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Can E-Technology Through the Internet be Used as a New Tool to Address the *Chlamydia trachomatis* Epidemic by Home Sampling and Vaginal Swabs?

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The Internet provides patients, as well as clinicians with immediate, confidential access to information about sexually transmitted diseases (STDs).^{1,2} Young individuals are avid users of the Internet and usage has been considered to be a risk factor for STDs.^{3–7} Data indicate that there are 246,402,574 North American Internet users.⁸

It is logical to link Internet educational sexual health material to self-screening tests for STDs and partner notification.⁹ We implemented an Internet educational website www.iwantthekit.org, which offered women free collection kits for self-collected vaginal samples with mailing to a laboratory for chlamydia and gonorrhea testing.¹⁰ Focus group research guided this program.¹¹ Over 1200 women have now used this program; we report new data and confirm earlier findings about the characteristics of women who used www.iwantthekit.org.

The Internet program was open initially to women in Maryland.¹⁰ (Washington, DC and West Virginia) were added in 2005 or 2006. The program was Institutional Review Board approved, and was advertised by radio, flyers, and magazines. Since 2005, 97.1% have used the Internet to request kits, and 2.9% used the toll free number. From July 2004 to May 2008, 1203 women mailed self-collected vaginal swabs for testing.

The kit included contact and consent forms, instructions, swab, and questionnaire. Later, new questions were added about education, insurance, and income. Swabs were tested for chlamydia and gonorrhea by commercial nucleic acid amplification tests.¹⁰ In 2006, nucleic acid amplification testing for trichomonas was added. Treatment was previously described.^{10,12}

Chi square tests were performed for univariate analysis, and logistic regression was performed using SAS version 9.1 (Cary, NC). $P \leq 0.05$ was considered significant. Variables significant in univariate logistic regression analysis and other variables considered important were entered into a multiple logistic regression model.

Overall, 3774 kits were requested and 32.4% were returned; kits returned for 2008 was 40.1%. Of 1203 participants, 64.0% were black, 28.2% were white, and 7.8% listed “other races,” multiple races, or ethnicities. Median age was 23 years (range, 14 – 63). Chlamydia

prevalence was 9.1%, by age group, 0.8% were age 14 years, all uninfected; 25.8% were 15 to 19 years (15.3% infected), 33.2% were 20 to 24 years (11.1% infected), 18.6% were 25 to 29 years (6.8% infected), and 21.8% were ≥ 30 years (1.2% infected). Prevalence was 11.1% for black, 9.7% for "Other," and 3.3% for white race. Prevalence varied: 10.2% for 2004, 6.4% for 2005, 9.5% for 2006, 9.5% for 2007, and 8.7% for 2008 ($P = 0.824$).

Of participants, 40.9% were from Baltimore, 49.1% were from other Maryland jurisdictions, 3.6% were from Washington, DC, and 4.6% were from West Virginia. Prevalence for Baltimore (10.1%) was higher than Maryland (9.5%), WA (4.7%), and West Virginia (3.7%). Approximately 40% of women called for results, while ~60% were contacted.

Although 2.1% of women reported no partners in the previous year, 38.7% had 1 partner, whereas 45.2% had 2 to 4 partners, 11.3% reported 5 to 9, 1.8% reported 10 to 15, and 0.9% reported >16 partners. Male partners were reported by 91.7%, female partners by 1.8%, and both sexes by 6.5%. Women reported high risk behavior: 38.6% and 59.2% having new or multiple partners, respectively, in last 90 days; 13.0% used condoms consistently; 79.3% reported oral sex, 31.2% reported anal sex, and 52.1% reported drinking before sex. Nonconsensual sex was reported by 22.5%. Most women (69.6%) reported a pelvic examination within the year; 3.1% reported a history of pelvic inflammatory disease (PID). Previous STDs were common, with 55.0% reporting a STD history and 39.5% having had chlamydia.

Overall, 62.2% reported ≥ 1 symptom, which was associated with chlamydia ($P = 0.02$). Discharge (47.8%) was associated with chlamydia ($P = 0.02$). Also associated with chlamydia was pain during intercourse (15.4%) ($P = 0.08$) and abnormal vaginal bleeding (6.9%), ($P = 0.01$). Neither lower abdominal pain (17.2%) ($P = 0.73$) nor pain during urination (6.1%) ($P = 0.13$) was chlamydia associated. Of chlamydia infected women, 96.5% were treated; 1.3% of the women were gonorrhea infected; all were treated. Of trichomonas tests for 496 women, 7.5% were positive; all were treated. Questions about socioeconomic status were available for 562 women; 42.7% reported high school education, 62.6% had insurance, and most incomes were \$10,000 to 50,000 (Table 1).

Results of the logistic regression Unversmodel indicated that factors independently associated with being chlamydia positive included age <25 years. (OR: 3.4), black race (OR: 3.4), and new partner (OR: 1.7) (Table 2). Almost 91% preferred to collect a their own specimen and 94.5% thought the swab was safe (Table 3). For sampling, 48.8% preferred vaginal swab, 11.5% preferred swab or urine, and 20.7% preferred pelvic exams. For collection ease, 96.7% rated collection easy/very easy (Table 3), 91.7% stated they would use the Internet program again, and by questionnaire 10.6% had used it previously (Table 3). Many participants found the program by "surfing-the-Internet" (30.1%), while 34.4% heard it by radio (Table 3). Preference for receiving results ($N = 1179$) included: 35.5%, e-mail; 9.8%, Internet; 32.0%, US mail; 32.7%, an 800 number; and 32.7%, listed phone call (>1 answer possible). Website data indicated from January to May, 2008, there were an average of 499,248 "hits"/month, with "sessions" averaging 3043/month, or ~100 sessions/d. Educational STD pages have been added to the website, including gonorrhea, trichomonas, human papillomavirus (HPV), herpes simplex-2 virus (HSV2), syphilis, bacterial vaginosis, and HIV.

Similar to our earlier manuscript,¹⁰ this report of the expanded Internet program continues to support the concept of an educational STD website that encourages self sampling at home and sending specimens to a laboratory. Prevalence was high for young women: for those <20 years, 15.3% were chlamydia infected. The program attracted young women; 59% were <25 years and $>77\%$ were <30 years. Young women often report fear of doctors and pelvic

examinations, concerns with privacy, stigma, and embarrassment at attending STD clinics¹³⁻¹⁵ may not seek care for STDs,^{16,17} or not know of chlamydia screening recommendations for sexually active young women. Provision of a confidential home collection method, may augment routine clinical care for chlamydia. Almost all women used Internet-linked e-mail to request a kit, supporting a preference for “Internet ordering,” in concert with the comfort of young adults with the Internet. The addition of more website STD educational pages may further enhance knowledge of participants about increasing rates of several STDs.

Self-collected vaginal swabs for the diagnosis of chlamydia are accurate, acceptable, and their use has been sanctioned by policy makers.¹⁸⁻²⁸ Our findings support the premise that self-collected vaginal swabs are acceptable to women. This study found that previously demonstrated risk factors for chlamydia, such as race, age, and new partners, remained significant characteristics of Internet users as well.²⁹⁻³³ More than half of women reported a previous STD, but viral infections (HSV2 and HPV) were reported less frequently. This may be because screening for HSV and HPV is not routinely performed, however research has indicated these viral infections are highly prevalent.^{34,35} Interestingly, 2.1% reported being HIV-positive.

Since previous chlamydia infection is associated with increased risk of being reinfected,^{36,37} Centers for Disease Control and Prevention recommends rescreening of previously infected women.^{12,38} This recommendation could be accomplished by Internet-recruitment of previously infected individuals using automated Internet e-mail reminders. In our data, more than 10% of 348 women reported reuse of this website, supporting this concept, but validation is required.

Income and insurance coverage information may indicate that it is not lack of financial support that motivates women to seek nonclinic testing, but rather issues of privacy and stigma.^{11,36} Many women indicated that e-mail was a preferred method for receiving results; US mail and phone were commonly listed, thus indicating several methods were acceptable. Funding could allow cost-saving Internet reporting by secure password protection, especially for negative results (majority). Many women learned of the website from a popular radio station, recommended by our focus groups.¹¹ Other ways for finding the website included “surfing the web” (30%), whereas 12% reported being told by a friend, indicating important tools for effective health communications.

Limitations to this study exist. Since all information was self-reported, there is possibility of recall bias and lack of veracity. Submission of samples was self-motivated, and women may have participated because of symptoms, rather than after learning about the asymptomatic nature of chlamydia, and thus, the prevalence may be overestimated. However, the fact that women would submit vaginal swabs via Internet recruitment merits further study. We recommend that Internet recruitment be extended to other areas of the country in order to validate our results. The limitation of having to call or contact approximately 60% of the women with their results and nonreturned kits raises a cost issue. A cost analysis is planned and could point the way for web implementation methods that might be more cost-effective.

Women exhibited high acceptability and high prevalence. Taking advantage of expanding services offered by the Internet with home collection may provide new outreach screening tools. Even home-testing for chlamydia with point-of-care-tests may be within our reach. Focus groups have indicated the need to “normalize” chlamydia testing, favoring home testing.^{11,13,36} Translational research could identify ways to better implement this type of program into public health practice and into wider geographical areas.

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TABLE 1

Socioeconomic Characteristics of 562 users of the Internet/Self-Administered Vaginal Swabs (SAS) Program

Characteristic	Total n (%)	Infected n (%)	Uninfected n (%)	P
Household income (\$/yr)				
<21 yr old	158			
<\$10,000	44 (27.9%)	9 (20.4%)	35 (79.6%)	0.86
=\$10,000–50,000	78 (49.4%)	12 (15.4%)	66 (84.6%)	
=\$50,000–100,000	29 (18.4%)	6 (20.7%)	23 (79.3%)	
>\$100,000	7 (4.4%)	1 (14.3%)	6 (85.7%)	
Individual income(\$/yr)				
>21 yr old	384			0.32
<\$10,000	108 (28.1%)	9 (8.3%)	99 (91.7%)	
<\$10,000–50,000	238 (62.0%)	14 (5.9%)	224 (94.1%)	
<\$50,000–100,000	33 (8.6%)	0 (0.0%)	33 (100.0%)	
>\$100,000	5 (1.3%)	0 (0.0%)	5 (100.00)	
Health insurance				
Yes	344 (61.9%)	29 (54.7%)	315 (62.6%)	0.26
No	212 (38.1%)	24 (45.3%)	188 (37.4%)	
Medicaid eligible				
Yes	58 (10.5%)	6 (10.3%)	52 (89.7%)	0.006
No	278 (50.4%)	18 (6.5%)	260 (93.5%)	
Not sure	216 (39.1%)	33 (15.3%)	183 (84.7%)	
Education				
<High school	33 (5.9%)	9 (27.3%)	24 (72.7%)	0.004
=High school	240 (42.7%)	26 (10.8%)	214 (89.2%)	
>High school	289 (51.4%)	22 (7.6%)	267 (92.4%)	

TABLE 2Multivariate Logistic Regression Analysis of Factors Associated With *Chlamydia trachomatis* Infection

Risk Factor	Multivariate 1 (n = 992)* OR (95% CI)
Age <25 vs. ≥25 yr	3.4 (1.9, 6.4)
Black race vs. white	3.4 (1.9, 5.9)
New partner	1.7 (1.1, 2.5)

* Variables included in the Model: race, age, multiple partners, new partners, prior CT, oral/anal sex, birth control, nonconsensual sex, interactions of race with birth control, oral sex, and multiple partners. Hosmer-Lemeshow Goodness of fit test = 0.54.

TABLE 3

Preference of Use of the Internet/Self-Administered Vaginal Swabs (SAS) Program and Use Profiles From 1203 SAS Users

Question	Answers n/N* (%)
Would you like to collect your own specimen?	
Yes	1056/1162 (90.9%)
No	105/1162 (9.0%)
Not sure	1/1162 (0.1%)
What sampling method you prefer?	
Pelvic exam by doctor	241/1165 (20.7%)
Self-obtained vaginal swab	568/1165 (48.8%)
Collect own urine sample	88/1165 (7.6%)
Vaginal swab or urine	134/1165 (11.5%)
Other combination choices	134/1165 (11.4%)
Is SAS safe?	
Yes	1070/1132 (94.5%)
No	11/1132 (1.0%)
Not sure	51/1132 (4.5%)
Would you use Internet/SAS again?	
Yes	1002/1093 (91.7%)
No	35/1093 (3.2%)
Not sure	56/1093 (5.1%)
How did you learn about this Internet program?	
Surfing the Internet	105/349 (30.1%)
Radio advertisement	120/349 (34.4%)
Saw a flyer somewhere	38/349 (10.9%)
Told by a friend	42/349 (12.0%)
Told by my sex partner	4/349 (1.2%)
Saw information on "myspace.com"	5/349 (1.4%)
Received an e-mail from "Dr. Meg"	1/349 (0.3%)
Other (TV, etc)	50/349 (14.3%)
Ease of collection of SAS	
Very easy/easy	1077/1114 (96.7%)
Very hard/hard	8/1114 (0.7%)
Not sure	29/1114 (2.6%)
Ease of understanding the instructions	
Very easy/easy	1095/1113 (98.4%)
Very hard/hard	4/1113 (0.4%)
Not sure	14/1113 (1.3%)
Have you ever used this program before this time?	
Yes	37/348 (10.6%)
Used 1 time	28/37 (75.7%)

Question	Answers n/N* (%)
Used 2–5 times	7/37 (18.9%)
Used >5 times	2/37 (5.4%)
No	311/348 (89.4%)

* Total responded to particular question.