HHS Public Access

Author manuscript

AIDS Behav. Author manuscript; available in PMC 2015 April 01.

Published in final edited form as:

AIDS Behav. 2014 April ; 18(0 3): 370–381. doi:10.1007/s10461-013-0568-z.

Comparing Study Populations of Men Who Have Sex with Men: Evaluating Consistency Within Repeat Studies and Across Studies in the Seattle Area Using Different Recruitment Methodologies

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Abstract

There is no gold standard for recruiting unbiased samples of men who have sex with men (MSM). To assess differing recruitment methods, we compared Seattle-area MSM samples from: venue-day-time sampling-based National HIV Behavioral Surveillance (NHBS) surveys in 2008 and 2011, random-digit-dialed (RDD) surveys in 2003 and 2006, and STD clinic patient data 2001–2011. We compared sociodemographics, sexual and drug-associated behavior, and HIV status and testing. There was generally good consistency between the two NHBS surveys and within STD clinic data across time. NHBS participants reported higher levels of drug-associated and lower levels of sexual risk than STD clinic patients. RDD participants differed from the other study populations in sociodemographics and some risk behaviors. While neither NHBS nor the STD clinic study populations may be representative of all MSM, both appear to provide consistent samples of MSM subpopulations across time that can provide useful information to guide HIV prevention.

Keywords

MSM; Recruitment methods; VDTS; HIV prevention; RDD

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Introduction

An estimated 64 % of all new diagnoses of HIV infection in the U.S. occur in men who have sex with men (MSM), a group representing approximately 2 % of the total U.S. adult and adolescent population [1, 2]. The success of public health efforts to prevent HIV transmission and the morbidity and mortality associated with the infection depend on having accurate data on factors such as HIV prevalence, sexual and drug-associated risk behaviors, and HIV testing and care among populations at high risk for infection. However, the best means for monitoring these parameters among MSM remain uncertain. Population-based surveys have been limited by the low proportion of MSM sampled and a lack of detailed data on their behavior [3–5], and alternative recruitment methods incorporate biases in selection and analysis that are difficult to evaluate [6–8].

Since 2003, the Centers for Disease Control and Prevention's National HIV Behavioral Surveillance System (NHBS) has employed venue-day-time sampling (VDTS) to recruit serial samples of MSM [9]. In this paper we compare Seattle-area samples of the local MSM population obtained from the 2008 and 2011 NHBS surveys of MSM, data from MSM attending the Public Health Seattle & King County Sexually Transmitted Diseases (STD) clinic, and from participants in two Seattle-area random digit dial (RDD) surveys of MSM [10, 11]. Our goals in these analyses were: (1) to assess the consistency in sociodemographic characteristics and behaviors associated with HIV transmission in repeat samples obtained through similar methods; (2) to compare how study populations recruited through different methods varied in these measures; (3) to use multivariate analyses to assess the association of sociodemographic and behavioral characteristics with HIV testing and with a measure of high-risk sex across study populations that use different recruitment methods. The latter provides an assessment of the consistency with which variables are associated with these outcomes across study populations. It also evaluates how these measures of HIV testing and high-risk sex are affected by differences in the composition of study populations.

Methods

NHBS–MSM Recruitment

Recruitment methods in both the 2008 and 2011 NHBS surveys were based on VDTS [9, 12]. Prior to implementation of the surveys, formative research was conducted to develop a list of appropriate venues, dates and times for recruiting MSM. From this, monthly recruitment events were randomly selected. Men entering a predetermined space at the venue were approached, queried about previous participation in the study and, if not already interviewed, invited to participate in the study. Eligibility requirements for both NHBS surveys required that participants be at least 18 years of age, be male, have had sex with a male in the previous 12 months, be competent to complete the interview in English (or Spanish in the 2011 NHBS survey), and reside in King or Snohomish Counties.

Study staff administered an eligibility screener to potential participants, obtained informed consent for those found to be eligible, and conducted a face-to-face interview using a handheld computer. Participants were paid $25 for completing an interview. All procedures were approved by the Washington State Institutional Review Board (IRB). NHBS activities

were determined to be research in which CDC was not engaged and CDC involvement did not require CDC IRB approval.

STD Clinic Data Acquisition

We used clinical data from patients seen at the Public Health Seattle & King County STD clinic 2001–2011. In addition to treatment for STDs, the STD clinic is accessed primarily for HIV testing by some patients. As some patients attended the STD clinic more than once in a given year, we used patient identifying codes to restrict the present analysis to the first new problem visit by all patients attending the STD clinic in each year. From 2001 through 2009, data were collected by health care personnel using standardized forms as part of routine clinical care. Starting in 2010, this information was elicited increasingly by patients' responses to a computerized questionnaire. STD clinic data from 2,107 patients seen in 2009 were used for comparison with the combined 2008 and 2011 NHBS samples. The use of data from the STD clinic for the present analysis was approved by the Washington State IRB.

RDD Survey Recruitment

Both the 2003 and the 2006 RDD studies were conducted by the Gilmore Research Group (Seattle, WA). They recruited MSM residing in three Seattle zip codes with high estimated concentrations of MSM, using similar methods [10, 11]. Eligibility requirements for both RDD surveys required that participants reside in one of the three target zip codes, be male, be 18 years of age or older, and have had sex with another male since age 14. No compensation was offered. Response rates, defined as the percent of completed interviews divided by the estimated number of all telephone numbers dialed that belonged to households with at least one MSM, were 46 % in 2003 and 22 % in 2006. These figures are based on the assumption that telephone numbers not contacted or screened had a similar proportion of eligible households as those screened. The 2003 RDD study was determined by the University of Washington IRB to be exempt from review and the 2006 RDD study was approved by the same board.

The present analysis was restricted to men reporting sex with another man in the previous 12 months, who were 18 years of age or older, and resided in King County, Washington in all data sets.

Variable Definitions

The two NHBS questionnaires were similar, though not identical. The RDD studies were designed to be consistent with one another and with the STD clinic data. Behavioral variables derive from self-report.

For race, NHBS questionnaires allowed participants to select more than one race. The RDD questionnaires and STD data included a category for 'Other/Mixed' race and multiple races, respectively. Hispanic ethnicity was evaluated by a separate question in NHBS and the STD clinic and was a category of the race question in the RDD surveys.

Education and income were evaluated in categories in the NHBS and RDD surveys that allowed collapse into a common classification. The STD clinic did not collect these variables. Area of residence was defined by zip code in all data sets.

Construction of a variable for unprotected (i.e., without a condom) anal sex in the previous 12 months with a male partner of unknown or opposite HIV status ("non-concordant UAI") varied in the different surveys. In the 2008 NHBS survey partner status derived from questions asking, "In the past 12 months, did you have anal sex without a condom with a man whose HIV status you didn't know?" and two analogous questions about HIV-positive and HIV-negative partners. In the 2011 NHBS survey, it was constructed from a series of questions on the number of male anal sex partners, the number with whom a condom was used, the number for whom HIV status was known, and what that status was. In the STD clinic and RDD studies it was derived from questions asking whether patients reported receptive or insertive anal sex with partners of HIV-positive, negative or unknown status, and the frequency of condom use with such partners.

NHBS used the following question to assess concurrent sexual partnerships: "During the time you were having a sexual relationship with this partner (i.e., the participant's last partner), did you have sex with other people?" This variable could not be evaluated for participants reporting that their last partner was a one night stand. An STD diagnosis in the previous year is based on a self-reported diagnosis of gonorrhea, syphilis or chlamydia in the NHBS and RDD studies, and in STD clinic data from patients completing the computerized form; health care personnel made the determination for the other STD clinic patients.

The RDD surveys did not collect information on drug injection history. Amphetamine use (both injected and non-injected) was evaluated over the past 12 months in NHBS and the STD clinic and the past 6 months in the RDD studies. A variable for cocaine use (injected or not, crack or powdered) in the previous 12 months was constructed for NHBS but not available from the other study populations. Popper (amyl nitrite) use was ascertained either with reference to the past 12 months (NHBS), or the past 6 months (RDD) or on the basis of month and date of last use (STD clinic). As RDD participants were not tested for HIV, and STD clinic patients were not universally tested, we compared self-reported HIV status across study populations.

Statistical Evaluation

We compared: (1) the 2008 with the 2011 NHBS study population; (2) the combined NHBS population with the 2009 STD clinic study population and; (3) the combined NHBS population with the 2006 RDD study populations. The 2006 RDD study was chosen for comparison, despite a lower response rate than the 2003 RDD study, because it was closer in time to the NHBS and STD clinic data and because it is more likely to reflect how RDD would currently function.

No system of weighting was used to adjust the data for study design in any of the study populations. Significance was evaluated by Pearson χ^2 statistics, and a test for trend by a linear-by-linear χ^2 test. Statistical significance is defined as a p value <0.05. We also present time trends graphs over the full time interval 2001–2011 for selected variables in the NHBS,

STD clinic, and RDD populations. Ninety-five percent confidence intervals are included in the graphs to provide an indication of variability in the data.

Logistic regression was used to evaluate the association of non-concordant UAI and an HIV test within the previous 2 years with: age, race, education, income, area of residence, a history of injection, amphetamine use, popper use, number of male sex partners, and any sex with a female. The 2-year HIV testing variable was selected to identify a population testing at a frequency well outside of CDC's recommended schedule for MSM. Separate models were constructed for each outcome in each study population. We evaluated the *p* value for each independent variable in a model incorporating all variables found to be significantly and independently associated with the dependent variable (i.e., those with a *p* value<0.05 in Table 5). Analyses were conducted in SPSS [13].

Results

Recruitment in NHBS

In the 2008 NHBS survey there were 34 recruitment venues, among which bars were the most common (accounting for 44 % of participants) followed by social organizations (19 %) and dance clubs (18 %). In the 2011 NHBS survey there were 41 venues, again with bars the most common (33 %), followed by dance clubs (22 %) and retail businesses (14 %). Eleven venues were used in both surveys.

Recruitment results in the 2008 NHBS survey have been published [14]: 27 % of men initially approached accepted the eligibility screener; 356 participants were eligible for the present analysis. In the 2011 NHBS survey, staff approached 3,098 men in 99 recruitment events between July 7 and December 4, 2011. Of these, 2,206 answered the preliminary query on previous participation. Eleven men indicated they had previously participated in the survey. Among the remaining 2,195 men, 628 accepted the screening interview (20 % of those initially approached), and 360 were eligible for the present analysis.

Sociodemographics

2008 NHBS Versus 2011 NHBS—There was little difference between the 2008 and 2011 NHBS participants in age, area of residence, and education (Table 1). Participants in 2011 had a somewhat higher proportion of Blacks and Hispanics and a lower proportion of those reporting multiple races. Differences in categorized income were significant. However, the differences were not such that one group simply tended to have a higher income than the other ($p_{trend} = 0.35$; $\chi^2 = 0.86$, 1 d.f.). Because differences between the 2008 and 2011 surveys in sociodemographic characteristics and risk behaviors (see below) were modest, we combined both populations for purposes of comparison with STD clinic and RDD study populations.

Combined NHBS Versus 2009 STD Clinic—STD clinic patients were similar in age distribution to the combined NHBS study population. There were significant differences in the groups' racial compositions, with the STD clinic patients more likely to be White and less likely to report multiple races. Examination of time trends in the proportion of Blacks and Hispanics (Fig. 1a, b) show a close correspondence between the NHBS and STD clinic

study populations. STD clinic patients were more likely than NHBS participants to live in north Seattle and east King County, and less likely to live on Seattle's Capitol Hill (Seattle's historic gay neighborhood), where the majority of NHBS recruitment venues were located, and in the adjoining Central District.

Combined NHBS Versus 2006 RDD—Participants in the 2006 RDD study differed significantly from NHBS participants in: age, race, education and income. In the time trend figures, the RDD data lies well outside of the range of STD clinic and NHBS data with respect to Black race, Hispanic ethnicity and the proportion of participants over 50 (Fig. 1a–c). In addition, the proportion of RDD participants over 50 years of age was substantially higher in 2006 than in 2003 (Fig. 1c). When the NHBS participants were restricted to residents of the zip codes which defined the RDD sample, the differences between the RDD and NHBS participants remained statistically significant for age, race, education, and income ($p < 8 \times 10^{-4}$).

Sexual Behavior

2008 NHBS Versus 2011 NHBS—There was no statistically significant difference between the 2008 and 2011 NHBS participants in the number of male sex partners, any sex with a female, or any non-concordant UAI (Table 2). NHBS participants in 2011 were significantly more likely than those in 2008 to report an STD diagnosis.

A more detailed depiction of sexual behavior was elicited by questions directed to behavior at participants' last male sexual contact (Table 3). Participants in the 2008 survey were more likely than those surveyed in 2011 to report that their last partner was a casual partner. Little difference was found between the NHBS surveys with respect to: participants' knowledge of their partner's HIV status, engaging in concurrent sexual partnerships, drug-use at last sexual contact, or the specific sexual practices in which they engaged.

Combined NHBS Versus 2009 STD Clinic—Compared to STD clinic patients, NHBS participants reported lower numbers of male sexual partners in the previous 12 months (Table 2). The difference was wholly accounted for by the higher proportion of the NHBS participants reporting a single sexual partner. After exclusion of those reporting one partner from both populations, there was no significant difference ($p = 0.65$; $\chi^2 = 0.86$, 2 d.f.). NHBS participants were less likely than STD clinic patients to report a female sex partner (Fig. 2a). While the combined NHBS study population was more likely than 2009 STD clinic patients to report any non-concordant UAI, the time trends figures did not show a consistent difference (Fig. 2b). The time trend figure for an STD diagnosis showed a rise between 2008 and 2011 in both NHBS participants and STD patients (Fig. 2c).

Combined NHBS Versus 2006 RDD—RDD participants differed in the number of male sex partners compared to NHBS participants, most strikingly in the higher proportion of RDD participants reporting a single partner. There was no significant difference between the groups in the proportion reporting a female sex partner or having an STD diagnosis. RDD participants were less likely than NHBS participants to report non-concordant UAI.

HIV Testing and Self-Reported HIV Status

2008 NHBS Versus 2011 NHBS—There was no significant difference between NHBS participants in 2008 and 2011 in self-reported HIV status (Table 4). Nor was there a significant difference in the proportion reporting an HIV test in the previous 12 months or 2 years.

Combined NHBS Versus 2009 STD Clinic—STD clinic patients were less likely to self-report HIV-positive status than NHBS participants. No significant difference was found in 12-month or 2-year HIV testing.

Combined NHBS Versus 2006 RDD—There was no significant difference between RDD and NHBS participants in self-reported HIV status, or HIV testing within either the past 12 or 24 months.

Drug-Associated Behavior

2008 NHBS Versus 2011 NHBS—There was no significant difference between NHBS participants in 2008 and 2011 in: a history of drug injection, or use of amphetamines, poppers or cocaine (Table 4).

Combined NHBS Versus 2009 STD Clinic—STD clinic patients reported significantly lower levels than NHBS participants of: a history of drug injection, use of amphetamines (Fig. 2d), and use of poppers.

Combined NHBS Versus 2006 RDD—RDD participants reported significantly lower levels of amphetamine and popper use than NHBS participants.

Multivariate Analysis of Associations with Risk Behaviors Across Recruitment Methods

Non-Concordant UAI—Several variables had a consistent relation with non-concordant UAI across study populations derived from all three recruitment methods (Table 5). The number of male sexual partners was significantly and positively associated with non-concordant UAI in all three study populations, though the odds ratios differed by recruitment method. In analyses excluding participants reporting only one male sex partner, sexual partner number remained significantly associated with non-concordant UAI in data from each recruitment method ($p < 2 \times 10^{-4}$). Income was significant in the RDD study population only. Having a female sex partner was significant among NHBS participants only. Race, education, area of residence, and a history of drug injection were not significantly associated with non-concordant UAI any study population.

The odds ratio for amphetamine use was elevated in data from each recruitment method but attained significance only among NHBS participants and STD clinic patients. The odds ratio for popper use was elevated in the data from all recruitment methods but significant only among STD clinic patients. Age was inversely associated in the NHBS and RDD populations but significant only among NHBS participants.

HIV Testing in the Previous Two Years—The odds ratio for an HIV test in the previous two years significantly increased with the number of male sex partners in each study population. No significant association with testing was found for: age, race, income, area of residence, a history of injection, or amphetamine use. Education was significantly and negatively associated with testing only among NHBS participants, having a female sex partner only in the STD clinic data, and use of poppers (positively) and amphetamines (negatively) only in the RDD data.

Discussion

We compared demographic and behavioral data obtained from different samples of MSM recruited in the Seattle area. Our findings suggest that VDTS and data collected from the STD clinic provide data on somewhat different samples of MSM. The substantial agreement between the two NHBS surveys and the smoothness and low variance of the time trend figures for the STD clinic suggest that serially collected data from both sources access internally consistent samples in terms of demographics and behavioral risks. This suggests that both STD clinic data and VDTS may be useful in monitoring behavioral trends in MSM and can be complementary sources of information.

Based the apparent differing proportionate distributions in the tables and in the time trends figures, RDD participants differed materially from both STD clinic patients and NHBS participants in sociodemographics, number of male sex partners and non-concordant UAI. Other studies have reported differences between venue attendees and RDD samples [15–18].

The NHBS and the STD clinic samples varied from one another. In particular, NHBS recruited a sample with higher levels of substance use, while STD clinic patients included men living in more varied parts of King County who were more likely to report sex with multiple male partners and with female partners. These differences indicate that NHBS surveys include important groups of MSM who might be missed by the use of STD clinic data as sentinel surveillance alone. On the other hand, such sentinel surveillance accesses a much larger population than NHBS and does so on an ongoing basis. Also in many parts of the U.S., the basis for such sentinel systems is already in place and can be sustained at relatively low cost. Our multivariate analyses suggest that sociodemographic differences between the NHBS and STD clinic study populations did not have a major influence on the measurement of non-concordant UAI and HIV testing. However, assessment of these key variables appears to be subject to differences in sexual partner number and patterns of drug use among study populations.

Comparing serial NHBS samples, we observed some variance in the populations' racial composition, income, and the proportion reporting a main last sex partner, but these differences were relatively small in magnitude. For STD diagnoses, we note that the number of combined syphilis, chlamydia and gonorrhea cases reported among MSM in King County increased from 867 in 2008 to 1,783 in 2011 [19, 20]. Thus, the increase in STD diagnoses both across the two NHBS samples and in the STD clinic data may well reflect a true time trend. These findings suggest that serial VDTS samples are capable of monitoring time trends.

The consistency of sociodemographic characteristics and risk behavior in repeat samples of NHBS participants is in marked contrast with previous findings showing substantial differences between two NHBS surveys of the Seattle-area IDU recruited by respondent-driven sampling (RDS) [21]. Although this difference could be a product of differences between MSM and IDU, the lower consistency among RDS samples supports the idea that RDS methodology produces samples with substantial variance [22, 23].

The interpretation of our results is qualified by several considerations. We compare two specific RDD samples, two specific VDTS-based samples and STD clinic patients in one city. The extent to which our findings can be generalized remains in question. Low participation rates in both the VDTS and RDD studies could have produced biased study populations and the samples were relatively small, limiting the precision of their estimates. Variable definitions in the different studies were not strictly identical. The effects of self-reporting bias may have varied in the different study populations. The collection of variables used is relatively crude and the populations might vary with respect to factors not evaluated by our analyses. As many variables were investigated, multiple testing considerations imply that some significant associations could have arisen by chance.

Neither the NHBS nor the STD clinic study populations could be claimed to represent an unbiased population of Seattle-area MSM. The use of sampling methods that, if biased, at least allows those biases to be clearly identified and understood has advantages. As both the NHBS and STD clinic study populations tended to report higher levels of sexual and drug-related risk behavior than the RDD samples, they may represent MSM subpopulations at elevated risk for HIV transmission. By focusing on high-risk MSM, the STD clinic and NHBS samples may have some advantages over a truly random MSM sample for monitoring behaviors relevant to the HIV epidemic.

We suggest that reproducibility and consistency of findings are useful criteria for evaluating a sampling method. Both the VDTS methods of the NHBS surveys and monitoring the STD clinic patients appear to meet the criteria of consistency over the short term. The VDTS methods in the 2008 and 2011 NHBS MSM surveys suffered from low participation rates. The possibility of changes over time in the characteristics of MSM who socialize at gay venues could affect the ability of VDTS methods to monitor longer term time trends. Similarly, the characteristics of persons treated at the STD clinic could be affected by changes in the structure of health care delivery such as those resulting from the Affordable Care Act. Nonetheless, both methodologies appear to offer reasonable approaches and can be expected to provide critical information for HIV behavioral surveillance.

Acknowledgments

Funding for this research came from a Grant from the National Institutes of Health (NIH) (1 R03 DA031072-01A1) and cooperative agreements with the Centers for Disease Control and Prevention (5U62PS000969 and 1U1BPS003250). This research was supported by the University of Washington Center for AIDS Research (CFAR), an NIH funded program (P30AI027757) which is supported by the following NIH Institutes and Centers (NIAID, NCI, NIMH, NIDA, NICHD, NHLBI, NIA). The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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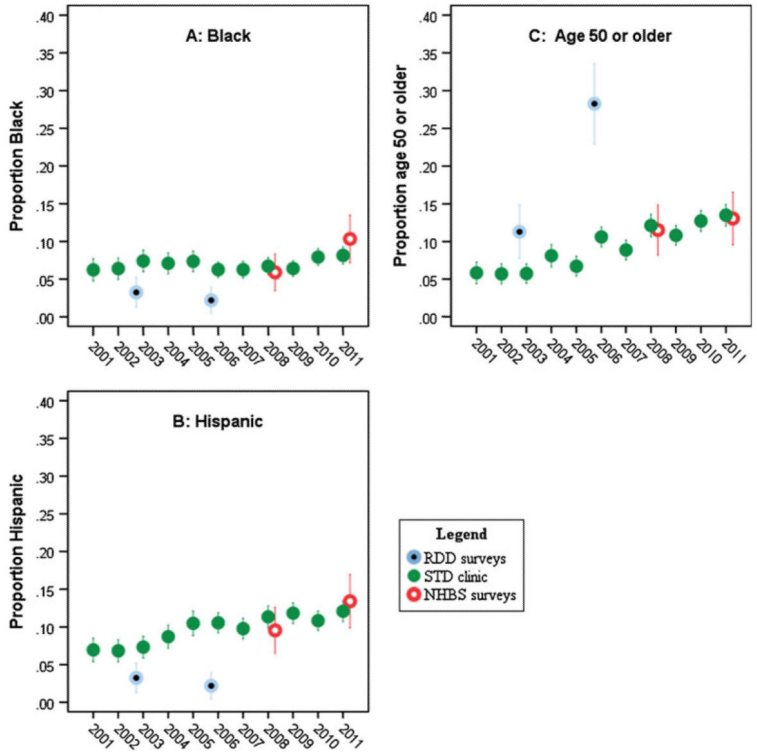

Fig. 1.

Time trends (with 95 % confidence intervals) in sociodemographics across samples of Seattle-area MSM. *RDD* random digit dial, *STD* sexually transmitted disease, *NHBS* National HIV Behavioral Surveillance

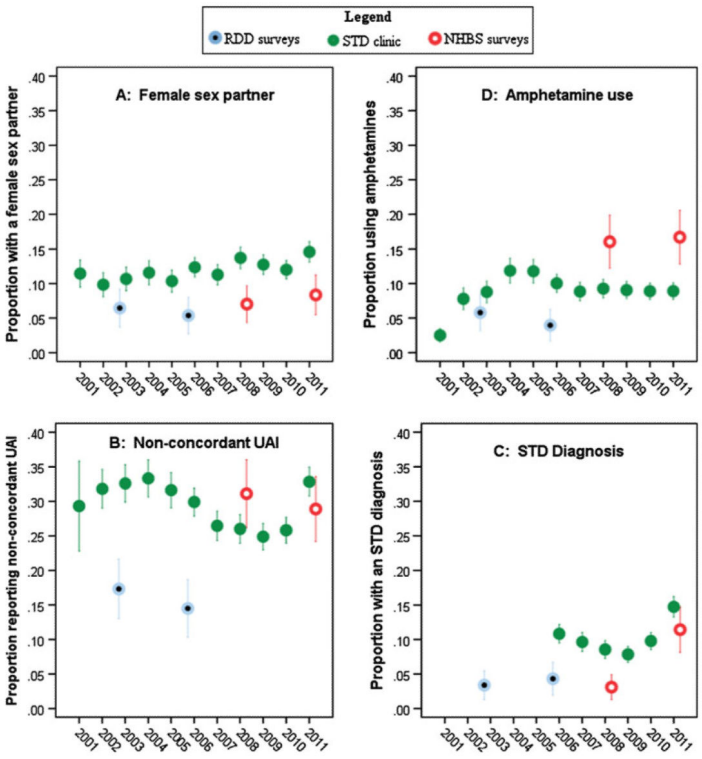

Fig. 2.

Time trends (with 95 % confidence intervals) in sexual and drug-associated risk in the previous 12 months across samples of Seattle-area MSM. *RDD* random digit dial, *STD* sexually transmitted disease, *NHBS* National HIV Behavioral Surveillance, *Non-concordant UAI* unprotected anal sex with a partner of unknown or opposite HIV status

Table 1

Sociodemographic variables among Seattle-area MSM participating in the 2008 and 2011 NHBS surveys, the 2006 RDD survey and MSM seen in the STD clinic in 2009

	NHBS survey 2008		NHBS survey 2011		STD clinic MSM 2009		RDD survey 2006		NHBS 2008 versus 2011 *p* value (χ^2; d.f.)[b]	NHBS versus STD clinic[a] *p* value (χ^2; d.f.)	NHBS versus RDD survey[a] *p* value (χ^2; d.f.)
	n/N	%	*n/N*	%	*n/N*	%	*n/N*	%			
Age, in years									0.42	0.45	$<1 \times 10^{-16}$
18–29	142/356	40	138/360	38	831/2,107	39	30/276	11	(2.84; 3)	(2.66; 3)	(100.8; 3)
30–39	109/356	31	96/360	27	578/2,107	27	71/276	26			
40–49	64/356	18	79/360	22	470/2,107	22	97/276	35			
≥50	41/356	12	47/360	13	228/2,107	11	78/276	28			
Race/ethnicity									0.02	$<1 \times 10^{-16}$	1×10^{-12}
White	223/356	63	223/358	62	1,464/2,038	72	242/274	88	(13.98; 5)	(102.8; 5)	(65.28; 5)
Black	21/356	6	37/358	10	1,35/2,038	7	6/274	2			
Hispanic	34/356	10	48/358	13	241/2,038	12	6/274	2			
Native American	4/356	1	5/358	1	12/2,038	1	2/274	1			
Asian	30/356	8	18/358	5	150/2,038	7	4/274	2			
Multiple/other race	44/356	12	27/358	8	36/2,038	2	14/274	5			
Area of residence									0.72	7 × 10-8	$<1 \times 10^{-16}$
North Seattle	57/348	16	59/349	17	455/2,107	22	145/279	52	(3.67; 6)	(44.16; 6)	(251.6; 6)
Downtown Seattle	39/348	11	45/349	13	318/2,107	15	–	–			
Capitol Hill	84/348	24	73/349	21	370/2,107	18	134/279	48			
Central District	76/348	22	82/349	24	322/2,107	15	–	–			
South Seattle	37/348	11	43/349	12	233/2,107	11	–	–			
South King County	35/348	10	25/349	7	190/2,107	9	–	–			
East King County	20/348	6	22/349	6	219/2,107	10	–	–			
Education									0.12	–	1×10^{-16}
≤High school grad.	69/356	19	89/360	25	–	–	28/279	10	(4.25; 2)		(74.01; 2)
Some post high school	144/356	40	123/360	34	–	–	53/279	19			
College grad.	143/356	40	148/360	41	–	–	198/279	71			
Income									0.02	–	8×10^{-10}
<$15,000	64/356	18	91/357	26	–	–	18/267	7	(10.08; 3)		(45.18; 3)

	NHBS survey 2008		NHBS survey 2011		STD clinic MSM 2009		RDD survey 2006		NHBS 2008 versus 2011	NHBS versus STD clinic[a]	NHBS versus RDD survey[a]
	n/N	%	*n/N*	%	*n/N*	%	*n/N*	%	*p* value (χ^2; d.f.)[b]	*p* value (χ^2; d.f.)	*p* value (χ^2; d.f.)
$15,000–$39,999	123/356	35	91/357	26	–	–	74/267	28			
$40,000–$74,999	101/356	28	111/357	31	–	–	85/267	32			
$75,000+	680/356	19	64/357	18	–	–	90/267	34			
N (total)	356		360		2,107		279				

[a] Combined 2008 and 2011 NHBS study samples

[b] Degrees of freedom

Table 2

Sexual behavior in the 12 previous months among Seattle-area MSM participating in the 2008 and 2011 NHBS surveys, the 2006 RDD survey and MSM seen in the STD clinic in 2009

	NHBS survey 2008		NHBS survey 2011		STD clinic MSM 2009		RDD survey 2006		NHBS 2008 versus 2011	NHBS versus STD clinic[a]	NHBS versus RDD survey[a]
	n/N	%	*n/N*	%	*n/N*	%	*n/N*	%	*p* value (χ^2; d.f.)[b]	*p* value (χ^2; d.f.)	*p* value (χ^2; d.f.)
Number male sex partners									0.24 (4.20; 3)	2×10^{-9} (43.79; 3)	9×10^{-6} (26.11; 3)
1	68/356	19	90/360	25	254/2,107	12	103/279	37			
2–4	114/356	32	102/360	28	732/2,107	35	82/279	29			
5–9	75/356	21	78/360	22	472/2,107	22	40/279	14			
10+	99/356	28	90/360	25	649/2,107	31	54/279	19			
Any sex with a female	25/356	7	30/359	8	265/2,078	13	15/279	5	0.50 (0.45;1)	2×10^{-4} (13.43; 1)	0.20 (1.64; 1)
Non-concordant UAI[c]	107/344	31	104/360	29	489/1,965	25	40/276	15	0.52 (0.41; 1)	0.01 (6.93; 1)	6×10^{-7} (24.93; 1)
STD diagnosis	11/355	3	41/359	11	159/2,026	8	12/278	4	2×10^{-5} (18.31; 1)	0.63 (0.24; 1)	0.09 (2.92; 1)
N (total)	356		360		2,107		279				

[a] Combined 2008 and 2011 NHBS study samples

[b] Degrees of freedom

[c] Unprotected (i.e. without a condom) anal intercourse with a partner of unknown or opposite HIV status

Table 3

Sexual behavior at last male sexual contact among Seattle-area MSM participating in the 2008 and 2011 NHBS surveys

	2008 NHBS survey		2011 NHBS survey		2008 NHBS versus 2011 NHBS
	n/N	%	*n/N*	%	*p* value (χ^2; d.f.)[a]
Knew partner's HIV status	247/356	69	237/360	66	0.31 (1.03; 1)
Concurrent sexual partners[b]	154/335	46	134/286	47	0.83 (0.05; 1)
Any drug-use	63/356	18	70/360	19	0.55 (0.36; 1)
Type of partner					0.04 (4.06; 1)
Main male	129/356	36	157/360	44	
Casual male	227/356	64	203/360	56	
Sexual practices					0.90 (1.09; 4)
Oral sex only	108/355	30	103/360	29	
Protected anal sex only	110/355	31	114/360	32	
Concordant UAI only[c]	95/355	27	104/360	29	
UAI with HIV unknown[d]	32/355	9	32/360	9	
Discordant UAI[e]	10/355	3	7/360	2	
N (total)	356		360		

[a] Degrees of freedom

[b] Participants whose last sexual contact was a one night stand are excluded from this variable

[c] The participant knew his own HIV status, that of his partner and they were the same

[d] The participant was unaware either of his own status or that of his partner

[e] The participant knew his own HIV status, that of his partner and they were different

Table 4

HIV testing and drug-associated behavior in the among Seattle-area MSM participating in the 2008 and 2011 NHBS surveys, the 2006 RDD surveys and MSM seen in the STD clinic in 2009

	NHBS survey 2008		NHBS survey 2011		STD clinic MSM 2009		RDD survey 2006		NHBS 2008 versus 2011	NHBS versus STD clinic[a]	NHBS versus RDD survey[a]
	n/N	%	*n/N*	%	*n/N*	%	*n/N*	%	*p* value (χ^2; d.f.)[b]	*p* value (χ^2; d.f.)	*p* value (χ^2; d.f.)
Self-reported HIV-positive	50/356	14	64/360	18	252/2,057	12	35/279	13	0.17 (1.86; 1)	0.01 (6.25; 1)	0.18 (1.80; 1)
HIV testing[c]											
12 months	188/306	61	189/294	64	1,195/1,787	67	144/242	60	0.47 (0.52; 1)	0.07 (3.26; 1)	0.37 (0.81; 1)
24 months	240/306	78	233/294	79	1,470/1,787	82	178/242	74	0.81 (0.06; 1)	0.06 (3.49; 1)	0.10 (2.74; 1)
Drug-associated behavior											
Injection, ever	57/356	16	52/358	15	138/2,107	7	–	–	0.58 (0.31; 1)	1×10^{-12} (50.72; 1)	–
Any amphetamine use[d,e]	57/356	16	60/359	17	189/2,086	9	11/278	4	0.80 (0.06; 1)	7×10^{-8} (29.19; 1)	2×10^{-7} (27.44; 1)
Any popper use[d]	94/356	26	107/360	30	378/2,052	18	45/279	16	0.32 (0.98; 1)	5×10^{-8} (29.89; 1)	9×10^{-5} (15.39; 1)
Any cocaine use[d,e,f]	98/356	28	99/358	28	–	–	–	–	0.97 (0.001; 1)	–	–
N (total)	356		360		2,107		279				

[a] Combined 2008 and 2011 NHBS study samples

[b] Degrees of freedom

[c] Among participants not self-reporting HIV-positive status

[d] Previous 12 months in NHBS surveys and STD clinic data; 6 months in the RDD survey

[e] Includes both injected and non-injected use

[f] Includes both crack and powdered cocaine

Table 5

Multivariate associations with non-concordant UAI and having an HIV test within the previous 2 years among Seattle-area MSM participating in the combined 2008 and 2011 NHBS surveys, the 2006 RDD survey and MSM seen in the STD clinic in 2009

	Non-concordant UAI[a]			HIV test, previous 2 years[b]		
	NHBS[c] OR	STD clinic OR	RDD OR	NHBS[c] OR	STD clinic OR	RDD OR
Age						
18–29	1.00	1.00	1.00	1.00	1.00	1.00
30–39	1.03	1.08	0.31	0.95	1.22	0.77
40–49	0.52	1.11	0.54	0.69	0.88	0.35
≥50	0.61	1.07	0.46	0.65	0.71	0.34
(*p* value)	(0.02)	(0.90)	(0.35)	(0.44)	(0.09)	(0.07)
(χ^2; d.f.)[d]	(10.01; 3)	(0.59; 3)	(3.30; 3)	(2.73; 3)	(6.45; 3)	(7.18; 3)
Education						
≤High school grad.	1.00	_ [e]	1.00	1.00	_ [e]	1.00
Some post high school	0.85	–	1.31	2.04	–	1.47
College grad.	0.72	–	0.65	1.22	–	0.91
(*p* value)	(0.38)	–	(0.34)	(0.03)	–	(0.54)
(χ^2; d.f.)	(1.94; 2)	–	(2.16; 2)	(7.37; 2)	–	(1.22; 2)
Income						
<$15,000	1.00	–	1.00	1.00	–	1.00
$15,000–$39,999	0.90	–	0.24	1.35	–	1.40
$40,000–$74,999	0.76	–	0.12	1.50	–	1.12
$75,000+	0.63	–	0.24	1.45	–	0.80
(*p* value)	(0.39)	–	(0.02)	(0.61)	–	(0.59)
(χ^2; d.f.)	(3.04; 3)	–	(9.80; 3)	(1.83; 3)	–	(1.90; 3)
Amphetamine use						
None	1.00	1.00	1.00	1.00	1.00	1.00
Any	2.03	2.04	2.21	0.73	1.31	0.17
(*p* value)	(0.002)	(3×10^{-5})	(0.31)	(0.33)	(0.31)	(0.045)
(χ^2; d.f.)	(9.95; 1)	(17.57; 1)	(1.02; 1)	(0.95; 1)	(1.04; 1)	(4.01; 1)
Popper use						
None	1.00	1.00	1.00	1.00	1.00	1.00
Any	1.44	1.43	2.02	1.67	1.12	6.33
(*p* value)	(0.08)	(0.01)	(0.13)	(0.08)	(0.55)	(0.004)
(χ^2; d.f.)	(3.17; 1)	(6.80; 1)	(2.33; 1)	(3.06; 1)	(0.36; 1)	(8.46; 1)
Number male sex partners						
1	1.00	1.00	1.00	1.00	1.00	1.00
2–4	1.22	1.02	1.88	1.77	2.17	3.01
5–9	2.91	1.21	5.47	3.77	2.94	5.18
10+	5.33	2.29	13.48	4.68	4.45	4.07

	Non-concordant UAI[a]			HIV test, previous 2 years[b]		
	NHBS[c] OR	STD clinic OR	RDD OR	NHBS[c] OR	STD clinic OR	RDD OR
(*p* value)	(3×10^{-13})	(1×10^{-9})	(1×10^{-7})	(1×10^{-7})	(4×10^{-12})	(1×10^{-5})
(χ^2; d.f.)	(61.26; 3)	(44.88; 3)	(34.96; 3)	(34.75; 3)	(56.12; 3)	(18.85; 3)
Any female sex partners						
None	1.00	1.00	1.00	1.00	1.00	1.00
Any	1.99	1.06	1.31	1.11	0.54	0.55
(*p* value)	(0.03)	(0.74)	(0.76)	(0.78)	(3×10^{-4})	(0.33)
(χ^2; d.f.)	(0.4.58; 1)	(0.11; 1)	(0.09; 1)	(0.08; 1)	(13.25; 1)	(0.97; 1)
N	716	2,107	279	602	1,855	266

The table includes only those variables significantly associated with the outcome variable in at least one study population; race, area of residence, and a history of injection were not significantly associated with either outcome variable in any study population

[a] Unprotected (i.e. without a condom) anal intercourse with a partner of unknown or opposite HIV status

[b] Among persons not reporting a previous HIV-positive test

[c] Combined 2008 and 2011 NHBS study samples

[d] Degrees of freedom

[e] Education and income were not evaluated in the STD clinic data