

# Sexual Behaviors and Sexually Transmitted Infections Among Male Veterans and Nonveterans

American Journal of Men's Health  
2017, Vol. 11(4) 791–800  
© The Author(s) 2017  
Reprints and permissions:  
sagepub.com/journalsPermissions.nav  
DOI: 10.1177/1557988317698615  
journals.sagepub.com/home/ajmh  


Mark W. Evans, MSPH<sup>1</sup>, Sonya Borrero, MD MS<sup>2,3,4</sup>,  
Jonathan Yabes, PhD<sup>2,5</sup>, and Elian A. Rosenfeld, PhD<sup>3,4</sup>

## Abstract

Little is known about the sexual health of male veterans. This study used nationally representative data from the 2011 to 2013 National Survey of Family Growth to compare sexual behaviors and history of sexually transmitted infections (STIs) between male veterans and nonveterans. The sample included 3,860 men aged 18 to 44 years who reported ever having sex with a man or woman. The key independent variable was veteran status. Sexual behavior outcomes included  $\geq 6$  lifetime female partners,  $\geq 10$  lifetime partners of either sex,  $\geq 2$  past-year partners of either sex, having past-year partners of both sexes, and condom nonuse at last vaginal sex. STI outcomes included past-year history of chlamydia, gonorrhea, or receiving any STI treatment; lifetime history of herpes, genital warts, or syphilis; and an aggregate measure capturing any reported STI history. Logistic regression models were used to evaluate associations between veteran status and each outcome. In models adjusting for age, race/ethnicity, education, income, and marital status, veterans had significantly greater odds than nonveterans of having  $\geq 6$  lifetime female partners ( $OR = 1.5$ , 95% CI [1.02, 2.31]). In models adjusting for age and marital status, veterans had significantly greater odds of having partners of both sexes in the past year ( $OR = 4.8$ , 95% CI [1.2, 19.8]), and gonorrhea in the past year ( $OR = 3.2$ , 95% CI [1.2, 8.5]). Male veterans were thus significantly more likely than nonveterans to have STI risk factors. Health care providers should be aware that male veterans may be at higher risk for STIs and assess veterans' sexual risk behaviors.

## Keywords

male reproductive health, sexually transmitted diseases/infections, risk behaviors, health screening, quantitative research

Received July 26, 2016; revised January 29, 2017; accepted February 6, 2017

## Introduction

Sexually transmitted infections (STIs) are a serious health issue in the United States, with an estimated 20 million new STI cases each year that result in roughly \$16 billion in direct annual medical costs (Owusu-Edusei et al., 2013). Preventing and containing STIs is a considerable public health challenge (Workowski, 2015). National STI screening guidelines and policies are primarily focused on women due to the serious reproductive consequences of these infections in women (Workowski, 2015; Workowski & Bolan, 2015; Zakher, Cantor, Pappas, Daeges, & Nelson, 2014). Consequently, research efforts are also largely focused on the sexual health of women, not men (Sonfield, 2002). However, understanding more about STIs and the sexual health behaviors and risks of men could be a means to not only prevent and contain

infections in men but also prevent infection and subsequent sequelae of STIs in women.

While there is limited research about the sexual health of men in general, there is a particular dearth of information

<sup>1</sup>University of Pittsburgh, School of Medicine, Pittsburgh, PA, USA

<sup>2</sup>Division of General Internal Medicine, University of Pittsburgh, School of Medicine, Pittsburgh, PA, USA

<sup>3</sup>Center for Women's Health Research and Innovation, Pittsburgh, PA, USA

<sup>4</sup>Center for Health Equity Research and Promotion, VA Pittsburgh Healthcare System, Pittsburgh, PA, USA

<sup>5</sup>Center for Research on Health Care Data Center, University of Pittsburgh, Pittsburgh, PA, USA

## Corresponding Author:

Sonya Borrero, Center for Research on Health Care, University of Pittsburgh, 230 McKee Place, Suite 600, Pittsburgh, PA 15213, USA.  
Email: [borrerosp@upmc.edu](mailto:borrerosp@upmc.edu)



about the sexual health of male veterans, a population that may be at higher risk for STIs. Higher rates of STIs have been documented in male and female active-duty military populations as well as female veterans compared with general U.S. populations (Armed Forces Health Surveillance Center, 2013; Gaydos, Howell, Quinn, McKee, & Gaydos, 2003; Goyal, Mattocks, & Sadler, 2012; Lehavot et al., 2014; Seña et al., 2000). Multiple studies have reported that military service members engage in high-risk sex behaviors, including having multiple partners, having concurrent partners, not using condoms or inconsistent use of condoms, and engaging in sexual activity under the influence of drugs or alcohol (Aldous et al., 2011; Jordan, Lee, Nowak, Johns, & Gaydos, 2011; Lehavot et al., 2014; Meyers et al., 2008). In one study of health behaviors in a representative sample of all active duty service members, both male and female, across all branches, over a third reported seldom or never using condoms with new sexual partners (Barlas, Higgins, Pflieger, & Diecker, 2013). Veterans also have higher prevalence of substance use disorders and mental health issues, including posttraumatic stress disorder (PTSD), which have been linked to sexual risk behaviors and STIs (Goulet et al., 2014; Hoerster et al., 2012; Hutton, McCaul, Santora, & Erbeling, 2008). There is also evidence that indicates that male veterans have a higher lifetime prevalence than nonveterans of having extramarital sex and paying for sex (London, Allen, & Wilmoth, 2013; London & Wilmoth, 2015). These findings indicate that male veterans may engage in more risky sex behaviors than their civilian counterparts.

Currently, there are no published studies directly comparing sexual risk behaviors and incidence of STIs in male veterans and nonveterans. This study sought to address this gap in the literature using nationally representative data from the National Survey of Family Growth (NSFG).

## Method

### *Data Source and Study Population*

All data analyzed in this study were from the cross-sectional survey, the 2011 to 2013 NSFG. The survey is designed by the Centers for Disease Control and Prevention's National Center for Health Statistics to provide nationally representative data on reproductive and sexual health measures (Lepkowski, Mosher, Davis, Groves, & Van Hoewyk, 2010). The 2011 to 2013 NSFG uses a stratified, multi-stage, national probability sample of women and men 15 to 44 years of age living in households in the United States and oversamples Blacks, Hispanics, and teens (Lepkowski et al., 2010). Data are collected via face-to-face computer-assisted interviews or by Audio Computer-Assisted Self-Interviewing for more sensitive questions (e.g., sexual history information). The 2011 to 2013 data set included a

total of 4,815 men, with a response rate of 72.1% (Copen, Chandra, & Febo-Vazquez, 2016). For this analysis, those who had never had sex with either a man or woman were excluded as were men younger than 18 years, since they could not have served in the armed forces. The current sample thus included all men aged 18 to 44 years who reported ever having had vaginal sex with a woman or oral or anal sex with a man.

### *Study Variables*

The key independent variable of interest was veteran status, which was based on the response to the question "Have you ever been on active duty in the Armed Forces for a period of 6 months or more?" Covariates included age, race/ethnicity, education, income, marital status, and sexual orientation.

Behavioral outcomes included binge drinking (defined as having five or more drinks within a couple of hours, consistent with U.S. Department of Health & Human Services [2015] definition for men) at least once in the past year,  $\geq 6$  lifetime female sexual partners,  $\geq 10$  lifetime sexual partners (female or male),  $\geq 2$  past-year sexual partners (female or male), having partners of both sexes in the past year, and condom nonuse at last vaginal sex. STI outcomes included a positive self-reported history of chlamydia (past 12 months), gonorrhea (past 12 months), herpes (lifetime), genital warts (lifetime), or syphilis (lifetime), and an aggregate measure capturing reported history of at least one of the five aforementioned STIs. Self-reported receipt of STI treatment in the past 12 months was also assessed.

Because number of sexual partners was capped in the NSFG data set (e.g., for lifetime number of sexual partners, all participants with 50 or more partners were assigned a value of 50) for privacy protection reasons, number of partners could not be treated as a continuous variable in these analyses. In the absence of standardized definitions of the number of partners that constitutes "high-risk" behavior (Jonsson, Karlsson, Rylander, Gustavsson, & Wadell, 1997; Karlsson et al., 1995; Kjaer et al., 1997; Ley et al., 1991; Mosher, Chandra, & Jones, 2005; Santelli, Brener, Lowry, Bhatt, & Zabin, 1998; Vaccarella et al., 2006), cut points were modeled on other studies examining STI risk (Burk et al., 1996; Centers for Disease Control and Prevention, 2010; Datta et al., 2007; Fenton et al., 2001; Finer, Darroch, & Singh, 1999; Hariri et al., 2011; Karlsson et al., 1995; Kjaer et al., 1997; Ley et al., 1991; Mosher et al., 2005; Santelli et al., 1998; Stahlman et al., 2014; Vaccarella et al., 2006).

### *Statistical Analysis*

Sociodemographic characteristics of the study sample, as well as behavioral and STI outcomes, were evaluated, by

veteran status, using *t* tests for age and Rao–Scott corrected chi-squared tests for the remaining variables, which were all categorical. This correction was applied to account for the complex sampling design of these survey data. Sociodemographic characteristics were also compared for veterans versus nonveterans, using the same tests, but stratified by whether participants reported a history of STI. Weighted logistic regression analyses were then used to evaluate the bivariate associations between veteran status and each of the outcomes to calculate an unadjusted odds ratio (*OR*). Two sets of multivariable logistic regression analyses were performed. Outcomes with sufficient numbers of events (i.e.,  $\geq 150$  events across both veterans and nonveterans), with an event defined as a single respondent who met the criteria for a variable (e.g., having had at least one STI), were adjusted for age, race/ethnicity, education, income, and marital status. Although sexual orientation was examined as a potential covariate, adjustment for this variable was not performed due to small numbers of participants identifying as not heterosexual or straight. Moreover, this variable did not differ by veteran status. Outcomes with fewer than 150 events were adjusted only for age and marital status, which were chosen a priori based on previously observed associations between these variables and sexual behaviors and STIs (Stamm et al., 1984; Taylor, Adimora, & Schoenbach, 2010).

Statistical analyses were performed in Stata SE software (version 14.1, StataCorp, College Station, TX). All estimates used survey weighting provided by the NSFG to reflect the national household population of men aged 15 to 44 years, with the use of the “subpop” command to restrict analysis to men who met the eligibility criteria. The University of Pittsburgh Institutional Review Board approved this analysis of the NSFG data set.

## Results

### Participant Characteristics

The current sample consisted of a total of 3,860 men: 409 veterans and 3,451 nonveterans. The sociodemographic characteristics of the study sample, as well as the unweighted sample sizes, are reported in Tables 1 and 2. Compared with nonveterans, veterans were slightly older, had higher income, and were more likely to be married or cohabiting. There were no significant differences between veterans and nonveterans with regard to race, education level, or sexual orientation. Among those reporting no history of STI, who constituted the majority of the sample, comparisons between veterans and nonveterans were similar. Among respondents reporting a history of at least one STI, veterans were more likely than nonveterans to be married or cohabiting, but there were no other significant differences.

### Sexual Behaviors and STIs

Results of bivariate analyses are reported in Table 3. The mean age at first sex (not reported in Table 3) was 16.8 in both groups (*SD* = 3.3 for veterans, 3.6 for nonveterans). For behavioral outcomes, veterans were significantly more likely than nonveterans to have had  $\geq 6$  lifetime female partners (66.0% vs. 52.1%,  $p < .01$ ), to have not used a condom at last vaginal sex (73.3% vs. 61.6%,  $p < .01$ ), and to have had sex with both female and male partners in the past year (4.4% vs. 1.1%,  $p = .02$ ). For STI outcomes, veterans were more likely than nonveterans to report ever having been diagnosed with genital warts (5.3% vs. 2.1%,  $p = .04$ ).

The results of the unadjusted and adjusted logistic regression analyses are reported in Table 4. In adjusted regression models, veterans had greater odds than nonveterans of having  $\geq 6$  lifetime female partners (adjusted *OR* = 1.54, 95% confidence interval [CI 1.02, 2.31]), of having had sex with both female and male partners in the past year (adjusted *OR* = 4.80, 95% CI [1.16, 19.79]), and of having had gonorrhea in the past 12 months (adjusted *OR* = 3.15, 95% CI [1.17, 8.47]). It is worth noting that the point estimates of the *ORs* for all other sexual behaviors and STIs examined were also greater than 1, indicating that veterans trended toward greater risk, although these associations were statistically nonsignificant.

## Discussion

In this study using nationally representative data from the 2011 to 2013 NSFG, male veterans were identified as being more likely than nonveterans to have had six or more lifetime female partners and to have had gonorrhea in the past year. Veterans were also reported to be more likely than nonveterans to have had both female and male partners in the past year. These findings indicate that, like their female veteran counterparts, male veterans seem to engage in more risky sex behaviors than nonveterans (Lehavot et al., 2014).

The finding that veterans are more likely to have six or more lifetime female partners is significant because a higher number of sexual partners has consistently been associated with greater STI acquisition (Datta et al., 2007; Fenton et al., 2001; Jonsson et al., 1997; Mosher et al., 2005). In addition, compared with nonveterans, male veterans also had higher odds of having gonorrhea in the past 12 months. Though the reasons for this are unclear, potential explanations are that from 2012 to 2013 the rate of reported cases of gonorrhea in men increased over 4% and that treatment of gonorrhea infections has become challenging due to antimicrobial resistance, an issue not occurring to the same degree in other STIs (Centers for Disease Control and Prevention, 2014).

**Table 1.** Sociodemographic Characteristics of Adult Males Who Had Ever Had Sex, by Veteran Status (*N* = 3,860).

Characteristic	Veterans ( <i>n</i> = 409)	Nonveterans ( <i>n</i> = 3,451)	<i>p</i>
	<i>n</i> (%)	<i>n</i> (%)	
Age in years, mean (range)	33.6 (19-44)	31.1 (18-45)	.02
Race			.31
White	255 (64.2)	1,660 (56.7)	
African American	54 (10.1)	651 (21.0)	
Hispanic (any race)	68 (18.2)	825 (21.2)	
Other or multiple races	32 (7.5)	315 (10.1)	
Education			.36
High school degree or less	161 (39.7)	1,721 (45.7)	
Associate's degree/some college	159 (35.6)	1,051 (29.8)	
Bachelor's degree or higher	89 (24.8)	679 (24.5)	
Household income <sup>a</sup>			.001
<200%	117 (25.7)	1,586 (42.4)	
200% to 399%	167 (39.5)	1,049 (30.1)	
≥400%	125 (34.9)	816 (27.5)	
Marital status			<.001
Married or cohabiting	239 (70.0)	1,503 (56.3)	
Single	97 (18.3)	1,658 (37.6)	
Widowed/divorced/separated	73 (11.7)	290 (6.17)	
Sexual orientation			.13
Heterosexual or straight	397 (96.9)	3,254 (95.9)	
Homosexual or gay	3 (0.3)	94 (2.2)	
Bisexual	9 (2.8)	36 (1.9)	

Note. *p* Values based on Rao–Scott chi-squared tests for independence.

<sup>a</sup>Household income reported as percentage of Federal Poverty Level (FPL) as defined by the U.S. Census Bureau, adjusted for family size. Each interview year uses the FPL from the previous calendar year (e.g., 2011 interviews use 2010 FPL thresholds; National Center for Health Statistics, 2014).

Given that prior STI diagnosis is associated with risk for acquiring new STIs, these findings suggest that veterans may have a higher risk of contracting new STIs (Peterman et al., 2006; Santelli et al., 1998).

Similar to their female veteran counterparts, male veterans were identified as being more likely than nonveterans to have had both male and female sex partners (Lehavot et al., 2014). Having sex partners of both sexes has implications for sexual health screening efforts. Men who have sex with men are at high risk for infection with a number of STIs, including HIV (Workowski, 2015; Workowski & Bolan, 2015). Currently, the Centers for Disease Control and Prevention recommend that sexually active men who have sex with men be screened annually for HIV, syphilis, chlamydia, and gonorrhea (Workowski & Bolan, 2015). However, there are no consensus guidelines for routine STI screening of men who have sex with women, apart from HIV screening for all sexually active men aged 13 to 64 years (Kalmuss & Tatum, 2007; Workowski & Bolan, 2015). Given that the different recommendations are based on differences in sexual behavior rather than sexual orientation, it is important for health care providers to assess their male veteran patients'

sexual history and sexual behaviors in order to determine if they should be screened for STIs. Although health care providers may be less familiar with discussing sexual health issues with male patients than with female patients, it remains the only way to assess risk. Yet less than half of sexually active men aged 20 to 44 years report receiving any sexual or reproductive health care, including counseling or advice about STIs, in a given year (Kalmuss & Tatum, 2007).

Proactively and routinely eliciting sexual histories in an open and nonjudgmental manner improves risk assessment, helps build trust and patient satisfaction, and can promote self-efficacy and safer sex and thus better sexual health outcomes (Nusbaum & Hamilton, 2002). This may be a particular challenge because of the lack of consensus guidelines for men's sexual health (The Alan Guttmacher Institute, 2002; Marcell & Male Training Center for Family Planning and Reproductive Health, 2014; Sonfield, 2002), and that men seek fewer preventive health services (Courtenay, 2000; Pinkhasov et al., 2010; Springer & Mouzon, 2011; Williams, 2003). Nonetheless, periodically performing risk assessment, risk reduction counseling, and screening of men who may be at higher

**Table 2.** Sociodemographic Characteristics of Adult Males Who Had Ever Had Sex, by STI Status (*N* = 3,860).

	STI (-)			STI (+)		
	Veterans ( <i>n</i> = 376)	Nonveterans ( <i>n</i> = 3,270)	<i>p</i>	Veterans ( <i>n</i> = 33)	Nonveterans ( <i>n</i> = 152)	<i>p</i>
	<i>n</i> (%)	<i>n</i> (%)		<i>n</i> (%)	<i>n</i> (%)	
Age in years, mean (range)	33.5 (19-44)	31.1 (18-45)	.03	34.8 (24-43)	32.7 (18-44)	.27
Race			.47			.49
White	235 (63.5)	1,579 (56.9)		20 (72.9)	71 (63.2)	
African American	51 (10.6)	601 (11.8)		3 (4.6)	43 (14.8)	
Hispanic (any race)	61 (18.1)	788 (21.1)		7 (19.5)	29 (18.9)	
Other or multiple races	29 (7.8)	302 (10.1)		3 (3.1)	9 (3.1)	
Education			.28			.51
High school degree or less	145 (39.2)	1,633 (45.9)		16 (45.2)	67 (33.3)	
Associate's degree/some college	148 (36.8)	990 (29.5)		11 (20.1)	55 (37.0)	
Bachelor's degree or higher	83 (23.9)	647 (24.6)		6 (34.7)	30 (29.6)	
Household income <sup>a</sup>			.001			.33
<200%	108 (25.8)	1,496 (42.8)		9 (23.5)	72 (35.1)	
200% to 399%	153 (40.8)	998 (29.8)		14 (23.7)	42 (29.0)	
≥400%	115 (33.4)	776 (27.4)		10 (52.8)	38 (35.9)	
Marital status			<.001			.02
Married or cohabiting	219 (69.4)	1,438 (56.4)		20 (76.9)	51 (50.3)	
Single	90 (19.0)	1,558 (37.5)		7 (10.7)	86 (40.2)	
Widowed/divorced/separated	67 (11.6)	274 (6.1)		6 (12.5)	15 (9.5)	
Sexual orientation			.10			.35
Heterosexual or straight	365 (96.8)	3,110 (96.1)		32 (98.6)	133 (89.4)	
Homosexual or gay	2 (0.2)	82 (2.1)		1 (1.4)	12 (5.1)	
Bisexual	9 (3.0)	62 (1.8)		0 (0.0)	7 (5.5)	

Note. STI = sexually transmitted infection. STI (-) refers to respondents who did not report a history of any STI; STI (+) refers to respondents who reported a history of at least one STI. *p* Values based on Rao-Scott chi-squared tests for independence.

<sup>a</sup>Household income reported as percentage of Federal Poverty Level (FPL) as defined by the U.S. Census Bureau, adjusted for family size. Each interview year uses the FPL from the previous calendar year (e.g., 2011 interviews use 2010 FPL thresholds; National Center for Health Statistics, 2014).

risk for STIs, such as male veterans, has the potential to benefit the sexual health of men and their partners.

There are a number of possible reasons that male veterans may engage in riskier sexual behaviors than their civilian counterparts. An important factor historically implicated in high-risk sexual behavior and STIs is alcohol use (Boden, Fergusson, & Horwood, 2011; Connor, Kydd, & Dickson, 2015; Cooper, 2002, 2006; Halpern-Felsher, Millstein, & Ellen, 1996; Kiene, Barta, Tennen, & Armeli, 2009; Leigh, 2002). Interestingly, no significant association between veteran status and binge drinking at least once in the past year was identified. This is consistent with findings in female veterans who were also reported to have higher rates of risky sex behaviors and STIs but not higher rates of binge drinking, suggesting that observed behavioral differences among veterans may be rooted in other psychosocial antecedents (Lehavot et al., 2014). One possibility is that the men who choose to serve in the military have higher risk tolerance or greater sensation seeking at baseline or are more likely to

engage in sexual risk behaviors than those who do not join the military, and that these behavioral patterns continue during and after their service (Goyal et al., 2012; Thompson, Kao, & Thomas, 2005). No difference in age at first sex was identified, though this finding alone does not rule out a "higher baseline risk" explanation. It is also possible that the sexual environment that service members are exposed to in the military, in which there is a high prevalence of partner concurrency, inconsistent condom use, and having sex under the influence of alcohol, leads to the adoption of riskier sexual practices that continue into their lives as veterans (Barlas et al., 2013; Goyal et al., 2012; Harbertson et al., 2015; Seña et al., 2000; Stahlman et al., 2014).

Another potential explanation for these findings is that psychological effects associated with military service may carry over into veterans' lives and affect their sexual risk taking behaviors. Mental health disorders, which are disproportionately observed in veteran populations, have been linked to riskier sexual behaviors (Berenson,

**Table 3.** Sexual Behaviors and History of Sexually Transmitted Infections of Adult Males Who Had Ever Had Sex, by Veteran Status (*N* = 3,860).

Characteristic	Veterans ( <i>n</i> = 409)	Nonveterans ( <i>n</i> = 3,451)	<i>p</i>
	<i>n</i> (%)	<i>n</i> (%)	
Binge drinking in past year <sup>a</sup>	208 (51.4)	1,820 (54.0)	.54
Sexual behaviors			
≥6 Lifetime female partners	274 (66.0)	1,854 (52.1)	.002
≥10 Lifetime partners (either sex)	201 (45.4)	1,377 (37.9)	.07
≥2 Partners in past year (either sex)	87 (18.0)	899 (19.2)	.69
≥1 Partner of both sexes in past year	8 (4.4)	35 (1.1)	.02
Condom nonuse at last vaginal sex	280 (73.3)	1,910 (61.6)	.008
Sexually transmitted infections (STI)			
Any STI	33 (7.6)	152 (4.1)	.07
Chlamydia (past 12 months)	6 (0.9)	42 (0.7)	.56
Gonorrhea (past 12 months)	7 (1.0)	32 (0.6)	.26
Herpes	10 (1.5)	49 (1.2)	.60
Genital warts	14 (5.3)	61 (2.1)	.04
Syphilis	6 (0.9)	26 (0.5)	.28
Treated for STI (past 12 months)	15 (2.0)	117 (2.5)	.48

Note. *p* Values based on Rao–Scott chi-squared tests for independence.

<sup>a</sup>Defined as having had ≥5 drinks within a couple of hours ≥1 time in the past 12 months.

**Table 4.** Unadjusted and Adjusted Logistic Regression Models (*N* = 3,860) With OR Expressed as Odds for Veterans Versus Nonveterans.

Characteristic	Unadjusted		Adjusted	
	OR	95% CI	OR	95% CI
Full model				
≥6 Lifetime female partners	1.78	[1.25, 2.54]	1.54	[1.02, 2.31]
≥10 Lifetime partners (either sex)	1.36	[0.98, 1.90]	1.21	[0.81, 1.83]
≥2 Partners in past year (either sex)	0.92	[0.63, 1.37]	1.51	[0.97, 2.35]
Condom nonuse at last vaginal sex	1.71	[1.15, 2.53]	1.17	[0.78, 1.77]
Any STI	1.93	[0.94, 3.95]	1.77	[0.84, 3.72]
Partial model				
≥1 Partner of both sexes in past year	4.18	[1.21, 14.46]	4.80	[1.16, 19.79]
Chlamydia (past 12 months)	1.32	[0.51, 3.43]	2.11	[0.85, 5.26]
Gonorrhea (past 12 months)	1.81	[0.63, 5.20]	3.15	[1.17, 8.47]
Herpes	1.22	[0.56, 2.65]	1.13	[0.48, 2.67]
Genital warts	2.70	[0.99, 7.37]	2.38	[0.90, 6.27]
Syphilis	1.81	[0.59, 5.53]	1.96	[0.57, 6.70]
Treated for STI (past 12 months)	0.81	[0.44, 1.48]	1.17	[0.62, 2.23]

Note. OR = odds ratio; CI = confidence interval; STI = sexually transmitted infection. Full models adjusted for age, race/ethnicity, education, income, and marital status. Partial models adjusted for age and marital status.

Breitkopf, & Wu, 2003; Lehavot, Hoerster, Nelson, Jakupcak, & Simpson, 2012; Marshall et al., 2013; Seal, Bertenthal, Miner, Sen, & Marmar, 2007; Stahlman et al., 2014). In particular, rates of PTSD are substantially higher among veterans than civilians, and research indicates that individuals with PTSD not only engage in riskier sexual behavior but also use sex as a coping mechanism

(Cohen et al., 2012; Hoerster et al., 2012; Howard, 2007; Killgore et al., 2008; Stecker, Fortney, Owen, McGovern, & Williams, 2010). Unfortunately, the NSFG does not assess mental health conditions.

The higher risk for STIs among veterans observed in this study could also be due to factors not examined in this study such as differences in patterns of sexual

activity (e.g., having concurrent sexual partners or exchanging sex for drugs or money) or of sexual networks (Harbertson et al., 2015). In addition, preexisting cultural norms about masculinity may be more concentrated in the military environment, which may promote greater risk-taking behaviors, potentially leading to long-term behavior change (Morris, Smith, Farooqui, & Surís, 2014). Although this study cannot distinguish between these possibilities, when interpreted in light of other research, these findings suggest that military service has or is linked to lasting effects on veterans' health and may contribute, in varying and interconnected ways, to higher risk sexual behavior and increased risk for STIs. Future research is needed to determine the underlying reasons why veterans engage in higher risk sexual behaviors than their nonveteran counterparts.

This analysis has some important limitations to consider. First, the NSFG is a cross-sectional study, so it does not include data about sexual behaviors across the life course or even in relation to the timing of military service. The lack of this temporal information prevents determination of the possibility of a causal relationship between military service and the risks identified here. Second, although the NSFG is nationally representative, the survey weights were not created with veteran status in mind and thus, this sample may be less representative of male veterans than it is of all men aged 18 to 44 years. It is also important to note that this sample includes only men younger than age 45, who comprise about 19% of all veterans (U.S. Department of Veterans Affairs Office of the Actuary, 2014). Third, the study's outcomes are based on self-report, which may lead to underreporting of the number of sexual partners or STI histories. However, the majority of the outcomes were obtained through Audio Computer-Assisted Self-Interviewing rather than face-to-face interviews, which should, in theory, limit the effects of social desirability bias. Fourth, the study is limited by the behavioral variables included in the NSFG questionnaire, which did not allow for further exploration of other specific sexual practices that could also contribute to risk, such as anonymous sex or group sex. Fifth, the aggregate STI measure combines two past-year diagnoses and three ever diagnoses, rendering it neither a wholly past-year nor a lifetime measure. Nevertheless, the measure may more accurately reflect morbidity as gonorrhea and chlamydia may be acquired (and treated) multiple times, while herpes and genital warts are incurable and often cause recurrent symptoms. Sixth, this study did not consider the potential effects of sexual assault on STI transmission or care-seeking behavior (Morris et al., 2014). Although the NSFG does include two questions about lifetime history of sexual assault, because the timing is unknown and because of the concern for potential differences in

underreporting between veterans and nonveterans (Morris et al., 2014), they were not included. Finally, this study did not consider the possible effects of deployment on STI transmission (Harbertson et al., 2015), as the NSFG does not ask about deployment history.

In summary, this is one of the first studies to compare male veterans' sexual behaviors and STI histories to those of nonveterans in a nationally representative sample. It identifies higher rates of sexual risk behaviors and prior STI in veterans. Health care providers need to be aware that male veterans may be at higher risk for STIs and routinely assess their sexual behaviors, screen for STIs accordingly, and perform risk reduction counseling during clinical encounters. In addition, future research is necessary to further understand the ways in which the experiences of military service and the sexual environment therein potentially influence veterans' sexual behaviors and risk for STIs.

### Authors' Note

Some of the data included in this article were presented as an abstract poster presentation at the Society of General Internal Medicine's 2016 Annual Meeting, May 11 to 14, 2016.

### Acknowledgments

The authors would like to thank Dan Winger of the Clinical and Translational Science Institute (CTSI) at the University of Pittsburgh, who provided statistical consultation.

### Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Mr. Evans was funded by the Clinical Scientist Training Program at the University of Pittsburgh School of Medicine. Dr. Borrero's effort on this study was supported by grant # R21 HD076327. CTSI support funded by National Institutes of Health Clinical and Translational Science Award program, grants UL1 RR024153 and UL1TR000005.

### References

- Alan Guttmacher Institute. (2002). *In their own right: Addressing the sexual and reproductive health needs of American men*. Washington, DC: Author.
- Aldous, W. K., Robertson, J. L., Robinson, B. J., Hatcher, C. L., Hospenthal, D. R., Conger, N. G., & Murray, C. K. (2011). Rates of gonorrhea and chlamydia in U.S. military personnel deployed to Iraq and Afghanistan (2004-2009). *Military Medicine, 176*, 705-710.

- Armed Forces Health Surveillance Center. (2013). Sexually transmitted infections, active component, U.S. Armed Forces, 2000-2012. *Medical Surveillance Monthly Report*, 20(2), 5-10.
- Barlas, F. M., Higgins, W. B., Pflieger, J. C., & Diecker, K. (2013). 2011 Department of Defense health-related behaviors survey of active duty military personnel. Fairfax, VA: Department of Defense.
- Berenson, A. B., Breitkopf, C. R., & Wu, Z. H. (2003). Reproductive correlates of depressive symptoms among low-income minority women. *Obstetrics & Gynecology*, 102, 1310-1317.
- Boden, J. M., Fergusson, D. M., & Horwood, L. J. (2011). Alcohol and STI risk: Evidence from a New Zealand longitudinal birth cohort. *Drug and Alcohol Dependence*, 113, 200-206.
- Burk, R. D., Ho, G. Y., Beardsley, L., Lempa, M., Peters, M., & Bierman, R. (1996). Sexual behavior and partner characteristics are the predominant risk factors for genital human papillomavirus infection in young women. *Journal of Infectious Diseases*, 174, 679-689.
- Centers for Disease Control and Prevention. (2010). Seroprevalence of herpes simplex virus type 2 among persons aged 14-49 years—United States, 2005-2008. *Morbidity and Mortality Weekly Report*, 59, 456-459.
- Centers for Disease Control and Prevention. (2014). *Sexually Transmitted Disease Surveillance 2013*. Atlanta, GA: U.S. Department of Health & Human Services.
- Cohen, B. E., Maguen, S., Bertenthal, D., Shi, Y., Jacoby, V., & Seal, K. H. (2012). Reproductive and other health outcomes in Iraq and Afghanistan women veterans using VA health care: Association with mental health diagnoses. *Women's Health Issues*, 22, e461-e471.
- Connor, J. L., Kydd, R. M., & Dickson, N. P. (2015). Alcohol involvement in sexual behaviour and adverse sexual health outcomes from 26 to 38 years of age. *PLoS ONE*, 10(8), e0135660.
- Cooper, M. L. (2002). Alcohol use and risky sexual behavior among college students and youth: Evaluating the evidence. *Journal of Studies on Alcohol*, 14, 101-117.
- Cooper, M. L. (2006). Does drinking promote risky sexual behavior? A complex answer to a simple question. *Current Directions in Psychological Science*, 15(1), 19-23.
- Copen, C. E., Chandra, A., & Febo-Vazquez, I. (2016). Sexual behavior, sexual attraction, and sexual orientation among adults aged 18-44 in the United States: Data from the 2011-2013 National Survey of Family Growth. *National Health Statistics Reports*, 88, 1-14.
- Courtenay, W. H. (2000). Constructions of masculinity and their influence on men's well-being: A theory of gender and health. *Social Science & Medicine*, 50, 1385-1401.
- Datta, S. D., Sternberg, M., Johnson, R. E., Berman, S., Papp, J. R., McQuillan, G., & Weinstock, H. (2007). Gonorrhea and chlamydia in the United States among persons 14 to 39 years of age, 1999 to 2002. *Annals of Internal Medicine*, 147, 89-96.
- Fenton, K. A., Korovessis, C., Johnson, A. M., McCadden, A., McManus, S., Wellings, K., . . . Nanchahal, K. (2001). Sexual behaviour in Britain: Reported sexually transmitted infections and prevalent genital chlamydia trachomatis infection. *Lancet*, 358, 1851-1854.
- Finer, L. B., Darroch, J. E., & Singh, S. (1999). Sexual partnership patterns as a behavioral risk factor for sexually transmitted diseases. *Family Planning Perspectives*, 31, 228-236.
- Gaydos, C. A., Howell, M. R., Quinn, T. C., McKee, K. T., Jr., & Gaydos, J. C. (2003). Sustained high prevalence of chlamydia trachomatis infections in female army recruits. *Sexually Transmitted Diseases*, 30, 539-544.
- Goulet, J. L., Martinello, R. A., Bathulapalli, H., Higgins, D., Driscoll, M. A., Brandt, C. A., & Womack, J. A. (2014). STI diagnosis and HIV testing among OEF/OIF/OND veterans. *Medical Care*, 52, 1064-1067.
- Goyal, V., Mattocks, K. M., & Sadler, A. G. (2012). High-risk behavior and sexually transmitted infections among U.S. active duty servicewomen and veterans. *Journal of Women's Health*, 21, 1155-1169.
- Halpern-Felsher, B. L., Millstein, S. G., & Ellen, J. M. (1996). Relationship of alcohol use and risky sexual behavior: A review and analysis of findings. *Journal of Adolescent Health*, 19, 331-336.
- Harbertson, J., Scott, P. T., Moore, J., Wolf, M., Morris, J., Thrasher, S., . . . Tran, B. R. (2015). Sexually transmitted infections and sexual behaviour of deploying shipboard US military personnel: A cross-sectional analysis. *Sexually Transmitted Infections*, 91, 581-588.
- Hariri, S., Unger, E. R., Sternberg, M., Dunne, E. F., Swan, D., Patel, S., & Markowitz, L. E. (2011). Prevalence of genital human papillomavirus among females in the United States, the National Health and Nutrition Examination Survey, 2003-2006. *Journal of Infectious Diseases*, 204, 566-573.
- Hoerster, K. D., Lehavot, K., Simpson, T., McFall, M., Reiber, G., & Nelson, K. M. (2012). Health and health behavior differences: U.S. military, veteran, and civilian men. *American Journal of Preventive Medicine*, 43, 483-489.
- Howard, M. D. (2007). Escaping the pain: Examining the use of sexually compulsive behavior to avoid the traumatic memories of combat. *Sexual Addiction & Compulsivity*, 14, 77-94.
- Hutton, H. E., McCaul, M. E., Santora, P. B., & Erbeling, E. J. (2008). The relationship between recent alcohol use and sexual behaviors: Gender differences among sexually transmitted disease clinic patients. *Alcoholism: Clinical & Experimental Research*, 32, 2008-2015.
- Jonsson, M., Karlsson, R., Rylander, E., Gustavsson, Å., & Wadell, G. (1997). The associations between risk behaviour and reported history of sexually transmitted diseases, among young women: A population-based study. *International Journal of STD & AIDS*, 8, 501-505.
- Jordan, N. N., Lee, S. E., Nowak, G., Johns, N. M., & Gaydos, J. C. (2011). Chlamydia trachomatis reported among U.S. active duty service members, 2000-2008. *Military Medicine*, 176, 312-319.
- Kalmuss, D., & Tatum, C. (2007). Patterns of men's use of sexual and reproductive health services. *Perspectives on Sexual and Reproductive Health*, 39, 74-81.
- Karlsson, R., Jonsson, M., Edlund, K., Evander, M., Gustavsson, Å., Bodén, E., . . . Wadell, G. (1995). Lifetime number of partners as the only independent risk factor for human



- papillomavirus infection: A population-based study. *Sexually Transmitted Diseases*, 22, 119-127.
- Kiene, S. M., Barta, W. D., Tennen, H., & Armeli, S. (2009). Alcohol, helping young adults to have unprotected sex with casual partners: Findings from a daily diary study of alcohol use and sexual behavior. *Journal of Adolescent Health*, 44, 73-80.
- Killgore, W. D., Cotting, D. I., Thomas, J. L., Cox, A. L., McGurk, D., Vo, A. H., . . . Hoge, C. W. (2008). Post-combat invincibility: Violent combat experiences are associated with increased risk-taking propensity following deployment. *Journal of Psychiatric Research*, 42, 1112-1121.
- Kjaer, S. K., van den Brule, A. J. C., Bock, J. E., Poll, P. A., Engholm, G., Sherman, M. E., . . . Meijer, C. J. L. M. (1997). Determinants for genital human papillomavirus (HPV) infection in 1000 randomly chosen young Danish women with normal pap smear: Are there different risk profiles for oncogenic and nononcogenic HPV types? *Cancer Epidemiology, Biomarkers & Prevention*, 6, 799-805.
- Lehavot, K., Hoerster, K. D., Nelson, K. M., Jakupcak, M., & Simpson, T. L. (2012). Health indicators for military, veteran, and civilian women. *American Journal of Preventive Medicine*, 42, 473-480.
- Lehavot, K., Katon, J. G., Williams, E. C., Nelson, K. M., Gardella, C. M., Reiber, G. E., & Simpson, T. L. (2014). Sexual behaviors and sexually transmitted infections in a nationally representative sample of women veterans and nonveterans. *Journal of Women's Health*, 23, 246-252.
- Leigh, B. C. (2002). Alcohol and condom use: A meta-analysis of event-level studies. *Sexually Transmitted Diseases*, 29, 476-482.
- Lepkowski, J. M., Mosher, W. D., Davis, K. E., Groves, R. M., & Van Hoewyk, J. (2010). *The 2006-2010 National Survey of Family Growth: Sample design and analysis of a continuous survey*. Hyattsville, MD: National Center for Health Statistics.
- Ley, C., Bauer, H. M., Reingold, A., Schiffman, M. H., Chambers, J. C., Tashiro, C. J., & Manos, M. M. (1991). Determinants of genital human papillomavirus infection in young women. *Journal of the National Cancer Institute*, 83, 997-1003.
- London, A. S., Allen, E., & Wilmoth, J. M. (2013). Veteran status, extramarital sex, and divorce: Findings from the 1992 National Health and Social Life Survey. *Journal of Family Issues*, 34, 1452-1473.
- London, A. S., & Wilmoth, J. M. (2015). Veteran status and paid sex among American men: Results from three national surveys. *Archives of Sexual Behavior*, 44, 997-1009.
- Marcell, A., & Male Training Center for Family Planning and Reproductive Health. (2014). *Preventive male sexual and reproductive health care: Recommendations for clinical practice*. Retrieved from [http://www.maletrainingcenter.org/wp-content/uploads/2014/09/MTC\\_White\\_Paper\\_2014\\_V2.pdf](http://www.maletrainingcenter.org/wp-content/uploads/2014/09/MTC_White_Paper_2014_V2.pdf)
- Marshall, B., Prescott, M., Liberzon, I., Tamburrino, M., Calabrese, J., & Galea, S. (2013). Posttraumatic stress disorder, depression, and HIV risk behavior among Ohio Army National Guard soldiers. *Journal of Traumatic Stress*, 26, 64-70.
- Meyers, D., Wolff, T., Gregory, K., Marion, L., Moyer, V., Nelson, H., . . . Sawaya, G. F. (2008). USPSTF recommendations for STI screening. *American Family Physician*, 77, 819-824.
- Morris, E. E., Smith, J. C., Farooqui, S. Y., & Surís, A. M. (2014). Unseen battles: The recognition, assessment, and treatment issues of men with military sexual trauma (MST). *Trauma, Violence, & Abuse*, 15, 94-101.
- Mosher, W. D., Chandra, A., & Jones, J. (2005). Sexual behavior and selected health measures: Men and women 15-44 years of age, United States, 2002. *Advance Data From Vital and Health Statistics*, 362, 1-55.
- National Center for Health Statistics. (2014). *2011-2013 National Survey of Family Growth user's guide*. Hyattsville, MD: Author.
- Nusbaum, M. R. H., & Hamilton, C. D. (2002). The proactive sexual health history. *American Family Physician*, 66, 1705-1712.
- Owusu-Edusei, K., Jr., Chesson, H. W., Gift, T. L., Tao, G., Mahajan, R., Ocfemia, M. C. B., & Kent, C. K. (2013). The estimated direct medical cost of selected sexually transmitted infections in the United States, 2008. *Sexually Transmitted Diseases*, 40, 197-201.
- Peterman, T. A., Tian, L. H., Metcalf, C. A., Satterwhite, C. L., Malotte, C. K., DeAugustine, N., . . . Douglas, J. M. (2006). High incidence of new sexually transmitted infections in the year following a sexually transmitted infection: A case for rescreening. *Annals of Internal Medicine*, 145, 564-572.
- Pinkhasov, R. M., Wong, J., Kashanian, J., Lee, M., Samadi, D. B., Pinkhasov, M. M., & Shabsigh, R. (2010). Are men shortchanged on health? Perspective on health care utilization and health risk behavior in men and women in the United States. *International Journal of Clinical Practice*, 64, 475-487.
- Santelli, J. S., Brener, N. D., Lowry, R., Bhatt, A., & Zabin, L. S. (1998). Multiple sexual partners among U.S. adolescents and young adults. *Family Planning Perspectives*, 30, 271-275.
- Seal, K. H., Bertenthal, D., Miner, C. R., Sen, S., & Marmar, C. (2007). Bringing the war back home: Mental health disorders among 103,788 US veterans returning from Iraq and Afghanistan seen at Department of Veterans Affairs facilities. *Archives of Internal Medicine*, 167, 476-482.
- Seña, A. C., Miller, W. C., Hoffman, I. F., Chakraborty, H., Cohen, M. S., Jenkins, P., & McKee, K. T. J. (2000). Trends of gonorrhea and chlamydia infection during 1985-1996 among active-duty soldiers at a United States Army installation. *Clinical Infectious Diseases*, 30, 742-748.
- Sonfield, A. (2002). Looking at men's sexual and reproductive health needs. *Guttmacher Policy Review*, 5(2), 7-10.
- Springer, K. W., & Mouzon, D. M. (2011). "Macho men" and preventive health care: Implications for older men in different social classes. *Journal of Health and Social Behavior*, 52, 212-227.
- Stahlman, S., Javanbakht, M., Cochran, S., Hamilton, A. B., Shoptaw, S., & Gorbach, P. M. (2014). Self-reported sexually transmitted infections and sexual risk behaviors

- in the U.S. military: How sex influences risk. *Sexually Transmitted Diseases*, 41, 359-364.
- Stamm, W. E., Koutsky, L. A., Benedetti, J. K., Jourden, J. L., Brunham, R. C., & Holmes, K. K. (1984). Chlamydia trachomatis urethral infections in men: Prevalence, risk factors, and clinical manifestations. *Annals of Internal Medicine*, 100, 47-51.
- Stecker, T., Fortney, J., Owen, R., McGovern, M. P., & Williams, S. (2010). Co-occurring medical, psychiatric, and alcohol-related disorders among veterans returning from Iraq and Afghanistan. *Psychosomatics*, 51, 503-507.
- Taylor, E. M., Adimora, A. A., & Schoenbach, V. J. (2010). Marital status and sexually transmitted infections among African Americans. *Journal of Family Issues*, 31, 1147-1165.
- Thompson, J. C., Kao, T.-C., & Thomas, R. J. (2005). The relationship between alcohol use and risk-taking sexual behaviors in a large behavioral study. *Preventive Medicine*, 41, 247-252.
- U.S. Department of Health & Human Services. (2015). *2015-2020 Dietary guidelines for Americans*. Washington, DC: U.S. Government Printing Office.
- U.S. Department of Veterans Affairs Office of the Actuary. (2014). *Veteran Population Projection Model 2014, Table 1L: VetPop2014 Living Veterans by Age Group, Gender, 2013-2043*. Retrieved from [http://www.va.gov/vetdata/veteran\\_population.asp](http://www.va.gov/vetdata/veteran_population.asp)
- Vaccarella, S., Franceschi, S., Herrero, R., Muñoz, N., Snijders, P. J., Clifford, G. M., . . . Shin, H.-R. (2006). Sexual behavior, condom use, and human papillomavirus: Pooled analysis of the IARC human papillomavirus prevalence surveys. *Cancer Epidemiology, Biomarkers & Prevention*, 15, 326-333.
- Williams, D. R. (2003). The health of men: Structured inequalities and opportunities. *American Journal of Public Health*, 93, 724-731.
- Workowski, K. A. (2015). Centers for Disease Control and Prevention sexually transmitted diseases treatment guidelines. *Clinical Infectious Diseases*, 61(Suppl. 8), S759-S762.
- Workowski, K. A., & Bolan, G. A. (2015). Sexually transmitted diseases treatment guidelines, 2015. *MMWR Recommendations and Reports*, 64(RR-03), 1-137.
- Zakher, B., Cantor, A. G., Pappas, M., Daeges, M., & Nelson, H. D. (2014). Screening for gonorrhea and chlamydia: A systematic review for the U.S. Preventive Services Task Force. *Annals of Internal Medicine*, 161, 884-893.