

Sexually transmissible infections and sexual risk behaviour among deployed, ship-assigned USA Navy and Marine Corps personnel

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Abstract. *Background:* Data show sexually transmissible infection (STI) diagnoses in USA military personnel engaging in unprotected sex are higher during deployment than before or after. We examined sexual risk behaviour, same-sex contact, mixed sex partnerships (both casual and committed partners) and STIs among ship-assigned USA Navy and Marine Corps personnel to assess increased risk. *Methods:* Data on sexual risk behaviour, partner type, gender, and healthcare provider-diagnosed STIs were collected longitudinally (2012–14) among sexually active personnel during deployment. Descriptive and bivariate data stratified by sex, STIs, and partner types were analysed using χ^2 and *t*-tests, with statistical significance defined as $P < 0.05$. *Results:* The final sample ($n = 634$) included 452 men (71%) and 182 women (29%). STI prevalence among males was 8% ($n = 36$); men who have sex with men (MSM) accounted for 25% of total STIs, and 43% of MSM reported an STI. Among all reporting STIs, 29% reported occasional partners, service member partners (15%) and non-condom use (16%). The highest proportions of non-condom use (71%), alcohol before sex (82%), and same-sex partners (67%) were reported by participants with mixed sex partners; 69% of these reported service member partners. *Conclusions:* Personnel with mixed partners reported high proportions of sexual risk behaviour. MSM accounted for 9% of the total population, but 25% of all STIs. As the majority of those with mixed partners and MSM also reported service member sex partners, safer sex education and prompt STI identification/treatment among these groups could reduce STI transmission among military personnel.

Keywords: concurrent partners, condom use, military personnel, sexually transmissible infections.

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Introduction

Sexually transmissible infections (STIs) can lead to reproductive morbidity such as pelvic inflammatory disease and infertility, and are the most frequently reported infectious diseases among both civilians and military personnel.^{1–6} There has been a sustained increase in STIs within both civilian and military populations since 2013,^{7,8} and direct medical costs for STIs are estimated to be US\$16 billion annually.¹ Budget cuts to state and local STI programs, decreased condom use, and structural factors (such as poverty) affecting access to STI care may account for this increase.⁹

A recent study of 181 recently seroconverted HIV-positive USA Army servicemen examined sexual risk behaviours during the interval between their last self-reported HIV-negative test and initial HIV-positive test result. Among these servicemen, 64% reported male–male sexual contact, sex with a service member (28%), multiple sexual partners (>42%), alcohol use with sex (39%), inconsistent condom use

(60%), and history of STIs (20%).¹⁰ It is unknown how these risk behaviours compare with those of HIV-negative service members who remain sexually active during a high STI-acquisition risk period such as deployment.

Within deploying military populations, there is little information showing differences in condom use, alcohol use with sex, same sex or service member sexual contact by type of partnership. Committed partnerships (also known as ‘regular’ or ‘main’ partnerships) have been defined as relationships perceived to be stable and monogamous, whereas casual partnerships have been defined as unattached and non-monogamous.^{11–13} Mixed partnerships, where service members with multiple partners have both casual and committed partner types concurrently, have not been assessed among military populations in peer-reviewed literature. In studies among both civilian and military populations, lower rates of condom use have been reported for sex with committed versus casual sexual partners, but

condom use is not described for those with both types of sexual partners.^{11,13–15} Other data reported from civilians travelling overseas (potentially comparable to deploying service members) have shown that >40% report non-use or inconsistent use of condoms when having sex with casual partners, with women reporting less frequent condom use than men, but again, it is unclear how this would compare to individuals having sexual contact with both committed and casual partners concurrently.¹⁶ Additionally, alcohol use has been shown to be significantly associated with unprotected sex and higher numbers sexual partners among civilian as well as military populations, but there are not specific details on how this may vary among those with only casual, committed or both partner types.^{14,17,18} Similarly, among military personnel who report multiple sexual partners, they are also more likely to report an STI,¹⁴ but like inconsistent condom use and alcohol use, it is unclear how these factors vary between individuals with mixed partnerships versus casual or committed partners only.

The current study, using data collected between 2012 and 2014, describes sexual risk behaviour among a USA Navy and Marine Corps shipboard population who remained sexually active during deployment. The primary study aims were to assess the prevalence of STIs, sexual risk behaviours and partner types (casual, committed, etc.) and associated variables during a shipboard deployment. The only comparable STI data from a USA Navy shipboard deployment were documented >20 years ago when women were not deployed aboard ships and little information on same- or mixed-sex partners was collected.¹⁹

Methods

Study overview

Survey data were collected from February 2012 through August 2014 from 11 ships for a longitudinal study designed to measure prevalence of self-reported STIs, risk behaviours and mental health reported in the time periods before, during, and after a deployment, among active-duty deploying, shipboard USA Navy and Marine Corps personnel; methods are described in detail elsewhere.²⁰ The present analysis reports data from the deployment survey (during deployment only), which was an anonymous, voluntary, self-completed questionnaire administered within the last 4 weeks of deployment that assessed respondents' sexual behaviour and diagnosed STIs while they were deployed (average length of 8 months). Participants were included in the analysis if they completed the deployment survey, reported age and sex, and indicated they were sexually active during the deployment time period. The 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).

Variable definitions

The survey collected information on healthcare provider-diagnosed STIs, sexual risk behaviours, condom use, alcohol use [measured by the Alcohol Use Disorders

Identification Test consumption questions (AUDIT-C)²¹ and past 30-day binge drinking, defined as five or more drinks on one occasion²²], drug use, and symptoms of mental health disorders [measured using the Center for Epidemiologic Studies Depression Scale (CES-D)²³ and the PTSD (posttraumatic stress disorder) Checklist-Civilian Version (PCL-C)²⁴]. Involuntary drug consumption (IDC)²⁵ was defined as an affirmative response to the question, *Have you ever been given a drug without your knowledge or consent? (In other words, do you think you have ever been 'roofied' or had your drink spiked?)*. Respondents were classified as STI-positive if they reported that a doctor or other health professional had told them they had gonorrhoea, chlamydia, trichomoniasis, or syphilis (or if they reported a burning discharge in the case of men) during the current deployment.

Participants were asked to list the last three locations they had sex in port. For each location listed, they were asked to provide information on partner type(s) (spouse, regular, occasional, one-night stand, and/or sex worker) using the question, *List the location below for the past three port calls or leave where you were allowed liberty during this deployment (in most recent to least recent order). For each port stop location, liberty visit, or leave, if you had sex in port, indicate what type of partner(s) you had sex with, his or her gender, if a condom was used, if you were drinking alcohol, and if this partner was a service member (mark all that apply)*. A regular partner was defined as someone respondents see regularly to have sex with or someone they would call a girlfriend or boyfriend, including someone they live with but are not married to. An occasional partner was defined as someone they see every once in a while to have sex with but not someone they are married to, living with, or have a committed relationship with. A one-night stand was defined as someone respondents had sex with or 'hooked-up' with one time, excluding 'prostitutes'. From this point forward, the term 'sex worker' will be used, but 'prostitute' was used on the survey because it was the accepted nomenclature familiar to respondents.

Variables were constructed to combine responses regarding partner type(s) and behaviours from each of the past three port stops (date varied by ship) to create a summary measure across all locations at which a given respondent had sex in port. For example, a respondent was defined as having sex with a sex worker at least once if they had reported doing so at one or more of the past three port stops. Similar variables were constructed from the above question on sex in port to designate not using a condom with at least one partner, alcohol use before sex with at least one partner, and sex with at least one service member, all in port.

Individuals were categorised as men who have sex with men (MSM) if they reported sexual activity with a same-sex partner and as MSW (men who have sex with women) or WSM (women who have sex with men) if they reported sexual activity with an opposite-sex partner only (or if the sex of their partner was missing).

Two different survey questions were used to categorise MSM and MSW/WSM. The first question only categorised individuals reporting sex in port and the second question categorised all individuals reporting sex during the deployment (including activity outside of ports).

When comparing sexual behaviours in port by partner type, those who had sex with a spouse or regular partner(s) across the past three port stops were categorised together as having 'committed' partners, whereas those who reported occasional partners, one-night stands, and sex workers across the past three port stops were categorised as having 'casual' partners.¹⁰ A third variable, 'mixed casual and committed partners', was constructed for this analysis to designate respondents who had had sex with at least one committed partner and one casual partner at one port stop or across multiple stops.

Data analysis

Data were analysed using SAS software, V.9.4 (SAS Institute, Cary, NC, USA). Descriptive statistics were calculated for all continuous variables and either column or row percentages for categorical variables (e.g. age, race, marital status, education, partner meeting locations, same-sex contact, number of sexual partners, alcohol use, mental health, partner type, condom use, alcohol before sex, whether partner was a service member, etc.). Separate analyses were performed on (1) all respondents

who were sexually active on deployment (including sex in port and sex outside ports) and (2) those who answered the survey question as having specifically had sex in port. Sensitivity analyses compared the full sample and subsets on demographic characteristics (e.g. age, race, marital status, education), as well as sexual behaviour. A two-sample *t*-test for continuous variables (e.g. age) and Pearson's χ^2 tests for categorical variables (e.g. race, marital status, other demographics, location they met sexual partners, type of sex, outside sexual partners, substance use, mental health) were used to assess whether there was a significant difference for each independent variable by sex (Table 1). Pearson's χ^2 tests for categorical variables (e.g. number of partners, partner type and sexual risk behaviour) were used to assess whether there was a significant difference for each independent variable by sex (Table 2) and STI status (Table 3). We report proportions of same-sex contact, condom use, alcohol before sex, and report of a service member partner stratified by whether participants had: (1) one partner, a spouse or regular partner only at one port location; (2) a regular partner at two or

Table 1. Demographics and sexual risk behaviour by sex among ship-assigned USA Navy and Marine Corps personnel reporting sexual activity during deployment

GED, general equivalency diploma; AUDIT-C, alcohol use disorders identification test; MDD, major depressive disorder; CES-D, Center for Epidemiologic Studies Depression Scale; PTSD, posttraumatic stress disorder; PCL-C, PTSD Checklist–Civilian Version

Characteristic	Total (<i>n</i> = 634)		Men (<i>n</i> = 452)		Women (<i>n</i> = 182)		<i>P</i> -value
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Age (years, <i>n</i> = 634)							0.02
18–19	48	7.6	32	7.1	16	8.8	
20–24	356	56.1	237	52.4	119	65.4	
25–29	135	21.3	108	23.9	27	14.8	
30–34	51	8.0	40	8.8	11	6.0	
35–39	29	4.6	25	5.5	4	2.2	
40+	15	2.4	10	2.2	5	2.7	
Mean \pm s.d., median	24.7 \pm 5.4, 23		25.1 \pm 5.6, 23		23.7 \pm 4.9, 22		<0.01
Range	18–54		18–54		18–44		
Race/ethnicity (<i>n</i> = 615)							0.39
White	330	53.7	242	55.1	88	50.0	
Black or African American	90	14.6	65	14.8	25	14.2	
Filipino	42	6.8	33	7.5	9	5.1	
American Indian or Alaska Native	12	1.9	7	1.6	5	2.8	
Asian	17	2.8	12	2.7	5	2.8	
Native Hawaiian or Pacific Islander	8	1.3	5	1.1	3	1.7	
Spanish/Hispanic/Latino	62	10.1	44	10.0	18	10.2	
Other	6	1.0	4	0.9	2	1.1	
Two or more races/ethnicities	48	7.8	27	6.1	21	11.9	
Marital status (<i>n</i> = 633)							<0.01
Married	285	45.0	218	48.2	67	37.0	
Single, in committed relationship, living with partner	157	24.8	86	19.0	71	39.2	
Single, never married, not in committed relationship	114	18.0	97	21.5	17	9.4	
Divorced, separated, or widowed	77	12.2	51	11.3	26	14.4	
Education level completed (<i>n</i> = 628)							0.58
\leq High school, GED	277	44.1	203	45.4	74	40.9	
Some college, vocation/tech school (non-military)	282	44.9	196	43.8	86	47.5	
\geq Undergraduate degree	69	11.0	48	10.7	21	11.6	
Tattoo, or piercing/injection, during deployment (<i>n</i> = 634)							0.58
Tattoo(s) reported	34	5.4	26	5.7	8	4.4	
Piercing and/or injection reported	15	2.4	12	2.6	3	1.6	
No	585	92.3	414	91.6	171	94.0	

(continued next page)

Table 1. (continued)

Characteristic	Total (<i>n</i> = 634)		Men (<i>n</i> = 452)		Women (<i>n</i> = 182)		<i>P</i> -value
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Location where participant meets new, casual or temporary sex partners (<i>n</i> = 631)							‡
Work	132	20.9	71	15.8	61	33.5	
Through friends, family	84	13.3	55	12.2	29	15.9	
Bars, club, restaurant, coffee house	263	41.7	248	55.2	15	8.2	
Internet	20	3.2	17	3.8	3	1.6	
Other	10	1.6	9	2.0	1	0.5	
Not applicable, don't seek partners	191	30.3	107	23.8	84	46.1	
Sex acts engaged in ^A (<i>n</i> = 559)							‡
Opposite sex (<i>n</i> = 500)							
Oral sex	415	83.0	305	85.2	110	77.5	
Vaginal sex	458	91.6	327	91.3	131	92.2	
Participant was the anal insertive partner	43	8.6	39	10.9	4	2.8	
Participant was the anal receptive partner	23	4.6	9	2.5	14	9.9	
Same sex/bisexual sex (<i>n</i> = 59)							‡
Oral sex	51	86.4	29	82.9	22	91.7	
Vaginal sex	43	72.9	22	62.9	21	87.5	
Participant was the anal insertive partner	29	49.1	25	71.4	4	16.7	
Participant was the anal receptive partner	32	54.2	27	77.1	5	20.8	
Engaged in quick anal sex ^B (<i>n</i> = 634)	77	12.1	55	12.2	22	12.1	0.98
Number of partners on deployment (<i>n</i> = 634)							
≥2	400	63.1	325	71.9	75	41.2	<0.01
1	234	36.9	127	28.1	107	58.8	
Among those with sexual relationship outside their main relationship, number of outside partners (<i>n</i> = 180)							0.03
4+	49	27.2	42	27.8	7	24.1	
2–3	68	37.8	62	41.1	6	20.7	
1	63	35.0	47	31.1	16	55.2	
Engaged in group sex (<i>n</i> = 634)	81	12.8	73	16.1	8	4.4	<0.01
Engaged in transactional sex (<i>n</i> = 634)	114	18.0	108	23.9	6	3.3	<0.01
Frequency participant drank alcohol before sex (<i>n</i> = 634)							<0.01
Rarely	104	16.4	74	16.4	30	16.5	
Occasionally	126	19.9	84	18.6	42	23.1	
Always, typically	175	27.6	158	35.0	17	9.3	
Did not drink alcohol before sex	229	36.1	136	30.1	93	51.1	
Prescription/non-prescription drugs used to enhance sex (<i>n</i> = 634)	48	7.6	42	9.3	6	3.3	<0.01
Involuntary drug consumption (i.e. 'roofied') (<i>n</i> = 634)	34	5.4	28	6.2	6	3.3	0.14
Hazardous alcohol use ^C (AUDIT-C; <i>n</i> = 634)	401	63.2	305	67.5	96	52.7	<0.01
Dependent alcohol use ^D (AUDIT-C; <i>n</i> = 634)	117	18.4	104	23.0	13	7.1	<0.01
Binge drinking, past 30 days ^E (<i>n</i> = 634)	282	44.5	216	47.8	66	36.3	<0.01
MDD ^F (CES-D score ≥22; <i>n</i> = 634)	191	30.1	128	28.3	63	34.6	0.12
PTSD ^G (PCL-C; <i>n</i> = 634)	93	14.7	61	13.5	32	17.6	0.19

‡Variables are not mutually exclusive.

^AWithin each of these classifications, the proportion was calculated from respondents who reported that specific type of sex (e.g. oral) divided by the total number of people who reported any type of sex during deployment, among only those respondents within that classification (e.g. same sex, opposite sex).^BDefined as anal sex where the participant or his/her partner only inserted the penis briefly.^CPositive screen for hazardous alcohol use defined as AUDIT-C score of ≥3 for women and ≥4 for men (cut-points used among civilians and veterans).^DPositive screen for dependent alcohol use was defined as an AUDIT-C score of ≥8 for both women and men.^EBinge drinking was defined as ≥4 drinks for women and ≥5 drinks for men on a typical day in the past 30 days based on response to the following question: 'Think about the days when you drank alcoholic beverages (such as beer, wine, or hard liquor) in the past 30 days. How many alcoholic beverages did you usually drink on a typical day when you drank?'.^FPositive screen for MDD based on a Center for Epidemiologic Studies Depression Scale score of ≥22, in the past week.^GPositive screen for PTSD based on PTSD Checklist–Civilian Version score of ≥50 and symptom criteria, in the past month.

more port locations; (3) one casual partner only; (4) two or more casual partners only; or (5) both casual and committed partners (Table 4). Percentages for partner type at the past three port stops and whether this partner was a service member were calculated among respondents with a single partner

across the three port stops and separately including those with multiple partners in port, with the latter indicating which partners they had had sex with at least once. Some denominators are different because of subset analyses, and all missing responses were excluded from the denominator for

Table 2. Sexual partner types and sexual behaviour by sex among ship-assigned USA Navy and Marine Corps personnel reporting sexual activity while in port

Characteristic	Total (<i>n</i> = 451)		Men (<i>n</i> = 321)		Women (<i>n</i> = 130)		<i>P</i> -value
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Number of partners (<i>n</i> = 451)							<0.01
≥2	179	39.7	148	46.1	31	23.9	
1	272	60.3	173	53.9	99	76.1	
1 partner only, partner type ^A (<i>n</i> = 272)							<0.01
Spouse	34	12.5	24	13.9	10	10.1	
Regular, non-spouse partner	105	38.6	39	22.5	66	66.7	
Occasional partner	20	7.3	6	3.5	14	14.1	
One-night stand, not a sex worker	69	25.4	62	35.8	7	7.1	
Sex worker	38	14.0	37	21.4	1	1.0	
Other	6	2.2	5	2.9	1	1.0	
1 or more partners, partner types ^B (<i>n</i> = 451)							
Spouse	64	14.2	47	14.6	17	13.1	0.67
Regular, non-spouse partner	149	33.0	76	23.7	73	56.1	<0.01
Occasional partner	79	17.5	45	14.0	34	26.1	<0.01
One-night stand, not a sex worker	177	39.3	158	49.2	19	14.6	<0.01
Sex worker	117	25.9	113	35.2	4	3.1	<0.01
Partner type among those with 1 service member partner ^C (<i>n</i> = 113)							0.09
Spouse	9	8.0	4	10.5	5	6.7	
Regular, non-spouse partner	76	67.3	21	55.3	55	73.3	
Occasional partner	13	11.5	4	10.5	9	12.0	
One-night stand, not a sex worker	15	13.3	9	23.7	6	8.0	
Specific partner type and behaviour (<i>n</i> = 451)							
Same-sex partner	41	9.1	21	6.5	20	15.4	<0.01
Non-condom use	171	37.9	90	28.0	81	62.3	<0.01
Alcohol use before sex	285	63.2	222	69.2	63	48.5	<0.01
Service member partner	219	48.6	107	33.3	112	86.1	<0.01

^ARespondents who marked 'Not applicable, I did not have sex during this deployment or in this location' or reported two or more sex partners across the past three port calls were excluded from the denominator.

^BHad sex with this partner type at least once during the past three port calls of this deployment; not mutually exclusive.

^CAmong respondents who reported a sexual encounter at one of the past three port calls with one service member (*n* = 113). Participants also identified what type of partner that service member was (e.g. spouse service member partner, occasional service member partner). Among those with service member partners, the proportion of each partner type within that subgroup is reported here.

Table 3. Sexual partner types and sexual behaviour by self-reported doctor-diagnosed sexually transmissible infection (STI) status among ship-assigned, male USA Navy and Marine Corps personnel reporting sexual activity while in port

Characteristic	STI-positive ^A		STI-negative		<i>P</i> -value
	<i>n</i>	%	<i>n</i>	%	
Total (<i>n</i> = 321)	28	8.7	293	91.3	
Number of partners					<0.01
≥2 (<i>n</i> = 148)	25	16.9	123	83.1	
1 (<i>n</i> = 173)	3	1.7	170	98.3	
Partner types ^B					
Spouse (<i>n</i> = 47)	7	14.9	40	85.1	0.11
Regular, non-spouse partner (<i>n</i> = 76)	13	17.1	63	82.9	<0.01
Occasional partner (<i>n</i> = 45)	13	28.9	32	71.1	<0.01
One-night stand, not a sex worker (<i>n</i> = 158)	16	10.1	142	89.9	0.38
Sex worker (<i>n</i> = 113)	19	16.8	94	83.2	<0.01
Sexual behaviour in port					
Same-sex partner (<i>n</i> = 21)	9	42.9	12	57.1	<0.01
Non-condom use (<i>n</i> = 90)	14	15.6	76	84.4	<0.01
Alcohol use before sex (<i>n</i> = 222)	22	9.9	200	90.1	0.26
Service member partner (<i>n</i> = 107)	16	14.9	91	85.1	<0.01

^ARespondents who reported either being diagnosed by a doctor or healthcare professional with chlamydia, gonorrhoea, syphilis, or trichomoniasis (or a burning discharge if male) during this deployment.

^BHad sex with this partner type at least once during the past three port calls of this deployment; not mutually exclusive.

Table 4. Sexual behaviour by sex partner type among ship-assigned USA Navy and Marine Corps personnel reporting sexual activity while in port ($n = 443$)^A

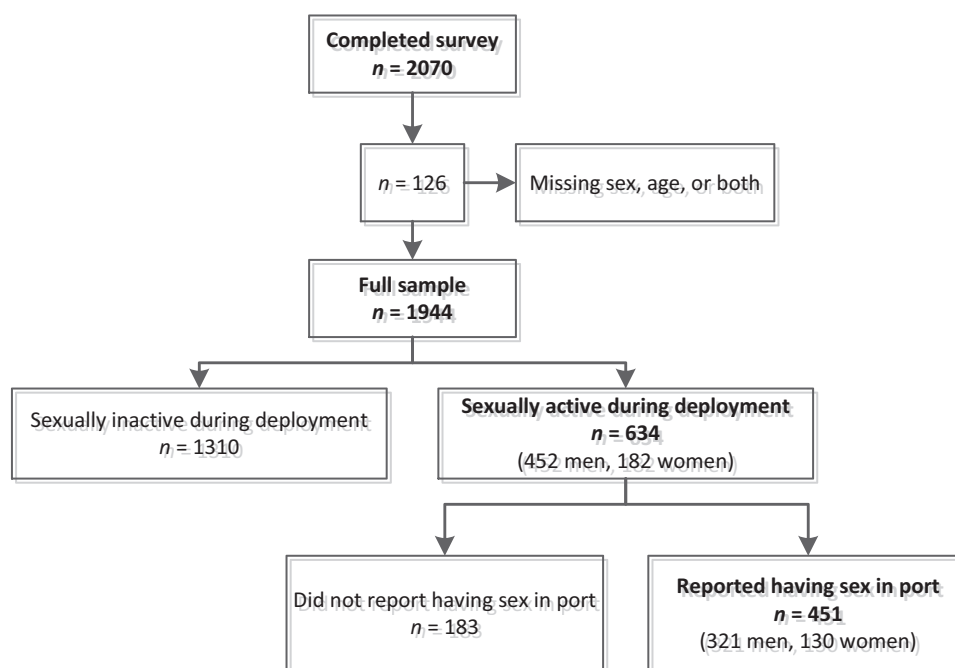
Characteristic	Spouse only or regular partner at 1 location		Regular partner at ≥ 2 locations		1 casual ^B partner only		≥ 2 casual ^B partners ^C		Mixed casual/committed ^D partners		<i>P</i> -value
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Total	90	20.3	54	12.2	128	28.9	122	27.5	49	11.1	
≥ 1 same-sex partner	40	44.4	26	48.1	60	46.9	53	43.4	33	67.3	0.06
Non-condom use with ≥ 1 partner	55	61.1	37	68.5	35	27.3	44	36.1	35	71.4	<0.01
Alcohol before sex with ≥ 1 partner	43	47.8	27	50.0	97	75.8	96	78.7	40	81.6	<0.01
≥ 1 service member partner	60	66.7	49	90.7	40	31.2	54	44.3	34	69.4	<0.01

^ARespondents listed the last three locations they had sex in port and provided information on each sex partner. Those who reported sex with both a spouse and a regular partner ($n = 8$) were excluded for ease of categorisation/interpretation.

^BOccasional, one-night stand, and/or sex worker partner(s).

^CIncludes those who listed occasional partner at >1 location or occasional partner at 1 location and sex worker at another location, etc.

^DSpouse and/or regular partner(s).

**Fig. 1.** Participant selection criteria.

each individual variable. For example, not all service members who were sexually active during deployment reported engaging in sexual activity while in port. Similarly, some service members who reported sexual activity in port provided no response to some of the questions about partners types or behaviours while sexually active in port. For this reason, the denominator comprised all the service members who responded to that question. Where categories were not mutually exclusive, *P* values were not calculated and proportions were reported. For example, participants could report more than one location where they met sexual partners and more than one type of sexual activity. Comparison of partner types and sexual behaviours by STI status was restricted to men due to the low number of women reporting an STI. All *P* values were based on two-tailed tests of significance, defined as $P < 0.05$.

Results

Of the 2070 service members who responded to the deployment survey, 126 were excluded due to missing responses on age, sex, or both; 634 (32.6%) of the remaining 1944 respondents met the inclusion criteria of being sexually active on deployment (men = 452/1495, 30.2%; women = 182/449, 40.5%; Fig. 1).

Participant characteristics

The median age of participants was 23 years, 56.1% were between the ages of 20 and 24 years, and 28.7% ($n = 182/634$) of the study population was female (see Table 1). Over half were white (53.7%), 14.6% were black or African American, and 7.8% marked two or more races or ethnicities. Forty-five percent were married, nearly one in four were in a committed

relationship living with a partner (24.8%), 18.0% were single and not committed, and 12.2% were divorced, separated, or widowed. Sensitivity analyses revealed that significantly higher proportions of sexually active respondents were between ages 20 and 24 years, single, and reported two or more races/ethnicities compared with those who were sexually inactive. No demographic differences were observed between those who reported sex partners in port ($n = 451$) and those who were sexually active on deployment but reported no partners in port ($n = 183$). However, there were significantly higher proportions of risk behaviour reported among individuals reporting sex in port than among those not reporting sex in port including: transactional sex, alcohol use before sex, and binge drinking, with marginally significantly higher proportions of participants reporting multiple partnerships outside their main relationship, IDC, or screening positive for hazardous alcohol use (via AUDIT).

Demographics and risk behaviour by sex

Table 1 shows demographics and risk behaviour during deployment, stratified by sex. Multiple sexual partners were common among participants, with 63.1% reporting sex with two or more partners during their deployment. Males demonstrated significantly higher proportions of risk behaviour compared with females, including higher proportions of two or more sexual partners (71.9% in men vs 41.2% in women, $P < 0.01$), partnerships outside their main relationship (41.1% vs 20.7% reported two to three partners outside their main relationship, $P = 0.03$), transactional sex (23.9% vs 3.3%), and alcohol misuse categories. IDC was reported by 5.4% of participants, though no significant difference was observed by sex.

Sexual activity in port

When participants reported only one sexual partner at one or more port stops during the deployment, partner type differed significantly by sex (Table 2); larger proportions of women reported regular partners (66.7% vs 22.5%) than men, whereas men reported more one-night stands or sex worker encounters (35.8% vs 7.1%; 21.4% vs 1.0%, respectively) than women. This pattern was similar among participants who reported sex with one or more sexual partners in port. Sexual behaviours also differed significantly by sex; larger proportions of women than men reported non-condom use with one or more partner (62.3% vs 28%, $P < 0.01$) and one or more service member partner (86.1% vs 33.3%, $P < 0.01$), whereas larger proportions of men reported alcohol use before sex with one or more partner (69.2% vs 48.5%, $P < 0.01$). Of those who reported non-condom use, 51.5% ($n = 88/171$) had only a spouse or regular partner (men: 38.9%, $n = 35/90$; women: 65.4%, $n = 53/81$).

Relative to MSW reporting sex in port ($n = 300$), MSM ($n = 21$) reported significantly higher proportions of multiple partnerships (86%, $n = 18$ vs 43%, $n = 130$) and having one or more service member partners (81%, $n = 17$ vs 30%, $n = 90$) in port.

Sexually transmissible infections

Among all sexually active participants (sexually active both in port and outside ports), STIs were reported by 8.0% ($n = 36/452$) of men and 1.6% of women ($n = 3/182$).

Among all men

Table 3 shows STI prevalence by exposure variables only for men (MSM and MSW combined) who were sexually active in port, but not women due to the low number of women who reported an STI. Among men who were sexually active in port, 8.7% reported an STI.

Among all men with two or more partners in port, 16.9% reported acquiring an STI, compared with 1.7% of those with only one partner in port and 6.1% ($n = 8/131$) of those who were sexually active on deployment but had no partners in port ($P < 0.01$). STI prevalence was also significantly higher among men reporting at least one occasional partner (28.9%, $n = 13/45$), regular partner (17.1%, $n = 13/76$), and/or sex worker (16.8%, $n = 19/113$), as well as those who reported non-condom use with one or more partner (15.6%, $n = 14/90$) and/or a service member partner (14.9%, $n = 16/107$). However, some of these associations were driven by MSM because the significance changed when MSM were excluded (e.g. sex worker was significant when MSM were included, but marginal when MSM were excluded).

Among MSW only

Among MSW with two or more partners in port, 12.3% ($n = 16/130$) reported acquiring an STI. STI prevalence was also notably high among MSW reporting at least one occasional partner (20.6%, $n = 7/34$; $P < 0.01$), regular partner (13.0%, $n = 9/69$; $P = 0.01$), and/or sex worker (10.2%, $n = 10/98$; $P = 0.07$).

Among MSM only

Although numbers were low among MSM sexually active in port ($n = 21$), MSM comprised 25.0% of STI-positive men ($n = 9/36$), with 42.9% of all MSM reporting an STI ($n = 9/21$). Significant percentages of both insertive and receptive anal sex were reported (Table 2).

Risk behaviour within mixed or single type partnerships

Table 4 shows same-sex contact, condom use, alcohol before sex, and report of a service member partner stratified by partner type. Analysis was limited to 69.9% ($n = 443/634$) of the sexually active sample, after excluding those who reported no sex partners in port ($n = 183$) and an additional eight who could not be clearly categorised because they reported both a spouse and a regular partner. Over half of this subset reported casual partners only (one partner: 28.9%; two or more partners: 27.5%), one-third reported only committed partners (spouse only or regular partner at one port stop: 20.3%; regular partner at two or more port stops: 12.2%), and 11.1% reported mixed (casual and committed) partners.

Additional sensitivity analyses compared demographics and risk behaviour between respondents reporting: (1) committed partners only; (2) casual partners only; and (3) mixed partners. Significant differences ($P < 0.001$) included higher proportions of reporting prescription or non-prescription drug use to enhance sex ($n = 11$, 23% vs $n = 6$, 4%; $n = 17$, 7%), IDC ($n = 9$, 18% vs $n = 3$, 2%; $n = 16$, 6%), and screening positive for dependent alcohol use ($n = 17$, 35% vs $n = 12$, 8%; $n = 56$, 22%) among those with mixed partners relative to those with either committed or casual partners only. Numbers were low, but a significantly higher proportion of those with mixed partners ($n = 11$, 23.9%) reported being the anal receptive partner in a same-sex encounter compared with respondents with either committed ($n = 4$, 3%) or casual ($n = 10$, 4%) partners only. Proportions reporting transactional sex (30–37% vs 1%), binge drinking (56–57% vs 31%), and screening positive for hazardous alcohol use (71–73% vs 53%, $P < 0.001$) were similarly high between those with casual only and mixed partners, but significantly higher than those with committed partners only ($P < 0.001$).

As shown in Table 4, non-condom use was proportionally higher among participants with mixed and committed partners (71%) than among those with casual partners (27–36%, $P < 0.01$). Reported alcohol use before sex was similar among those reporting casual (76–79%) and mixed partners (82%), but higher than among those with committed partners (48–50%, $P < 0.01$). Respondents with mixed partnerships also represented the highest proportion reporting a same-sex partner (67.3%) and the majority reported sex with a service member (69.4%). Of those with mixed partners and a same-sex partner, 72.7% ($n = 24/33$) also reported a service member partner.

Discussion

Principal findings

In this sample of sexually active, deployed shipboard USA active-duty Navy and Marine Corps personnel, men reported significantly higher proportions of multiple sexual partners, transactional sex, and condom use than women across, on average, an 8-month deployment. Among men reporting sexual activity in port, these risk behaviours were significantly higher among MSM than MSW. Additionally, 81% of MSM reported at least one service member sexual partner in port compared with only 30% of MSW; proportions of women reporting service member sexual partners were higher than among cumulative MSM/MSW. Greater proportions of women met sexual partners at work during deployment, as was also shown previously using pre-deployment data from this population.²⁰ STI rates were highest among MSM, but they were also high among MSW with two or more partners, occasional, regular, and/or sex worker partners. High levels of sexual risk were reported among MSM, MSW subsets, and within mixed partnerships; a high frequency of service member sexual partners suggest feasibility of targeted interventions to more efficiently interrupt STI transmission among service members and their beneficiaries (i.e. spouse).

Comparison to other studies

A higher proportion of service members that remain sexually active during the deployment time period engage in sexual risk behaviour when compared with data from prior publications that report sexual activity among service members before or after deployment.^{20,26} Service members in the current study reported a higher proportion of same-sex contact with anal insertive (49%) or anal receptive (54%) sex compared with previously published data on sexually active service members pre-deployment (anal insertive: 25%; anal receptive: 20%).²⁰ Similarly, a higher proportion of service members from the current study reported four or more partnerships outside their main relationship (27% vs 17%), engaging in transactional sex (18% vs 4%), and always drinking alcohol before sex (28% vs 7%) compared with the same pre-deployment study data.²⁰ Comparability of this data is limited by different time intervals (12 months for pre-deployment vs an average of 8 months for deployment), and that deployment data report risk behaviour only among sexually active service members, but predeployment data report risk behaviour among all service members whether they were sexually active or not (but 92% reported sexual activity).

Among sexually active men in port, a substantially larger proportion of MSM reported STIs (43% among MSM, 25% of all the STIs reported) compared with MSW, and this was mirrored in significantly higher proportions of multiple partners, occasional and transactional partners, and non-condom use. Although MSM numbers were low and therefore findings within this population subset should be interpreted with caution, interventions to quickly identify and treat STIs among MSM during deployment could substantially reduce STI transmission risk within the deployed population as a whole. In risk behaviour data collected from USA Army service members (64% MSM) who recently acquired HIV, 17% reported never using condoms and 43% reported inconsistent condom use, 28% reported a service member sex partner (36% in MSM vs 13% in MSW), over 40% reported sex with a casual or stranger sex partner, 42% reported four or more sex partners, and 51% reported sex while drunk.¹⁰ These data are consistent with data from the current study.

The nexus of subgroups with high rates of service member partners, low condom use, and multiple partnerships suggests the potential presence of a tightly connected sexual network. Further examination of whether there is a connected service member sexual network within sexually active deployed service members during deployment could inform the feasibility of identifying and interrupting STIs within this group, and may also facilitate linkage to others in the network for risk-reduction interventions.

A recent meta-analysis¹⁶ of articles published from 2000 to 2017 focusing on STI risk behaviour of civilians aged 13–90 years (57% male) travelling internationally showed that having casual sex abroad was associated with male gender and alcohol consumption, consistent with the current study findings that men were more likely than women to report occasional partners or one-night stands and report higher rates of alcohol misuse before sex among respondents with one or

more casual partner. These data may speak to a generalisability of the current study to a wider population.

STI prevalence among deployed sexually active men in the present study was 8.0%, which is higher than the 4.2% of unmarried, non-deployed, sexually active military men who reported an STI in the past year, as shown previously,¹⁴ suggesting that STI rates may be higher during the deployment time period than during non-deployment time periods. It is important to note that previous data²⁶ show that the absolute number of STIs reported before or after deployment was higher than during deployment, but the rate of acquisition during deployment was higher, likely because of both a reduced number of sexually active personnel and higher risk of STI acquisition with non-condom use during that specific time period.

Navy personnel deployed to Iraq unsurprisingly experienced high levels of stress,²⁷ which has been associated with increased STI risk behaviours such as non-condom use and a greater number of sexual partners;¹⁴ this may partially account for the increased risk behaviour and STI acquisition among the deployed shipboard population.

STI prevalence among women in the current study sample was very low (1.6%) compared with 6.9% reported in another military study population¹⁴ and 2.4% in the 2015 Health-Related Behaviors (HRB) study,²⁸ which suggests that the deployment time period for women may be a lower STI risk acquisition period than before or after deployment.

Nearly half of respondents reported at least one service member partner in port (men and women combined: 49%; men: 33%; women 86%), which may play an important role in the transmission of STIs within the military community and potentially to beneficiaries. Similar to previously published pre-deployment data,²⁰ higher proportions of women reported service member partners than men. Given the high rate of non-condom use among women, this may lead to more STI transmission among military personnel. Service member partnerships were also reported at a high rate among a sample of recently diagnosed HIV-positive USA Army servicemen (28.0%).¹⁰ Hakre *et al.* reported that higher proportions of MSM (36%) had service member sex partners than MSW (13%), which aligns with data from the current study among MSM in port during the deployment time period (MSM: 80.9%; MSW: 30%; 80.5% of all respondents, including women, with a same-sex partner). Among those with mixed partners and a same-sex partner, nearly three-quarters also had a service member partner. Respondents with mixed partners tended to exemplify the high rates of alcohol use before sex compared with those with only casual partners, in addition to the high rates of non-condom use of those with only committed partners, making them more susceptible to STI acquisition. With 69.4% of respondents reporting a service member partner, this high-risk group may propagate a cycle of STI transmission within the military community during deployment.

Strengths and limitations

Strengths of this study include comprehensive information on sexual risk behaviours not included in electronic health record

databases or standardised USA military health surveys, as well as data collection directly from shipboard personnel while deployed; few studies have captured data on this deployed USA Navy and Marine Corps population because of inherent logistical challenges.

This study had several limitations. The variables constructed to designate sexual behaviours by partner types across one or more port stops included respondents with partial information, which may have biased results; for example, MSM may be underrepresented in these data. This study may not be generalisable beyond deployed shipboard USA Navy and Marine Corps personnel, but similarities in findings with other military data and civilian studies among university students and travellers abroad suggest it may. The self-reported nature of these data is subject to recall bias, but this was minimised by data collection within the last 4 weeks of deployment.

Conclusion

MSM, followed by MSW reporting sex with occasional partners, regular partners, or sex workers in port, reported the highest prevalence of STIs in this population. Some of the highest sexual risk behaviour in port (same-sex contact, non-condom use, and alcohol with sex) was reported among those who had mixed sex partners (both casual and committed). The majority of those with mixed partners (69%) as well as MSM (81%) reported service member sex partners; these subsets appear to be at high risk of transmitting and acquiring STIs, especially within the military and beneficiary population. If the military focuses prevention activities on service members with these risk factors, STI transmission in military populations could be significantly reduced.

Conflicts of interest

The authors declare no conflicts of interest.

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