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TRENDS IN HIV PREVALENCE AND RISK BEHAVIOR AMONG MEN WHO HAVE SEX WITH MEN IN NEW YORK CITY, 2004–2011

Kathleen H. Reilly,
HIV Epidemiology Program, New York City Department of Health and Mental Hygiene, New York City, New York.

Alan Neaigus,
HIV Epidemiology Program, New York City Department of Health and Mental Hygiene, New York City, New York.

Samuel M. Jenness,
Department of Epidemiology, University of Washington, Seattle, Washington.

Travis Wendel,
Department of Anthropology, John Jay College of Criminal Justice, New York, New York.

Holly Hagan,
College of Nursing, New York University, New York, New York.

David M. Marshall IV,
Department of Anthropology, John Jay College of Criminal Justice, New York, New York.

Christopher S. Murrill,
HIV Epidemiology Program, New York City Department of Health and Mental Hygiene, New York City, New York.

Beryl A. Koblin
New York Blood Center, New York, New York.

Abstract

This study examined trends in HIV prevalence and HIV-related risk behaviors from 2004 through 2011 among men who have sex with men (MSM) in New York City. MSM were venue-sampled, interviewed, and offered HIV testing in serial cross-sectional studies. Significant differences in overall time trends were determined using the Spearman rank correlation and logistic regression models. There were 457 (2004–2005), 550 (2008), and 510 (2011) participants in each study round. There was no significant trend in HIV prevalence over time, and past 12 month unprotected anal intercourse remained steady. However, drug use and number of sex partners declined. Among those who did not self-report being HIV positive, the percentage that tested for HIV in the past 12 months increased. The results from this study suggest that from 2004 through 2011 more MSM in New York City are being tested for HIV and have declining drug use and fewer sex partners.

Address correspondence to Kathleen H. Reilly, PhD, MPH, HIV Epidemiology Program, New York City Department of Health and Mental Hygiene, 42-09 28th St., CN: 22-109, Long Island City, NY 11101. kreilly3@health.nyc.gov.

New York City (NYC) remains an epicenter of the HIV epidemic in the United States. The NYC metropolitan statistical area (MSA) continues to have the greatest number of reported AIDS cases compared with other MSAs (Centers for Disease Control and Prevention, 2005, 2009). A total of 39,846 men who have sex with men (MSM) were living with HIV/AIDS in NYC at the end of 2011 (New York City Department of Health and Mental Hygiene, 2011b). Nationally and in NYC, MSM comprise the greatest number of new HIV diagnoses (New York City Department of Health and Mental Hygiene, 2011b; L. Torian, Chen, Rhodes, & Hall, 2011). In 2011 most new HIV diagnoses among males in NYC were among MSM (66%); for those with a known transmission risk category, the proportion rises to 86%.

Behavioral surveillance is used to identify trends in behaviors that could increase the risk of acquiring HIV infection, because there may be considerable lags between initial infection, diagnosis, and reporting (Gallagher, Sullivan, Lansky, & Onorato, 2007). In 2003 the U.S. Centers for Disease Control and Prevention (CDC) developed the National HIV Behavioral Surveillance (NHBS) System to monitor HIV-related behaviors among groups at high risk for HIV infection in U.S. cities with high levels of AIDS to better target and evaluate HIV prevention efforts (Centers for Disease Control and Prevention, 2001). The current analysis examined trends in HIV prevalence and HIV-related risk behaviors including sexual risk (i.e., unprotected anal intercourse and number of sex partners), drug use, and HIV testing behaviors over time among NYC MSM at three NHBS study time points.

METHODS

SAMPLING AND RECRUITMENT

Subjects were recruited to participate in the NHBS study of MSM in NYC in 2004–2005 (MSM1), 2008 (MSM2), and 2011 (MSM3). NHBS is an ongoing, national, cross-sectional study sponsored by the CDC that monitors HIV risk behaviors, testing history, exposure to and use of HIV prevention services, and HIV prevalence among MSM, injection drug users (IDU), and high-risk heterosexuals in 3-year cycles (Gallagher et al., 2007; Lansky, Sullivan, Gallagher, & Fleming, 2007). NHBS is conducted in collaboration with the CDC by local public health departments, universities, and other collaborators, and uses venue-based sampling (VBS) to enumerate and recruit MSM participants (Gallagher et al., 2007). VBS methods for NHBS have been described in detail elsewhere (MacKellar et al., 2007). Venues were identified as places where MSM congregate, as determined through observational and interview-based ethnography. Recruitment venues were categorized as bars; cafes or restaurants; dance clubs; house ball events; fitness clubs or gyms; gay pride or similar events; social organizations; parks; retail businesses; street locations; raves, circuit parties, or similar events; sex establishments or environments; and other venues.

At each recruitment event, field staff operating in a mobile van outside the venue enumerated all adult men who entered the venue. These men were sequentially and nonpreferentially approached by interviewers who described the study to them. Interested men were then screened for eligibility. Eligible men who provided their informed consent were given a structured survey interview administered in private by trained interviewers and a voluntary HIV test. Eligibility criteria were male, ≥18 years of age, NYC MSA residence, and English or Spanish comprehension. “Ever had oral or anal sex with a man” was an

eligibility criterion for MSM3, but not for MSM1 or MSM2. The current analysis was restricted to men who reported anal or oral sex with a man in the past 12 months and who were living in one of NYC's five boroughs.

MEASURES

The survey instrument was developed by the CDC in collaboration with local NHBS project sites. Interview data were collected on demographics, HIV testing experiences, and medical history. Specimens were collected for HIV testing. For MSM1, blood specimens were tested for HIV antibody by enzyme-linked immuno-sorbent assay (EIA; Genetic Systems HIV-1/HIV-2 PLUS EIA, Bio-Rad Laboratories, Redmond, WA); reactive specimens were confirmed by Western blot assay (Genetic Systems HIV-1 Western Blot, Bio-Rad Laboratories). For MSM2 and MSM3, oral mucosal transudate was collected and tested for HIV antibodies using the OraQuick Advance oral specimen collection device (OraSure Technologies, Bethlehem, PA); if the test was positive, participants were asked to provide oral mucosal transudate specimens for confirmation using OraSure HIV-1 Western Blot testing kits (OraSure Technologies). Participants were asked to return in 2 weeks for their confirmatory test results.

STATISTICAL ANALYSIS

Means and standard deviations (for normal continuous data), medians and interquartile ranges (IQR) (for nonnormal continuous data), and the frequencies and percentages for each level of categorical variables were calculated. Significant differences in overall time trends were determined using the Spearman rank correlation (nonnormal continuous variables) and single variable logistic regression models using study round as the independent variable (dichotomous categorical variables). Odds ratios (OR) and 95% confidence intervals (CI) were calculated to examine the association of time (study round) and dichotomous study variables, including age (18–30 vs. > 30), race (White vs. non-White), education (college graduate vs. noncollege graduate), country of birth (United States or Puerto Rico vs. foreign born), sexual identity (gay vs. bisexual or heterosexual), recruitment venue (park vs. other), past 12 month sexual behavior (> 3 male sex partners and unprotected anal intercourse), and past 12 month drug use (injection drug use, noninjection drug use [excluding marijuana], and noninjection methamphetamine use), and HIV prevalence. Analyses of behaviors related to health care and HIV testing (visited a health care provider in the past 12 months, tested for HIV in the past 12 months, ever tested for HIV, and consented to study HIV test) were restricted to those who did not self-report being HIV positive. Interactions between study year and race/ethnicity were examined. Because the study sample composition varied between study years, variables (race, education, and/or recruitment venue type) that were significantly associated with both study year and the outcome of interest ($p < .05$) were adjusted for in logistic regression models. A subanalysis was conducted to examine if there were differences in sexual and drug use behaviors by HIV self-reported status (positive vs. negative/unknown) using logistic regression models with the behavior of interest as the dependent variable and study round and self-reported HIV status as independent variables. Analyses were conducted using SAS 9.2 (Cary, NC).

ETHICS

Local study procedures involving human subjects were approved by the Institutional Review Boards of the New York City Department of Health and Mental Hygiene (DOHMH), New York Blood Center, National Development and Research Institutes, and John Jay College of Criminal Justice.

RESULTS

At 195 venue recruitment events (2004: 82; 2008: 59; 2011: 54), 18,563 men were enumerated (9,373, 6,593, 2,597), 4,131 men were approached (1,498, 1,130, 1,503), 2,266 men were screened for eligibility (1,128, 581, 557), 2,113 were eligible to participate (1,003, 573, 537), and 1,679 enrolled in the study (570, 573, 536). Of those who enrolled, 1,517 MSM who reported oral or anal sex with a man in the past 12 months and residency in one of NYC's five boroughs (457, 550, 510) were included in the current analysis.

Table 1 shows demographic characteristics of participants by study period. Over time, the median age in years did not vary over time (29 years [IQR: 23, 37], 32 years [IQR: 25, 42], 29 years [IQR: 23, 40] [Spearman rho = 0.02, $p = .54$]) and the proportion of White participants decreased (41.0%, 31.1%, 29.4%; OR: 0.8; 95% CI [0.7, 0.9]; $p = .0001$). Smaller proportions of participants had completed college (49.2%, 40.4%, 26.1%; OR: 0.6; 95% CI [0.5, 0.7]; $p < .0001$), and greater proportions were recruited from parks (0.7%, 8.7%, 16.5%; OR: 3.2; 95% CI [2.4, 4.2]; $p < .0001$). There was no significant trend in the proportions of MSM who were foreign born or who identified as gay. There was also no significant linear trend in HIV prevalence among those with positive or negative HIV test results ($n = 321$, $n = 458$, $n = 475$).

Table 2 shows the prevalence of sexual and drug use risk factors. The proportion of participants reporting more than three male sex partners in the past 12 months decreased somewhat (62.4%, 47.8%, 51.4%; OR: 0.8; 95% CI [0.7, 0.9]; $p = .001$); while the proportion reporting unprotected anal intercourse (UAI) was unchanged (50.5%, 50.7%, 51.8%; OR: 1.0; 95% CI [0.9, 1.2]; $p = .70$). Past 12 month noninjection drug use (excluding marijuana) decreased over time (46.6%, 34.2%, 33.7%; OR: 0.8; 95% CI [0.7, 0.9]; $p < .0001$), with noninjection methamphetamine use also declining (13.8%, 5.8%, 4.3%; OR: 0.5; 95% CI [0.4, 0.6]; $p < .0001$). The prevalence of injection drug use remained low and steady over time (1.1%, 2.2%, 1.2%; OR: 1.0; 95% CI [0.6, 1.7]; $p = .96$).

There were no significant differences in trends over time by self-reported HIV status for any sexual or drug use behaviors (more than three male sex partners [$p = .62$], UAI [$p = .98$], noninjection drug use [excluding marijuana] [$p = .14$]). Noninjection methamphetamine use decreased more sharply among those who reported that they were HIV positive (21.3%, 8.5%, 4.8%) compared to those who reported negative or unknown status (13.0%, 5.4%, 4.2%), although this difference was not statistically significant ($p = .08$).

Table 3 shows unadjusted prevalence of health care and HIV testing behaviors and HIV prevalence among MSM in NYC who reported negative or unknown HIV status ($n = 410$, $n = 479$, $n = 448$). The percentage of those who tested for HIV in the past 12 months increased

(62.4%, 64.7%, 76.1%; OR: 1.4; 95% CI [1.2, 1.6]; $p < .0001$), the percentage of those who had ever tested for HIV increased (90.2%, 87.1%, 94.0%; OR: 1.3; 95% CI [1.0, 1.6]; $p = .05$), and the percentage of those consenting to the study HIV test increased (71.2%, 82.5%, 93.3%; OR: 2.3; 95% CI [1.9, 2.8]; $p < .0001$)). Among those with positive or negative HIV test results ($n = 292$, $n = 395$, $n = 418$), there was no significant trend in HIV prevalence among those who reported negative or unknown status. Of those who tested HIV positive ($n = 60$, $n = 131$, $n = 91$), the frequency of those who did not disclose or were unaware of their HIV infection decreased modestly, but the decrease was not significant (51.7%, 52.7%, 39.6%; OR: 1.3; 95% CI [0.9, 1.8]; $p = .10$).

In adjusted analyses, significant decreases were seen in the proportion of participants who had more than three male sex partners in the past 12 months (adjusted for race and education; AOR: 0.8; 95% CI [0.7, 1.0]; $p = .01$), used noninjection drugs (excluding marijuana) in the past 12 months (adjusted for race and education; AOR: 0.8; 95% CI [0.7, 0.9]; $p = .003$), and used noninjection methamphetamine in the past 12 months (adjusted for race and education; AOR: 0.5; 95% CI [0.4, 0.7]; $p < .0001$). Among those who reported HIV negative or unknown status, significant increases were seen in proportions of participants who agreed to an HIV test as part of the study (adjusted for education; AOR: 2.1; 95% CI [1.7, 2.6]; $p < .0001$) and had ever tested for HIV (adjusted for education; AOR: 1.4; 95% CI [1.1, 1.7]; $p = .01$). Testing for HIV in the past 12 months was not associated with race, education, or recruitment venue, so the model was not adjusted for any of these variables (OR: 1.4; 95% CI [1.2, 1.6]; $p < .0001$). None of the study year and race/ethnicity interaction terms were found to be significant.

DISCUSSION

This study examined trends in HIV prevalence and risk behavior over the course of 7 years among MSM, the risk group most affected by HIV in the city with the nation’s largest HIV epidemic. The results from this study indicate increasing HIV testing, declining drug use, and fewer sex partners among MSM in NYC from 2004 through 2011.

The increasing prevalence of HIV testing in the past 12 months is promising. Frequent testing can aid in the identification of new infections, which could be rapidly linked to care, thereby improving patient outcomes (Kitahata et al., 2009; Moir et al., 2010). However, it is unclear whether HIV testing is associated with reductions in risk behavior among those who are HIV negative and if HIV testing prevents new infections (Denison, O’Reilly, Schmid, Kennedy, & Sweat, 2008). The marginally significant decrease in the proportion of participants who did not disclose or did not know their infection status further indicates the potential benefit of annual HIV testing among MSM.

There was no significant trend in HIV prevalence over time. However, this study was limited to only three time points, and therefore nonlinear trends could not be explored. Stable HIV prevalence may be indicative of improved survival and viral suppression due to the widespread availability of antiretroviral therapy and earlier detection of infection (Hogg et al., 1998; Kitahata et al., 2009; L. V. Torian & Xia, 2013). Public health efforts should be strengthened to prevent new infections, thereby reducing HIV prevalence.

Despite intense local efforts to increase the visibility, accessibility, and acceptability of free condoms through the NYC DOHMH's "NYC Condom" campaign (Burke et al., 2009; Burke et al., 2011), approximately half of all participants in each study round reported inconsistent condom use in the past 12 months. Although the NYC DOHMH has been successful in promoting and distributing condoms, results from the current study highlight that innovative prevention strategies are needed and initiatives should be continued and intensified to promote condom use with every sex act among MSM in NYC. Condom use is a cost-effective method of HIV prevention; however, alternative HIV prevention strategies, such as preexposure prophylaxis, should also be considered (Juusola, Brandeau, Owens, & Bendavid, 2012).

The current study found that the proportion of participants reporting more than three sex partners in the past 12 months decreased significantly over time. The NYC Community Health Survey (CHS), however, has found the proportion of MSM who reported at least three sex partners in the past 12 months increasing over the same time periods (unadjusted crude proportion of MSM with ≥ 3 sex partners 2004: 22.7%, 95% CI [17.3%, 29.1%]; 2008: 28.0%, 95% CI [18.5%–40.0%]; 2011: 46.4%, 95% CI [31.4%–62.1%]) (New York City Department of Health and Mental Hygiene, 2004, 2008, 2011a). CHS utilizes stratified random sampling, which may provide a better estimate of behavior for the general population of MSM in NYC. Previous studies have found that those who find sex partners online are likely to have greater numbers of sex partners compared to those who find sex partners offline (Horvath, Rosser, & Remafedi, 2008; Rosser et al., 2009). NHBS samples may not be representative because, with the increase in the availability of Internet websites and mobile apps that can be used to find sex partners, some MSM may consider using the Internet as a more efficient means of meeting multiple sex partners than attending gay-oriented venues. It is possible that CHS participants are more likely to seek sex partners online than those MSM who were recruited in venues. Those who exclusively seek sex partners through the Internet could be less likely to attend MSM venues and therefore be less likely to be recruited to participate in NHBS.

Previous studies report a high prevalence of substance use among MSM in NYC (Halkitis et al., 2011). Similar to the current study, a serial cross-sectional study of drug-using trends among MSM in NYC conducted at gay community events also found declining drug use among HIV-negative MSM from 2002 to 2007 (Pantalone, Bimbi, Holder, Golub, & Parsons, 2010). According to the Community Epidemiology Work Group of the National Institute on Drug Abuse, methamphetamine use in NYC is low compared to use in other parts of the United States, although the Drug Abuse Warning Network (DAWN) found that methamphetamine-related emergency department visits among the general population in NYC increased 63% from 2004 to 2009 (Marel, Smith, Rainone, & Toledo, 2012). A shift in the social organization of methamphetamine use has been facilitated by the Internet, and MSM who use methamphetamine may prefer to seek drugs and sex partners online rather than attend gay-oriented venues (Braine, Acker, van Sluytman, Friedman, & DesJarlais, 2011). The decline in drug use found in the current study could therefore reflect a decline in venue attendance by drug-using MSM.

This study is subject to several limitations. This was a serial cross-sectional study and differences across study rounds, such as variations in the types of venues included for each year's sampling universe, may have introduced bias, although differences in demographics were examined, and factors that varied by both study round and behavioral outcome of interest were controlled for in adjusted analyses. The study questionnaire elicited sensitive information regarding sexual behavior and HIV status, and participants may not have felt comfortable disclosing this information to study interviewers even though all interviewers were trained in survey administration with emphasis on asking study questions in an objective and neutral manner. Participants may have been more likely to claim a recent test in the most recent sample because of increased awareness of the public health value attached to this answer. The results of this study may not be generalizable to all MSM in NYC or other MSM populations. Efforts were made to include a diverse selection of MSM venues in the sampling universe; MSM that do not attend these venues, however, would not have had the opportunity to participate.

CONCLUSIONS

We found that over the past 7 years, more MSM in New York City are being tested for HIV and report declining drug use and fewer sex partners. Increasing prevalence of HIV testing and decreasing prevalence of those who did not disclose or were unaware of their HIV status are promising, because those who are aware of their infection are presumed to have a lower sexual transmission rate (Marks, Crepaz, & Janssen, 2006). Behavioral risk factors, including greater number of sex partners and drug use, also appear to be on the decline. Stable rates of UAI, however, are of concern and indicate that efforts should be strengthened to increase consistent condom use among MSM in NYC. Condom use is a cost-effective means of preventing HIV and other sexually transmitted infections; however, the decision to use condoms is complex, rooted in emotional and physical factors (Balan, Carballo-Diaguez, Ventuneac, & Remien, 2009), as well as perceived vulnerability, peer norms, and condom availability (MacPhail & Campbell, 2001). Innovative strategies are needed to promote condom use in this vulnerable population.

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TABLE 1.

Characteristics of NYC MSM National HIV Behavioral Surveillance (NHBS) Participants (2004, 2008, 2011)

	2004 (*N* = 457) *n* (%)	**2008 (*N* = 550) *n (%)***	**2011 (*N* = 510) *n* (%)**	**OR [95% CI] for trend**	***p* value**
Age (years)					.79
18–30	247 (54.0)	244 (44.4)	278 (54.5)	1.0 [0.9, 1.2]	
> 30	210 (46.0)	306 (55.6)	232 (45.5)		
Race					**0.001**
White	185 (41.0)	171 (31.1)	148 (29.1)	0.8 [0.7, 0.9]	
Non-White	266 (59.0)	379 (68.9)	360 (70.9)		
Highest level of education completed					**< .0001**
College	225 (49.2)	222 (40.4)	133 (26.1)	**0.6 [0.5, 0.7]**	
No College	232 (50.8)	328 (59.6)	377 (73.9)		
Country of Birth					0.07
United States/Puerto Rico	349 (76.4)	452 (82.2)	414 (81.2)	0.9 [0.7, 1.0]	
Foreign	108 (23.6)	98 (17.8)	96 (18.8)		
Sexual Identity					*.55*
Gay	358 (79.9)	439 (79.8)	399 (78.4)	1.0 [0.8, 1.1]	
Bisexual/Heterosexual	90 (20.1)	111 (20.2)	110 (21.6)		
Recruitment Venue					**< .0001**
Park	3 (0.7)	48 (8.7)	84 (16.5)	**3.2 [2.4, 4.2]**	
Other	454 (99.3)	502 (91.3)	426 (83.5)		
HIV prevalence	60 (18.7)	131 (28.6)	91 (19.2)	1.0 [0.8, 1.2]	0.75

NYC: New York City; MSM: men who have sex with men; OR: odds ratio; CI: confidence interval.

TABLE 2.

Unadjusted Prevalence of HIV Risk Behaviors Among NYC MSM National HIV Behavioral Surveillance (NHBS) Participants (2004, 2008, 2011)

	2004	2008	2011	OR [95% CI] for trend	*p* value	AOR [95% CI] for trend	*p* value
	(*N* = 457)	(*N* = 550)	(*N* = 510)				
	n (%)	*n* (%)	*n* (%)				
Past 12 month sexual behavior							
>3 male sex partners	285 (62.4)	263 (47.8)	262 (51.4)	**0.8 [0.7, 0.9]**	**0.001**	**0.8 [0.7, 1.0]**[a,b]	**0.01**
Unprotected anal intercourse	231 (50.5)	279 (50.7)	264 (51.8)	1.0 [0.9, 1.2]	.70		
Past 12 month drug use							
Injection drug use	5 (1.1)	12 (2.2)	6 (1.2)	1.0 [0.6, 1.7]	.96		
Noninjection drug use (excluding marijuana)	212 (46.6)	188 (34.2)	172 (33.7)	**0.8 [0.7, 0.9]**	**< 0.0001**	**0.8 [0.7, 0.9]**[a,b]	**0.003**
Noninjection methamphetamine use	63 (13.8)	32 (5.8)	22 (4.3)	**0.5 [0.4, 0.6]**	**< 0.0001**	**0.5 [0.4, 0.7]**[a,b]	**< 0.0001**

MSM: men who have sex with men; NYC: New York City; OR: odds ratio; CI: confidence interval; AOR: adjusted odds ratio.

[a]Adjusted for education (college graduate vs. noncollege graduate).

[b]Adjusted for race (White vs. non-White).

TABLE 3.

Unadjusted Prevalence of Health Care and HIV Testing and HIV Prevalence Among MSM in NYC Who Reported Negative or Unknown HIV Status (2004, 2008, 2011)

	2004 (*N* = 410)	**2008 (*N* = 479)**	**2011(*N* = 448)**	**OR [95% CI] for trend**	***p* value**	**AOR [95% CI] for trend**	***p* value**
	***n* (%)**	***n* (%)**	***n* (%)**				
Health care and HIV testing							
Visited a health care provider in the past 12 months	347 (84.6)	401 (83.7)	374 (83.5)	1.0 [0.8, 1.2]	0.65		
Tested for HIV (past 12 months)	256 (62.4)	310 (64.7)	341 (76.1)	**1.4 [1.2, 1.6]**	**< 0.0001**	**1.4 [1.2, 1.6]**	**< 0.0001**
Tested for HIV (ever)	369 (90.2)	417 (87.1)	421 (94.0)	**1.2 [1.0, 1.6]**	**0.05**	**1.4 [1.1, 1.7][a]**	**0.01**
Consented to study HIV test	292 (71.2)	395 (82.5)	418 (93.3)	**2.3 [1.9, 2.8]**	**< 0.0001**	**2.1 [1.7, 2.6][a]**	**< 0.0001**
HIV prevalence	31 (10.6)	69 (17.5)	36 (8.6)	0.9 [0.7, 1.1]	0.23		

MSM: men who have sex with men; NYC: New York City; OR: odds ratio; CI: confidence interval; AOR: adjusted odds ratio.

[a]Adjusted for education (college graduate vs. noncollege graduate).