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Lifetime Sexual Assault and Cervical Cytologic Abnormalities Among Military Women

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Abstract

Background: Little is known about the reproductive health of military women. This study sought to determine women Veterans' competing risk factors, including life span sexual assault (LSA) exposures, associated with recent and lifetime cervical cytologic abnormalities.
Methods: This cross-sectional study of a retrospective cohort of 999 Midwestern Veterans (enrolled in the VA) included computer-assisted telephone interviews and chart reviews.
Results: Over half (57%) of participants self-reported lifetime abnormal cytology. Chart review demonstrated 16% had abnormal cytology in the preceding 5 years. Almost two thirds of participants (62%) reported LSA, and one third (32%) reported assault during military service. Women with completed LSA were more likely to self-report abnormal cytology than peers with no or attempted-only assaults (63% vs. 51%, $p < 0.01$). In logistic regression models comparing competing risks for abnormal cytology, type of military service (Active Component [AC] or both AC and Reserve or National Guard) was significant even when human papillomavirus (HPV) was included. LSA was significant when well-established risk factors, except HPV, were included. Nearly all participants had health insurance (84%), and only one third (32%) used the VA for all care.
Conclusions: Military type and completed LSA are significant risk factors for abnormal cervical cytology and should be routinely assessed by women's care providers. LSA and gynecologic health risk factors are widespread in the female Veteran population. These findings have clinical implications for vigilant screening, gynecologic follow-up, and behavioral health interventions. Most participants had insurance and used only some or no VA care, so findings are relevant to all women's health providers.

Introduction

Women serving in the military are a rapidly growing population, with health risk exposures that are significant and distinctive to women's healthcare. Unfortunately, the extent of military women's health problems is comparatively unknown. In particular, the unique gynecologic health of military women is relatively unexplored, although surprisingly little is known about the complex relationship between sexual violence and women's long-term reproductive health in either civilian or military populations. It is estimated that one of six American women experience rape during their lifetime,[1] with 20%–24% of women raped during their college years.[2] Violence exposure is widespread in the military population, with estimates that 25%–49% are sexually assaulted during childhood[3,4] and 23%–30% during military service.[5,6]

Moreover, the very risk factors identified as predictors or sequelae of sexual assault (SA) (younger age at first sexual intercourse, number of sexual partners, sexually transmitted infections [STI], smoking) are also associated with higher rates of abnormal Pap tests and cervical cancer. It is notable that these same risk factors are highly prevalent in military women.[5,7–9] Prior research has found that sexual abuse and intimate partner violence (IPV) are both associated with elevated risk of oncogenic human papillomavirus (HPV) and cervical cancer in college women, prisoners, and some civilian

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populations.[10–13] Studies of Veteran populations have noted links between SA and gynecologic symptoms, such as chronic pelvic pain, repeated vaginitis or yeast infections, menstrual problems, and painful intercourse.[13,14]

The purpose of this cross-sectional study was to determine women Veterans' competing risk factors associated with recent and lifetime cervical cytologic abnormalities. We propose a theoretical model that identifies the multiple gynecologic health disparities military women experience that can be associated with an elevated risk of abnormal cervical cytology (Fig. 1). These disparities include (1) trauma exposures, (2) risk behaviors, (3) care access, (4) sociodemographic and military factors, and (5) healthcare use and gynecologic procedures. Knowledge of the occcurrence, timing, frequency, intensity, and duration of these risk factors is necessary to understand the comparative risk of abnormal cervical cytology. Our study did not intend to test this entire model but used it as a heuristic framework to guide the analysis. We hypothesize that women with military and lifetime SA are a population that is more likely to have a high concentration of risk cofactors and thus higher rates of recent and lifetime cervical cytologic abnormalities.

Materials and Methods

Following Institutional Review Board (IRB) approval, all women ≤51 years of age who enrolled at the Iowa City or Des Moines Veterans Administration Medical Centers (VAs) or centrally based outlying clinics (CBOCs) within the 5 years preceding study interview (July 2005–August 2008) were identified. Using the Veterans Health Information System & Technology Architecture (VistA) System, Veterans enrolling after June 2005 and before study completion were periodically identified and added to the cohort. VA enrollment could have been initiated for healthcare, disability claim, registry enrollment, or outreach participation.

An introductory letter and consents, along with postage-paid return envelopes, were sent to potential subjects. A toll-free number was provided so Veterans could ask any questions, schedule interviews, or refuse participation. Women refusing participation were asked why, as well as three health-related questions to allow comparison with participants: (1) In general, would you say your health is excellent, very good, good, fair, or poor? (2) Have you ever been told you have had an abnormal Pap test? (3) In the last year,

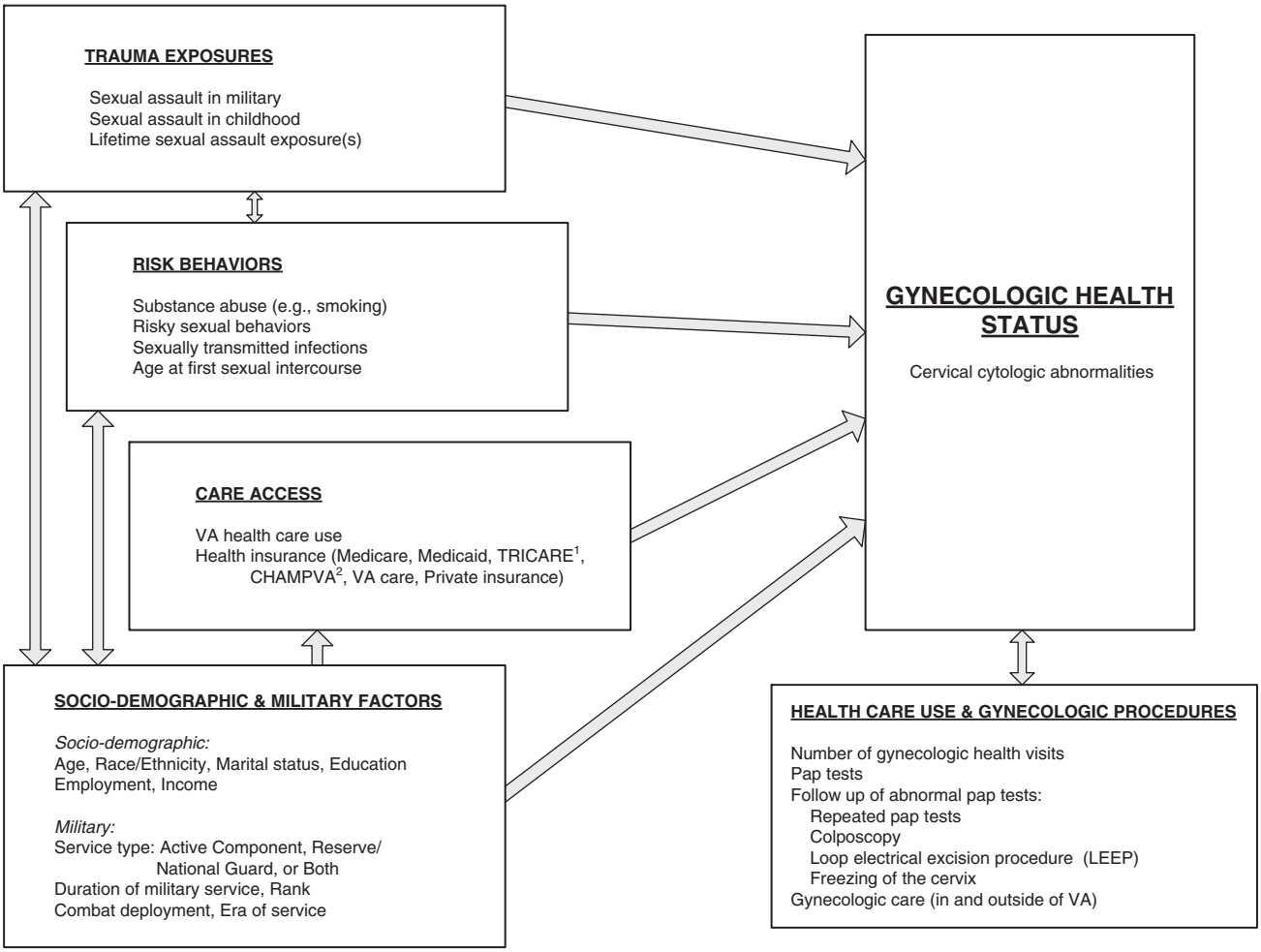

FIG. 1. Conceptual model: women veterans' gynecologic health disparities and abnormal cervical cytology. [1]TRICARE is the health care program serving Uniformed Service members, retirees and their families worldwide. [2]CHAMPVA is the Civilian Health and Medical Program of the Department of Veterans Affairs.

approximately how many times have you seen a doctor or healthcare provider for gynecologic health issues? Two weeks after the introductory letter, potential subjects not initiating contact were recruited by telephone. IRB-approved mail and phone protocols were continued until contact was made or subjects were deemed unreachable. When address or phone problems occurred, effort was made to find current contact information using internet white pages, VA's Computerized Record System (CPRS), and Accurint (a confidential Lexis Nexis research tool).[15]

Although 32% of women in our sample ($n=772$) were at one time unreachable because of address or phone problems, 56% of these Veterans were successfully located. Approximately half (52%) of those found completed the interview. Women interested in participating were screened for study eligibility. While seeking to be as inclusive as possible, the inclusion and exclusion criteria were selected on the following biologic and theoretical bases. Subjects who were (1) aware of *in utero* diethylstilbestrol (DES) exposure, (2) currently receiving treatment with immunosupressants, or (3) >age 51 years were excluded from participation. Although the cohort of women exposed to DES was likely small in the included age group, DES exposure represents an existent iatrogenic, thus potential etiology of cervical malignancy. Used as therapeutic agents in a range of medical treatments unrelated to sexual trauma, immunosupressants are a recognized risk factor for cervical dysplasia and genital malignancies. Age ≤51 years captured the majority of patients while reducing the occurrences of women experiencing menopause, its physiologic symptoms, and associated visits. In addition, although the risk of nononcogenic HPV infections increases significantly at ages 45 and older, the risk of oncogenic HPV is lower in this age group.[16] As outlined above, immunocompromised states may increase the risk of genital malignancies. We chose to include pregnant women and women with HIV and AIDs because these diagnoses represented potential markers of SA sequelae and risky sexual behaviors, and these diagnoses would rarely reflect complications of medical interventions.

Consented participants completed a computer-assisted telephone interview (CATI) programmed with the Blaise Survey Development System.[17] The CATI assessed demographics; life span sexual assault (LSA); gynecologic diagnoses, procedures, and care use; and risk behaviors. The average interview took 1 hour and 16 minutes, and most (89%) completed it in one call. Subjects were reimbursed $30.00 for participation. Interviewer performance and data quality were routinely monitored, with a random sample of 3% of participants (including all interviewers) called back to evaluate data collection quality. VA telephone records for a random 15% of interviews were examined to validate that participant calls were made for the time and duration indicated.

Research instruments

LSA was assessed using the legal definition of rape adopted by The American Medical Association (AMA) and American College of Obstetricians and Gynecologists (ACOG). Commonly used in sexual violence research,[18,19] this definition includes any act occurring without a woman's consent, involving the use or threat of force, and includes attempted or completed sexual penetration of the vagina, mouth, or rectum. Smoking history was queried; possible responses were never, no longer smoking, currently smoking. Risky sexual behaviors were assessed by the Sexual Risk Index (SRI), previously used in military populations[20] and based on factors commonly associated with STIs: alcohol or drug use leading to unintended sex, sexual partner having concurrent sexual partners, and number of different sexual partners. Number of partners was queried categorically: none, 1, 2, 3–5, 6–10, 11–15, ≥16 partners. Cervical cytologic (Pap test) outcomes were obtained by (1) medical record abstraction within the 5 years preceding participation and (2) self-report of ever being told by a healthcare professional they had an abnormal Pap test. The Bethesda system was used to classify Pap test outcomes.[21] When more than one Pap test result occurred during the past 5 years, the highest severity was used in analyses. Outcomes included surgical pathology for women who had surgical follow-up of abnormal Pap tests (e.g., biopsy). HPV was queried by: Has a healthcare professional ever told you that you have venereal warts or HPV, that is, human papillomavirus? Other STIs queried included gonorrhea, chlamydia, syphilis, genital herpes, HIV, and AIDS.

Chart review methodology

Women reported using both VA and non-VA providers for gynecologic care. Of the 1004 women completing the interview, 54% reported using non-VA providers, and 80% reported using VA providers. The average number of non-VA providers was 1.75 (range 1–8, mean 1.8, standard deviation [SD] 0.96). Chart reviews for non-VA care were done by mailing medical record requests to all non-VA providers identified by participants ($n=958$). Most providers responded after one contact attempt (84%). Twenty providers (2%) never returned records after multiple attempts. A total of 928 charts were triaged for gynecologic information associated with Pap tests, and ultimately 453 charts with Pap test information were abstracted.

Local and remote site electronic chart reviews of gynecologic information were done for VA users. This included 100 study refusers (201 records) and 100 women who could not be contacted (204 records). An average of 2.35 VA sites was found for each participant using VA gynecologic services. Table 2 shows the number of women who had at least one chart reviewed and the result (i.e., abnormal or normal). Chart abstractors were trained and overseen by the principal investigator (A.G.S.) and a co-investigator (C.H.S.) board-certified in obstetrics and gynecology, who reviewed and arbitrated questions.

Five percent (50 of 928) of non-VA chart reviews were reviewed by a different person. Nineteen variables specific to Pap test and surgical cytopathology were compared using SAS Procedure COMPARE,[22] for a total of 950 comparisons with excellent agreement (98.8%). For VA records, 100% comparison was made between abstractor CPRS reviews and electronic cytopathology data extracted from the VistA System. Twelve variables from 1204 charts were compared, for a total of 14,448 comparisons. There was excellent agreement (98.6%).

Statistical analysis

All statistical analyses were done with SAS 9.2.[22] Alpha was set at 0.05, and all p values are two-tailed. In addition to descriptive statistics, logistic regression was used to examine independent risk factors for abnormal Pap tests based on odds ratio (OR) findings.

Results

Sixty-nine percent (1670 of 2414) of the sample were located and invited to participate in the study, and 1055 subjects consented to participate, giving a response rate of 63% and a final completed sample of 1004 (Fig. 2). The most frequent reason for refusing participation was being too busy (36%). Of the 615 Veterans declining participation, 64% agreed to answer standard questions by telephone. No significant differences were found between participants and refusers with regard to average age (38.3 vs. 37.9 years), self-report of very good or excellent health (43.5% vs. 45.1%), number of gynecologic visits in last year (2.1 vs. 1.7), or ever being told by a provider they had an abnormal Pap test (56.9% vs. 51.2%). Of the 1004 completed interviews, data from 5 participants were removed because of ineligible responses to the query if a clinician ever told them they had an abnormal Pap test (e.g., reporting never had a Pap test). Therefore, subsequent analyses pertain to a sample size of 999.

Participants ranged from 20 to 52 years at interview, with a median age of 40 (Table 1). The majority were white, employed, married, well-educated, enlisted personnel, served in the Active Component (AC), and entered the military between 18 and 19 years of age, serving a median of 4 years. Most had some type of insurance to cover all or part of medical bills. Half received some VA care, roughly one third received all, and the rest received no VA care. Virtually all participants (97%) reported having a Pap test within the past 5 years; of those, 63% had the test at a VA facility.

Over half (57%) of the sample self-reported they had at least one abnormal Pap test during their lifetime. Of these women, 13% had an abnormal Pap test within the last year, 21% within the last 3 years, 18% within the last 5 years, and 49% more than 5 years earlier. Women with abnormal Pap tests were more likely to be over 29 years old, married or divorced, college-educated, have served in AC and been enlisted personnel compared to those without abnormal Pap tests (Table 1). Women who had ever acknowledged an abnormal Pap test result were more likely to report at least one Pap test (84% vs 75%, $p < 0.0003$) within the last 5 years. VA chart review revealed one or more abnormal Pap tests in 17% of those who had not had a hysterectomy and in 16% when subjects with hysterectomies were included.[23] No statistically significant differences were found in the proportion of Pap test abnormalities for participants (16%), refusers (14%, $n = 100$), and women unable to be contacted (10%, $n = 100$). Participants were more likely to have had a Pap test at a VA facility within the preceding 5 years (80%) compared to refusers (66%, $p < 0.001$) or those unable to be contacted (52%, $p < 0.001$). No difference was found in ever having an abnormal Pap test by whether gynecologic care was received at or outside of VA (55% vs. 58%). There was 91% agreement between participants' self-report of having a Pap test at a VA within the past 5 years and chart findings. There was 82% agreement between both (1) having a Pap test at the VA within the last 5 years and (2) reporting results correctly as abnormal vs. normal. Given these validations, subsequent analyses used lifetime self-reported Pap test data to allow a more comprehensive

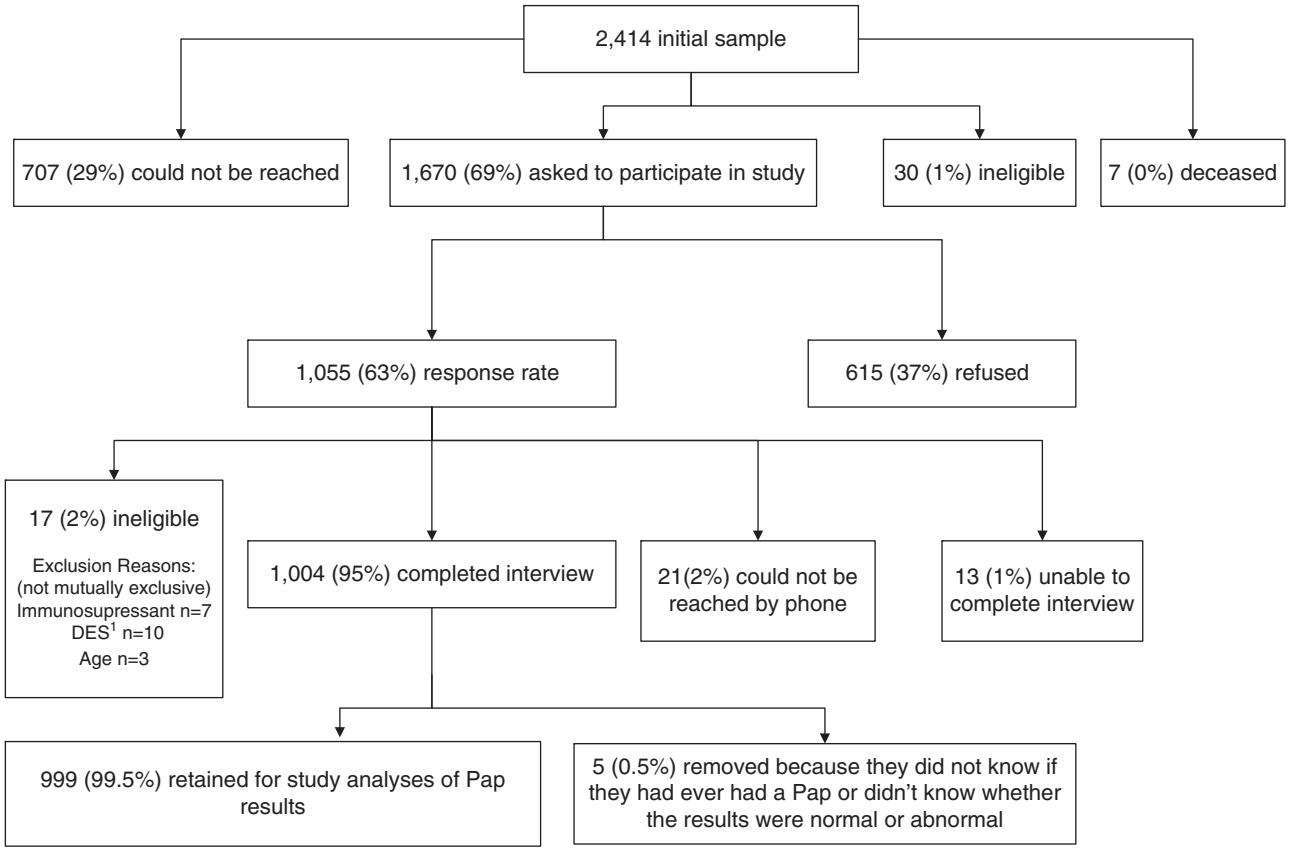

FIG. 2. Study response rate. [1]DES, diethylstilbestrol.

Table 1. Sample Characteristics of VA-Enrolled Military Women Veterans

Variable	(n = 999)	Lifetime Pap test results[a] Normal (n = 431)	Abnormal (n = 568)	p
Demographics				
Age, years				
20–29	222 (22.2)	107 (24.8)	115 (20.3)	0.043
30–39	266 (26.6)	99 (23.0)	167 (29.4)	
40–52	511 (51.2)	225 (52.2)	286 (50.4)	
White, non-Hispanic	799 (80.0)	345 (80.1)	454 (79.9)	0.964
Employed	516 (51.7)	207 (48.0)	309 (54.4)	0.046
Marital status				
Single	227 (22.7)	116 (26.9)	111 (19.5)	0.017
Married	441 (44.1)	185 (42.9)	256 (45.1)	
Divorced	331 (33.1)	130 (30.2)	201 (35.4)	
Highest education attained				
High school/GED completed	152 (15.2)	69 (16.0)	83 (14.6)	0.040
Some college/technical training	562 (56.3)	257 (59.6)	305 (53.7)	
College completed or greater	285 (28.5)	105 (24.4)	180 (31.7)	
Income <20,000	199 (19.9)	95 (22.0)	104 (18.3)	0.144
Have health insurance	834 (83.5)	354 (82.1)	480 (84.5)	0.447
VA healthcare utilization				
All	321 (32.2)	148 (34.3)	173 (30.5)	0.403
Some	560 (56.2)	232 (53.8)	328 (57.7)	
None	116 (11.6)	50 (11.6)	66 (11.6)	
Military				
Military service type				
Active Component (AC)	596 (59.7)	250 (58.0)	346 (60.9)	0.004
Reserve or National Guard (RNG)	123 (12.3)	70 (16.2)	53 (9.3)	
Both AC and RNG	280 (28.0)	111 (25.8)	169 (29.8)	
Active duty service duration, years				
Mean (median)	5.3 (4)	5.0 (4)	5.6 (4)	0.050[b]
Years served by military service type				
Mean (median)				
AC	5.8 (4)	5.4 (4)	6.1 (4)	0.132[b]
RNG	1.2 (1.2)	1.1 (1.2)	1.4 (1.2)	0.232[b]
Both AC and RNG	6.2 (5)	6.5 (5)	6.0 (4.6)	0.350[b]
Enlisted rank	941 (94.8)	396 (91.9)	545 (96.0)	0.013
Age joined military <20 years	576 (57.7)	254 (58.9)	322 (56.7)	0.477
Served in military combat area or war zone	294 (29.4)	139 (32.3)	155 (27.3)	0.088
Era of service[c]				
OEF/OIF	353 (35.3)	157 (36.4)	196 (34.5)	0.074
Persian Gulf	306 (30.6)	116 (26.9)	190 (33.5)	
Post-Vietnam	340 (34.0)	158 (36.7)	182 (32.0)	

[a]Data are *n* (%) unless specified as mean (median). Chi-square test results presented unless specified otherwise.
[b]*t* tests.
[c]Era of service is defined as the most recent era served. Service era dates: Post-Vietnam era, May 8, 1975–August 1, 1990; Persian Gulf era, August 2, 1990–November 10, 1998; Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), November 11, 1998–August 31, 2010.
GED, general equivalency diploma.

determination of risks and outcomes that might have been underestimated if delimited to 5 years.

Severity of abnormal Pap tests varied widely (Table 2). Although almost half had with the lowest severity, 18% had high-grade squamous intraepithelial lesion (HGSIL) or lesions of greater severity. Eighty-seven percent of those with a lifetime abnormal Pap test required further evaluation. The number of different types of evaluations women had ranged from 0 to 5 (average 2). Women experiencing completed LSA were more likely than women who had no or attempted-only LSA to have therapeutic interventions (freezing of the cervix: 30% vs. 20% and 30%, $p < 0.04$; cone biopsy: 38% vs. 22% and 34%, $p < 0.001$) as opposed to surveillance (repeated or frequently repeated Pap tests, colposcopy), where no significant differences were found by LSA exposure. Interestingly, no significant differences were found in rates of the loop electrical incision procedure (LEEP) between these groups.

Gynecologic health risks were pervasive in this sample (Table 3). Two thirds of participants reported LSA, with a mean of 6.8 completed rapes (median 2). Of women experiencing completed SA, the first assault occurred for 68% of women during childhood. The average age of females at first SA was

Table 2. Pap Test Severity Summary: Chart Review Data Collected for Most Recent 5 Years

Pap smear categories	*Study participants* (n = *999*)	*Study refusers* (n = *100*)	*Unable to contact* (n = *100*)
No Pap smear chart data	198	34	48
Normal	673 (84%)	57 (86%)	47 (90%)
Abnormal	128 (16%)	9 (14%)	5 (10%)
Bethesda System			
ASC-US	60	3	3
ASC-H	4	0	0
LSIL	41	5	2
HSIL	15	1	0
CIS	6	0	0
Glandular			
AIS	0	0	0
AGC	2	0	0

AGC, atypical glandular cells; AIS, adenocarcinoma in situ; ASC-H, atypical squamous cells high-grade; ASC-US, atypical squamous cells of undetermined significance; CIS, carcinoma *in situ;* HSIL, high-grade squamous intraepithelial lesion; LSIL, low-grade squamous intraepithelial lesion.

14.8 years (SD 7.4, range < year–44 years). The next highest risk period for first assault was during military service (21%). The average age at first military assault was 21.4 years (SD 3.6). One third (32%) reported assault during military, service, and of these, one fourth were assaulted solely during military service. A history of cervical cancer was reported by 34 participants, with no difference found by LSA exposure. Women with at least one completed LSA (82% of assaulted) had a 64% increased risk of an abnormal Pap test than women with no LSA ($p < 0.01$)(Table 3). Women with two or more completed LSAs were no more likely than women with one completed LSA to have an abnormal Pap test. Women whose initial sexual intercourse occurred at younger ages were more likely to have abnormal Pap tests (≤9 years, OR 1.90, $p < 0.05$; 10–19 years: OR 2.29, $p < 0.01$). Over half (58%) had smoked at some time in their life and were found at greater risk for an abnormal Pap test. Women who had been pregnant more than once had an increased risk of abnormal Pap tests by 89% compared to those never pregnant ($p < 0.01$). However, there was no difference found in the average number of pregnancies by Pap test outcomes.

Table 3. Associations Between Abnormal Lifetime Pap Tests and Gynecologic, Smoking, and Sexual Assault Factors

Factor	*Normal* (n = *431*) %	*Abnormal* (n = *568*) %	*Bivariate OR (95% CI)*
Gynecologic health			
Age at first intercourse[a]			
≥20	15	14	1.00
10–19	70	79	2.29 (1.50-3.49)**
≤9	14	7	1.90 (1.14-3.18)*
Diagnosed with HPV	4	24	8.82 (5.09-15.28)**
Diagnosed with an STI	18	28	1.83 (1.35-2.49)**
Smoking			
Never smoked	46	39	1.00
Ex-smoker	18	26	1.66 (1.19-2.32)**
Current smoker	36	35	1.12 (0.84-1.48)
Sexual assault history			
No LSA	44	34	1.00
Attempted LSA only	13	10	0.99 (0.65-1.51)
At least one completed LSA	44	56	1.64 (1.25-2.14)**

[a]Intercourse included consensual intercourse and completed sexual assault.

*$p < 0.05$; **$p < 0.01$.

CI, confidence interval; HPV, human papillomavirus; LSA, life span sexual assault; OR, odds ratio; STI, sexually transmitted infection.

Women diagnosed with STI, not including HPV, had an 83% increased risk of abnormal Pap tests ($p < 0.01$). Women who reported HPV had an unadjusted OR of 8.82 of having an abnormal Pap test compared to their peers with no HPV diagnoses ($p < 0.01$). Furthermore, participants who had at least one SA during military service were more likely to report HPV than those who experienced no SAs during this time period or no SAs ever (21%, 13%, and 12%, respectively, $p < 0.002$). Notably, over half (54.6%, $n = 83$) were first told they had HPV during military service, with 28.9% ($n = 44$) told after and the rest (16.4%, $n = 25$) initially told before military service.

Women were asked about the gender of their sexual partners during military service. The majority reported male-only (88%), 6% reported having both men and women partners, 4% having no partners, and 2% having female-only partners. There was no statistically significant difference in self-reported lifetime abnormal Pap tests by whether women had male-only partners ($n = 882$) compared to those with female-only partners ($n = 19$) (58% vs. 47%, $p = 0.37$) during military service.

Lifetime sexual risk behaviors were prevalent in this sample, with 17%–54% of women acknowledging these before, during, or after military service. The largest proportion of women reported these behaviors occurred during military service. Women who acknowledged these risk behaviors were more likely to have abnormal Pap tests (Table 4).

Three interim logistic regression models (data not reported) were created to identify a parsimonious set of significant risk factors among the following sample characteristics: (1) demographic, (2) military service, and (3) sexual risk. A model including age and all significant interim model variables except for HPV and STI history was completed (Table 5). Given the established strong association between HPV and abnormal Pap tests, we excluded HPV from this model to reveal the strength of competing risk cofactors. When all factors were simultaneously entered into the model, those remaining significantly associated with the odds of an abnormal Pap test included (1) military service type: AC or both AC and Reserve/National Guard (RNG) service, (2) sexual initiation aged 10–19, (3) unintended sex after alcohol or drug use (during military), (4) more than two sex partners (prior to military), and (5) completed LSA. As expected, HPV was highly significant when included in the final model. Even with HPV included, however, military service type remained a significant risk factor for abnormal Pap tests.

Discussion

In a logistic regression model including competing risk factors for abnormal cervical cytology except HPV and STI,

Table 4. Predictors of Abnormal Pap Tests by Sexual Risk Behaviors Before, During, and After Military Service

	Before		*During*		*After*	
Sexual risk variables	*Occurrence %*	*Bivariate ORs (95% CI)*	*Occurrence %*	*Bivariate OR (95% CI)*	*Occurrence %*	*Bivariate OR (95% CI)*
Had unintended sex after drinking alcohol or using drugs						
Never	74	1.00	64	1.00	75	1.00
At least once	24	1.89 (1.39-2.58)**	33	2.09 (1.58-2.77)**	17	1.56 (1.11-2.19)*
Number of sex partners						
<3	60	1.00	44	1.00	57	1.00
≥ 3	39	1.73 (1.33-2.26)**	54	1.73 (1.34-2.23)**	34	1.19 (0.91-1.56)
Sexual partners had other concurrent sexual partners						
None	67	1.00	56	1.00	63	1.00
Some or all	30	1.38 (1.04-1.82)*	42	1.58 (1.22-2.04)**	28	1.21 (0.90-1.62)

Responses of "Don't know" were treated as missing, and a multiple imputation method was used before running the logistic regressions. *$p < 0.05$; **$p < 0.01$.

completed LSA and high-risk sexual behaviors remained significant risk factors. Given that LSA occurred in two thirds of our participants and is a common occurrence in military women,[4,5,24] these findings have strong implications for reproductive health. Each year, 5% of Pap tests in the United States are read as abnormal, and 20% of American women have had at least one abnormal Pap test in their lifetime.[25] In notable contrast, over half of women Veterans (57%) in our sample self-reported an abnormal Pap test in their lifetime. A study of Persian Gulf War service women found elevated rates of self-reported abnormal Pap tests (25%–26%) during deployment.[26] This is similar to our finding that 27% of women deployed to combat self-reported abnormal Pap tests. However, our population also included women from other eras of service. The high rate of chart-reviewed abnormal Pap tests found in participants (16%) was more than triple the expected rate in the study states of Iowa and Illinois (5%).[27] Therapeutic interventions (e.g., cone biopsy) as opposed to surveillance were more likely in women with completed assault. Our finding that 18% of those with abnormal Pap tests had HGSIL or greater makes the routine overtreatment of low-grade lesions or underuse of surveillance a less likely explanation. Our results indicate military women are a population vulnerable to abnormal cervical cytology.

Established risk factors associated with abnormal cervical cytology (HPV, STI, smoking, early sexual initiation, sexual risk behaviors) were widespread in this sample and found to occur most often in women with LSA. The majority of high-risk sexual behaviors occurred with greatest frequency during military service. Through voluntary or involuntary sexual relations, infected military men may be one prominent source of STI transmission (and gynecologic health risk) for military women. Military men are often deployed to areas where the opportunity for contracting STIs is great, and AC servicemen have been shown to demonstrate high-risk sexual behaviors, such as frequent partner turnover, multiple partners, sexual bingeing, and negative attitudes toward condom use.[28] Other research has found that civilian women who have experienced multiple types of lifetime sexual violence have elevated rates of STI and cervical cancer.[11] Thus, it was not surprising that we found that completed LSA (penetration) was associated with abnormal Pap tests, given this is the route of oncogenic HPV transmission.

Type of military service (AC or both AC and RNG) was a significant risk factor for abnormal cervical cytology, even when considered in a logistic regression (LR) model that included HPV. The identification of "military service type" as significantly associated with ever having an abnormal Pap may be a proxy for a variety of factors. These military populations and their work and living environments likely differ, or these data may reflect that AC service provides a more continuous and intensive time at risk for LSA and other health and sexual risk behaviors or exposures. It may also represent differences in the current populations of AC and RNG women Veterans, with a higher proportion of young Veterans in the RNG population. Furthermore, a greater number of women who served in the AC had experienced SA during childhood compared to their RNG peers. AC Veterans were more likely to have ever smoked and to have more sexual partners during and after military service than RNG Veteran women. In addition to having more partners, partner sexual health may be different for AC compared to RNG. Further investigation is required to explain this finding.

Our findings have key implications for women's healthcare providers. (1) Given no differences in rates of abnormal Pap tests between healthcare settings and ready access to and use of both VA and other care, these results are relevant to all women's health providers. (2) While clinicians are sensitized to query gender-based violence, both LSA and military service history and type should be routinely assessed as risk markers for gynecologic health, health-related behaviors, and ultimately abnormal Pap tests. Although many women may be unaware of their HPV infections, they will remember their military service. (3) As Veterans were geographically mobile, used multiple gynecologic care sites, and had high rates of abnormal Pap tests, vigilant gynecologic follow-up of this population is indicated. (4) Sexual and health risk behaviors were endemic and should be assessed and addressed by clinicians throughout the military woman's life span. (5) Awareness that women Veterans have multiple gynecologic health disparities that result in different levels of gynecologic

Table 5. Characteristics Associated with Lifetime Abnormal Pap Tests: Multivariate Logistic Regression Results

	Multivarate OR (95% CI)	
	Model with LSA	*Model with LSA and HPV*
Demographics		
Age, years		
20–29	1.00	1.00
30–39	1.25 (0.84-1.87)	1.40 (0.92-2.14)
40–52	0.96 (0.67-1.39)	1.18 (0.80-1.74)
Marital status		
Single	1.00	1.00
Married	1.30 (0.91-1.87)	1.30 (0.89-1.89)
Divorced	1.46 (0.99-2.13)	1.39 (0.94-2.07)
Military service		
Reserve or National Guard (RNG)	1.00	1.00
Active component (AC)	1.67 (1.09-2.55)*	1.61 (1.04-2.51)*
AC and RNG	1.76 (1.10-2.80)*	1.67 (1.03-2.70)*
Sexual risk		
Age at first intercourse		
≥20	1.00	1.00
10–19	1.66 (1.05-2.62)*	1.59 (0.99-2.56)
≤9	1.14 (0.64-2.04)	1.15 (0.63-2.10)
Had unintended sex after drinking alcohol or using drugs[a]		
Before military service	1.11 (0.76-1.63)	1.15 (0.78-1.69)
During military service	1.57 (1.11-2.22)*	1.43 (0.99-2.05)
After military service	1.04 (0.69-1.57)	1.05 (0.69-1.61)
More than 2 sex partners[a]		
Before military service	1.47 (1.08-2.01)*	1.36 (0.99-1.88)
During military service	1.26 (0.93-1.70)	1.13 (0.83-1.54)
After military service	0.92 (0.67-1.26)	0.85 (0.61-1.19)
Sexual assault variables		
No LSA	1.00	1.00
Attempted LSA	0.95 (0.61-1.48)	0.90 (0.57-1.44)
Completed LSA	1.40 (1.02-1.93)*	1.31 (0.94-1.83)
Smoking		
Never smoked	1.00	1.00
Current smoker	0.86 (0.63-1.18)	0.89 (0.64-1.23)
Ex-smoker	1.28 (0.89-1.83)	1.29 (0.89-1.88)
HPV		7.43 (4.21-13.12)***
Sexually transmitted infections		1.23 (0.87-1.73)

[a]Responses of "Don't know" were treated as missing, and a multiple imputation method was used before running the logistic regressions.
*$p < 0.05$; ***$p < 0.001$.

care needs has implications for both resource allocation and public health interventions. Our cross-sectional study design limits findings to associations but not prediction. Although we studied a Midwestern cohort that may not be generalizable to other geographic settings, a notable proportion of subjects used VA sites throughout the United States. Self-selection bias for participation is a usual study limitation. However, chart review comparisons among participants, refusers, and those who could not be reached reduced this concern. Most of our participants were white; thus, our results might not be generalizable to racial minorities. Our participants may differ from the general female Veteran population because they were selected from women enrolled in the VA. Concerns about representativeness of the sample are lessened by the similarity of abnormal cytology rates in women who received care outside of the VA but cannot be eliminated. Given that LSA rates were consistent with other studies of military women,[5,6] response bias is less of a concern but cannot be disregarded. Although memory failure can be an issue in retrospective self-report data, chart review validation of self-reported Pap test results reduces but does not omit this concern.

Conclusions

Military women are a high-risk population for abnormal cervical cytology and consequently have unique reproductive health and gynecologic care needs. LSA is a significant risk factor for abnormal cervical cytology and, along with military service history, should be routinely assessed. LSA and gynecologic health risk factors appear endemic in the female Veteran population. Our findings have implications for resource allocation and clinical management of this population as well as for future research investigating the reproductive health of military populations and gynecologic health consequences of LSA.

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