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Trichomonas vaginalis infection in women who submit self-obtained vaginal samples after Internet recruitment

Charlotte A. Gaydos, MS, MPH, DrPH[1], **Yu-Hsiang Hsieh, PhD**[1], **Mathilda Barnes, MS**[1], **Nicole Quinn, BS**[1], **Patricia Agreda, MS, MBA**[1], **Mary Jett-Goheen, BS**[1], **Pamela Whittle, BA**[2], and **Terry Hogan, MPH**[1]

[1]Johns Hopkins University, Baltimore, Maryland [2]Baltimore City Health Department, Baltimore, Maryland

Abstract

Background—Submission of self-obtained vaginal samples (SOVs) collected at home could remove barriers that women face in getting tested for sexually transmitted infections (STIs). Internet-recruitment of SOVs is highly acceptable.

Methods—Sexually active women ≥ 14 yr were recruited by an educational Internet program www.iwantthekit.org (IWTK) which offered free testing for trichomonas as part of a panel, which also offered testing for chlamydia and gonorrhea. Kits were ordered on-line, SOVs were sent via U.S. mail to the laboratory, and tested by nucleic acid amplification tests (NAATs). Demographics and sexual risk factors were accessed by questionnaires. Women called or were contacted to receive their results.

Results—Of women requesting kits, 1525 (43%) returned swabs by mail. Sixty-one percent were <25 yr, 52% were Black, and 80% were single. Vaginal discharge was reported by 44%, prevalence for trichomonas was 10%, (10% for chlamydia, 1% for gonorrhea), and 18% had at least one prevalent STI. Multivariate logistic regression demonstrated several significantly associated risks factors: Black Race adjusted odds ratios (OR) 2.69; residence of Illinois OR 3.85; not having health insurance OR 1.57; lack of a bachelor's degree OR 5.53; having 2–15 partners OR 1.60; having ≥16 partners in previous year OR 3.51; being bi-sexual OR 2.0; not always using condoms OR 3.04; and having a partner who had a previous STI OR 1.71. Age was not associated with trichomonas infection. All infected women were treated.

Conclusions—A high prevalence of trichomonas and high sexual risk factors were demonstrated. Internet recruitment was a useful method of screening women for trichomonas infection.

Keywords

Trichomonas vaginalis; self-obtained vaginal swabs; Internet

Corresponding Author: Charlotte A. Gaydos, MS, MPH, DrPH, 550 North Wolfe Street, 530 Rangos Building, Baltimore, MD 21205, 410-614-0932; FAX: 410-614-0932, cgaydos@jhmi.edu.

Introduction

Trichomonas infections, caused by the parasite *Trichomonas vaginalis* (TV), are highly prevalent sexually transmitted infections (STIs) worldwide, with estimates of 7–8 million infections annually in the United States and 180 million globally[1]. As such, they represent the most common curable STI in sexually active women[2, 3]. Trichomonas infections have been associated with poor reproductive outcomes such as low birth weight (LBW) and premature birth[4, 5]. In a cohort of over 13,000 women there was an attributable risk of trichomonas associated with LBW in Blacks of 11% vs. 1.6% in Hispanics, and 1.5% in Whites[4]. The National Health and Nutrition Examination Survey 2001–2004 (NHANES) estimated that 3.1% of women in the United States have TV[6]. Miller et al. reported that 2.8% of women 18 to 26 years in the National Longitudinal Study of Adolescent Health cohort were positive for trichomoniasis, with infections in black women ranging from 10.5% to 13%[7]. Data from the National Health and Nutrition Examination Surveys, combining the 2001–2002 and 2003–2004 waves, demonstrated that TV was associated with other STIs among women in the civilian, non-institutionalized U.S. population in a sample of 3,648 women, representing a weighted sample of the experience of 65,563,298 women between the ages of 14 and 49 years[8]. The prevalence of trichomoniasis was 3.2% with over 80% of cases being asymptomatic. Thus, better methods are needed to screen women for trichomonas. Submission of self-obtained vaginal samples (SOVS) collected at home could increase screening as well as remove barriers that women face in getting tested for STIs[9, 10]. Internet-recruitment of women to provide such specimens has been shown to be highly acceptable to women for testing of chlamydia and gonorrhea[11]. The purpose of this study was to provide trichomonas screening for such Internet recruited SOVS, determine prevalence, and to ascertain risk factors associated with trichomoniasis.

Methods

Sexually active women ≥ 14 yr were recruited by the Internet program www.iwantthekit.org (IWTK) which was educational for STIs and offered free testing from home-collected vaginal samples for trichomonas, chlamydia, and gonorrhea. The study was approved by the Institutional Review Board and written consent was obtained from the women. Kits were supplied free of charge by ordering from the website. It was possible to also obtain a kit by a toll free phone call. Swab samples were sent in a dry state in pre-addressed postage-paid mailers via U.S. mail directly to the testing laboratory. This program was active in Maryland, the District of Columbia, West Virginia, select counties in Illinois, and Denver, Colorado. Trichomonas testing began in 2006. Testing was performed by nucleic acid amplification test (NAAT), Aptima TV, ASR (analyte specific reagent) assay, Gen-Probe, Inc., San Diego, CA.

Women were instructed to call for results in 1–2 weeks and to give a preferred method (email, cell phone, letter, and recently, text message) for notification of results, if they forgot to call. Infected women were offered free treatment at participating clinics. Counseling about partner referral was routinely given over the phone when appointments for treatment were made with the infected woman.

Demographics and risk factors for trichomonas infection were accessed by self-administered questionnaires, which could be taken on line or with paper in the kit. Chi squared tests were performed for bivariate analysis, and logistic regression was performed using SAS® version 9.1 (Cary, NC). P values of ≤0.05 were considered significant. Variables significant in bivariate analysis and other variables considered as potential confounders were entered into a multiple logistic regression model.

Results

There were 1525 women who requested kits and subsequently returned SOVs by mail. Only a very few were requested by phone. Return rate for total requested kits was 43%. Sixty-one percent of women were <25 yr, 21% were ages 14–19 yr, 17% were ages 25–29 yr and 21% were ≥ 30 yr (Table 1).

Over half (52%) were Black, 36% were White, 80% were single, 66% were from Maryland including Baltimore [27% were from Baltimore City and 39% were from other jurisdictions in Maryland] (Table 1). Of participants, 28% reported income <$10,000, 49% reported $10,000–$49,000, 13% reported >$50,000, 41% reported no insurance, 5% had less than a high school education, 32% reported a high school education, and 58% reported some higher education. Symptoms of any type were reported by 59%. Vaginal discharge was reported by 44%, lower abdominal pain by 16%, and pain during intercourse by 12% (Table 1). The infection prevalence for trichomonas was 10%, 10% for chlamydia, 1% for gonorrhea, and 18% had at least one prevalent STI. Of 149 positive trichomonas infections, most had only that infection, but many were coinfected: trichomonas only:120 (50.5%) ; trichomonas and chlamydia: 25 (16.8%) ; trichomonas and gonorrhea: 2 (1.3%) ; and triple infections: trichomonas, chlamydia, and gonorrhea: 2 (1.3%).

Bivariate analysis for trichomonas infection indicated the following significant ($p<0.05$) risk factors: Black Race, lack of health insurance, less education, more than 1 partner in the last year, lack of consistent condom use, a reported partner who ever had a STI, having trichomonas in the past, and having had a STI previously (Table 2). Multivariate logistic regression analysis demonstrated the significant associated adjusted odds ratios (OR): Black Race OR 2.69; residence of Illinois OR 3.85; being without health insurance OR1.57; lack of a bachelor's degree OR 5.53; having 2–15 partners OR 1.60; having ≥16 partners in previous year OR 3.51; being bi-sexual OR 2.0; not always using condoms OR 3.04; and having a partner who had a previous STI OR 1.71 (Table 3). Age was not associated with trichomonas. All women infected with trichomonas, as well as chlamydia or trichomonas, were successfully treated in collaborating clinics.

Discussion

Our Internet recruited population demonstrated a high prevalence for trichomoniasis among women, who submitted SOVs collected at home, similar to a previously reported high prevalence for chlamydia[11]. However, unlike chlamydia, age was not associated with trichomonas infection, although other studies have associated trichomonas infection with older age[7, 12]. However, only 38% of our women were ≥ 25 yr. Like many other reports, Black Race was significantly associated with infection with a prevalence of 13.2% compared to 5.6% in Whites in our study[6, 7, 12].

Our demographic factors demonstrated that over half of women had insurance, that 80% were single and only 5% had less than a high school education with many having more than a high school education, while many had incomes of $10,000–49,999/yr. Taken together one could postulate that many of these women could have attended a clinic for the diagnosis of trichomonas or other STIs. However, if such infections are asymptomatic or only mildly symptomatic, women may not attend clinics. Home collection of genital samples appears to be a highly desirable and convenient method for screening for STIs[13–16] and has been shown to be potentially cost savings[17]. Until more clinical trials are conducted, we will not be able to discern whether the Internet recruitment and home collection will facilitate more testing and more treatment for prevalent trichomonas and other STIs. According to our previous studies, the Internet method of recruitment appeared to be considered safe; women

preferred to collect their own specimens and reported they would use the Internet program again[11].

We acknowledge that a limitation of our study was that only 43% of women who ordered kits returned them; thus we cannot estimate the acceptability of those women who did not return the kits. A home-screening randomized controlled trial for chlamydia and gonorrhea did demonstrate that home screening was acceptable and showed that women who received a home testing intervention completed significantly more STI tests overall and more STI tests when asymptomatic, when compared with women who did not receive the home testing option[16]. Additionally, another study has reported that 75.7% of women, who were given a choice in a one-year follow-up contraceptive study that screened for STIs, chose the home-collection method over visiting a clinic or their own doctor[15]. In that study, women who chose home-based testing were more likely to complete a test compared to all clinic-based testers. The authors recommended that future interventions to increase screening for STIs should consider home-based or patient-controlled testing[15]. This concept fits well with the "Patient-Centered Medical Home Movement" as a model of primary care which has been recommended as a strong foundation for a high performing U.S. health care system[18, 19].

Another limitation is that recruitment for our study was limited to a relatively small geographic area of the United States and so one cannot make inferences about uptake and prevalence to the rest of the country.

While 58% of women reported any type of symptoms in our study, (44% reported vaginal discharge), only 16% and 8% reported lower abdominal pain and abnormal vaginal bleeding, respectively. Thus, it is difficult to ascertain whether these women were mostly symptomatic, minimally symptomatic, or were asymptomatic with trichomonas infection. As other STIs such as chlamydia and gonorrhea were also being tested and were also prevalent, it is uncertain what, if any, symptoms were due to trichomonas or other STIs. In fact, the prevalence of any STI (trichomonas, chlamydia or gonorrhea) in this cohort was 18%. It is noteworthy that 16.8% of those infected with trichomonas were also infected with chlamydia only, while 1.3% were coinfected with gonorrhea only, and 1.3% of those infected with trichomonas were triple infected. Only 50.5% had trichomonas only. These data indicate that trichomonas infection may be a marker of other STIs.

It is revealing that in multivariate analysis of our study that having had a previous STI, but not having had trichomonas in the past, was associated with a present infection with trichomonas. These findings are similar to the 2001–2002 and 2003–2004 waves of the National Health and Nutrition Examination Surveys, which demonstrated that TV was associated with other STIs among women in the civilian, non-institutionalized U.S. population[8]. In those surveys, all STIs were more common among women with a positive test for TV and 80% were asymptomatic[8]. HSV-1 and HSV-2 were significantly associated with trichomoniasis. In crude analyses, a positive treponemal test was 6 times more common and HIV was 13 times more common among women with trichomoniasis[8]. These data underscore the significance of prevalent trichomonas infections. Similar to our study, others have reported that risk factors for prevalent and incident trichomonas infections in STD clinics included Black Race, having a concurrent chlamydial infection, having multiple partners, and having had a previous STI[12].

Many other recent reports have associated TV with HIV transmission and acquisition[5, 20–27]. Other data indicate that trichomonas infections are associated with pelvic inflammatory disease[25, 28]. Additionally, it has been estimated that the overall annual economic burden of trichomonas for the only private sector was $18.9 million among all U.S. women[29]. Neither the cost of the public sector infections nor the sequelae costs were included in this estimate.

With such costs and adverse outcomes associated with trichomonas infection, better methods of screening women are needed, especially if they are asymptomatic. Recruitment via the Internet and home collection of samples may facilitate easy public health screening and Internet programs can also be educational. Can we continue to ignore trichomonas infections in the United States? Many public health officials say "no"[27, 30–32]. Is it time to make trichomonas infection a reportable disease? Many say "yes". The health inequity of adverse birth outcomes and increasing associations with HIV resulting from the much greater prevalence in Black women make this public health initiative difficult to ignore. New optimal prevention, diagnosis, and control strategies for trichomonas are imperative and may have the ability to decrease racial disparity gaps and to decrease adverse outcomes due to these infections[6].

In summary, we have demonstrated that Internet recruitment of women to collect vaginal samples at home can serve as another tool in expanding public health screening for trichomonas; that women who use such a program have a high prevalence of trichomonas; and that these women appear to have significant acceptability of such a program.

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Table 1

Basic demographic characteristics, reported symptoms, and screening results in women who participated in Internet-based screening program (N=1525).

Risk factor	Characteristic	n (%)
Age (years)		
	14–19	320 (21)
	20–24	612 (40)
	25–29	252 (17)
	≥30	320 (21)
	Missing	21 (1)
Race		
	Caucasian	550 (36)
	African American	793 (52)
	Asian	21 (1)
	Other	105 (7)
	Missing	56 (4)
Ethnicity		
	Hispanic	83 (5)
	Non-Hispanic	1337 (88)
	Missing	105 (7)
Marital status		
	Single	1215 (80)
	Married	111 (7)
	Separated	45 (3)
	Divorced	68 (4)
	Missing	86 (6)
State		
	West Virginia	109 (7)
	Maryland	598 (39)
	Baltimore	419 (27)
	District of Columbia	60 (4)
	Illinois	107 (7)
	Denver	174 (11)
	Other States	7 (1)
	Missing	51 (3)
Income		
	<$10,000	430 (28)
	$10,000–$49,999	754 (49)
	$50,000–$99,999	140 (9)
	>$100,000	31 (2)
	Missing	170 (11)
Health insurance		

Risk factor	Characteristic	n (%)
	Without insurance	626 (41)
	With insurance	803 (53)
	Missing	96 (6)
Education		
	Less than high school	70 (5)
	High school	483 (32)
	Community college	251 (16)
	Some college	316 (21)
	Bachelors	196 (13)
	Masters	50 (3)
	Doctoral	13 (1)
	Other	63 (4)
	Missing	83 (5)
Symptoms (one or more)		
	Any	879 (58)
	Vaginal discharge	678 (44)
	Lower abdominal pain	249 (16)
	Pain during urination	90 (6)
	Abnormal vaginal bleeding	126 (8)
	Pain during intercourse	186 (12)
	None	534 (35)
	Missing	112 (7)
Infection type		
	Any STI†	278 (18)
	Chlamydia trachomatis‡	148 (10)
	Neisseria gonorrhoeae‡	21 (1)
	Trichomonas vaginalis	149 (10)

† Sexually Transmitted Infection

‡ One subject did not have the test result

Table 2

Bivariate analysis of *Trichomonas vaginalis* infection status on risk factors for infection in women who participated in Internet-based screening program (N=1525).

Risk factor	Characteristic	N	*Trichomonas vaginalis* prevalence (%)
Age (years)			
	14–19	320	34 (10.6)
	20–24	612	51 (8.3)
	25–29	252	29 (11.5)
	≥30	320	33 (10.3)
	Missing	21	2 (9.5)
Race[†]			
	White	550	31 (5.6)
	Black	793	105 (13.2)
	Asian	21	0 (0)
	Other	105	9 (8.6)
	Missing	56	4 (7.1)
Ethnicity			
	Hispanic	83	5 (6.0)
	Non-Hispanic	1337	128 (9.6)
	Missing	105	16 (15.2)
Marital status			
	Single	1215	123 (10.1)
	Married	111	6 (5.4)
	Separated	45	5 (11.1)
	Divorced	68	9 (13.2)
	Missing	86	6 (7.0)
State			
	West Virginia	109	6 (5.5)
	Maryland	598	61 (10.2)
	Baltimore	419	42 (10.0)
	District of Columbia	60	3 (5.0)
	Illinois	107	18 (16.8)
	Denver	174	15 (8.6)
	Other States	7	0 (0)
	Missing	51	4 (7.8)
Income			
	<$10,000	430	42 (9.8)
	$10,000–$49,999[§]	754	75 (10.0)
	$50,000–$99,999[§]	140	9 (6.4)
	>$100,000	31	3 (9.7)
	Missing	170	20 (11.8)

Risk factor	Characteristic	N	*Trichomonas vaginalis* prevalence (%)
Health insurance†			
	With	803	60 (7.5)
	Without	626	78 (12.5)
	Missing	96	11 (11.5)
Education†			
	Less than high school	70	7 (10.0)
	High school	483	52 (10.8)
	Community college	251	33 (13.1)
	Some college	316	35 (11.1)
	Bachelors	196	3 (1.5)
	Masters	50	1 (2.0)
	Doctoral	13	1 (7.7)
	Other	63	9 (14.3)
	Missing	83	8 (9.6)
Age had first sex (years)			
	5–9	4	0 (0)
	10–14	410	54 (13.2)
	15–19	933	83 (8.9)
	20–24	65	3 (4.6)
	25–29	8	1 (12.5)
	Missing	105	8 (7.6)
Number of partners in the last year†			
	None	19	0 (0)
	1	512	38 (7.4)
	2–4	710	76 (10.7)
	5–9	154	18 (11.7)
	10–15	24	7 (29.2)
	≥16	14	3 (21.4)
	Missing	92	7 (7.6)
New partner within past 3 months			
	No	826	70 (8.5)
	Yes	606	72 (11.9)
	Missing	93	7 (7.5)
>1 partner last 3 months			
	No	1052	95 (9.0)
	Yes	371	47 (12.7)
	Missing	102	7 (6.9)
Current sex within past 3 months			
	No	138	18 (13.0)
	Yes	1296	123 (9.5)

Risk factor	Characteristic	N	*Trichomonas vaginalis* prevalence (%)
	Missing	91	8 (8.8)
Partner's Sex			
	Males only	1320	124 (9.4)
	Females only	38	3 (7.9)
	Males and females	101	16 (15.8)
	Missing	66	6 (9.1)
Vaginal sex			
	No	13	1 (7.7)
	Yes	1423	141 (9.9)
	Missing	89	7 (7.9)
Oral sex			
	No	412	47 (11.4)
	Yes	1029	95 (9.2)
	Missing	84	7 (8.3)
Anal sex			
	No	1215	127 (10.5)
	Yes	227	15 (6.6)
	Missing	83	7 (8.4)
Condom use with vaginal sex[†]			
	Always	188	8 (4.3)
	Most of the time	536	59 (11.0)
	Some of the time	378	45 (11.9)
	Never	330	29 (8.8)
	Missing	93	8 (8.6)
Condom use with oral or anal sex			
	Always	101	10 (9.9)
	Most of the time	143	15 (10.5)
	Some of the time	208	20 (9.6)
	Never	731	69 (9.4)
	Missing	342	35 (10.2)
Ever tested for STI[‡]			
	No	341	27 (7.9)
	Yes	1105	117 (10.6)
	Don't know	15	0 (0)
	Missing	64	5 (7.8)
Ever treated for STI[‡]			
	No	626	49 (7.8)
	Yes	809	93 (11.5)
	Don't know	15	1 (6.7)
	Missing	75	6 (8.0)

Risk factor	Characteristic	N	*Trichomonas vaginalis* prevalence (%)
Partner had STI†‡			
	No	392	24 (6.1)
	Yes	290	34 (11.7)
	Don't know	769	85 (11.1)
	Missing	74	6 (8.1)
Having Trichomoniasis in the past†			
	No	1276	110 (8.6)
	Yes	249	39 (15.7)
Having STI in the past†‡			
	No	713	56 (7.9)
	Yes	812	93 (11.5)
Drink before sex			
	No	611	55 (9.0)
	Yes	845	87 (10.3)
	Missing	69	7 (10.1)

† $p<0.05$

‡ Sexually Transmitted Infection

Table 3

Multivariable logistic regression of *Trichomonas vaginalis* infection status on risk factors for infection in women who participated in Internet-based screening program (N=1222).

Variables	Characteristic	Adjusted OR (95% CI) *
Age		
	14–19 years	0.80 (0.43 – 1.46)
	20–24 years	0.62 (0.36 – 1.07)
	25–29 years	1.18 (0.64 – 2.17)
	≥ 30 years	1.00
Race		
	African American†	2.69 (1.71 – 4.23)
	Caucasian, Asian, and Other	1.00
State		
	Illinois†	3.85 (1.52 – 9.72)
	Maryland (including Baltimore), Denver	1.25 (0.57 – 2.74)
	West Virginia, District of Columbia, Other	1.00
Health insurance		
	Without†	1.57 (1.06 – 2.35)
	With	1.00
Education		
	Without Bachelor Degree†	5.53 (2.18 – 14.00)
	With Bachelor Degree	1.00
Number of partners in the past year		
	0–1	1.00
	2–15†	1.60 (1.03 – 2.51)
	≥ 16†	3.51 (1.30 – 9.47)
Bisexual		
	Yes†	2.00 (1.05 – 3.80)
	No	1.00
Condom use during vaginal sex		
	Most of the time, Some of the time, or Never†	3.04 (1.35 – 6.85)
	Always	1.00
Partner had STI‡		
	Yes†	1.71 (1.02 – 2.86)
	No	1.00

* Adjusted for all other listed risk factors

† $p<0.05$

‡ Sexually Transmitted Infection