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What happened to the HIV Epidemic among Non-injecting Drug Users in New York City?

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Abstract

Background and aims—HIV has reached high prevalence in many non-injecting drug user (NIDU) populations. Aims of this study were to 1) examine the trend in HIV prevalence among non-injecting cocaine and heroin NIDUs in New York City, 2) identify factors potentially associated with the trend, 3) estimate HIV incidence among NIDUs.

Design—Serial-cross sectional surveys of persons entering drug treatment programs. Persons were permitted to participate only once per year, but could participate in multiple years.

Setting—Mount Sinai Beth Israel drug treatment programs in New York City, USA.

Participants—We recruited 3298 non-injecting cocaine and heroin users from 2005 to 2014. Participants were 78% male, 6% white, 26% Hispanic and 66% African-American. Smoking crack cocaine was the most common non-injecting drug practice.

Measures—Trend tests were used to examine HIV prevalence, demographics, drug use, sexual behavior and use of antiretroviral treatment (ART) by calendar year. Chi square and multivariable logistic regression were used to compare 2005 – 2010 versus 2011 – 2014.

Findings—HIV prevalence declined approximately 1% per year ($p < 0.001$), with a decline from 16% in 2005 – 2010 to 8% in 2011– 2014 ($p < 0.001$). The percentages of participants smoking crack and having multiple sexual partners declined, the percentage of HIV positive people on ART increased. HIV incidence among repeat participants was 1.2 per 1000 person-years (95% CI 0.03/1000 - 7/1000).

Conclusions—HIV prevalence has declined and a high percentage of HIV-positive non-injecting drug users (NIDUs) are receiving antiretroviral treatment, suggesting an end to the HIV epidemic

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among NIDUs in New York City. These results can be considered a proof of concept that it is possible to control non-injecting drug use related sexual transmission HIV epidemics.

Introduction

While injecting illicit psychoactive drugs is commonly associated with transmission of HIV, non-injecting use of illicit drugs, particularly amphetamine-type stimulants (ATS) [1] and crack cocaine [2] have frequently been associated with sexual transmission of HIV. A number of studies have found high HIV prevalence among heterosexual non-injecting drug users (NIDUs): 37% in Porto Alegre, Brazil [3], 43% in China [4], 13% in Canada [5], 24% in Portugal [6], 29% in Russia [7] , and 20% in Trinidad and Tobago [8] and among men-who-have-sex-with-men (MSM) non-injecting ATS users, with HIV prevalence of 40% in NYC [9-12], 61% in Los Angeles [11], 42% in Vancouver Canada [13], and 51% in Northern Thailand [14].

Interventions such as needle/syringe programs and opiate agonist drug treatment have been quite successful in controlling high prevalence heroin injection HIV epidemics in many high income settings [15], but these interventions would not be applicable to non-injecting stimulant drug use HIV epidemics. Promotion of condom use would be the most directly applicable to non-injecting drug use sexual transmission, but impaired judgment and perceived enhanced sexuality while under the influence of stimulant use may interfere with consistent condom use [16]. The runs-followed-by-crashes pattern of some stimulant drug use can also make it difficult to adhere to antiretroviral (ART) treatment [17]. There are psychosocial interventions to change stimulant drug use and sexual risk behavior among persons who use drugs, but these generally have modest effect sizes and are resource intensive [18]. Thus, the population-level effectiveness of interventions to control non-injecting drug use HIV epidemics remains to be determined.

HIV is a lifelong infection, and drug use disorders are chronic conditions, so that HIV epidemics among persons who use drugs often last several decades. While NIDUs could be considered a “key population” for HIV transmission in a number of countries, standard surveillance methods do not permit tracking of HIV infection among NIDUs over time within the MSM or heterosexual transmission categories. Thus, data on long-term patterns of HIV infection among NIDUs is relatively limited [19]. Non-injecting cocaine use has been a critical factor in HIV transmission in Brazil, and Brazil has been conducting serial cross-sectional studies of HIV among NIDUs. The results of the latest study, however, have not yet been released [20].

There have been multiple studies showing high rates of HIV infection among NIDUs/ persons who smoke crack cocaine in NYC, including persons recruited through street outreach [16], respondent driven sampling [21], substance treatment programs [22] and “high risk heterosexuals” recruited through time-location sampling [23]. A study of NIDUs entering Mount Sinai Beth Israel drug treatment programs in NYC found that HIV prevalence increased from 7% among persons entering in 1995-2000 to 13% among NIDUs entering treatment in 2005-2011[22].

NYC has implemented several evidence-based programs that would potentially reduce HIV transmission among NIDUs/crack cocaine users, including the NYC condom distribution program (begun in 2007) [24], a policy of providing ART to all HIV seropositives (adopted in 2011), [25] and providing detoxification services for NIDUs/crack cocaine users. In this report, we:

1) Examine trends in HIV prevalence among predominantly crack cocaine using heterosexual NIDUs over the 2005-2014 time period.

2) Identify factors potentially related to changes in HIV prevalence, including a) changes in the demographic characteristics of the NIDU population, b) changes in drug use and sexual risk behavior among NIDUs, c) changes in ART utilization among NIDUs, and d) turnover in the NIDU population.

3) Estimate HIV incidence among NIDUs during 2005-2014.

4) Consider the applicability of the NYC findings to other areas with high HIV prevalence among NIDUs.

Methods

Overview

The data presented were collected as part of the “Risk Factors” study of HIV infection among persons who use drugs in NYC [26, 27]. Subjects are recruited from persons entering the Mount Sinai Beth Israel detoxification and methadone maintenance treatment programs. Grouping subjects by calendar year creates serial cross-sectional surveys of the population entering the programs that can be analyzed for trends over time, including trends in HIV prevalence. The serial cross-sectional surveys can also be analyzed for changes in the relationships between individual characteristics e.g., whether the associations between demographic characteristics and HIV serostatus change over time. Persons are permitted to participate once in each calendar year, so that the data for each year forms a cross-sectional survey for that year. These are the same methods used in our previous study that showed the increase in HIV prevalence among NIDUs from 1990-1995 to 2005-2010.[22]

Substance use disorders are a chronic, relapsing condition, and many persons cycle in and out of treatment many times during their drug use careers. We permitted individuals to participate multiple times in the study, though only once per year. We can thus examine HIV seroconversion among persons participating in different years.

Subject recruitment

The detoxification and methadone maintenance programs serve NYC as a whole and there were no changes in the requirements for entrance into the program over the study period. Persons using opiates, cocaine and amphetamines were eligible to participate in the study.

Persons seeking treatment solely for alcohol, marijuana, and other drugs without use of opiates, cocaine and amphetamine were excluded.

Both injecting and non-injecting drug users participated in the study, but only persons who are currently using drugs but have never injected illicit drugs are included. (Separate studies are conducted of persons currently injecting and of persons who have injected in the past but are now using through non-injection routes.)

In the detoxification program, research staff visited the wards of the program in a preset order and examined intake records to construct lists of patients admitted within the prior 3 days. All of the patients on the intake list for a specific ward were asked to participate in the study. As there was no relationship between the assignment of patients to wards and the order that the staff rotated through the wards, these procedures should produce an unbiased sample of persons entering the program. In the methadone program, newly admitted patients (those admitted in the previous month) were asked to participate in the research. Participants were paid $20 for their time and effort. In both programs, approximately 95% of those asked agreed to participate.

Data Collection and Measures

Written informed consent was obtained and a trained interviewer administered a structured questionnaire covering demographics, drug use, sexual behavior, and use of HIV prevention services. Most drug use and HIV risk behavior questions referred to the 6 months prior to the interview, which would be prior to entry into the drug treatment programs.

Participants were seen by counselors for HIV pretest counseling and serum collection. HIV testing was conducted at the NYC Department of Health Laboratory using commercial, enzyme-linked, immunosorbent assays (EIA) with Western blot confirmation (BioRad Genetic Systems HIV-1-2+0 EIA and HIV-1 Western Blot, BioRad Laboratories, Hercules, CA).

Data Analysis: Trends, including HIV prevalence

We used Cuzick's test for trend, chi square tests, weighted least squares tests, and logistic regression for statistical testing. For logistic regression analyses, listwise deletion was used for missing data. Cuzick's tests for trend with calendar year as a unit of analysis were our primary tests for changes over time.

We also used a step-down trend test [28, 29] to identify the year when the change in HIV prevalence was significantly different from the overall fluctuations in HIV prevalence. The step-down test for trend yielded two time periods; 2005 – 2010 and 2011 – 2014. We then compared subject characteristics in 2005 – 2010 to 2011– 2014 as an additional method of assessing change. This additional method was not intended to replace the Cuzick's test for trend, but does provide results that are easier to interpret.

As noted above, we permitted individual persons to participate more than once in the study (though not more than once in any year). There were a modest number of persons with repeat participation, 279 (8%) overall, 225 (11%) in 2005-2010 and 54 (4%) in 2011-2014.

For the comparisons of 2005-2010 versus 2011- 2014, we conducted analyses with the repeat interviews included and with the repeat interviews excluded. The results were nearly identical, with no more than a 10% difference in any of the odds ratios. We report here the results with the repeat interviews included in order to maintain consistency in subject numbers with the year-by-year trend analyses.

Data Analyses: HIV Incidence

If a repeat participant was HIV seronegative at first participation, then HIV testing at a later participation would detect seroconversion. Subjects were matched on name, drug treatment program identification number, gender, and date of birth to ensure that these were the same individuals participating on multiple occasions. Subjects who were HIV seronegative at their first study participation and then were HIV seropositive at a later participation were used as the numerator for calculating HIV incidence. The denominator was the total number of years between first and last participation for subjects who remained seronegative plus one half of the time between the last seronegative participation and the first seropositive participation of the subjects who did seroconvert. (Assuming seroconversion occurred midway between last seronegative and first seropositive participation.) The binomial test was used for calculating exact confidence intervals.

Stata software [30] was used for statistical analyses.

Ethical approval

The study was approved by the Mount Sinai Beth Israel IRB.

Results

Table 1a presents HIV prevalence, demographic characteristics and recent (past 6 month) drug use behaviors for the 3298 subjects by year for 2005 – 2014. Multiple statistically significant trends are noted: HIV prevalence decreased, the percentage of women decreased, the percentage of Whites increased, the percentage of African Americans decreased, the percentage of subjects reporting recent intranasal heroin use increased, and the percentage of those reporting recently smoking crack cocaine decreased. (Approximately 83% of the sample reported polysubstance alcohol plus other drug use; polysubtance use was not related to HIV serostatus.) Table 1b presents the Table 1a data condensed for subjects recruited in 2005 – 2010, 2011 – 2014, (based on the step-down test for trend noted above) and for the entire study period (2005 – 2014). All trends that were statistically significant in the year-by-year analyses were also significant in the 2005 – 2010 versus 2011 – 2014 step-down trend comparisons; there were no trends that were significant in one but not the other analysis.

HIV Prevalence

We examined whether the reduction in HIV prevalence was consistent across demographic and drug use behavior subgroups (see Table 2a). (We did not include sexual risk behaviors as predictors of HIV serostatus because of the likelihood HIV seropositive persons would have known their status and reduced their sexual risk behaviors.) All subgroups except MSM

showed a reduction of approximately 50%. We examined possible interactions between demographic characteristics and drug use behavior and the change in HIV prevalence; none were significant.

We used multivariable logistic regression with backwards elimination to examine whether the factors associated with being HIV seropositive were the same in 2005– 2010 versus 2011–2014, and whether the difference in HIV prevalence between 2005 – 2010 and 2011–2014 remained statistically significant after controlling for potential confounding variables. Results are presented in Table 2b along with the model with year of interview as a variable. The AORs for the demographic characteristics were almost identical and the time factor was significant in all models ($p < 0.001$ for the year of interview model).

Sexual Risk Behaviors

We examined sexual risk behaviors for primary and secondary partners by HIV status for 2005– 2010 versus 2011– 2014 (See Table 3). “Unsafe sex” was defined as reporting being sexually active (vaginal or anal intercourse) and not using condoms 100% of the time. There was a statistically significant decline in the percentage of seronegative NIDUs reporting multiple sex partners. There was a reduction in the percentage of HIV seropositive subjects who reported unsafe sex with casual partners, but with the small sample size of HIV seropositives this did not reach statistical significance (chi square = 2.3, $p = 0.13$).

Utilization of ART

Over 98% of the participants reported that they had been tested for HIV prior to recruitment into the study. NIDU utilization of ART among our participants increased from 58% in 2005 to 66% in 2006, and between 81% and 92% from 2011 to 2014 ($z = 3.4$ $p = 0.001$). Because the increase in ART utilization occurred well before 2011, however, the 2005-2010 to 2011-2014 comparison was not statistically significant (chi square = 2.8, $p = 0.09$)

Potential Turnover in the NIDU Population

To assess the potential turnover in the NIDU population, we compared persons most likely to leave the NIDU population—those who were 50 or older in 2005 – 2010—with those most likely to be relatively new entrants into the population—those who were 30 or younger in 2011–2014 (See Table 4). There were multiple demographic and drug use differences, and a large difference in HIV prevalence (0% vs. 17%). The potential turnover in the NIDU population is consistent with the trends noted in Table 1a.

HIV Incidence

Among 247 subjects who were initially HIV seronegative and participated more than once in the study, there was one HIV seroconversion in 859 person-years at risk for an HIV incidence of 1.2/1000 person-years at risk (PYAR) (95% CI 0.03/1000 PYAR – 7/1000 PYAR). HIV incidence for persons reporting crack cocaine use in any interview in the study was 1.5 /1000 PY (95% CI: 0.4/1000 PYAR to – 8.5/1000 PYAR).

Discussion

In our studies of heroin and cocaine NIDUs entering the Mount Sinai Beth Israel drug treatment programs [22], we observed a significant increase in HIV prevalence from 7% in 1995 – 1999 to 13% in 2005 – 2011, and now see a decrease to 8% in 2011– 2014. This recent decrease was consistent across demographic and drug use behavior subgroups and occurred simultaneously with a low incidence rate (1.2/1000 PY), suggesting population-level processes.

There are a number of factors that might plausibly explain the reduction in HIV prevalence and the very low HIV incidence among repeat participants in this study. Greater loss of HIV seropositives than HIV seronegatives to the NIDU population would reduce prevalence and could have occurred through transitions to injecting drug use, death, disability, cessation of non-injecting drug use, and age related factors.

With respect to the low HIV incidence rate we observed, there was an overall decline in crack use in NYC [31] that was also observed among our participants. We do not have data on the settings in which crack was being used by study subjects, but propose that the overall decline in crack use in NYC also produced a decline in using “crack houses,” settings in which exchanges of sex for crack would likely to lead to sexual transmission of HIV [32].

We observed a significant decrease in the percentage of HIV negative subjects reporting multiple sex partners in the 6 months prior to the interview, from 36% to 25%. Having multiple partners within short time periods has been associated with HIV transmission [33].

The provision of ART to the HIV seropositive NIDUs in our study increased from under 60% in 2005 to over 80% in 2014. This increase should have reduced infectiousness at the population level. Also, the percentage of HIV positives engaging in unsafe sex was quite low, particularly from 2011-2014.

Generalization to other locations

As noted in the introduction, high HIV prevalence has been noted in many NIDU populations, particularly among NIDUs who use stimulants (crack cocaine and ATS), but there are important limitations of interventions to reduce stimulant drug use and to reduce unsafe sexual behavior among NIDUs. We interpret the data presented here as a proof of concept that it is possible to bring high prevalence HIV epidemics under public health control. The interventions implemented in NYC, specifically the safer sex/condom social marketing program and the provision of ART to HIV positive NIDUs, are not unique to NYC. These interventions were, however, implemented on a public health scale, with over 30 million free condoms distributed annually, over 98% of our participants tested for HIV, and over 80% currently on ART. We would also note that programs in NYC do provide short-term inpatient detoxification for NIDUs. While short-term detoxification rarely leads to total cessation of drug use, it may provide for a reduction in dependence and greater stability in the lives of NIDUs. Finally, we would note that these interventions were provided over long time periods—a decade or longer, while the crack cocaine epidemic itself declined.

It should be possible to replicate these conditions in other areas with high HIV prevalence among NIDUs, and "end HIV epidemics" [34] among NIDUs in these areas, as well.

Limitations

Several limitations should be considered. First, the data presented here are from subjects recruited from a single set of substance use programs. We have previously compared HIV risk behavior, HIV prevalence and incidence data from entrants into the Mount Sinai Beth Israel programs with data from injecting and non-injecting users recruited from community settings and other drug treatment programs [21, 35-37] and consistently found close agreement in absolute values and in trends. Most recently, we compared HIV incidence among PWID repeat participants in the Mount Sinai Beth Israel programs with HIV incidence estimated from New York State and New York City Health Department HIV surveillance systems, and found great consistency [38]. The declining prevalence and low HIV incidence among NIDUs in this study are also consistent with the decline in newly identified cases of heterosexually transmitted HIV in NYC (from 1053 cases in 2001 to 77 cases in 2014) [39] and the reduction in HIV prevalence among "high risk heterosexuals" in NYC who were part of the National HIV Behavioral Surveillance (NHBS) study (from 12.3% in 2010 to 3.9% in 2013) [40, 41].

Second, we did not have data from a standard cohort study to compare with the method for measuring HIV incidence used in this report. A cohort study to measure with precision the very low HIV incidence we observed would have been extremely expensive, and generalizing from an ethically conducted cohort study—with frequent HIV testing, referral to HIV treatment and sexually transmitted disease treatment—to the underlying NIDU population could be problematic.

Third, the percentage of subjects reporting methamphetamine use was very low (< 1%) and the percentage reporting male-with-male sexual behavior was also low (< 10%) so that we would not generalize to methamphetamine users or to MSM populations.

Despite these limitations, the data presented here clearly show a reduction in HIV seroprevalence and a low rate of HIV incidence (1.2/1000 PY) among the non-injecting heroin and cocaine users in this study.

HIV and Drug use Epidemiology

HIV epidemics among people who use drugs often occur following changes in patterns of drug use. HIV epidemics among PWID may be particularly likely when use patterns change to injecting drugs that are injected very frequently, e.g. cocaine [42], or short acting opiates [43]. Outbreaks of sexually transmitted HIV are particularly likely in association with increased use of drugs that are believed to increase sexual pleasure, such as crack cocaine [44] and methamphetamine among MSM [45].

We now have several effective public health interventions for reducing HIV transmission among people who use drugs, including needle/syringe programs, medication assisted treatment for opiate use, ART treatment as prevention for HIV seropositives, condom distribution, and pre-exposure prophylaxis for HIV seronegatives. We do need systems for

monitoring patterns of drug use so that if drug use patterns change towards those with greater HIV risk, we can adapt effective interventions to the changing local situation. There will also be instances where changes in the patterns of drug use reduce the likelihood of HIV transmission, such as a decline in crack cocaine use. We need to monitor these situations to adapt interventions to accelerate declines in HIV transmission and to address possible non-HIV harmful consequences in the new patterns of drug use. Drug use is a dynamic phenomenon and populations of persons using drugs by injecting and non-injecting routes of administration are also in flux. Controlling HIV transmission among persons who use drugs requires monitoring drug use patterns and adapting evidence-based interventions to changing local situations.

Additional research is needed to determine the long-term outcomes of non-injecting drug use-sexual transmission HIV epidemics in other areas. Such research should include analyses of possible changes in patterns of non-injecting drug use as well as in HIV infection.

Conclusions

NYC experienced a high seroprevalence HIV epidemic among NIDUs, reaching 19% in 2006. Prevalence has now declined to 8%, and incidence is now 1.2/1000 PY. This change is likely to be the result of simultaneously occurring processes—the decline in the crack cocaine epidemic, turnover in the NIDU population—and focused interventions, including the provision of ART for all HIV seropositives. Current HIV prevention and care programs for NIDUs should be maintained in NYC along with monitoring of possible changes in drug use in order to ensure that HIV incidence in this high-risk group remains very low. Other areas experiencing high HIV prevalence epidemics among NIDUs should implement combined HIV prevention and care for NIDUs on a public health scale, with an understanding that these programs will need to be maintained over long periods of time. Other areas should also monitor changes in patterns of drug use to so that interventions may be adapted as needed.

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Table 1a

Demographic characteristics and drug use behaviors of non-injecting drug users entering Mount Sinai Beth Israel drug treatment programs, New York City 2005-2014.

Year	N	HIV+ * %	Avg. Age (SD) #	Male * %	Female * %	While * %	African American * %	Latino/a %	Heroin * %	Speedball %	Cocaine %	Crack * %
2005	314	14.3	41 (7)	72.3	27.1	4.8	66.9	26.4	40.8	11.5	35.7	73.6
2006	404	19.1	41 (8)	76.0	23.5	5.2	64.9	28.5	38.9	11.9	39.9	75.5
2007	383	14.6	42 (7)	77.3	22.7	6.0	64.2	25.3	33.2	6.8	46.0	73.4
2008	378	17.2	43 (7)	74.3	25.4	5.0	69.8	22.2	34.7	7.4	41.8	76.2
2009	321	13.4	44 (8)	81.3	18.7	5.6	70.4	22.7	41.4	9.0	44.9	71.0
2010	271	15.1	43 (8)	78.6	21.4	6.3	67.5	23.2	41.0	5.2	33.6	70.8
2011	280	10.4	46 (7)	84.3	15.7	5.0	72.1	21.1	49.6	8.9	47.5	65.4
2012	300	9.3	45 (9)	80.7	19.3	10.0	58.7	29.7	57.7	8.0	41.7	57.3
2013	308	4.9	47 (8)	85.1	14.9	6.5	64.6	26.3	64.1	11.4	45.8	60.6
2014	339	6.5	47 (10)	79.4	20.1	7.1	59.9	31.0	70.9	10.4	41.9	56.3

Percentages for demographic variables may not add to 100% due to missing data. Missing data < 1 % for all variables.

*Significant difference by Cuzick's test for trend ($p < 0.05$)

#Significant trend by variance-weighted least squares test ($p < 0.05$)

Table 1b

Demographics and drug use characteristics of non-injecting drug users in New York City 2005-2014 by time periods.

	Time Period					
	2005-2010		**2011-2014**		**2005-2014**	
Average age (SD)*	42 (7.4)		46 (8.6)		44 (8.1)	
	N	**%**	**N**	**%**	**N**	**%**
Gender*						
Male	1585	76.5	1009	82.2	2594	78.7
Female	481	23.2	216	17.6	697	21.1
Race/ethnicity*						
White	113	5.5	89	7.3	202	6.1
African American	1391	67.2	780	63.6	2171	65.8
Hispanic	515	24.9	334	27.2	849	25.7
Heroin*	787	38	746	61.1	1533	46.6
Speedball	181	8.7	119	9.7	300	9.1
Cocaine/ nasal	842	40.7	541	44.1	1383	41.9
Crack Cocaine/ smoked*	1525	73.6	732	59.7	2257	68.5
HIV+*	327	15.8	94	7.7	421	12.8

Percentages for demographic variables may not add to 100% due to missing data. Missing data < 1 % for all variables.

*significant difference($p<0.05$) across time periods by t-test (age) and chi-square test (all other variables)

Table. 2a

Comparison of HIV prevalence by demographic and drug use characteristics across time periods

	2005-2010		2011-2014	
	Total n	**% HIV+**	**Total n**	**% HIV+**
Gender/MSM				
Non-MSM Male*	1403	10.8	952	5.7
Female*	481	22.0	216	10.7
MSM#	157	40.8	53	32.1
Race/ethnicity				
White	113	5.3	89	2.3
African American*	1391	17.7	780	8.7
Hispanic*	515	13.8	334	7.2
Drug use				
Heroin				
No*	1284	19.6	475	11.6
Yes*	787	9.5	746	5.1
Speedball				
No*	1890	16.1	1104	7.8
Yes	181	12.7	119	6.7
Cocaine				
No*	1229	18.4	686	7.9
Yes*	842	12.0	541	7.4
Crack cocaine				
No*	546	7.5	494	3.9
Yes*	1525	18.8	732	10.3

*Significant difference by chi-square test ($p < 0.05$) across time periods

#MSM: men who have sex with men

Table 2b

Logistic models of HIV prevalence among NIDUs in New York City 2005-2014

	2005-2010	2011-2014	2005-2014	2005-2014 (annual)
Time period	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95% CI)**
2005-2010	-	-	1 (ref)	
2011-2014	-	-	0.6 (0.5-0.8)*	
Year-of-interview (2005-2014)				0.92 (0.89-0.96)*
Gender/MSM				
Non-MSM Male	1 (ref)	1 (ref)	1 (ref)	1 (ref)
MSM#	5.3 (3.6-7.7)*	7.8 (3.9-15.5)*	5.8 (4.2-8.1)*	5.91 (4.24-8.24)*
Female	2.1 (1.6-2.8)*	2.1 (1.3-3.6)*	2.1 (1.6-2.7)*	2.09 (1.63-2.68)*
Race ethnicity				
White	1 (ref)	1 (ref)	1 (ref)	1 (ref)
African American	3.5 (1.5-8.3)*	3.6 (0.8-15.7)	3.6 (1.7-7.6)*	3.65 (1.73-7.70)*
Latino/a	3.5 (1.4-8.4)*	3.7 (0.8-16.6)	3.6 (1.7-7.8)*	3.64 (1.69-7.85)*
Age				
31 or greater	1 (ref)	1 (ref)	1 (ref)	1 (ref)
18-30 years	0.5 (0.3-1.0)	0&	0.5 (0.2-0.8)*	0.45 (0.24-0.85)*
Drug use				
Heroin/nasal	0.6 (0.4-0.8)*	0.6 (0.3-0.9)*	0.6 (0.4-0.7)*	0.57 (0.44-0.73)*
Cocaine/nasal	0.7 (0.5-0.9)*	-	0.7 (0.6-0.9)*	0.72 (0.57-0.91)*
Crack cocaine/smoked	1.7 (1.1-2.5)*	1.7 (1.0-3.1)	1.8 (1.3-2.4)*	1.74 (1.26-2.39)*

AOR could not be calculated as there were no HIV seropositive NIDU in the younger age group in the second time period

For multivariable logistic analyses we used case-wise deletion when any observation had a missing value for one or more of the predictor variables. This reduced sample sizes by < 3%.

*Significant effect ($p < 0.05$

Table 3

Comparison of sexual risk behaviors across time periods (2005-2010 vs. 2011-2014) and by year

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005-2010	2011-2014
HIV− (N)	269	326	322	309	278	230	251	271	290	315	1734	1127
	%	%	%	%	%	%	%	%	%	%	%	%
Unsafe sex w/ primary partner[#]	54.7	44.2	46.0	44.3	42.8	43.0	43.8	46.9	41.7	43.2	45.8	43.8
Unsafe sex w/ casual partner	13.8	17.2	19.4	19.2	19.8	20.0	23.2	13.7	18.5	13.0	18.2	16.8
Multiple sex partners[#*]	39.0	36.7	38.5	37.4	38.1	37.8	28.7	23.9	29.7	21.8	37.9	25.9
HIV+ (N)	44	76	54	64	43	41	29	28	15	22	322	94
	%	%	%	%	%	%	%	%	%	%	%	%
Unsafe sex w/ primary partner	22.7	23.7	18.5	15.6	27.9	17.1	17.2	21.4	6.7	31.8	20.8	20.2
Unsafe sex w/ casual partner	5.0	7.9	13.5	9.4	9.3	9.8	3.5	7.1	0.0	5.0	9.0	4.3
Multiple sex partners	17.8	23.4	26.8	23.1	27.9	24.4	17.2	10.7	26.7	27.3	23.9	19.2

[#]Significant difference by Cuzick's test for trend ($p < 0.05$) across years

[*]Significant difference by chi-square test ($p < 0.05$) across the 2005-2010 and 2011-2014 time periods

Table 4

Comparison of younger age group (18-29) in 2011-2014 to the older age group (50 or older) in 2005-2010

	Younger (< 30 years) 2011-2014		Older (50+ years) 2005-2010	
	N	%	N	%
Total	60	100	292	100
Gender				
Male	42	70.0	228	78.1
Female	18	30.0	64	21.9
Race/ethnicity*				
White	27	45.0	17	5.8
African American	10	16.7	216	74.0
Latino/a	19	31.7	55	18.8
Drug use				
Heroin*	48	81.4	104	35.6
Speedball*	10	16.9	24	8.2
Cocaine	28	46.7	117	40.1
Crack cocaine*	16	26.7	204	69.9
Unsafe sex among HIV−				
With primary partner*	28	47.5	79	32.9
With casual partner	11	18.6	33	13.7
Multiple sex partners among HIV−	15	25.0	72	29.6
HIV+ serostatus*	0	0	49	16.8

Percentages within demographic characteristics may not always add to 100% due to missing data or questions where multiple responses were permitted, e.g., recent drug use.

*Significant difference by chi-square test ($p < 0.05$)