Undiagnosed HIV Infection Among New York City Jail Entrants, 2006: Results of a Blinded Serosurvey

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Objective: Since 2004, when all New York City jail entrants began being offered rapid testing at medical intake, HIV testing has increased 4-fold. To guide further service improvement, we determined HIV prevalence among jail entrants, including proportion undiagnosed.

Methods: Remnant serum from routine syphilis screening was salvaged for blinded HIV testing in 2006. Using HIV surveillance data and electronic clinical data, we ascertained previously diagnosed HIV infections before permanently removing identifiers. We defined "undiagnosed" as HIV-infected entrants who were unreported to surveillance and denied HIV infection.

Results: Among the 6411 jail entrants tested (68.9% of admissions), HIV prevalence was 5.2% overall (males 4.7%; females: 9.8%). Adjusting for those not in the serosurvey, estimated seroprevalence is 8.7% overall (6.5% males, 14% females). Overall, 28.1% of HIV infections identified in the serosurvey were undiagnosed at jail entry; only 11.5% of these were diagnosed during routine jail testing. Few (11.1%) of the undiagnosed inmates reported injection drug use or being men who have sex with men.

Conclusions: About 5%–9% of New York City jail entrants are HIV infected. Of the infected, 28% are undiagnosed; most of whom denied recognized HIV risk factors. To increase inmate's acceptance of routine testing, we are working to eliminate the required separate written consent for HIV testing to allow implementation of the Centers for Disease Control and Prevention–recommended opt out testing model.

INTRODUCTION

Identification of undiagnosed persons with HIV infection is a cornerstone of the Centers for Disease Control and Prevention's (CDC) approach to controlling the HIV epidemic in the United States[1–2] based on evidence that those who are aware of their HIV status reduce transmission risk behaviors by about half compared with the undiagnosed.[3] Although CDC has only recently advocated for routine testing in all medical settings,[1] they have called for routine HIV testing in correctional settings for over a decade because of the substantially higher HIV prevalence among inmates compared with the nonincarcerated.[4–5]

In New York City, elevated HIV seroprevalence in the large city-run jail system has been well characterized through blinded HIV serosurveys,[6–7] that is, studies that involve HIV testing of deidentified remnant serum drawn for routine clinical purposes, such as syphilis testing. In 6 serosurveys during 1989–1998, seroprevalence in New York City jails decreased in males from a high of 16.2% in 1989 to 7.6% in 1998 and from 25.1% in 1989 to 18.1% in 1998 among females.[6–7] However, the proportion of HIV-infected inmates who were unaware of their serostatus has never been assessed. CDC estimates that 21% of persons with HIV are undiagnosed nationwide.[8] In New York City, population-based estimates of the proportion of HIV-infected persons who are undiagnosed have ranged from 5%, with a wide 95% confidence interval (CI) of 0.7%–29.9% from a 2006 blinded serosurvey of noninstitutionalized New Yorkers,[9] to 12%–29% based on calculated estimates of the undiagnosed using census, research, and surveillance data.[10]

Since the last jail serosurvey in 1998, named HIV reporting has been implemented and New York City's jail HIV testing program has been dramatically expanded. In March 2004, New York City's Department of Health and Mental Hygiene (DOHMH) began to routinely offer voluntary rapid HIV testing to all city jail entrants during medical intake. Because of the New York State requirements, a true opt out testing model[1,5] was not introduced because a separate written consent was and is still necessary for each HIV test. Annual jail testing volume increased from 6500 tests in 2003 to 25,000 tests in 2006. Rapid testing technology also allowed more inmates to get their results before release.

To guide further service improvement, DOHMH conducted a blinded serosurvey of New York City jail entrants to determine current HIV prevalence and to estimate the proportion of HIV-infected jail entrants who have not previously been diagnosed.

METHODS

Study Population

New York City Department of Correction operates 11 correctional facilities/jails, including 9 Rikers Island facilities and 2 borough houses of detention. During 2006, there were 93,327 male admissions among 64,383 unique individuals and 11,896 female admissions among 8073 unique individuals. Average daily jail census was 13,000–14,000 inmates. Median length of stay was 7 days; 25% were released within 3 days (Dr. Farah Parvez, personal communication, June 2008).

DOHMH's Bureau of Correctional Health Services (CHS) coordinates all medical, mental health, and dental services for New York City jail inmates, including routine, voluntary health screening at intake. During the health screening referred to as "medical intake", which a part of the processing before housing inmates, nursing staff verbally offers HIV testing at the beginning of intake process. They document in the electronic medical record whether or not the patient consents to testing and have the patient sign the required written consent if they do consent. The test is conducted by nursing staff or a patient care associate. Results are provided during medical intake before the inmate moves on to the housing area. Negative results are provided by nursing staff. Positive results are provided by physicians. Syphilis testing is conducted on all inmates by the jail-based health care personnel conducting the medical intake process. This serosurvey was conducted using remnant serum specimens drawn for this routine universal syphilis testing.

All consecutive new admissions to New York City jails beginning in May 1, 2006, were eligible for inclusion in the sample. Sample targets were 4411 unique persons for men and 1791 for women (6202 overall). Sample size calculations were done separately for men and women to ensure adequate power to assess predictors within each sex, thus targets for women represent a greater proportion of the study sample than of all jail inmates. To reach target sample sizes, men's study period lasted through June 1, 2006 (31 days), and for women through August 13, 2006 (104 days).

Definitions

"Serosurvey testing" refers to blinded HIV testing conducted for this study on all inmates using remnant serum collected for routine syphilis testing. "Jail testing" refers to routine, voluntary HIV testing as part of medical care that inmates receive during their jail stay. "Diagnosed" HIV infection refers to persons with HIV-positive specimens during serosurvey testing and previous evidence of HIV diagnosis either from self-report at intake or from information in New York City's population-based HIV surveillance registry [HIV/AIDS Reporting System (HARS)]. "Undiagnosed" HIV infection refers to persons with HIV-positive specimens during serosurvey testing but no previous evidence of HIV diagnosis.

Sample Selection and Data Management

During the specimen collection period, New York City's Department of Correction provided DOHMH with a daily list of newly admitted jail inmates, including name, date of birth, sex, race, address, and admission facility. These records provided the basis for identifying eligible persons for the serosurvey and were linked to electronic data on remnant serum specimens provided from the syphilis-testing laboratory. This process established which admissions had specimens drawn for syphilis testing and which specimens had been exhausted during syphilis testing. Deduplication was conducted to ensure that all specimens were from unique individuals. If repeat specimens were available, an individual's earliest specimen was used.

We obtained electronic medical records for intake exams for all new jail admissions during the specimen collection period. These records contained medical history data, including self-reported HIV infection status and other disease history, medication, and treatment history (including history of treatment for mental health disorders), and selected HIV risk factors. This information was collected through a standardized medical intake questionnaire in which jail-based health care workers completed data elements based on their interview with the patient. Regarding drug use, the inmates were asked: "Do you use drugs?" and fields were provided to record which drugs: barbiturates, marijuana, crystal meth, crack, methadone, heroin, cocaine, other; and how much of each drug used. This intake also included a specific question regarding a history of violence: "Have you ever been charged with a violent act (rape, assault)?" Notably, this system documented whether inmates consented to HIV testing at intake but not whether they were actually tested. To determine which new admissions had tested positive for HIV through jail HIV testing, names of inmates testing positive during the specimen collection period were obtained through routine HIV reporting and linked with new admissions records.

Transmission risk categories were assigned based on the following risk factors: a history of injection drug use (IDU), men who have sex with men (MSM), and high-risk heterosexual behavior. For this analysis, persons reporting sex only with someone of the opposite sex who were also noted in the medical record to have reported "multiple partners", "unprotected sex", or a history of sexually transmitted disease diagnosis were classified as "high-risk" heterosexual. Men with both IDU and MSM risks were classified as injection drug users (IDUs). Otherwise, when more than 1 risk factor was reported, persons were classified using the CDC hierarchy of transmission categories.[11] Persons reporting none of the identified risks were reported classified as "no identified risk." Occupational exposure and perinatal exposure were not assessed but would be expected to be very rare in this population as they are in the general population.

Surveillance Registry Matching

Records for all new jail admissions were temporarily linked with HARS. Linkages were performed using a 32-match key hierarchy, consisting of components of first name, last name, date of birth, and when available, Social Security number. Exact matches of first name, last name, and date of

birth were automatically considered as true matches. All other potential matches were manually reviewed by 2 independent reviewers to determine if there was a true match. If 2 reviewers disagreed, a third made the final match determination.

The 6% of jail admissions with a non–New York City zip codes were included in the surveillance linkage process because HIV surveillance unit in New York City investigates and confirms all reports from New York City providers regardless of the residence of the reported patient (more than 7% of confirmed cases have a non–New York City residence), and most non–New York City jail admits (76%) were from adjoining states.

Deidentification of Data

After all data sources were obtained and combined, all new admissions in the sample were assigned a random identification number (ID). All other identifying information was deleted. Specimens were stripped of their previous laboratory accession number and relabeled with the corresponding study ID. All electronic and hardcopy documents linking the study ID to any patient identifiers were destroyed, leaving the study ID as a unique study identifier now unlinked to any personal identifying information. After this point, there was no way that investigators could relink inmates' identifying information with their subsequent serosurvey HIV test results. Blinded serosurveys are specifically allowed by law in New York State, and this study's protocol was approved by the DOHMH IRB (# 05-082) as exempt research.

Laboratory Testing

Once data and specimens were delinked from identifying data, specimens were HIV tested using Bio-Rad HIV-1/HIV-2 EIA plus "O" (Bio-Rad Laboratories, Hercules, CA), with reactive tests confirmed using Bio-Rad HIV-1 Western blot. HIV results were added to each corresponding record using the study ID to link records to HIV test results.

Data Analysis

We compared the distribution of demographic and HIV status variables between inmates who did or did not have specimens available for serosurvey testing using χ^2 analyses. HIV prevalence and 95% CIs were calculated both overall and for all demographic and risk strata after weighting by sex to account for female inmate oversampling. Weights were generated by dividing the sex ratio of all unique individuals in the city jail system in 2006 by the sex ratio of those who were included in this analysis. Prevalence calculation denominators included any inmate with positive or negative HIV serosurvey test results and excluded persons with indeterminate results. Unadjusted odds ratios with 95% CIs were calculated for all strata, based on logistic regression models weighted by sex. All available descriptive variables described above were included in univariate analyses. Factors significant at the $P < 0.20$ level in univariate testing were considered for inclusion in a multivariate logistic regression model using backward elimination to determine predictors of being HIV infected.

Using the same weighted modeling approach described above, we examined predictors of being HIV infected, but undiagnosed, among all inmates testing positive through serosurvey testing. In addition, to evaluate if a targeted approach to reoffering HIV testing after intake could be utilized to identify a substantial portion of the undiagnosed, we examined predictors of being HIV infected among all inmates who presented without evidence of HIV diagnosis (ie, "undiagnosed" HIV-infected inmates versus uninfected based on HIV serosurvey testing). To adjust for eligible inmates exclusion because of lack of remnant serum, true seroprevalence estimates for the entire jail entrant population were calculated by multiplying measured prevalence by the likelihood of being in HARS for all inmates divided by that in the serosurvey sample [ie, (proportion matching to HARS among all inmates/proportion matching to HARS among inmates with specimen for serosurvey testing) × (measured serosurvey seroprevalence)].

All analyses were initially conducted stratified by gender; but because stratified results did not identify any additional risk factors compared with combined results controlling for gender, we present combined overall results only. All analyses were performed using SAS 9.1 (SAS Institute, Cary, NC).
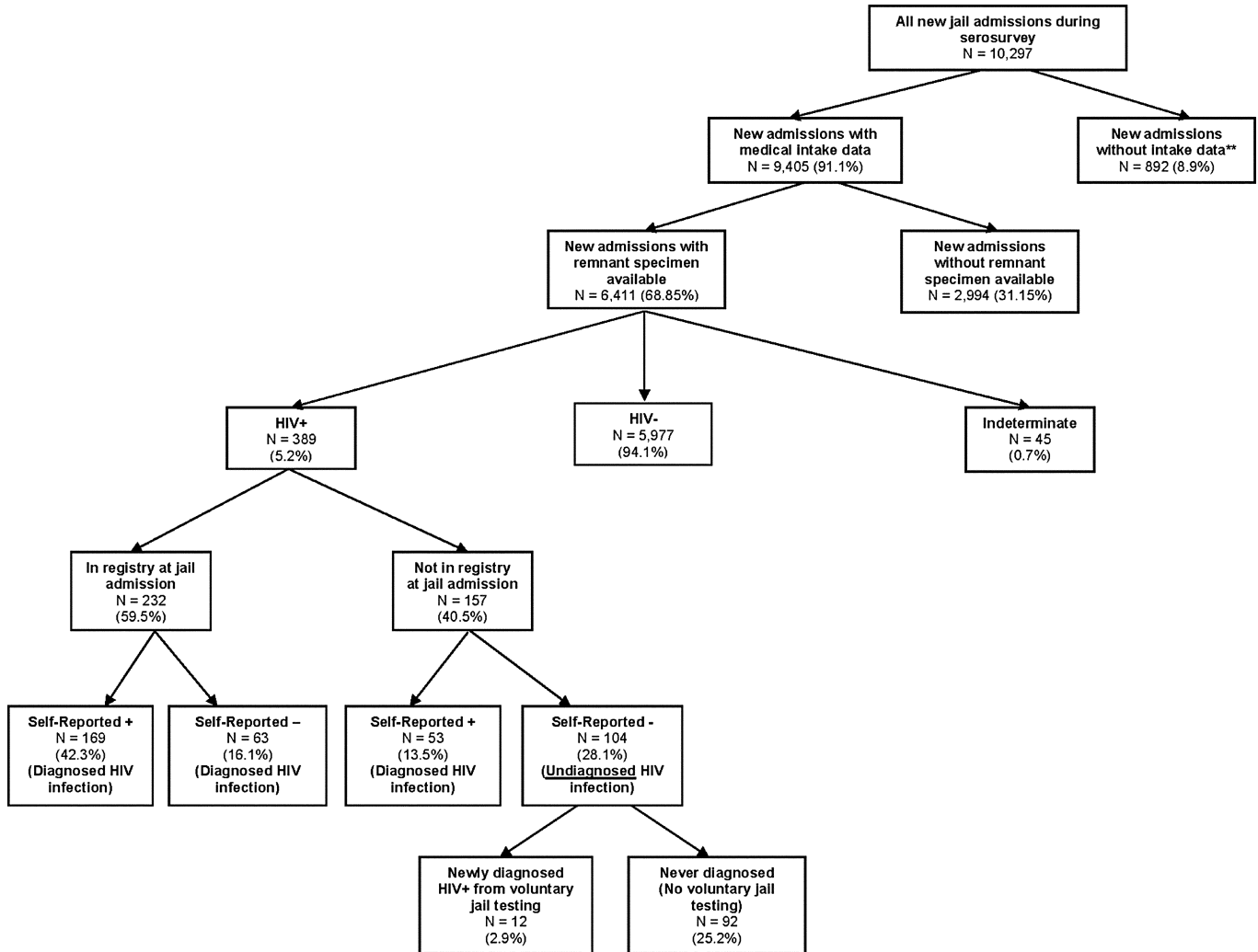
RESULTS

Overall Serosurvey Results

Of 10,297 inmates admitted during specimen collection, 9405 (91.1%) had record of a medical intake exam, and of these, 6411 (68.9%) had adequate remnant serum volume from routine syphilis testing for HIV serosurvey testing (Fig. 1). The most common reasons specimens were unavailable were (1) specimen drawn but exhausted during syphilis testing (51%), (2) inmate had medical intake screening but no sample drawn (24%), and (3) inmate admitted to jail system but either discharged or not available for medical intake (eg, left for court hearing) (23%).

Of 6411 specimens that were tested in the serosurvey, 389 (5.2%) tested HIV positive, 5977 (94.1%) tested HIV negative, and 45 had indeterminate results (0.7%). Only 7 of 5977 inmates who tested negative (0.11%) self-reported being HIV infected at intake. Among the 389 HIV-infected inmates, 232 (59.5%) were in HARS at jail admission. Of these, 169 (72.4%) self-reported as HIV infected and 63 (27.6%) did not. Among the 157 (40.5%) HIV-infected inmates not in HARS, 53 (32.4%) self-reported as HIV positive, and likely largely represent persons who were diagnosed but unreported to HARS. The remaining 104 of those not in HARS (28.1% of all HIV-positive inmates) did not self-report being HIV infected; we considered this group to have undiagnosed HIV infection at intake.

Comparison of Tested and Nontested New Admissions

Admissions with a specimen available (n = 6411) differed significantly with regard to race, age, and HIV risk factors (all $P < 0.001$) compared with new admissions without a specimen (n = 2994) (Table 1). Compared with those in the serosurvey sample, new admissions without a specimen were

FIGURE 1. 2006 New York City jail serosurvey specimen selection and results*. *Percentages weighted by sex based on study design. †46 of these 892 had specimens available for testing but no medical intake data, making a total of 6,457 with remnant serum available of the 10,297.

less likely to be black (55.3% vs. 58.2%, $P < 0.0001$); tended to be older (median age range: 35–39 years vs. 30–34 years, $P < 0.0001$); and were more likely to be IDUs (11.9% vs. 6.1%, $P < 0.0001$). Importantly, new admissions without a specimen were more likely to self-report being HIV infected (10.6% vs. 3.6%, $P < 0.001$) and be in HARS (9.3%, vs. 3.9%, $P < 0.001$). Only 1.0% of males reported a history of sex with another man, but this proportion was similar for those with or without a specimen (0.7% vs. 1.0%).

HIV Prevalence Based on Serosurvey Testing

HIV prevalence for all inmates in the serosurvey was 5.2%: 4.7% in men and 9.8% in women (Table 2). Adjusting our serosurvey prevalence to reflect all new admissions (those with and without remnant serum) based on proportion matching to HARS, the estimated true New York City inmate prevalence would be 8.7% overall (95% CI: 8.1% to 9.2%): 6.5% in males (95% CI: 6.0% to 7.1%) and 14% in females

(95% CI: 12.7% to 15.3%). Multivariate logistic regression found that female and black inmates, and those with medical insurance, were significantly more likely ($P < 0.05$) to be HIV infected than others in the serosurvey. Those reporting history of IDU, MSM sexual activity, syphilis, previous incarceration, a prior HIV test, and hepatitis C were also more likely ($P < 0.0001$) to be HIV infected. Odds of being HIV infected increased with age ($P < 0.0001$).

''Undiagnosed'' HIV Infection

Of the 389 persons who were identified as HIV infected by serosurvey testing, 104 (28.1%) appeared to have been not diagnosed at the time of their admission. Undiagnosed inmates were significantly less likely than other HIV-infected jail entrants to self-report previous HIV test [adjusted odds ratio (AOR) = 0.19; 95% CI: 0.08 to 0.45], history of mental health treatment (AOR = 0.25; 95% CI: 0.10 to 0.64), hepatitis C infection (AOR = 0.06; 95% CI: 0.01 to 0.47), and MSM

TABLE 1. Characteristics of Eligible New York City Jail Entrants in 2006 Serosurvey, by Availability of Specimens for Serosurvey HIV Testing (n = 9405)

	Admissions With Remnant Specimen Available		Admissions Without Remnant Specimen Available		
	n	%*	n	%*	P†
Total	6411	100.0	2994	100.0%	0.0001
Sex					
Male	4669	72.8	2066	69.0	—
Female	1742	27.2	928	31.0	—
Race/ethnicity					
Black	3730	58.2	1656	55.3	<0.0001
Hispanic	1997	31.1	917	30.6	
White	501	7.8	311	10.4	
Other/unknown	183	2.9	110	3.7	
Age group in yrs					
16–19	733	11.4	184	6.1	<0.0001
20–29	2020	31.5	826	27.6	
30–39	1632	25.5	801	26.8	
40–49	1615	25.2	883	29.5	
50–59	340	5.3	266	8.9	
60+	71	1.1	34	1.1	
Transmission risk factor					
MSM	47	0.7	31	1.0	0.13
Injection drug use history	390	6.1	356	11.9	<0.0001
High-risk heterosexual	2924	45.6	1159	38.7	<0.0001
No identified risk	3050	47.6	1448	48.4	0.48
Self-reported HIV status					
Positive	229	3.6	317	10.6	<0.0001
Negative or unknown	6182	96.4	2677	89.4	
Matched to HIV registry					
Yes	253	3.9	277	9.3	<0.0001
No	6158	96.1	2717	90.7	

*Weighted by sex based on study design.
†The P values for all comparisons based on χ^2 analysis.

sexual activity (AOR = 0.18; 95% CI: 0.04 to 0.82) (Table 3). Undiagnosed inmates were also younger than the diagnosed (AOR = 11.1 for 16–29 vs. 40–49 age group; 95% CI: 4.5 to 27.2).

Detection of Undiagnosed HIV Through Jail Testing

Of the 104 persons who appeared not to have been previously diagnosed, 32 (30.2%) consented to HIV testing at intake based on the electronic intake record. Of these, 12 were diagnosed by the serosurvey's end. Thus, of 104 previously undiagnosed, 12 (11.5%) were newly diagnosed by routine jail testing by the end of the serosurvey, independent of the serosurvey. Assuming the sample period is representative of the entire calendar year, we estimate that 820 persons (95% CI: 619 to 1021) enter the New York City jail system each year with a previously undiagnosed HIV infection. Of these, 743

(95% CI: 552 to 934) would potentially remain undiagnosed if testing conditions remain similar to the time of the serosurvey.

Should We Target Testing to Specific Entrants?

Just 13 (11.1%) of the 104 undiagnosed reported the well-established HIV risk factors of MSM or IDU activity and only an additional 41 (39.2%) reported a sexually transmitted disease history, unprotected sex, and/or multiple sex partners. We examined predictors of HIV infection among jail inmates who had no evidence of a previous HIV diagnosis at admission (n = 6126; ie, all HIV-negative entrants plus 104 undiagnosed HIV-positive entrants) (Table 4). Women (AOR = 1.7; 95% CI: 1.0 to 3.0) and self-reported MSM (AOR = 5.2; 95% CI: 1.7 to 15.9) were more likely to be HIV infected (Table 4). Younger persons were less likely to be HIV infected (16–29 compared with 40–49 years: AOR = 0.55; 95% CI: 0.32 to 0.92). However, only 31.2% of undiagnosed inmates had any of these 3 characteristics (ie, female sex, MSM, or age 40–49 years). Notably, those who were HIV infected were equally likely to consent to testing as those who were not HIV infected (30.2% vs. 31.8%, P = 0.75).

DISCUSSION

HIV prevalence among New York City jail entrants remains markedly elevated above the general population (~2.5–3.5 times as high for men and ~14–20 times as high for women) but appears to have decreased nearly by half since the last serosurvey in 1998. Importantly, >25% of HIV-infected jail entrants appear undiagnosed at admission. To our knowledge, this is the first jail serosurvey to estimate the proportion of HIV infections that are undiagnosed by linking to serosurvey results with HIV surveillance and electronic medical record data. Despite a 4-fold increase in jail testing, most undiagnosed infections still are not identified through routine, voluntary jail testing, largely because of the low acceptance of HIV testing (~30% consenting). Despite the fact that IDU and MSM continue to be at higher HIV risk than others, most undiagnosed (~90%) reported neither of these recognized HIV risk factor. This underscores the importance of increasing the proportion of inmates tested through the New York City jails' routine testing program rather than relying on a targeted testing approach based on self-reported risk factors. Implementation of a true opt out model without a separate written consent for each HIV test[1,5] when this becomes legally possible in New York State would likely result in a larger proportion of inmates learning their HIV status.

Compared with prior New York City jail serosurveys, HIV seroprevalence decreased in males from 7.6% in 1998 to 4.7% in 2006 and from 18.1% in 1998 to 9.8% among females. This likely, in part, mirrors the decrease in new diagnoses seen citywide during this period, particularly among intravenous drug users[12] and among correctional populations nationwide.[13] Despite decreases, jail prevalence remains markedly elevated above estimates for New York City's general population (1.9% for men and 0.7% for women[14]), particularly for women. This higher prevalence, which has been seen in other correctional serosurveys in the United States and elsewhere,[15] is likely attributable to a higher prevalence of

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TABLE 2. Predictors of Testing Positive for HIV Infection Among All New York City Jail Entrants in 2006 Serosurvey (n = 6411)

	Total Admissions (N)	HIV-Infected Admissions (n)	% HIV Positive*	Univariate Logistic Regression			Multivariate Logistic Regression		
				Odds Ratio	95% CI	*P*	Odds Ratio	95% CI	*P*
Total	6411	389	5.2	—	—	—	—	—	—
Sex									
Male	4669	218	4.7	1.00	Reference	—	1.00	Reference	—
Female	1742	171	9.8	2.22	(1.69 to 2.93)	<.0001	1.98	(1.47 to 2.68)	<0.0001
Race/ethnicity‡									
Black	3730	249	5.7	1.63	(1.05 to 2.52)	0.03	1.84	(1.13 to 3.00)	0.01
Hispanic	1997	111	4.9	1.38	(0.87 to 2.18)	0.17	1.38	(0.83 to 2.29)	0.21
White	501	26	4.4	1.00	Reference	—	1.00	Reference	—
Other/unknown	183	3	1.6	—	—	—	—	—	—
Age group in yrs§									
16–19	733	6	0.4	—	—	—	—	—	—
20–29	2020	44	1.9	0.16	(0.11 to 0.22)	<0.0001	0.24	(0.17 to 0.35)	<0.0001
30–39	1632	127	6.5	0.70	(0.54 to 0.92)	0.01	0.76	(0.57 to 1.00)	0.05
40–49	1615	164	9.1	1.00	Reference	—	1.00	Reference	—
50–59	340	41	12.4	1.33	(0.94 to 1.88)	0.10	1.25	(0.86 to 1.81)	0.24
60+	71	7	8.7	—	—	—	—	—	—
Transmission risk factor									
MSM	47	16	34.0	11.97	(7.05 to 20.33)	<0.0001	9.28	(5.10 to 16.89)	<0.0001
Injection drug use history	390	73	16.9	4.70	(3.34 to 6.63)	<0.0001	1.97	(1.30 to 2.98)	0.00
High-risk heterosexual	2924	158	4.6	1.16	(0.91 to 1.49)	0.24	1.03	(0.78 to 1.35)	0.86
No identified risk	3050	142	4.0	1.00	Reference	—	1.00	Reference	—
History of previous HIV test									
Yes	4626	351	6.6	3.77	(2.61 to 5.43)	<0.0001	2.70	(1.85 to 3.94)	<0.0001
No	1785	38	1.8	1.00	Reference	—	1.00	Reference	—
History of syphilis									
Yes	340	66	18.3	4.59	(3.30 to 6.38)	<0.0001	1.87	(1.27 to 2.75)	0.00
No	6071	323	4.7	1.00	Reference	—	1.00	Reference	—
History of incarceration									
Yes	4772	349	6.2	2.98	(2.08 to 4.27)	<0.0001	1.63	(1.11 to 2.39)	0.01
No	1639	40	2.2	1.00	Reference	—	1.00	Reference	—
Current medical insurance									
Yes	2564	210	7.3	1.90	(1.53 to 2.37)	<0.0001	1.44	(1.14 to 1.83)	0.00
No	3847	179	4.0	1.00	Reference	—	1.00	Reference	—
History of marijuana use									
Yes	803	24	2.4	0.41	(0.26 to 0.64)	<0.0001	0.60	(0.37 to 0.96)	0.03
No	5608	365	5.7	1.00	Reference	—	1.00	Reference	—
History of hepatitis C									
Yes	257	66	22.7	6.12	(4.40 to 8.49)	<0.0001	2.32	(1.55 to 3.47)	<0.0001
No	6154	323	4.6	1.00	Reference	—	1.00	Reference	—

*Weighted by sex based on study design.
†Also adjusting for borough of residence.
‡Other/unknown race grouped with white in regression analyses.
§For age, 16–19 and 20–29 grouped as 16–29, and 50–59, and 60+ grouped as 50+, in regression analyses.

risk factors among inmates, including intravenous drug use and sexually transmitted infections.[15]

As has been seen in other correctional serosurveys,[16] women were twice as likely to be HIV infected, but here we are able to document that, if infected, they were slightly less likely to be undiagnosed (23% undiagnosed vs. 29% for men), likely because of widespread prenatal testing. Women's disproportionately higher prevalence in our population is likely because a higher proportion of female inmates than men are jailed on drug-related crimes (DOHMH corrections report, Farah Parvez, MD, MPH; NYC Department of Health and Mental

Hygiene, unpublished data, 2010), placing them at higher HIV risk from either IDU or exchange sex (ie, trading sex for drugs/money) performed to support their drug use. Along these lines, a history of drug use was the only significant predictor of HIV infection among female jail entrants without an HIV diagnosis at entry. Also, sexual networks and partnership dynamics have been shown to affect HIV risk.[16–17] These factors may be playing a role here, but we are not able to explore their influence because this information was not among that available to us from the electronic medical record or other data sources.

TABLE 3. Predictors of Being Undiagnosed* Among HIV-Infected New York City Jail Entrants in 2006 Serosurvey (n = 389)

	Total HIV-infected Admissions (N)	Undiagnosed HIV-infected Admissions (n)	% of HIV-Infected Admissions that were Undiagnosed†		Univariate Logistic Regression			Multivariate Logistic Regression		
			Column %	Row %	Odds Ratio	95% CI	*P*	Odds Ratio	95% CI	*P*
Total	389	104	100.0	28.1	—	—	—	—	—	—
Sex										
Male	218	64	82.7	29.4	1.00	Reference	—	1.00	Reference	—
Female	171	40	17.3	23.4	0.74	(0.40 to 1.36)	0.32	0.83	(0.39 to 1.77)	0.63
Age group in yrs‡										
16–19	6	2	1.7	49.9	—	—	—	—	—	—
20–29	44	29	29.7	69.0	7.90	(3.72 to 16.76)	<0.0001	11.06	(4.51 to 27.17)	<0.0001
30–39	127	34	31.9	29.0	1.55	(0.86 to 2.79)	0.15	1.48	(0.76 to 2.86)	0.25
40–49	164	33	30.6	20.9	1.00	Reference	—	1.00	Reference	—
50–59	41	5	4.7	10.5	0.49	(0.19 to 1.29)	0.15	0.56	(0.19 to 1.60)	0.28
60+	7	1	1.3	17.6	—	—	—	—	—	—
Transmission risk factor										
MSM	16	3	3.9	18.8	0.31	(0.10 to 1.00)	0.05	0.18	(0.04 to 0.82)	0.03
Injection drug use history	73	10	6.9	11.4	0.23	(0.09 to 0.56)	0.001	0.75	(0.24 to 2.34)	0.62
High-risk heterosexual	158	41	39.2	27.7	0.64	(0.38 to 1.07)	0.09	0.70	(0.38 to 1.28)	0.24
No identified risk	142	50	50.0	37.7	1.00	Reference	—	1.00	Reference	—
History of previous HIV test										
Yes	351	77	76.3	23.8	0.14	(0.06 to 0.31)	<0.0001	0.19	(0.08 to 0.45)	0.0002
No	38	27	23.7	68.8	1.00	Reference	—	1.00	Reference	—
History of mental health treatment										
Yes	101	11	9.1	12.0	0.28	(0.13 to 0.61)	0.001	0.25	(0.10 to 0.64)	0.004
No	288	93	90.9	32.5	1.00	Reference	—	1.00	Reference	—
History of hepatitis C										
Yes	66	3	1.3	2.3	0.05	(0.01 to 0.29)	0.001	0.06	(0.01 to 0.47)	0.01
No	323	101	98.7	32.9	1.00	Reference	—	1.00	Reference	—

*Tested positive in serosurvey but did not self-report being HIV infected and were not in HIV surveillance registry.
†Weighted by sex based on study design.
‡For age, 16–19 and 20–29 grouped as 16–29, and 50–59 and 60+ grouped as 50+, in regression analyses.

More than a quarter of HIV-infected jail entrants appear to be undiagnosed at admission. This is substantially higher than the 5% estimated from a 2004 New York City household serosurvey[9] and more aligned with the 12%–29% estimate calculated for New York City overall[10] and CDC's nationwide 21% estimate.[8] The vast majority (~90%) of undiagnosed inmates did not self-report recognized HIV risk factors (ie, MSM or IDU activity). MacGowan et al[18] reported similar results: only 15% of new diagnoses in Florida, Louisiana, upstate New York, and Wisconsin jails reported IDU or MSM activity. Likewise, among Los Angeles jail entrants, Harawa et al[19] found that 68% of men and 55% of woman reported no HIV risk factors.

Our analysis assessing which inmates were most likely to have undiagnosed HIV infection among those without an established HIV diagnosis at intake identified women, MSM, and persons 40–49 years as at increased risk. However, these groups account for only a third of the undiagnosed. Taken together, this information confirms that increasing acceptance of routine HIV testing (ie, offering all inmates testing regardless of risk) is likely the best approach to diagnosing more of the jail entrants with undiagnosed infection.

At the time of this study, most undiagnosed infections were not identified through jail testing. Since DOHMH's establishment of the jail rapid testing program in 2004, testing has increased 4-fold to 25,000 tests in 2006. However, there were >105,000 admissions to New York City jails in 2006, representing >72,000 unique individuals. Two thirds of inmates did not consent to HIV testing. Those with undiagnosed HIV infections were just as likely to consent to testing as HIV-negative inmates, suggesting that the undiagnosed are not deliberately avoiding testing because they suspect their HIV-positive status. DOHMH CHS has been conducting qualitative interviews with inmates to better understand reasons for declining HIV testing at intake.

It is likely that more inmates would consent to testing with a more streamlined opt out approach that does not include a separate written consent for each HIV test conducted. A separate written consent is still required by New York State despite CDC recommendations for their elimination,[1] including in correctional settings.[5] Prison systems in Wisconsin and Rhode Island have implemented opt out testing with great success[20–21] and have achieved testing rates as high as 86%.[20] New York City DOHMH continues to advocate for reform in

TABLE 4. Predictors of Having Undiagnosed HIV Infection Among All New York City Jail Entrants Without an HIV Diagnosis at Admission in 2006 Serosurvey (n = 6126)

	Total Inmates Entering Without an HIV Diagnosis (N)	HIV-Infected Inmates Entering Without an HIV Diagnosis (n)	% of Total Inmates Entering Without an HIV Diagnosis that were Found to be HIV Infected†	Univariate Logistic Regression			Multivariate Logistic Regression		
				Odds Ratio	95% CI	*P*	Odds Ratio	95% CI	*P*
Total	6126	104	1.5						
Sex									
Male	4515	64	1.4	1.00	Reference	—	1.00	Reference	—
Female	1611	40	2.5	1.77	(1.03 to 3.04)	0.04	1.74	(1.00 to 3.00)	0.05
Age group in yrs‡									
16–19	729	2	0.2	—	—	—	—	—	—
20–29	2005	29	1.4	0.51	(0.30 to 0.85)	0.01	0.55	(0.32 to 0.92)	0.02
30–39	1539	34	2.0	0.98	(0.58 to 1.64)	0.93	1.01	(0.60 to 1.70)	0.98
40–49	1484	33	2.0	1.00	Reference	—	1.00	Reference	—
50–59	304	5	1.5	0.73	(0.30 to 1.81)	0.50	0.77	(0.31 to 1.92)	0.58
60+	65	1	1.7	—	—	—	—	—	—
Transmission risk factor									
MSM	34	3	8.8	5.02	(1.67 to 15.11)	0.004	5.16	(1.70 to 15.68)	0.004
Injection drug use history	327	10	2.3	1.52	(0.66 to 3.47)	0.32	1.27	(0.55 to 2.94)	0.57
High-risk heterosexual	2807	41	1.3	0.86	(0.56 to 1.32)	0.48	0.90	(0.58 to 1.39)	0.62
No identified risk	2958	50	1.6	1.00	Reference	—	1.00	Reference	—
History of violence									
Yes	500	2	0.3	0.19	(0.04 to 0.90)	0.04	0.20	(0.04 to 0.94)	0.04
No	5626	102	1.6	1.00	Reference	—	1.00	Reference	—

*Tested positive in serosurvey but did not self-report being HIV infected and were not in HIV surveillance registry.
†Weighted by sex based on study design.
‡For age, 16–19 and 20–29 grouped as 16–29, and 50–59 and 60+ grouped as 50+, in regression analyses.
§History of violence is affirmative response to the following question during medical intake: "Have you ever been charged with a violent act (rape, assault)?"

HIV consent laws to increase the number of inmates and other New Yorkers tested through the elimination of a separate written consent for HIV testing.

To attempt further improvement within current legal constraints, DOHMH CHS has investigated the provider side of HIV testing via a recent correctional clinical staff survey. Many staff still incorrectly believe they are unqualified to offer or test for HIV because they are not specialized HIV testing counselors. CHS has renewed efforts to emphasize to clinical staff that HIV testing is a routine part of medical care. Staff have been retrained on a standardized, nonjudgmental approach to offering HIV testing such as "I recommend HIV screening for all my patients," or "it is important for every person to know his/her HIV status." A system of at least 1 HIV testing reoffer during postintake medical visits has also been introduced. Ongoing monitoring of these and other programmatic interventions is in place by an established clinical quality improvement team.

During our study, some inmates did consent to testing but were not tested because of operational issues such as jail release before testing or other competing medical issues during medical intake. Since this serosurvey, substantial strides have been made in ensuring that nearly all inmates who consent to HIV testing are tested: in 2008, 98% of those accepting testing had a rapid HIV test at intake.

Our study's primary limitation is that new admissions without a specimen showed evidence of higher HIV prevalence than those in the serosurvey based on our linkage to HIV surveillance data. Many specimens were entirely consumed during routine syphilis screening, whereas for others, phlebotomy was not performed. This suggests that our prevalence results are conservative estimates; prevalence may be nearly twice as high as measured (~8.7% versus 5.2% overall). Also, the low proportion reporting HIV risk factors, including IDU and MSM activity, suggests that risk factors may have been underreported. However, these results are what actually available to clinicians caring for inmates. Finally, HARS matching process is inexact complicated by multiple pseudonyms sometimes used by incarcerated persons.

In conclusion, HIV prevalence appears to have substantially decreased among New York City jail entrants; however, over one quarter of HIV-infected jails entrants are undiagnosed, representing more than 100 persons in our sample alone. Despite a 4-fold increase in jail testing, most undiagnosed infections are not identified during voluntary jail testing, largely due to low testing acceptance rates. Most undiagnosed inmates did not report recognized HIV risk factors, reinforcing the need to improve inmate acceptance of the jails' current routine testing program rather than focus on increasing efforts among inmates reporting specific behaviors. To increase inmate's acceptance of routine testing, we are working to eliminate the required separate written consent for HIV testing to allow implementation of the CDC-recommended opt out testing model.

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