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***Trichomonas vaginalis* infection among homeless and unstably housed adult women living in a resource-rich urban environment**

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Abstract

Objective—The social context of poverty is consistently linked to *Trichomonas vaginalis* infection, yet few studies regarding *T. vaginalis* have been conducted exclusively among low-income individuals. We identified social determinants of health associated with prevalent *T. vaginalis* infection among homeless and unstably housed adult women.

Methods—Between April and October of 2010, we conducted cross-sectional *T. vaginalis* screening and behavioural interviews in an existing cohort of San Francisco homeless and unstably housed women. Data were analysed using multivariable logistical regression.

Results—Among 245 study participants, the median age was 47 years and 72% were of non-Caucasian race/ethnicity. *T. vaginalis* prevalence was 12%, compared to 3% in the general population, and 33% of infected individuals reported no gynaecological symptoms. In adjusted analysis, the odds of *T. vaginalis* infection were lower among persons older than 47 years, the population median (OR=0.14, 95% CI 0.04 to 0.38), and higher among those reporting recent short-term homeless shelter stays (OR=5.36, 95% CI 1.57 to 18.26). Race and income did not reach levels of significance. Sensitivity analyses indicated that testing all women who report recent unprotected sex would identify more infections than testing those who report gynaecological symptoms (20/30 vs 10/30; p=0.01).

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Contributors EDR conceived the study, led the interpretation of study findings and led writing efforts. JC contributed to the design of the study, supervised all field operations and contributed to multiple manuscript versions. SED contributed to the analysis plan, interpretation of findings, multiple manuscript versions and conducted final analyses. BG conducted initial analyses and contributed to multiple manuscript versions. CM and PCH contributed to the analysis plan, interpretation of findings and multiple manuscript versions. SSP provided clinical guidance, assisted in developing the study design, contributed to the analysis plan, interpretation of findings and multiple manuscript versions.

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Conclusions—The prevalence of *T. vaginalis* is high among homeless and unstably housed adult women, over one-third of infected individuals have no gynaecological symptoms, and correlates of infection differ from those reported in the general population. Targeted screening and treatment among impoverished women reporting recent unprotected sex, particularly young impoverished women and all women experiencing short-term homelessness, may reduce complications related to this treatable infection.

INTRODUCTION

The prevalence of *Trichomonas vaginalis* infection among US women between ages 14 and 49 years is 3.1%, and even higher in certain subgroups.¹ Individuals infected are often asymptomatic¹ and, without treatment, *T. vaginalis* may increase risks for conditions such as pelvic inflammatory disease² and HIV infection.³

Research conducted among US women suggests that *T. vaginalis* is associated with Latina and African-American ethnicity/race, increasing age and poverty.¹ Among low-income African-American adolescent women, studies reveal 13% prevalence and significant associations between *T. vaginalis* and sex with non-steady partners.⁴

While the epidemiology of some sexually transmitted diseases can be better understood in the context of social determinants of health, such as race and poverty, behavioural and contextual data have traditionally been limited.⁵ In particular, few studies regarding *T. vaginalis* have been conducted exclusively among low-income adult women, an endeavour that could reveal unique patterns of infection. The goal of this study was to provide a better understanding of *T. vaginalis* transmission patterns and inform screening services intended to reduce health complications associated with untreated infection in very low-income women.

METHODS

This cross-sectional study was conducted within ‘Shelter, Health and Drug Outcomes among Women’, an existing cohort study aimed at understanding women’s health, health services use and experiences of violence, with a focus on influences from HIV infection. Recruitment has been described previously.⁶ In brief, a mobile outreach team approached women at free meal programmes, homeless shelters and low-cost single room occupancy hotels. Inclusion criteria were female sex (biological), age >18 years and a lifetime history of housing instability (homeless or stayed with a series of other people because there was nowhere else to sleep (‘couch-surfed’)). HIV testing occurred during study screening and infected women were oversampled to ensure statistical power for HIV-specific analyses. Participants were reimbursed \$35 for study participation.

Data presented here represent one study visit per participant between April and October 2010. Participants provided self-collected vaginal swab specimen and were interviewed about potential correlates of infection. Specimens were tested for *T. vaginalis* infection using a commercially available point of care assay (OSOM Trichomonas Rapid Test; Genzyme Diagnostics). In accordance with treatment guidelines at the time of the study, individuals

who tested *T. vaginalis* positive were offered single-dose Metronidazole therapy and provided take-home doses for treatment of sexual partners.

Independent variables exploring social determinants of health during the prior 6 months have been described and cited in our previously reported research.⁶ They included socioeconomic factors, sex exchange, violence and HIV status (table 1). Unprotected sex (ie, sex without a condom), number of sexual partners and sex exchange were considered to be in the causal pathway of *T. vaginalis* infection and were therefore not included in adjusted analyses; however, they are reported here for descriptive purposes.

ORs and CIs determined the magnitude of effect and variability in each estimate. Inferences were based on simultaneous adjustment for independent variables using multiple logistical regression with Firth's bias correction to account for quasi-complete separation due to small cell sizes. Covariates with a CI that did not include one in unadjusted analysis were included in adjusted analysis. Multicollinearity between covariates was examined using the variance inflation factor and none was found (all VIFs <2.3).

RESULTS

Among 300 homeless and unstably housed women participating in the cohort study, interview and *T. vaginalis* testing data were available for 245 individuals (126 HIV+ and 118 HIV-). No significant differences were detected between participants who did and did not have available data for the current analysis with regard to socioeconomic and sexual behaviour variables ($p>0.05$). Most study participants were of non-Caucasian race/ethnicity (72%), the median age was 47 years and half were HIV-infected (51%; table 1). During the 6 months prior to baseline, 41% of participants had insufficient access to food, clothing, a bathroom, a place to wash or shelter, 18% slept on the street or in a public place and 11% were incarcerated.

The overall prevalence of *T. vaginalis* infection was 12%. One-third of women in both the *T. vaginalis*-positive and *T. vaginalis*-negative groups reported no gynaecological symptoms (ie, severe pelvic pain, burning during urination, blood in the urine, abnormal discharge or odour, new sores, lumps or warts on the genitals)⁷ during the 6 months prior to being interviewed (33.3% vs 32.7%; $p=0.95$).

Regarding unadjusted risk factors established in prior research, 9% of respondents reported exchanging sex for money (no significant association with *T. vaginalis* infection), while 7% reported exchanging sex for drugs, food or a place to sleep (OR=3.51, 95% CI 1.10 to 10.02). The median number of male sexual partners was one; having more than one male sexual partner increased the odds of *T. vaginalis* infection by 5% (OR=1.05, 95% CI 1.01 to 1.22). Just over 38% of respondents reported unprotected vaginal or anal sex in the past 6 months, which increased the odds of *T. vaginalis* infection by more than threefold (OR=3.79, 95% CI 1.74 to 8.68).

Regarding social determinants of health, adjusted analysis indicated that the odds of *T. vaginalis* infection were significantly lower among women in each of the two oldest age quartiles compared to the youngest quartile (OR_{age=48-53} = 0.12, 95% CI 0.02 to 0.40;

$OR_{age>53} = 0.15$, 95% CI 0.03 to 0.52; table 1), and correspondingly, older than the population median ($OR_{age>47} = 0.14$, 95% CI 0.04 to 0.38). In addition, short-term homeless shelter stays increased the odds of infection fivefold (5.36, 95% CI 1.57 to 18.26), and long-term homeless shelter stays did not reach a level of significance.

The estimated sensitivity to detect infections by screening persons who reported recent unprotected sex (20/30=0.67) was significantly higher than sensitivity to detect infections by other targeting criteria including screening those who were younger than the population median (4/30=0.13; $p<0.01$), reported recent short-term homelessness (6/30=0.20; $p<0.01$) or reported gynaecological symptoms (10/30 = 0.33; $p = 0.01$).

DISCUSSION

The prevalence of *T. vaginalis* infection in this cohort of homeless and unstably housed adult women was high (12%) compared to the general population (3%),¹ and one-third of the infected women were asymptomatic. In opposition to findings from the general population, race/ethnicity and income were not significantly associated with *T. vaginalis* infection. Consistent with findings from other vulnerable populations, the 12% prevalence of *T. vaginalis* observed here was similar to the 13% prevalence reported by Crosby *et al*⁴ among low-income African-American adolescent women. Taken together, the existing evidence confirms higher *T. vaginalis* prevalence and different correlates of infection in samples comprised exclusively of low-income individuals compared to the general population.

Unique to the current study, and specific to unstably housed individuals, was the finding that the odds of *T. vaginalis* infection were over fivefold higher among women experiencing short-term homeless shelter stays, while the effect among those experiencing long-term homeless shelter stays was nonsignificant, with an OR close to 1. Reasons for this difference by time homeless are currently unclear. Future studies that distinguish length of time homeless may elucidate this finding. While the sample is small, results also uniquely indicate that testing all unstably housed women who reported recent unprotected sex would have identified more infected individuals than the current common practice of testing women who report gynaecological symptoms ($p = 0.01$).

The prevalence of trichomoniasis among HIV-infected women reported in previous studies has been high (6.1%–52.6%) and interactions between *T. vaginalis* and HIV infection have been noted.⁸ However, we did not find a strong association between HIV and *T. vaginalis*. This is likely due to the cross-sectional nature of the current study and the fact that *T. vaginalis* can be cleared with treatment, whereas HIV cannot. It is also possible that risks linking HIV and *T. vaginalis* are strongly mediated by socioeconomic factors,⁹ some of which may have been undetectable in the current study due to a population composed entirely of extremely impoverished women.

Results should be considered in light of several potential limitations. The 12% *T. vaginalis* prevalence found in this study using OSOM technology may not be significantly different from previous studies showing lower *T. vaginalis* levels because many previous studies have used less sensitive microscopic examination ('wet mount') of vaginal fluid. However, the 3%

prevalence among US women reported by Sutton *et al*¹ was established using PCR, which is even more sensitive than OSOM. Thus, the difference between the general population and unstably housed women is likely to be at least as large as that reported here. In addition, the sample population included in the current study was small. However, recruiting a probability sample of unstably housed women from community venues likely reduced the possibility of a biased sample from San Francisco's larger population of homeless and unstably housed women.

The high prevalence of asymptomatic *T. vaginalis* infection reported here suggests that homeless and unstably housed women are at disproportionately high risk for negative health outcomes associated with untreated infection. Because *T. vaginalis* is treatable, this concerning public health finding may also be seen as an opportunity. Our data support enhanced *T. vaginalis* screening and treatment among impoverished women,¹⁰ emphasising the potential of non-clinical settings like homeless shelters. Targeting all unstably housed women reporting recent unprotected sex, especially young impoverished women and all women experiencing short-term homelessness, may be an effective strategy to identify and treat *T. vaginalis* infection and reduce associated complications from untreated *T. vaginalis*.

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Associations between *Trichomonas vaginalis* infection and social determinants of health during the past 6 months (N=245)

Table 1

	Prevalence N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
<i>Social determinants of health</i>			
Race			
African-American	114 (46.5)	-	
Caucasian	69 (28.2)	0.53 (0.19 to 1.32)	
Latina	13 (5.3)	0.63 (0.07 to 2.86)	
Mixed	35 (14.3)	0.75 (0.22 to 2.10)	
Other	14 (5.7)	0.58 (0.06 to 2.62)	
Age (years)			
20-42	63 (25.7)	-	-
43-47	60 (24.5)	0.73 (0.30 to 1.71)	0.97 (0.39 to 2.39)
48-53	68 (27.8)	0.12 (0.02 to 0.40) *	0.13 (0.03 to 0.48) *
54+	54 (22.0)	0.15 (0.03 to 0.52) *	0.17 (0.03 to 0.62) *
High school graduate	159 (64.9)	0.78 (0.36 to 1.72)	
Total income/\$100t	9.35 (11.5)	1.01 (0.97 to 1.03)	
Incarceration	28 (11.4)	0.95 (0.24 to 2.80)	
Percentage of nights sleeping in a shelter			
0	214 (87.3)	-	-
1-25	18 (7.3)	4.24 (1.42 to 11.74) *	5.36 (1.57 to 18.26) *
26-100	13 (5.3)	0.98 (0.10 to 4.35)	1.09 (0.11 to 5.52)
Percentage of nights sleeping in a public space			
0	201 (82.0)	-	-
1-25	35 (14.3)	2.01 (0.79 to 5.08)	
26-100	9 (3.7)	1.41 (0.15 to 6.71)	
Unmet subsistence needs [‡]	102 (41.6)	1.47 (0.69 to 3.14)	
Instrumental support [§]	202 (82.5)	4.82 (1.21 to 43.79) *	2.89 (0.69 to 26.73)
Sexual orientation			
Heterosexual	188 (76.7)	-	-

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	Prevalence N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Homosexual	16 (6.5)	1.06 (0.20 to 3.73)	
Bisexual	41 (16.7)	0.39 (0.08 to 1.26)	
Experienced recent sexual violence	11 (4.5)	1.91 (0.35 to 7.17)	
Experienced recent physical violence	46 (18.8)	1.15 (0.42 to 2.78)	
HIV and antiretroviral therapy (ART) status			
HIV –	119 (48.6%)	-	
HIV+/ART+	102 (41.6%)	1.10 (0.49 to 2.44)	
HIV+/ART–	24 (9.8%)	1.18 (0.28 to 3.81)	

* 95% CI does not include 1.

‡ Insufficient access to food, clothing, a bathroom, place to wash or shelter.

§ Had someone to lend money or a place to sleep.