed to answer general questions about their gynecological health. No difference in average age (38.3 years vs. 37.9 years), self-report of very good or excellent health (43.5% vs. 45.1%), number of gynecological visits in the past year (2.1 vs. 1.7), or ever being told by a provider about an abnormal cervical cancer screening test (56.9% vs. 51.2%) was found among those who consented relative to those who declined to participate. Participants were reimbursed $30 for their time and effort to complete the interview. Of those who provided consent, 1004 completed the interview. Among these, 996 had complete data for the LSA and STI variables and were included in this analysis.

The purpose of the original study was to evaluate differences in cervical dysplasia and cancer among women veterans who had and had not experienced LSA,[22] so women who were aware of diethylstilbestrol exposure *in utero* or used

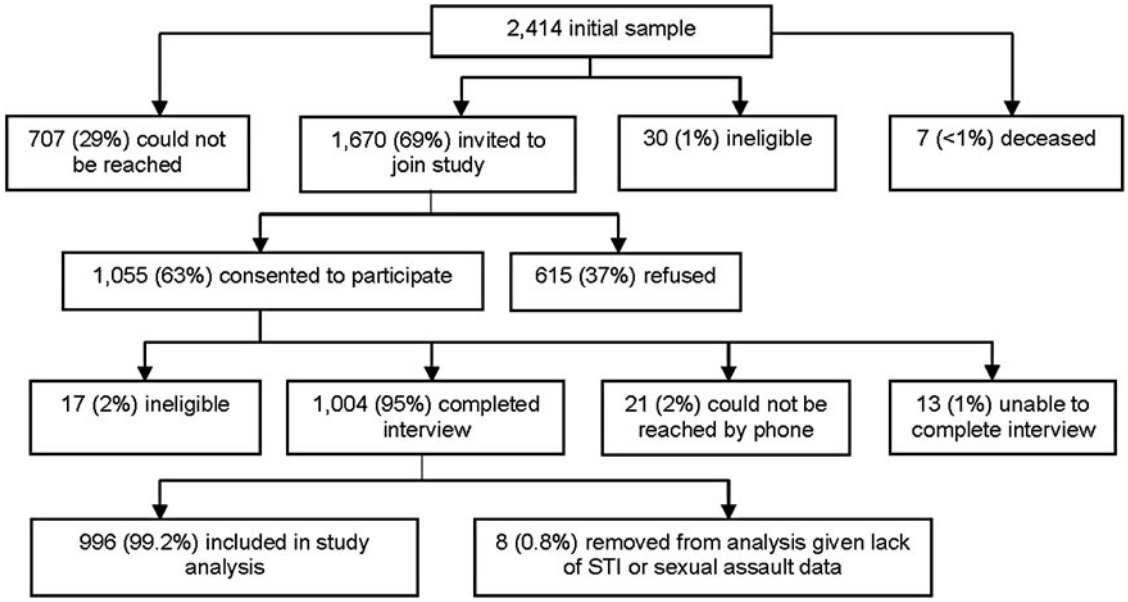


FIG. 2. Study sample of women veterans 51 years of age or younger enrolled for care at two Midwestern VA or community-based outpatient clinics between 2000 and 2008.

immunosuppressant medication at the time of interview were excluded from study participation. Eligible women who agreed to participate in the study completed a computer-assisted telephone interview lasting ~1 hour that assessed demographic characteristics, LSA, mental health diagnoses, reproductive health history, and sexual risk behaviors. This study was approved by the University of Iowa, Iowa City VA Medical Center, and South Texas Veterans Health Care System Institutional Review Boards.

Measures

Lifetime sexual assault. LSA was ascertained using the legal definition adopted by the American Medical Association and the American College of Obstetricians and Gynecologists,[47,48] which includes any sexual act that occurred without a woman's consent involving the use or threat of force or against the woman's wishes, including attempted or completed sexual penetration of the vagina, mouth, or rectum. Study participants were read this definition before the beginning of that interview section and were asked whether they had experienced sexual assault at any time in their life.

Sexually transmitted infections. Participants were asked whether they had ever been given a diagnosis of gonorrhea, chlamydia, syphilis, genital herpes, and/or genital warts/HPV infection by a healthcare provider. Fewer than 1% of participants reported human immunodeficiency virus (HIV) infection, so these data were not included to maintain participant confidentiality. Lifetime diagnosis of each STI was assessed individually and response options included yes, no, and don't know.

Potential confounding variables. For this analysis, we examined ecosocial (age, race/ethnicity, marital status, education, health insurance, and military service type) and psychosocial factors (ever being diagnosed with depression, PTSD, or treatment for drug and alcohol abuse) that may contribute to STI acquisition among veteran women who have experienced LSA. These psychosocial variables were assessed using *Diagnostic and Statistical Manual of Mental Disorders* 4th edition criteria as described in previous studies.[49,50]

Proximal risk factors for STI diagnosis including sexual partner characteristics and involvement in high-risk sexual behaviors were ascertained by self-report. Number of lifetime sexual partners was categorized as 0–1, 3–5, 6–9, 10–12, and 13 or more partners. Involvement with nonmonogamous sexual partners (none vs. some or all), use of drugs and/or alcohol, resulting in unintended sex (never vs. at least once), use of barrier contraceptive methods, and condom use after consumption of drugs and/or alcohol (latter two variables categorized as always, usually, sometimes vs. rarely, never) were assessed using a modified version of the Sexual Risk Index items.[51] The Sexual Risk Index was based on factors associated with STIs in male military populations and included the variables already listed as well as sex with commercial sex workers, which was not ascertained among our study population.[51] Involvement with a sexual partner who had a known STI including HIV (none vs. one or more) and age at first intercourse were also evaluated as high-risk sexual behaviors. Age at first intercourse was categorized according to the commonly used definition of early sexual initiation as less than or equal to 14 years (categorized as high risk) versus 15+ years.[52–55]

Potential mediating factors for STI development in military populations and hypothesized proximal risk factors that may result in increased biological susceptibility to STI acquisition were not assessed in this study.

Statistical analysis

Participants who reported a history of completed LSA were compared with those without completed assault (including attempted sexual assault or no sexual assault). Those with attempted but not completed LSA reported similar

frequencies of lifetime STI and involvement in high-risk sexual behaviors as those with no sexual assault, and STI frequencies for both of these groups were far lower than in the completed LSA group. Participants who responded affirmatively to past diagnosis of any one of the listed STIs were grouped and compared with those who had no STI history. Four participants each had missing data regarding sexual assault or STI history (eight total) and were dropped from this analysis (Fig. 2).

Bivariate analyses were completed for all study variables using Chi-squared tests to assess differences between women veterans who did and did not report a history of STIs. A logistic regression model was created to evaluate the independent contribution of completed LSA on lifetime STI diagnosis while adjusting for potential confounding variables. The selection of variables was determined by a bivariate p value cutoff of 0.25 or whether the variables were deemed important to include regardless of statistical significance (*i.e.*, age). Variable interactions were investigated. Variables that were no longer significant when included in the multivariate model were removed to achieve parsimony. Participants who provided a ''don't know'' response for any of the high-risk sexual behavior variables were excluded from corresponding analyses. All statistical analyses were performed using STATA version 11 (STATA Corp., College Station, TX).

Results

Of the 996 women veterans included in this analysis, the mean age of participants was 38.3 years. The majority were white, non-Hispanic, married, had more than a high school education, and had health insurance at the time of interview. When combining all mental health illnesses, 60% had been diagnosed with depression or PTSD or been treated for drug or alcohol abuse.

Diagnosis of an STI at any time in their lives was reported by 32% ($n=324$) of the study population. Specifically, 5% reported a lifetime history of gonorrhea, 15% reported past chlamydia, 8% reported genital herpes infection, 15% reported genital warts or HPV infection, and less than 1% reported a history of syphilis, not mutually exclusive. Four percent of women self-reported receiving an STI diagnosis as a direct result of their sexual assault. Women with a lifetime STI diagnosis were significantly more likely than those without an STI diagnosis to also report a history of depression, PTSD, and treatment for substance abuse (Table 1).

Table 1. Sociodemographic, Military, and Health Characteristics by Sexually Transmitted Infection History

	Total (n=996), n *(%)*	*No STI history (n=672),* n *(%)*	*Self-reported STI history (n=324),* n *(%)*	p
Age				
20–29	225 (22.6)	153 (22.8)	72 (22.2)	0.3
30–39	260 (26.1)	165 (24.6)	95 (29.3)	
40–52	511 (51.3)	354 (52.7)	157 (48.5)	
Race/ethnicity				
White	799 (80.2)	536 (79.8)	263 (81.2)	0.4
Black	74 (7.4)	47 (7.0)	27 (8.3)	
Other[a]	123 (12.3)	89 (13.2)	34 (10.5)	
Current marital status				
Never married[b]	228 (22.9)	156 (23.2)	72 (22.2)	0.1
Married	424 (42.6)	298 (44.4)	126 (38.9)	
Divorced/widowed	344 (34.5)	218 (32.4)	126 (38.9)	
Education				
HS/GED	152 (15.3)	113 (16.8)	39 (12.0)	0.07
Some college/tech	564 (56.6)	366 (54.5)	198 (61.1)	
Completed college or greater	280 (28.1)	193 (28.7)	87 (26.9)	
Military service type				
Active Component (AC)	593 (59.5)	388 (57.7)	205 (63.3)	0.09
Reserve or National Guard (RNG)	123 (12.4)	93 (13.8)	30 (9.3)	
Both AC and RNG	280 (28.1)	191 (28.4)	89 (27.5)	
Health insurance				
Yes	831 (83.7)	557 (83.3)	274 (84.6)	0.6
Health history				
Ever diagnosed with depression[c]	521 (52.5)	325 (48.6)	196 (60.7)	<0.001
Ever diagnosed with PTSD	231 (23.3)	137 (20.5)	94 (29.1)	0.003
Ever sought care for drug or alcohol abuse	161 (16.2)	84 (12.5)	77 (23.8)	<0.001

[a]Twelve participants identified as Hispanic or Latina, 6 as Asian or Pacific Islander, 5 as Native American or Alaskan Native, and 100 participants self-reported multiple races and ethnicities.
[b]Never married includes those who may have lived with a partner as though married.
[c]Unknown for four participants.
STI, sexually transmitted infection; HS/GED, high school/general education diploma; PTSD, post-traumatic stress disorder.

Involvement in high-risk sexual behaviors was common in this cohort. Thirty percent reported ever having a sexual partner who had a known STI, including HIV; 46% reported use of alcohol or drugs that led to unintended sex; and 59% reported having a nonmonogamous sexual partner. Five or more lifetime partners were reported by 72% of the study population with a mean of 9.0 and standard deviation of ±3.4 lifetime sexual partners. In addition, 9% reported first having intercourse with a male partner before the age of 15. With the exception of ever having a sexual partner who had a known STI or having a nonmonogamous sexual partner, there were no ''don't know'' responses for the high-risk sexual behavior variables. Notably, 36% of women veterans with a history of STI reported they had no partners with known STI. Younger age at first intercourse, greater number of lifetime partners, having a nonmonogamous partner, use of substance leading to unintended sex, and having a partner with an STI were all significantly associated with a lifetime STI diagnosis. Approximately 85% of the entire study population and 97% of those who had a lifetime history of any STI reported one or more of these high-risk sexual behaviors. However, there was no significant difference between inconsistent or absent condom use, including after use of alcohol and drugs and lifetime STI diagnosis (Table 2).

In this cohort, 51% ($n = 508$) reported completed LSA. Those who had ever experienced completed LSA were significantly more likely to report a lifetime STI diagnosis than those who were never sexually assaulted or experienced attempted but not completed assault (62% vs. 38%, $p < 0.05$). The unadjusted odds of reporting lifetime STI among those who experienced completed LSA compared with those without a completed sexual assault history were 1.91 (95% confidence interval [CI], 1.45–2.50). Results of the multivariate logistic regression analysis revealed that psychosocial factors (*i.e.*, drug/alcohol abuse) and proximal risk factors related to sexual partner characteristics (having a sexual partner with a known STI and having nonmonogamous sexual partners) were significantly associated with an increased risk of lifetime STI. One ecosocial factor, age more than 40 years, was associated with a lower STI risk. After adjusting for age, substance abuse treatment, and involvement in high-risk sexual behaviors, women with a completed LSA had 1.49 (95% CI 1.07–2.08) greater odds of a lifetime STI diagnosis (Table 3).

Table 2. History of Lifetime Sexual Assault and Sexual Risk Behaviors by Sexually Transmitted Infection History

	Total (n = *996*), n *(%)*	*No STI history,* (n = *672*), n *(%)*	*Self-reported STI history,* (n = *324*), n *(%)*	p
LSA				
No completed assault	488 (49.0)	364 (54.2)	124 (38.3)	<0.001
Completed assault	508 (51.0)	308 (45.8)	200 (61.7)	
No. of high-risk behaviors				
0	149 (15.0)	138 (20.5)	11 (3.4)	<0.001
1+	847 (85.0)	534 (79.5)	313 (96.6)	
No. of lifetime sexual partners				
0–1	34 (3.4)	28 (4.2)	6 (1.9)	<0.001
2–5	359 (36.0)	280 (41.7)	79 (24.4)	
6–8	258 (25.9)	183 (27.2)	75 (23.2)	
9–12	151 (15.2)	83 (12.4)	68 (21.0)	
13+	194 (19.5)	98 (14.6)	96 (29.6)	
No. of partners with known STI/HIV[a]				
None	687 (69.8)	572 (85.8)	115 (36.3)	<0.001
One or more	297 (30.2)	95 (14.2)	202 (63.7)	
Age at first sex with male				
≤14 Years	83 (8.5)	47 (7.2)	36 (11.1)	0.03
15+ Years	896 (91.5)	609 (92.8)	287 (88.9)	
Barrier contraceptive method use				
Rarely, never	590 (59.2)	394 (60.0)	196 (60.9)	0.8
Always, usually, sometimes	389 (39.7)	263 (40.0)	126 (39.1)	
Alcohol/drugs leading to unintended sex				
At least once	450 (45.7)	259 (39.1)	191 (59.1)	<0.001
Never	535 (54.3)	403 (60.1)	132 (40.1)	
Condom use after alcohol/drugs				
Rarely, never	481 (48.3)	309 (61.4)	172 (59.9)	0.7
Always, usually, sometimes	309 (39.1)	194 (38.6)	115 (40.1)	
Nonmonogamous partners[b]				
Some, all	573 (58.6)	338 (51.5)	235 (73.0)	<0.001
None	405 (41.4)	318 (48.5)	87 (27.0)	

[a]Reported as unknown by 1.2% of study population.
[b]Reported as unknown by 0.5% of study population.
LSA, lifetime sexual assault; STI/HIV, sexually transmitted infection/human immunodeficiency virus.

Table 3. Logistic Regression for Association Between Completed Sexual Assault and Sexually Transmitted Infections

	aOR (95% CI)
Age	
20–29 (reference)	1.0
30–39	0.73 (0.46–1.14)
40–52	**0.53 (0.35–0.79)**
Ever sought care for drug or alcohol abuse	
No (reference)	1.0
Yes	**1.76 (1.15–2.67)**
Sexual partner with known STI	
None (reference)	1.0
One or more	**9.72 (6.98–13.54)**
Nonmonogamous partners	
None (reference)	1.0
Some, all	**1.54 (1.09–2.17)**
LSA	
No completed assault (reference)	1.0
Completed assault	**1.49 (1.07–2.08)**

Bolded values indicate a significant association.
aOR, adjusted odds ratio; CI, confidence interval.

Discussion

The results of this study extend the current literature by demonstrating that among VA-enrolled female veterans, a history of completed LSA is associated with an almost twofold increase in the odds of a lifetime STI diagnosis. This association remains significant even when adjusting for involvement in high-risk sexual behaviors and a history of substance use disorder.

In this cohort, 30% reported a history of STI diagnosis, which is higher than what is reported in other studies among women veterans. In a study using national VA data to evaluate STI infection among 71,504 women veterans who served in Operation Enduring Freedom/Operation Iraqi Freedom and sought care between 2001 and 2010, 0.17% had a documented diagnosis code of gonorrhea, 0.29% had chlamydia, 2.33% had genital herpes, and 4.46% received a diagnosis code of cervical dysplasia.[46] In another study comparing 151 women veterans (2% of the study population) with nonveterans, veterans were more likely to report a history of genital warts (9% vs. 7%, $p = 0.4$) and chlamydia (4% vs. <1%, $p < 0.05$) and test positive for herpes simplex virus type 2 (40% vs. 26%, $p < 0.05$).[25] Neither of these studies considered the relationship between LSA and STI risk. The higher proportion of STIs found in our study of VA-enrolled women veterans may be related to the robust sample size, the use of self-reported outcome data rather than data collection from one healthcare system, and evaluation of lifetime rather than a delimited time period of STI screening.

Our results are consistent with other studies conducted among nonveteran women regarding the relationship between LSA and lifetime STI risk. In a population-based survey of 18–44-year-old California women, those with past child or adult sexual abuse had twofold to threefold greater odds of lifetime chlamydia diagnosis than those without sexual abuse histories.[14] Studies conducted among women who have experienced intimate partner violence, which may include sexual violence, also demonstrate that these women are at increased risk of acquiring STIs.[14,34,56,57]

Our research has many strengths, but also some limitations. Our study is one of the first to describe the relationship between LSA and lifetime STI risk among a large sample of VA-enrolled women veterans and thus serves to inform reproductive health professionals about the unique healthcare needs of this growing population. However, our study population comprises predominately white and married women veterans enrolled for healthcare from two Midwestern VA sites. In 2011, national statistics on veteran women demonstrated that 67% identified as white, non-Hispanic, making this group over-represented in our study population, yet, nationally 56% were married, which was less common in our population.[58] Previous research demonstrates that unmarried women who represent racial and ethnic minority groups may be at higher risk for sexual violence and STIs.[20,39,56] As such, our results may over or underestimate the risk of STIs among a more diverse group of women veterans who have been sexually assaulted. Although we evaluated characteristics such as marital status, level of education, health insurance, and mental health illness at the time of the study, these responses may have been different at the time sexual assault or STI diagnoses occurred and may not accurately identify characteristics of those at greatest risk.

A history of STIs, the main outcome of this investigation, was ascertained by self-report and not by data abstraction from the medical record. This may have led to an underestimation of the proportion of women veterans with a lifetime STI history if participants were embarrassed to report or could not recall past reproductive health diagnoses. Alternatively, self-reported STI history may provide more robust information than data obtained from a single medical record review at one healthcare site (*e.g.*, VA) for a population of patients known to seek healthcare within multiple health systems. It is possible that women veterans who agreed to participate in the study may be more likely to have experienced sexual assault and remember adverse gynecological health outcomes, including STI events, resulting in both selection and recall bias. However, no differences in reported health, number of gynecological visits, or previous abnormal cervical cancer screening results were found between those who agreed and those who declined to participate in this study.

Although our study demonstrates a significant association between LSA and increased STI risk, no causal, temporal, or mechanistic relationship can be established. Previous studies among veteran and nonveteran women who have experienced LSA describe greater involvement in risky sexual behaviors, including alcohol or drug use during sexual situations, feeling unable to refuse to engage in unwanted sexual activity,[35,37,59] and higher number of lifetime sexual partners,[27,31] which may contribute to a higher rate of STIs. However, even when adjusting for involvement in high-risk sexual behaviors, we found a reduced, yet still significant association between completed LSA and increased STI risk. As noted in previous literature, this finding suggests that involvement in high-risk sexual behaviors among women who have been sexually assaulted may contribute to long-term STI risk,[14,23] but may not entirely explain the association between sexual assault and STI risk. Rather, a combination of behavioral and

biological risks, such as cervicovaginal infections, oncogenic HPV infection, smoking, and job-related psychosocial stressors, may influence the relationship between LSA and STIs.[44,45,60] Evaluation of differences in biological risk factors for STIs may reveal additional pathways that explain the relationship between LSA and lifetime STI among women veterans.

In conclusion, there are limited data on the unique reproductive health risks faced by women who serve in the U.S. military.[3] Our study is the first to examine the relationship between LSA and STI risk among women veterans, particularly within the context of ecosocial, psychosocial, mediating, and proximal risk factors, and indicates that a history of LSA may place women veterans at higher risk for STIs than those who have not been assaulted. The Centers for Disease Control and Prevention recognize military populations as high-risk for STIs[61] and currently recommends STI screening based on demographic criteria (*i.e.*, age) and involvement in high-risk behaviors.[62] Our results suggest that a history of LSA should also be ascertained when determining a need for STI screening among both military and veteran populations. LSA is an independent risk factor associated with lifetime risk of STI, and along with age, current behavioral risks, or military status, must be considered an indication for STI screening. Conversely, because many military women do not report sexual assault,[29] an STI diagnosis among women veterans should trigger questioning about sexual assault with an appropriate level of sensitivity. Our findings also highlight areas for future research to further understand the relationship between sexual assault and STI risk among women veterans, including to determine how sexual assault at one point in time (*e.g.*, premilitary, during military, and after military service) effects lifetime STI risk and identify other mechanisms beyond involvement in high-risk sexual behaviors that explain this relationship. While this research is being conducted, the immediate reproductive health needs of women veterans can be addressed by querying for a history of military service among those who seek care outside the VA, assessing a history of LSA, and understanding and addressing the reproductive health sequelae (*e.g.*, increased lifetime STI risk) for those who report sexual assault.

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Author Disclosure Statement

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Address correspondence to:
Vinita Goyal, MD, MPH
South Texas Veterans Health Care System
7400 Merton Minter Boulevard
San Antonio, TX 78229

E-mail: vinitagoyalmd@gmail.com