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BRIEF REPORT

HIV Testing Among Patients Infected with *Neisseria gonorrhoeae*: STD Surveillance Network, United States, 2009–2010

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Abstract We used data from the STD Surveillance Network to estimate HIV testing among patients being tested or treated for gonorrhea. Of 1,845 gonorrhea-infected patients identified through nationally notifiable disease data, only 51% were tested for HIV when they were tested or treated for gonorrhea. Among the 10 geographic sites in this analysis, the percentage of patients tested for HIV ranged from 22–63% for men and 20–79% for women. Nearly 33% of the un-tested patients had never been previously HIV-tested. STD clinic patients were more likely to be HIV-tested than those in other practice settings.

Keywords HIV testing · *Neisseria gonorrhoeae*

Introduction

Thirty years into the HIV/AIDS epidemic, approximately 21% of the 1.1 million HIV-positive persons in the U.S. do not know they are infected [1]. Early HIV diagnosis and treatment improves patient outcomes [2] and reduces on-going HIV transmission through suppression of viral load and decreased risk behavior [3, 4].

People infected with gonorrhea may have increased risk for HIV infection due to risk behavior and biologic facilitation of HIV transmission [5, 6]. Substantially higher HIV prevalence is observed in sexually transmitted disease (STD) clinics compared to other practice settings providing HIV testing [7]. In 2006, the Centers for Disease Control and

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Prevention (CDC) recommended that all patients seeking treatment for STDs be screened routinely for HIV [8].

Previous research indicates the proportion of patients with STDs who are tested for HIV is sub-optimal. Studies utilizing claims data from commercially insured patients indicate only 28–33% of those screened or diagnosed for STDs were tested for HIV [9, 10]. This percentage may be somewhat higher in STD clinics, where studies indicate 56–61% of STD clinic patients are tested for HIV [7, 11].

To date, no study has examined HIV testing among patients diagnosed with STDs across a full range of practice settings. In this analysis, we examine what proportion of patients identified through notifiable disease reporting data are tested for HIV concurrently with gonorrhea diagnosis or treatment. We compare HIV testing rates by practice setting. In-depth demographic and behavioral information on patients infected with gonorrhea are not collected as part of notifiable disease surveillance. Therefore, sentinel surveillance data are needed to examine this question.

Methods

Data are drawn from the STD Surveillance Network (SSuN), a sentinel surveillance system comprised of 12 state and local STD programs following common protocols for data collection and management [12]. Patients are randomly selected from laboratory-confirmed cases reported by providers or laboratories to health departments. Interviewers collect detailed demographic, behavioral, and health care information. Interviews are conducted as soon as possible after a case is reported; 41% of the patients in the present study were interviewed within 30 days of their positive gonorrhea test, while 92% were interviewed within 60 days.

Data from ten SSuN sites contained sufficient interview data to be included in the analysis. Five sites are located in state health departments, while the other five are located in independently-funded city project areas. California has both a state project site and a city project site (San Francisco). San Francisco is a separate STD project area from the State of California; they receive independent funding and conduct independent surveillance. Therefore, California's data are analyzed exclusive of San Francisco's.

During January, 2009–June, 2010, there were 68,974 gonorrhea cases reported across the ten jurisdictions. Of these, 6,628 (10%), were randomly selected for interview. Interviewers achieved a 52% response rate, reaching 3,432 patients. We excluded 1,490 patients missing data on HIV testing or key characteristics of interest and an additional 97 patients who reported previously testing HIV-positive. The analytic sample included 1,845 patients. Using variables available in national surveillance case report data—age, race/ethnicity, and provider type—we performed a sensitivity analysis comparing all gonorrhea cases reported to participating jurisdictions to patients included in the present analysis.

Each patient's self-reported date of last HIV test was matched with the gonorrhea testing or treatment date indicated by health providers in case reports. Concurrent HIV testing was defined as testing within one month of either gonorrhea testing or treatment. Prevalence of concurrent HIV testing was compared by study site, demographic characteristics, gender of sex partners, and practice setting of diagnosis. Chi-square tests for independence were used to assess statistical differences.

We then constructed multivariate log binomial models to estimate adjusted prevalence ratios for HIV testing and patient characteristics. Models were estimated separately for men and women. Both men's and women's models included SSuN site, age, race/ethnicity, and provider type; the men's model also included gender of sex partner. Last, we examined whether patients who were not HIV tested at the time of gonorrhea diagnosis or treatment had ever previously been tested for HIV. We tabulated time since last HIV test for patients who had been previously HIV tested in the following categories: 2–6, 7–12, and 13+ months.

Results

Table 1 shows the percentage of gonorrhea patients tested for HIV by sex and other patient characteristics. Overall, approximately 51% of both men and women were tested for HIV concurrently with gonorrhea testing or treatment, and 49% were not tested for HIV at this time. The range of patients tested for HIV by SSuN site was 22–63% for men and 20–79% for women. The percentage of patients tested for HIV differed significantly by SSuN site for men ($\chi^2 = 43.03$, $p < 0.01$) and for women ($\chi^2 = 36.66$, $p < 0.01$). Men were most likely to be tested for HIV in Alabama (60%), Chicago (63%), and New York City (62%), and least likely to be tested in San Francisco (22%). Women were most likely to be tested in Chicago (79%), followed by Baltimore (60%), New York City (58%), and Philadelphia (56%). Women were also least likely to be tested in San Francisco (20%).

We compared the proportion of patients with gonorrhea who reported concurrent HIV testing at diagnosis or treatment by age, race/ethnicity, and gender of sex partners. Analyses were stratified by sex (Table 1). Among men, the proportion tested for HIV differed by age and gender of sex partners, but did not differ by race/ethnicity. Men younger than 25 years old were more likely than older

Table 1 Percentage of gonorrhea patients tested for HIV by sex and other characteristics

	Men ($N = 918$)				Women ($N = 927$)			
	% (N)	95% confidence interval	χ^2 test statistic	p value	% (N)	95% confidence interval	χ^2 test statistic	p value
SSuN site			43.03	<0.01			36.66	<0.01
Alabama	60.0 (35)	43.8–76.2			37.3 (67)	25.7–48.9		
Baltimore	39.7 (73)	28.5–51.9			60.2 (103)	50.7–69.7		
California	57.0 (193)	50.0–64.0			46.3 (177)	39.0–53.7		
Chicago	62.5 (16)	38.8–86.2			79.4 (34)	65.8–93.0		
Colorado	53.2 (111)	43.9–62.4			49.5 (103)	39.9–59.2		
Connecticut	49.4 (83)	38.6–60.1			48.1 (106)	38.6–57.6		
New York City	61.5 (109)	52.3–70.6			58.2 (91)	48.1–68.4		
Philadelphia	55.4 (159)	47.6–63.1			56.3 (158)	48.6–64.1		
San Francisco	22.2 (81)	13.2–31.3			20.0 (10)	2.5–55.6		
Washington	43.1 (58)	30.4–56.8			33.3 (78)	22.9–43.8		
Age			3.84	0.05			0.23	0.63
15–24 years	54.4 (428)	49.7–59.2			51.0 (661)	47.2–54.9		
25+ years	48.0 (490)	43.5–52.4			49.3 (266)	43.2–55.3		
Race/ethnicity			1.47	0.48			11.85	<0.01
Black	50.3 (481)	45.8–54.8			52.6 (586)	48.5–56.6		
White	48.7 (199)	41.8–55.7			35.8 (120)	27.3–44.4		
Hispanic/other	54.2 (238)	47.9–60.5			52.9 (221)	46.4–59.5		
Gender of sex partners			5.12	0.02				–
MSW	48.1 (572)	44.0–52.2			–	–		
MSM	55.8 (346)	50.6–61.0			–	–		
Provider type			40.67	<0.01			34.37	<0.01
STD clinic	58.0 (409)	53.2–62.7			70.9 (141)	63.4–78.4		
ER/hospital	26.7 (135)	19.2–34.1			42.9 (205)	36.2–49.7		
Private outpatient	54.6 (132)	46.1–63.0			42.9 (182)	35.7–50.1		
Public outpatient	49.5 (91)	39.2–59.7			55.8 (120)	47.0–64.7		
Family planning	52.1 (73)	40.6–63.5			48.6 (222)	42.1–55.2		
Other	51.3 (78)	40.2–62.4			47.4 (57)	34.0–61.0		
Total	51.0 (918)	47.8–54.2			50.5 (927)	47.3–53.7		

men to be HIV tested ($\chi^2 = 3.84$, $p = 0.05$). Nearly 56% of men who have sex with men (MSM) were tested for HIV compared to 48% of men who have sex exclusively with women (MSW) ($\chi^2 = 5.12$, $p = 0.02$). Conversely, among women, significant differences in testing were observed by race/ethnicity. Only 36% of white women were tested for HIV, compared to 53% of either black or Hispanic/other women ($\chi^2 = 11.85$, $p < 0.01$).

Table 1 also shows the percentage of gonorrhea patients tested for HIV by practice setting. The percentage of patients tested for HIV differed by practice setting for both men ($\chi^2 = 40.67$, $p < 0.01$) and women ($\chi^2 = 34.37$, $p < 0.01$). In categorical STD clinics, 58% of men were tested for HIV. The percentage tested was similar in other practice settings, with the exception of emergency rooms/hospitals, where only 27% of men were HIV tested. Women were more likely to be tested for HIV in STD clinics (71%) than in all other settings. Only 43% of women were HIV tested in both emergency rooms/hospitals and private outpatient settings, while 56% were tested in public outpatient settings, and 49% were tested in family planning facilities.

We assessed the degree to which race/ethnicity may confound the relationship between practice setting and HIV testing among women (not shown). Only 7% of white women were diagnosed with gonorrhea in categorical STD clinics, compared to 18% of black women and 13% of Hispanic women ($\chi^2 = 10.46$, $p < 0.01$). Women of every race were more likely to test for HIV in STD clinics than in other types of practice settings. However, the difference in

Table 2 Adjusted prevalence ratios from multivariate log binomial models of HIV testing on patient characteristics: male and female gonorrhea patients

	Men ($N = 918$)			Women ($N = 927$)		
	aPR	95% confidence interval	p value	aPR	95% confidence interval	p value
SSuN site						
New York City	1.00			1.00		
Alabama	0.88	0.65–1.18	0.39	0.63	0.45–0.90	0.01
Baltimore	0.66	0.48–0.91	<0.01	1.12	0.90–1.40	0.30
California	0.87	0.73–1.05	0.14	0.81	0.64–1.03	0.09
Chicago	0.99	0.66–1.49	0.98	1.24	0.97–1.58	0.08
Colorado	0.86	0.70–1.07	0.17	0.81	0.63–1.04	0.10
Connecticut	0.94	0.73–1.22	0.66	0.82	0.63–1.05	0.12
Philadelphia	0.87	0.72–1.06	0.17	1.02	0.82–1.26	0.89
San Francisco	0.31	0.20–0.47	<0.01	0.33	0.10–1.09	0.07
Washington	0.80	0.57–1.11	0.18	0.66	0.45–0.98	0.04
Age						
15–24 years	1.00			1.00		
25+ years	0.87	0.76–0.98	0.03	0.90	0.78–1.03	0.13
Race/ethnicity						
Black	1.00			1.00		
White	1.01	0.84–1.21	0.96	0.87	0.66–1.16	0.35
Hispanic/other	1.02	0.88–1.18	0.76	1.14	0.96–1.35	0.14
Gender of sex partners						
MSW	1.00			–	–	
MSM	1.22	1.07–1.40	<0.01	–	–	–
Provider type						
STD clinic	1.00			1.00		
ER/hospital	0.44	0.33–0.59	<0.01	0.60	0.49–0.72	<0.01
Private outpatient	0.87	0.72–1.04	0.13	0.68	0.56–0.82	<0.01
Public outpatient	0.82	0.66–1.03	0.09	0.77	0.64–0.92	<0.01
Family planning	0.83	0.65–1.06	0.13	0.75	0.63–0.90	<0.01
Other	0.94	0.75–1.17	0.56	0.67	0.51–0.88	<0.01

HIV testing by practice setting was statistically significant only for black women; 74% were tested for HIV in STD clinics compared to 48% in other practice settings ($\chi^2 = 23.39$, $p < 0.01$).

We also assessed the degree to which gender of sex partner may confound the relationship between practice setting and HIV testing. Among MSM in the analytic sample, 49% were diagnosed with gonorrhea in STD clinics, while only 42% of MSW were diagnosed in STD clinics ($\chi^2 = 4.71$, $p = 0.03$). Both MSM and MSW were more likely to be HIV tested in STD clinics than in other types of practice settings. However, this difference was statistically significant only among MSW, with 58% HIV tested in STD clinics compared to 41% in other practice settings ($\chi^2 = 16.72$, $p < 0.01$). Among MSM, 58% were tested for HIV in STD clinics compared to 54% in other settings ($\chi^2 = 0.47$, $p = 0.49$).

In order to explore potential confounding more comprehensively, we constructed a multivariate log binomial model of HIV testing on patient characteristics. Table 2 shows adjusted prevalence ratios from this model. Using New York City as the reference group due to stability of sample size and HIV testing, men in Baltimore were 34% less likely to be tested for HIV, while men in San Francisco were 69% less likely to be tested for HIV. Women in Alabama were 37% less likely to be tested for HIV than those in New York City, and those in Washington were 34% less likely to be tested. There were no other significant differences by SSuN site.

All of the other bivariate associations retained significance in the multivariate model, with the exception of race/ethnicity for women. Men were 56% less likely to be tested for HIV in ER/hospitals compared to STD clinics, but no other significant differences in testing by provider type

Table 3 HIV testing history among patients not tested for HIV at the time of gonorrhea testing or treatment

	All sites $N = 909$ (%)	San Francisco $N = 71$ (%)	Other SSuN sites $N = 838$ (%)	χ^2 test statistic	p value
Never tested	32.6	4.2	35.0	28.16	<0.01
	$N = 826$[a]	$N = 48$[b]	$N = 778$[c]		
Time since last HIV test				30.67	<0.01
Tested 2–6 months ago	39.0	62.5	37.5		
Tested 7–12 months ago	11.1	25.0	10.3		
Tested 13+ months ago	14.0	6.3	14.5		

[a] Could not ascertain number of months since last HIV test for 83 persons (9%)

[b] Could not ascertain number of months since last HIV test for 23 persons (32%)

[c] Could not ascertain number of months since last HIV test for 60 persons (7%)

were detected. On the other hand, women were significantly less likely to be tested in every other provider type compared to STD clinics.

Table 3 provides information on previous HIV testing for patients not tested concurrently with their most recent gonorrhea diagnosis. Nearly 33% of these 909 patients had never been previously tested for HIV, meaning 16% of all interviewed patients had never been tested for HIV. HIV testing history was significantly different in San Francisco compared to the other nine sites. In San Francisco, only 4% of patients who were not HIV tested at the time of their most recent gonorrhea diagnosis had never been previously HIV-tested, compared to 35% in other sites ($\chi^2 = 28.16$, $p < 0.01$). Additionally, more patients in San Francisco had been HIV tested in the previous 6 or 12 months compared to patients in other sites.

Last, using information available in case reports, we compared all gonorrhea cases reported to participating jurisdictions to those included in the analytic sample (not shown). Findings from this analysis suggest men in the analytic sample were slightly less likely to be black (52 vs. 57%) and more likely to be diagnosed in STD clinics (45 vs. 35%) than all men reported as gonorrhea cases. Women in the analytic sample were less likely to be black (63 vs. 69%) and slightly more likely to be diagnosed in STD clinics (15 vs. 12%) compared to all reported cases. The age distribution was nearly identical among interviewed patients compared to all gonorrhea case reports.

Discussion

Despite the recommendation that all patients seeking treatment for STDs should be tested for HIV, only 51% of gonorrhea patients were tested in this analytic sample. The proportion of gonorrhea patients tested for HIV was higher in categorical STD clinics than in other practice settings, particularly among women. However, most reported gonorrhea cases in the U.S. are not diagnosed in STD clinics. National case report data indicate that in 2009, nearly 78% of gonorrhea cases were reported from non-STD clinic practice settings [13].

Our study showed that San Francisco patients were less likely than those in other SSuN sites to test for HIV at the time of gonorrhea diagnosis or treatment. However, other studies show high HIV testing prevalence in San Francisco, particularly among MSM [11, 14]. One reason for the large discrepancy between San Francisco and other SSuN sites in terms of HIV testing at the time of gonorrhea diagnosis or treatment is that patients in San Francisco were more likely than those in other sites to have tested for HIV in the 6 or 12 months preceding their gonorrhea diagnosis. Previous testing behavior notwithstanding, a gonorrhea diagnosis indicates current sexual risk and necessitates a new HIV test.

This analysis has limitations and strengths. We relied on self-reported HIV testing, and patients may not have known when they were last tested for HIV. Additionally, these data do not indicate why so few gonorrhea patients were tested for HIV. It is possible that providers did not offer or encourage HIV testing, but it is also possible that patients preferred not to test at the time of their gonorrhea diagnosis.

Findings may be subject to bias due to interview non-response and missing data. For example, patients tested for HIV at the time of their recent gonorrhea diagnosis may have been more likely than those not recently tested for HIV to report when they were last tested, and thus also more likely to be included in the analytic sample. However, findings from the sensitivity analysis suggest demographic differences between patients included in the analytic sample and all gonorrhea case reports are minimal.

Patients in our sample were slightly more likely to be diagnosed in an STD clinic versus another type of facility. If patients tested in STD clinics were more likely to be HIV tested than those seeking care in other facility types, 51%

may be an overestimate of HIV testing. Though these findings are not nationally generalizable, the SSuN sites are geographically diverse and include major metropolitan areas. Interviewed patients in this study were randomly selected from all case reports and are not limited to patients of a particular practice setting or insurance type.

Conclusions

HIV testing is critical for linking HIV-positive individuals to care and controlling disease transmission. Patients diagnosed with gonorrhea and other STDs have known HIV risk, even if they were recently HIV tested. Given expanded funding for HIV testing under the Affordable Care Act [15] and existing interventions for increasing HIV testing in STD clinics [16, 17], increased testing coverage for patients with STDs is feasible and urgently needed. Additionally, it is critical to continuously monitor HIV testing rates among persons infected with STDs and other high risk groups.

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