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Sexually transmitted infections and sexual behaviour of deploying shipboard US military personnel: a cross-sectional analysis

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ABSTRACT

Objectives Sexually transmitted infection (STI) prevalence and risk behaviour may differ at different phases of deployment. We examined STI prevalence and sexual behaviour in the predeployment time period (12 months prior) among recently deployed shipboard US Navy and Marine Corps military personnel.

Methods Data were collected from 1938 male and 515 female service members through an anonymous, self-completed survey assessing sexual behaviours and STI acquisition characteristics in the past 12 months. Cross-sectional sex-stratified descriptive statistics are reported.

Results Overall, 67% (n=1262/1896) reported last sex with a military beneficiary (spouse, n=931, non-spouse service member, n=331). Among those with a sexual partner outside their primary partnership, 24% (n=90/373) reported using a condom the last time they had sex and 30% (n=72/243) reported their outside partner was a service member. In total, 90% (n=210/233) reported acquiring their most recent STI in the USA (88%, n=126/143 among those reporting ≥1 deployments and an STI ≥1 year ago) and a significantly higher proportion (p<0.01) of women than men acquired the STI from their regular partner (54% vs 21%) and/or a service member (50% vs 26%).

Conclusions Findings suggest a complex sexual network among service members and military beneficiaries. Findings may extend to other mobile civilian and military populations. Data suggest most STI transmission within the shipboard community may occur in local versus foreign ports but analyses from later time points in deployment are needed. These data may inform more effective STI prevention interventions.

INTRODUCTION

Sexually transmitted infections (STIs) comprise approximately 75% of reportable infectious diseases within the US Department of Defense, reducing readiness, causing substantial reproductive morbidity, generating significant healthcare costs and causing lost personnel time.[1–4] Scant data exist for changes in STI risk during a military deployment cycle, and previous data collected in the US Navy and US Marine Corps on STIs and sexual behaviours are limited.[1 5–7] Furthermore, shipboard personnel are exempt from standardised predeployment and postdeployment health assessments administered to 'boots on the ground' land-based deploying personnel, thus limiting comprehensive population health assessments in this seagoing risk group.

The most recent STI study examining a deployed shipboard US Navy population focused on STI acquisition from sex workers during port visits[8] and was conducted over 20 years ago when women were barred from deployments. Women now comprise approximately 17% of shipboard crews, the 'Don't Ask, Don't Tell' policy has been implemented and repealed[9 10] and internet-based social networking has expanded as a venue to meet sexual partners.[11] Although the prevalence of STIs and STI risk factors vary by US military service branch,[1 5] most data demonstrate both are elevated in US military personnel compared with civilians.[7 12 13]

The present study examines STI risk behaviours in the 12 months prior to deployment among an understudied but important US Navy and Marine Corps shipboard population. Gaining an understanding of the risk environment for deploying shipboard service members, and defining components of their sexual network and typical sexual risk behaviours will enable development of specific interventions to mitigate STI risk for shipboard personnel, and for other mobile military and civilian populations. Benefits specific to the US Navy and Marine Corps include increasing readiness and decreasing STI-related healthcare costs among service members and their beneficiaries.

METHODS

Study overview

From February 2012 through August 2014, data were collected for a longitudinal study designed to measure prevalence of self-reported STIs and associated sexual, alcohol use, mental health and lifestyle risk factors among active-duty deploying, shipboard US Navy and Marine Corps personnel at three different time points across the deployment cycle. An anonymous, voluntary, self-completed questionnaire was administered at (1) predeployment, within 2 weeks of departure from

Table 1 Demographics of active-duty deploying US Navy and Marine Corps respondents by sex

Characteristic	Total (N=2453) N (%)	Men (n=1938) n (%)	Women (n=515) n (%)	p Value
Age (years, n=2453)				<0.01
17–19	125 (5.1)	92 (4.8)	33 (6.4)	
20–24	1148 (46.8)	883 (45.6)	265 (51.5)	
25–29	563 (23.0)	433 (22.3)	130 (25.2)	
30–34	296 (12.1)	257 (13.3)	39 (7.6)	
35–39	206 (8.4)	174 (9.0)	32 (6.2)	
40+	115 (4.7)	99 (5.1)	16 (3.1)	
Mean±SD, median	26.4±6.6, 24	26.7±6.7, 24	25.3±6.2, 24	<0.01
Range	18–64	18–63	19–64	
Service branch (n=2435)				<0.01
Navy	2043 (83.9)	1543 (80.2)	500 (97.7)	
Marine Corps	392 (16.1)	380 (19.8)	12 (2.3)	
Military rank (n=2433)				<0.01
E1–E3	864 (35.5)	650 (33.9)	214 (41.6)	
E4–E6	1291 (53.1)	1038 (54.1)	253 (49.2)	
E7–E9, W1–W5, O1–O9	278 (11.4)	231 (12.0)	47 (9.1)	
Years in the military (n=2388)				<0.01
0	55 (2.3)	42 (2.2)	13 (2.6)	
1	466 (19.5)	340 (18.1)	126 (25.0)	
2–3	775 (32.5)	584 (31.0)	191 (37.9)	
4+	1092 (45.7)	918 (48.7)	174 (34.5)	
Mean±SD, median	5.5±5.6, 3	5.9±5.9, 3	4.1±4.3, 3	<0.01
Range	0–36	0–36	0–23	
Number of official deployments completed (n=2358)				<0.01
0	546 (23.2)	395 (21.3)	151 (30.2)	
1	783 (33.2)	580 (31.2)	203 (40.6)	
2+	1029 (43.6)	883 (47.5)	146 (29.2)	
Mean±SD, median	2.1±2.5, 1	2.3±2.6, 1	1.3±1.4, 1	<0.01
Range	0–20	0–20	0–10	
Race/ethnicity (n=2407)				<0.01
White	1276 (53.0)	1055 (55.6)	221 (43.3)	
Black or African American	309 (12.8)	215 (11.3)	94 (18.4)	
Filipino	132 (5.5)	106 (5.6)	26 (5.1)	
American Indian or Alaska Native	20 (0.8)	14 (0.7)	6 (1.2)	
Asian	73 (3.0)	58 (3.1)	15 (2.9)	
Native Hawaiian or Pacific Islander	18 (0.8)	10 (0.5)	8 (1.6)	
Spanish/ Hispanic/Latino	358 (14.9)	275 (14.5)	83 (16.3)	
Other	41 (1.7)	32 (1.7)	9 (1.8)	
Two or more races/ethnicities	180 (7.5)	132 (7.0)	48 (9.4)	
Marital status (n=2451)				<0.01
Single, never married, not in committed relationship	748 (30.5)	588 (30.4)	160 (31.1)	
Single, in committed relationship, living with partner	541 (22.1)	361 (18.7)	180 (35.0)	
Married	996 (40.6)	875 (45.2)	121 (23.5)	
Divorced, separated or widowed	166 (6.8)	112 (5.8)	54 (10.5)	
Education level completed (n=2426)				<0.01
≤High school, GED	1030 (42.5)	863 (45.0)	167 (32.8)	
Some college, vocational/tech school (non-military)	1031 (42.5)	779 (40.7)	252 (49.4)	
≥Undergraduate degree	365 (15.1)	274 (14.3)	91 (17.8)	
Tattoo, or piercing/injection, past 12 months (n=2309)				<0.01
Tattoo(s) reported	731 (31.7)	517 (28.6)	214 (43.0)	
Piercing and/or injection reported	88 (3.8)	58 (3.2)	30 (6.0)	
No	1490 (64.5)	1236 (68.3)	254 (51.0)	

E, enlisted rank; GED, general equivalency diploma; O, officer rank; W, warrant officer rank.

home port, assessing sexual behaviour history in the preceding 12 months; (2) deployment, within the last 4 weeks of deployment, assessing sexual behaviour while underway; and (3) postdeployment, within 3 months after return from deployment, assessing sexual behaviour since return. Data reported in the current analysis are from the predeployment survey. This

study protocol and procedures were approved by the Naval Health Research Center Institutional Review Board (NHRC.2010.0033) and Walter Reed Army Institute of Research Human Subjects Protection Branch (WRAIR #1766).

Inclusion criteria

Military personnel were eligible for study inclusion if they were active duty, attached to a participating ship within the US Third Fleet area of responsibility and available to participate during

Table 2 Sexual partner type and sexual behaviours among active-duty deploying US Navy and Marine Corps respondents by sex

Characteristic	Total		Men		Women		p Value
	N	%	N	%	N	%	
Partner type at last sex* (n=1896)							<0.01
Spouse	931	49.1	811	54.5	120	29.5	
Regular, non-spouse	619	32.7	387	26.0	232	57.0	
Occasional	183	9.7	144	9.7	39	9.6	
One-night stand, not a sex worker	141	7.4	129	8.7	12	3.0	
Sex worker	11	0.6	11	0.7	0	0.0	
Other	11	0.6	7	0.5	4	0.9	
Service member sex contact partner type† (n=446)							<0.01
Spouse	115	25.8	66	33.7	49	19.6	
Regular, non-spouse	236	52.9	74	37.8	162	64.8	
Occasional	60	13.5	31	15.8	29	11.6	
One-night stand, not a sex worker	31	7.0	23	11.7	8	3.2	
Sex worker	2	0.5	2	1.0	0	0.0	
Other	2	0.5	0	0.0	2	0.8	
Location where participant meets new, casual or temporary sex partners (n=2335)							‡
Work	384	16.5	270	14.7	114	23.0	
Through friends, family	661	28.3	529	28.8	132	26.6	
Bars, club, restaurant, coffee house	563	24.1	517	28.1	46	9.3	
Internet	229	9.8	214	11.6	15	3.0	
Sporting events	108	4.6	103	5.6	5	1.0	
School	201	8.6	163	8.9	38	7.7	
Other	44	1.9	39	2.1	5	1.0	
Not applicable, don't seek partners	1345	57.6	1044	56.8	301	60.7	
Sex acts engaged in, past 12 months§							‡
Opposite sex (n=1904)							
Oral sex	1584	88.8	1316	89.6	268	85.4	
Vaginal sex	1729	97.0	1428	97.2	301	95.9	
Participant was the anal insertive partner	331	18.6	325	22.1	6	1.9	
Participant was the anal receptive partner	83	4.7	16	1.1	67	21.3	
Same sex (n=93)							
Oral sex	74	83.2	34	75.6	40	90.9	
Vaginal sex	3	74.2	NA	NA	36	81.8	
Participant was the anal insertive partner	22	24.7	17	37.8	5	11.4	
Participant was the anal receptive partner	18	20.2	11	24.4	7	15.9	
Bisexual sex (n=79)							
Oral sex	69	94.5	31	88.6	38	100.0	
Vaginal sex	61	83.6	28	80.0	33	86.8	
Participant was the anal insertive partner	23	31.5	21	60.0	2	5.3	
Participant was the anal receptive partner	18	24.7	14	40.0	4	10.5	
Engaged in quick anal sex,¶ past 3 months (n=2202)	240	10.9	194	11.2	46	9.8	0.39
Total partners, past 12 months (n=1650)							
Mean±SD, median	3.9±15.2, 1		3.9±15.2, 1		3.8±15.3, 1		0.14
Range	1–340		1–340		1–210		
Among those with sexual relationship outside their main relationship, number of outside partners, past 12 months (n=395)							<0.01
1 outside partner	210	53.2	151	48.9	59	68.6	
2–3 outside partners	120	30.4	99	32.0	21	24.4	
4+ outside partners	65	16.5	59	19.1	6	7.0	
Engaged in group sex, past 3 months (n=2105)	119	5.4	111	6.3	8	1.7	<0.01
Engaged in transactional sex, past 12 months (n=2229)	83	3.7	79	4.5	4	0.8	<0.01
Frequency participant drank alcohol before sex, past 12 months (n=2359)							0.02

Continued

Table 2 Continued

Characteristic	Total N	Total %	Men N	Men %	Women N	Women %	p Value
Rarely	548	23.2	419	22.6	129	25.7	
Occasionally	881	37.4	705	38.0	176	35.0	
Always, typically	162	6.9	139	7.5	23	4.6	
Don't know/remember	43	1.8	38	2.1	5	1.0	
Did not drink alcohol before sex in the past 12 months	725	30.7	555	29.9	170	33.8	
Prescription/non-prescription drugs used to enhance sex, past 12 months, Yes (n=2351)	375	16.0	309	16.7	66	13.2	0.05

*Respondents who marked 'Not applicable, I never had sex' or reported two or more sex partners at last sex were excluded from the denominator.
†Among respondents who reported their most recent sexual encounter was with a service member (n=446), participants also identified what type of partner that service member was (eg, spouse service member partner, occasional service member partner). Among those with service member partners at most recent sexual encounter, the proportion of each partner type within that subgroup is reported here.
‡Variables are not mutually exclusive.
§Within each of these classifications, the proportion was calculated from respondents who reported that specific type of sex (eg, oral) divided by the total number of people who reported any type of sex within the past 12 months, among only those respondents within that classification (eg, same sex, opposite sex).
|¶Defined as anal sex where the participant or his/her partner only inserted the penis briefly.

survey administration. Aircraft carriers, destroyers, amphibious assault ships, landing ship docks and amphibious transport docks were included as platforms for study participation. Permission to survey personnel was obtained from US Third Fleet and ship commanding officers.

Data collection tool

The survey collected information on basic demographics (eg, age, marital status, education, rank, service branch, deployment history), history of healthcare provider-diagnosed STIs, sexual risk behaviours, condom use, alcohol use (measured by an abbreviated version of the Alcohol Use Disorders Identification Test, drinks per week/day/occasion, binge drinking and Cut down, Annoyed, Guilty, Eye-opener (CAGE) alcohol assessments), drug use, symptoms of mental health disorders (measured using the Center for Epidemiologic Studies Depression Scale and the posttraumatic stress disorders (PTSD) Checklist–Civilian Version) and recent stressful life events.

Marital status classifications 'Single, in a committed relationship, but not living with a partner' and 'Single, living with a partner' were collapsed for analysis. Respondents were instructed to mark 'Single, living with a partner' if they normally reside with their sexual partner but were currently deployed or stationed away, and 'Separated' if they were no longer in a committed relationship with their spouse but not yet legally divorced (not temporarily separated due to deployment).

Respondents were determined to have an STI if they reported that a doctor or other health professional had told them they had gonorrhoea, chlamydia, trichomoniasis, syphilis, herpes, hepatitis B, genital warts, anal warts, pubic lice (crabs) and/or other STIs/conditions in the past 12 months.

Transactional sex was defined as sex that was provided or received for money, goods (eg, gifts, free drinks, drugs, housing) and/or improved work conditions or assignments. Respondents provided information on whether their sexual partner was male and/or female and were classified into mutually exclusive categories of having only same-sex partners, only opposite-sex partners, or both. Respondents provided information on partner type (eg, spouse, regular, occasional, etc) the last time they had sex and whether this partner was a service member. An outside (not main) sexual relationship was defined as oral, vaginal and/or anal sex with anyone other than the respondent's reported spouse, regular, committed partner or live-in partner. See online supplementary material for additional information on study variables.

Data analysis

To detect a significant association between the exposure of interest and outcome (0.01 α level, 95% power), the target sample size was 5480 participants. Data were analysed using SAS software, V.9.2 (SAS Institute, Cary, North Carolina, USA). Descriptive statistics were calculated for all continuous variables and percentages for categorical variables. Reported values were excluded if they were logically inconsistent or impossible. All other missing responses were excluded from the denominator for each individual variable. Two-sample T tests for continuous variables and Pearson's χ^2 tests for categorical variables (or Fisher's exact test where expected count was less than 5) were used to assess whether there was a significant difference for each independent variable by sex. Where categories were not mutually exclusive (ie, type of sex engaged in, where respondents met sexual partners), p values were not calculated and proportions were reported. All p values were based on two-tailed tests

Table 3 Pathogen-specific proportion of self-reported doctor-diagnosed sexually transmitted infections (STIs) among active-duty deploying US Navy and Marine Corps respondents reporting ≥1 STI in the past 12 months by sex

Characteristic*	Total N	Total Per cent	Men n	Men Per cent	Women n	Women Per cent
Overall, ≥1 STI reported	58	2.4	32	1.7	26	5.1
Chlamydia only	30	51.7	16	50.0	14	53.8
Chlamydia and gonorrhoea only	1	1.7	0	0.0	1	3.8
Chlamydia, gonorrhoea and ≥1 other STI	7	12.1	7	21.9	0	0.0
Chlamydia and ≥1 other STI†	2	3.4	2	6.3	0	0.0
Gonorrhoea only	2	3.4	1	3.1	1	3.8
Gonorrhoea and ≥1 other STI‡	3	5.2	3	9.4	0	0.0
Herpes only	4	6.9	0	0.0	4	15.4
Herpes and ≥1 STIs†‡	1	1.7	1	3.1	0	0.0
Anogenital warts only	6	10.3	2	6.3	4	15.4
≥1 other STI§	2	3.4	0	0.0	2	7.7

*Variables are mutually exclusive.
†Excluding gonorrhoea.
‡Excluding chlamydia.
§Excluding any STI (s) reported in other categories.

of significance, defined as p≤0.05. p Values were not adjusted for multiple comparisons.

RESULTS

Logistical and administrative requirements of accessing our study population during combat operations was time intensive requiring over 2 years to collect data on all three time points among the 11 ships. We chose to stop recruitment prior to reaching our original enrolment because a recalculation of study power suggested a smaller study population would achieve adequate power, and it was important to disseminate this information in a timely manner. All ships approached by study personnel agreed to participate, with the exception of one ship slated for decommissioning. Of the 2806 surveys collected, 2593 (92%) respondents aboard 11 ships completed the predeployment survey (primarily within the 1st week of deployment). The proportion of completed surveys ranged from 84% to 98% with more incomplete surveys reported among destroyer platforms. Those not reporting either gender (n=17) and/or age (n=123) were excluded (final n=2453, men=1938, women=515).

Participant characteristics

Overall, the study population median age was 24 years, with nearly half (46.8%) between the ages of 20 years and 24 years (table 1) and 21% (n=515/2453) female. The majority (83.9%) was US Navy and enlisted (88.6%). Just over half of respondents were on their first or second official deployment and had been in the military for 3 years or less. All demographic factors differed significantly by sex (p≤0.05). A higher proportion of men were aged 30 years or older (27.4% vs 16.9%) and married (45.2% vs 23.5%) than women.

In total, 67% (n=1262/1896) of all respondents reported their most recent sexual encounter was with either a spouse (n=931) or non-spouse service member (n=331, table 2). A fourth of respondents (24.8%, n=446/1800) reported their most recent sexual partner was also a service member. A higher proportion of women than men (78.9%, n=321/407 vs 63.2%, n=941/1489) reported a spouse or non-spouse service member as their most recent sexual encounter.

Among respondents who reported they had an outside sexual relationship (n=395), 53% reported 1 outside partner, 30% reported 2 or 3, and 17% reported 4 or more. Among those who reported an outside sexual relationship, 30% (n=72/243) reported their last sexual encounter was with a service member.

STIs and condom use

Overall, 2156 participants reported no history of an STI (81% of women, n=411/505 and 92% of men, n=1745/1896). Within the past 12 months, 2.4% of service members (n=58/2401) reported a physician or healthcare professional told them they had one or more STIs, with the majority of those (68.9%, n=40/58) reporting chlamydia alone or in combination with one or more other STIs (table 3, also see online supplementary material). Significantly (p<0.01) higher proportions of women than men reported diagnosis with chlamydia, gonorrhoea and/or trichomoniasis (3.4%, n=17/505 vs 1.5%, n=29/1896) or chlamydia, gonorrhoea, trichomoniasis, syphilis, herpes and/or hepatitis B in the past 12 months (4.2%, n=21/505 vs 1.6%, n=30/1896). Among men, 1.4% (n=25) reported a burning discharge from their penis in the past 3 months, similar to the proportion (1.5%) who reported physician-diagnosed chlamydia, gonorrhoea or trichomoniasis in the past 12 months.

Overall, about a fourth of all respondents (26.3%, n=582) reported using a condom the last time they had sex. Among men and women who reported on condom use and had an outside sexual relationship, only 24.1% (n=90/373) used a condom the last time they had sex.

STI acquisition variables

Among respondents reporting a location (n=234) where they believed they acquired their most recent STI (20% of whom reported an STI in the previous 12 months), 90% (n=210/233) reported acquiring their last STI in the USA (table 4). A significantly larger proportion of women reported their STI was acquired from a service member than did men (50% vs 25.8%, p<0.01). Among respondents who reported ≥one deployments and a physician diagnosed STI ≥1 year ago, 88% (n=126/143) reported acquiring their STI within the USA.

DISCUSSION

Principal findings

Among shipboard US active-duty Navy and Marine Corps personnel, 67% of most recent sexual partners were either service members or military beneficiaries (among women only, this increased to almost 80%). Few personnel in concurrent

Table 4 Sexually transmitted infection (STI) acquisition location and partner type among active-duty deploying US Navy and Marine Corps respondents by sex*

	Total		Men		Women		
Characteristic	N	Per cent	n	Per cent	n	Per cent	p Value
Where infected with last STI (n=233)							0.04
Within USA	210	90.1	128	87.1	82	95.4	
Outside USA	23	9.9	19	12.9	4	4.7	
Type of partner acquired STI from (n=287)							<0.01
Spouse	39	13.6	22	11.7	17	17.2	
Regular	92	32.1	39	20.7	53	53.5	
Occasional	46	16.0	32	17.0	14	14.1	
One-night stand (not a sex worker)	64	22.3	57	30.3	7	7.1	
Sex worker	20	7.0	17	9.0	3	3.0	
Don't know	26	9.1	21	11.2	5	5.1	
STI acquired from service member (n=298)	101	33.9	51	25.8	50	50.0	<0.01

*Respondents who marked 'Not applicable, I have never had a sexually transmitted disease' were excluded from the denominator.

partnerships reported condom use at last sex. Most STIs were acquired within the USA with many acquired from spouses or regular partners.

Strengths and weaknesses

Data were collected directly from shipboard military personnel prior to, during and immediately after deployment, which is operationally challenging and rarely attempted. Other US military STI data are generally acquired from electronic health record databases[1 12] or from large standardised US military health surveys that contain few questions on sexual risk behaviour.[5 6 13] Other more comprehensive studies have been typically confined to a specific subpopulation, are less recent and/or were not designed to assess behaviour specifically across deployment cycles.[7 8] We are unaware of any comparable sexual behaviour data on male and female service members as that collected in the current study. Study findings will therefore be discussed in context with studies most closely resembling data presented herein, while noting such comparisons are imprecise.

Data from shipboard US Navy and Marine Corps active-duty service members at predeployment may not be generalisable to personnel from other service branches; however, information assessed captured behaviour over the prior 12 months while personnel were primarily shore-based and likely comparable to other shore-based service members. Data were obtained through convenience sampling; however, survey administration was conducted at various times to optimise recruiting a representative sample of service members from most departments and across a variety of ship platforms. All measures collected in this survey were self-reported and subject to recall bias, but the time period assessed (limited to the past 12 months), may have reduced the likelihood of this. Several questions were of a highly sensitive nature, and some questions had a larger proportion of non-response than others. For example, illicit drug use is prohibited by the Uniform Code of Military Justice, and respondents may have been reluctant in disclosing such information despite the anonymous data collection. Additionally, this study showed a larger proportion of women than men reported a healthcare provider-diagnosed STI in the past 12 months (primarily chlamydia); however, data are self-reported (not based on biological STI testing) so it is possible, study prevalence does not capture asymptomatic infection. However, a detection bias is unlikely to account for the higher prevalence observed among women, since military and civilian population-based studies show higher chlamydia prevalence among women, even when universal screening occurs.[14] Furthermore, data collected in a cross-sectional manner cannot capture time-dependent trends. This limitation should be addressed with data from additional time points.

Comparison with other studies

The last published shipboard assessment of STI risk, conducted nearly 20 years ago among an all-male crew, showed sex worker contact (before and during deployment) in foreign ports as a primary factor associated with STIs,[8] which continues to be the prevailing concept to date.[15 16] The current study shifts the focus of STI acquisition among male shipboard sailors from sex workers to predominantly regular sexual partners within the local military community (not foreign port or liberty stops). Almost no service members reported their most recent sexual encounter was with a sex worker and few respondents believed their last STI was acquired from one. Nearly one-fifth of personnel reportedly met their sexual partners at the workplace. Half of women (and a quarter of men) acquired their last STI from another service member, and over half of the female respondents believed they acquired their STI from a spouse or regular partner (many of whom were service members). Nearly all (90%) of service members acquired their last STI within the USA, even after excluding those without prior deployment. This shift in partner type and location may enable more successful partner referral for treatment programmes.[17]

Concurrent partnerships within this study population were frequent. Previous studies show concurrent sexual partnerships as a risk factor for STI transmission,[18] so overlapping concurrent partnerships may increase STI transmission within the military setting. Unlike data collected from the 2008 Department of Defense (DoD) Health Related Behaviours Survey[6] which showed a larger proportion of men than women with outside sexual partners (37.1% vs 17.5%), the current study found that equal proportions of men and women (17.3% vs 17.6%) reported outside sexual partners (although men more frequently reported three+ partners). The Health Related Behaviours Survey population differs from the current study population in that it was not designed to assess service members' health at deployment onset, and only includes service members who are not currently deployed. These differences may reflect different sexual practices among men scheduled to deploy and those assigned to shore-based duty stations, but additional information is needed to adjust for other confounding factors.

The chlamydia prevalence reported here is consistent with estimates (1.7%, 95% CI 1.4% to 2.0%) determined by biological STI testing reported in a recent US population-based study[14 19] and US Navy and Marine Corps population-based screening study,[20] supporting the validity of our data and suggesting similarity to shore-based military personnel and civilian prevalence.

Implications

With substantial proportions of service members reporting sex with a spouse and/or other service members, structural interventions should be implemented to educate service members on safer sex behaviours and STI reduction and should be sex-specific and extended to military beneficiaries. Contact tracing, screening and treatment of sexual partners may be more feasible given that the target population is largely composed of other service members or beneficiaries with full coverage by the military healthcare system. Even treatment of at least the index case may contribute to reduced STI prevalence within the entire military network since many sexual contacts may be other service members and beneficiaries.

Approximately 20% of women (with an opposite-sex partner) and 24% of men (with a same-sex partner) are reportedly engaging in anal receptive sex. Efforts to educate female and male service members and their beneficiaries on the increased HIV transmission risk through anal sex compared with vaginal sex,[21] and guidance on proper condom use (ie, lubricant needs to be used with condoms during anal sex) may protect service members from STIs.

Leadership messages encouraging condom use should be sex-specific, given the variations in regular and casual partnerships, types of sexual contact, number of outside sexual partners and differences in STI-associated morbidity by sex. Given that only a quarter of respondents with multiple sexual partners reported using a condom at last sex, STI reduction interventions within the shipboard US military population should emphasise consistent condom use with all sexual partners among non-monogamous service members and more frequent STI screening.

Future research

Women comprise approximately 17% of the US Navy (and 21% of this study population), with men outnumbering women by about 5 to 1. Data collected from US civilian population-based studies and individuals seeking care at STI clinics show higher proportions of concurrent partnerships in populations where the sex ratio is unbalanced[22–24] and unbalanced sex ratios may have an impact on STI transmission.[23] Future studies should examine these social and structural factors which may influence STI risk.

Previous data have shown characteristics of sexual and social network contacts can impact an individual's STI acquisition and transmission risk and the ability to engage in safer sex behaviours.[25–27] A better understanding of the sexual network among shipboard personnel about to deploy (which may extend to shore-based service members) is needed since effective interventions will vary based on partner selection patterns, demographic and social factors and predominant pathogen (ie, chlamydia in the current study) within the sexual network.[25 26 28 29]

Key messages

- The majority (67%) of US shipboard personnel reported last sex with a military beneficiary (either a spouse or non-spouse service member).
- Only 24% of shipboard personnel who reported having one or more sex partners outside their primary sexual relationship used a condom at last sex.
- The majority (90%) of most recent sexually transmitted infections (STIs) were acquired within the USA.
- More women than men (50% vs 26%) reported their most recent STI was acquired from another service member.

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