Sexual Risk Behavior and Drug Use in Two Chicago Samples of Men Who Have Sex with Men: 1997 vs. 2002

Michael Fendrich, Mary Ellen Mackesy-Amiti,
Timothy P. Johnson, and Lance M. Pollack

ABSTRACT *Employing data from two Chicago-based household probability samples of men who have sex with men (MSM) implemented 5 years apart (the "UMHS 1997" and the "2002 MSM supplement" studies), we evaluated changes in risk behavior as well as the potential viability of two alternative perspectives for explaining these changes—risk management and safe-sex norm abandonment. We found significantly increased rates of unprotected insertive and receptive anal intercourse in the 2002 study. Sixty-eight percent of UMHS men reported having sex with partners having HIV positive or unknown status, compared with 38% of the MSM supplement men (p<.0001). Serosorting mediated and moderated the most extreme forms of risk behavior. Positive statistical associations between drug use and unprotected sex were stronger in the UMHS sample than in the MSM supplement. Findings suggesting that "risk management" strategies have shaped MSM behavior as it emerged in the early part of this decade have considerable implications for HIV prevention strategies.*

KEYWORDS *Epidemiology, HIV/AIDS, Men who have sex with men, Sexual behavior, Substance use*

The incidence of HIV/AIDS among men who have sex with men (MSM) has rebounded in recent years in the USA.[1–3] The number of HIV/AIDS diagnoses among MSM increased 11% from 2001 through 2005.[2] Coinciding with these trends, surveys of MSM in North America and Europe have suggested that there has been an increase in rates of unprotected sexual intercourse among MSM.[4–7]

These trends underscore the need for a renewed emphasis on education and prevention strategies. Nevertheless, programs need to be informed by knowledge of behavioral and psychosocial factors underlying increases in risky behavior. Reviewing the literature in this area, there are two major schools of thought among

Fendrich is with the Center for Addiction and Behavioral Health Research, Helen Bader School of Social Welfare, University of Wisconsin-Milwaukee, Milwaukee, WI, USA; Mackesy-Amiti is with the Community Outreach Intervention Projects, Division of Epidemiology and Biostatistics, School of Public Health, University of Illinois at Chicago, Chicago, IL, USA; Johnson is with the Survey Research Laboratory, College of Urban Planning and Public Affairs, University of Illinois at Chicago, Chicago, IL, USA; Pollack is with the Center for AIDS Prevention Studies, University of California San Francisco, San Francisco, CA, USA.

Correspondence: Michael Fendrich, PhD, Center for Addiction and Behavioral Health Research, Helen Bader School of Social Welfare, University of Wisconsin-Milwaukee, Milwaukee, WI, USA. (E-mail: fendrich@uwm.edu)

researchers investigating changing HIV risk behavior over the past 15 years. One conceptualizes engagement in unprotected sex as an abandonment of safer sex norms (henceforth referred to as "norm abandonment") advocated in prevention programs targeted to MSM. The other contends that the goal of safer sex is intact, but the means of achieving that goal is being adapted by individuals to fit their needs and circumstances. This is reflected in the various strategies MSM employ in their sexual encounters that they believe balances their risk of disease contraction/transmission with the benefit of maintaining (or maximizing) their sexual pleasure and sexual relationships (henceforth referred to as "risk management").

One line of research consistent with the notion that HIV increases are a function of safe-sex norm abandonment focuses on the rise of "treatment optimism"[7] among MSM. This explanation suggests that the widespread adoption of highly active antiretroviral therapies resulted in the belief that HIV/AIDS was no longer a fatal disease. Optimism about treatment outcomes in turn led to increases in unprotected sex and other unsafe sex practices. Data from cross sectional studies suggest that attitudes may shift *in response* to perceptions about therapeutic improvements.[8–10] Longitudinal research, however, indicates that such changes may actually be a post-hoc "rationalization" for risky behavior rather than a cause.[4,11]

Another perspective consistent with the norm abandonment rationale focuses on the idea that MSM have potentially been "overexposed" to prevention messages, and, as a result, their behavior reflects backlash or burnout. In particular, Ostrow[12] offers the idea that the HIV rebound (and changing sexual behavior) reflects a rejection of safe-sex norms advocated by the plethora of prevention programs targeted to gay men during the HIV epidemic. Data from the Multicenter AIDS cohort study suggest that lack of concern about HIV transmission and safe sex fatigue may be more pronounced among HIV-seropositive men than other MSM.[13] Additionally, these same data suggest that while lower HIV transmission concerns affected risk behavior in both HIV-negative and HIV-positive MSM, safe sex fatigue was an independent risk factor for HIV risk behavior only among HIV-positive MSM.[13] These findings suggest that while burnout may play a role in shifting behavioral trends, there is a need to investigate the role of other variables to more fully explain this phenomenon.

The role of drugs in sexual activity among MSM has been given a great deal of attention in the research literature.[14] Of particular interest is the rise of club drugs and methamphetamine among MSM in the early part of the current decade.[15] Some have suggested that excessive drug use and drinking facilitates "cognitive escape"—a mechanism that promotes engagement in same sex behaviors and undermines prevention messages.[16,17] This explanation for changes in risky sexual behavior—a trend toward increasing use of substances that facilitate escape among MSM—would be consistent with norm abandonment models of sexual risk behavior.

Researchers focused on norm abandonment explanations have mainly examined global measures of unsafe sex, such as unprotected anal intercourse. Risk management strategies, however, by their very nature require more nuanced outcome measures to gauge sexual behavior. For example, research suggests that MSM often limit their unprotected anal intercourse encounters to those with a similar HIV status—practicing what has often been labeled as "serosorting."[5,7,18–20] In addition to serosorting, researchers have identified other risk minimization strategies such as "strategic positioning,"[7,20,21] in which HIV-negative subjects limit unprotected anal intercourse encounters to insertive behavior, which is *perceived* by many as having a lower potential for HIV transmission.

It should be underscored that non-condom use in intercourse potentially conveys disease risk, whether or not there is an attempt to manage HIV risk. Serosorting assumes reliable knowledge about partners' HIV status—a problematic assumption, even for those in stable relationships.[20,22,23] In addition, even if serosorting or strategic positioning potentially reduces the spread of HIV, non-condom use increases the risk of transmission of *other* diseases besides HIV, such as syphilis gonorrhea, and chlamyida.[24] Thus, research demonstrating increases in risk management behavior among MSM over time potentially underscores the need for intensified prevention programs reemphasizing the protective role of condoms in the spread of HIV and a range of other STDs.

Systematic population-based research evaluating trends in risk behavior among MSM is lacking. One recent study of MSM living in San Francisco revealed that between 1997 and 2002, condom use decreased but serosorting increased.[7] For a number of reasons related to the unique socio-cultural and geographical situation of MSM in San Francisco, which contains the largest concentration of gays and lesbians in the USA,[25] these findings are not necessarily generalizable to other cities and settings.

Accordingly, we examined sexual risk behavior and drug use among MSM living in Chicago over a very similar time period by comparing two different population-based probability samples of MSM: the Chicago component of the Urban Men's Health Study conducted in 1997/1998 (UMHS 1997)[26] and a supplement to a Chicago drug abuse epidemiology survey conducted in 2002/2003 (MSM supplement).[27] The epidemiological significance of this period within Chicago is clear when health department statistics are examined. The number of newly diagnosed AIDS cases among Chicago MSM was relatively steady in the period spanning from 1997 to 2002, averaging around 400 cases per year.[28,29] At the same time, corresponding with the increasing availability of new therapies, there was a steady growth in the number of Chicago MSM living with AIDS; this number grew from under 3,000 in 1997 to over 4,000 in 2002.[29] When non-AIDS, HIV cases are considered, the prevalence grew from just under 5,000 MSM in 1999 to over 7,000 in 2002 and over 8,000 in 2003.[29]

We evaluate changes in risk behavior over the two survey periods to examine five issues. First, we evaluate whether there were shifts in same gender sexual behavior among MSM in Chicago from 1997 to 2002. Next, we specifically focus on examining changes in condom use during anal sex across samples. We also examine differences in serosorting behavior across samples, with a particular focus on respondents who report that they are HIV negative in each sample. Given the expected increase in serosorting over time, when between sample differences in risk behavior are found, we investigate whether these differences are mediated by serosorting behavior. In addition, in light of our review suggesting the possible increase in risk management over time, we explore whether these differences in risk behavior are *moderated* by serosorting behavior. The "risk management" perspective on behavior suggests that among HIV-negative subjects, self-reported serosorters within the more recent MSM supplement sample are more likely to report riskier behavior than those practicing serodiscordant sex. Finally, we examine the extent to which substance use patterns across samples have changed and the extent to which unprotected sex among sexually active HIV-negative men in each sample is differentially associated with substance use. The expectation is that if increases in sexual risk behavior obtain between the 1997 UMHS cohort and the 2002 MSM supplement, they should be marked by concurrent increases in substance use.

METHODS

Sample

The two samples employed in this study have been described extensively elsewhere. Briefly, the UMHS 1997 is a multi-city probability sample of adult MSM designed to estimate the prevalence of HIV and HIV-related risk behavior.[26] The study drew a stratified probability sample of adult MSM from San Francisco, New York, Chicago, and Los Angeles. The UMHS employed a random digit dial telephone survey methodology and sampled telephone exchanges overlaying ZIP codes that were identified as having moderate to high MSM residential density (via mapping of AIDS caseload data, male-male partnered household data from the US census, addresses from a gay commercial mailing list, and areas designated as gay neighborhoods by local informants). Within Chicago, UMHS 1997 sampled telephone number prefixes covering ten zip codes. Interviews were obtained using computer-assisted telephone interview (CATI) technology between April 1997 and February 1998 on 414 adult MSM.

The MSM supplement executed a household survey in two Chicago ZIP codes with a high population of MSM, based on consultation with a community advisory board (and the ZIP codes with the highest MSM residential density observed in UMHS 1997). Surveys were administered from September, 2002 through January, 2003 using audio computer-assisted self-interview (ACASI) technology. Households were screened by interviewers, and adult males who had a history of consensual sex with other men or who identified themselves as gay or bisexual were selected to be interviewed. A total of 216 interviews were completed for this study.

Measures

Details about the questionnaires in both studies have been described in previous publications.

Sexual Behavior: The UMHS 1997 queried respondents about their sexual behavior during the past year. After being asked about the total number of male and female sexual partners, respondents were asked with how many of those *partners* did they engage in various sexual behaviors over the past year. Those behaviors included insertive and receptive anal intercourse with a condom, without a condom with withdrawal before ejaculation, or without a condom with ejaculation. This was followed by a partner-by-partner evaluation of the four most recent partners (including female partners). Specifically, if the respondent reported having a primary partner, then the first partner asked about was always that primary partner. Otherwise partners were asked about in reverse temporal order, i.e., starting with the most recent partner. However, for respondents who reported having four or more partners in the past year and having both male and female partners, if the first three partners asked about were all the same gender, then the fourth partner was designated to be the most recent partner of the other gender. The evaluation included questions about each partner's characteristics as well as the sexual behavior engaged in with them.

The MSM supplement included summary measures of sexual behaviors over the past 6 months. Respondents who indicated that they had engaged in insertive or receptive anal intercourse in the past 6 months (yes/no) were then asked how many *times* they had engaged in that behavior in the past 6 months and the percent of time it was done without a condom.

Based on these questions, four comparable dichotomous risk outcome measures were constructed across the two samples. These included two general measures of

unprotected sex: any receptive anal intercourse without a condom and any insertive anal intercourse without a condom. In addition, we were able to derive two roughly equivalent measures of non-condom use: 100% non-condom use in receptive anal intercourse and 100% non-condom use in insertive anal intercourse. We also investigated whether men in each sample had multiple male partners and casual sex. Respondents were classified as having multiple partners if they had more than one male sex partner during the time window of the study (12 months for UMHS and 6 months for the MSM supplement). Respondents were classified as having had casual sex if they listed at least one partner in response to similar questions about "someone you had sex with only once" (although the MSM supplement explicitly used the term "casual sex" while the UMHS used the term "one night stands" in the question).

Our measure of serosorting was actually an index of "non-serosorting behavior" (serodiscordant sex) based on responses to questions about subjects' awareness of the HIV status of their partners (i.e., whether any partners were HIV positive or of unknown HIV status). Specifically, subjects in the MSM supplement were asked, "In the past 6 months, did you have sex with any men whom you know to be HIV positive or whose status you did not know." Any HIV-negative man who responded in the affirmative to this question was counted as having had serodiscordant sex. In the UMHS study partner-by-partner evaluation, respondents were asked if the partner had ever had an HIV test and what was his or her most recent result. We constructed a measure to parallel the question asked in the MSM supplement by calculating whether any male partners of HIV-negative respondents were reported to be HIV positive or of unknown status.

Substance Use: In regard to alcohol use, UMHS respondents were first asked how often they drank alcohol in the past 6 months (never, once a month, 2–3 times a month, 1–2 times a week, 3–4 times a week, nearly every day, at least once a day) and, on days they drank, how many drinks did they usually have. In regard to substance use, UMHS respondents were asked how many times in the past 6 months they had used each of 11 types of drugs: marijuana/hashish, poppers/inhalants, crack cocaine, cocaine other than crack, methamphetamines, other amphetamines, ecstasy, psychedelics/ hallucinogens, barbiturates/tranquilizers/sedatives, heroin/ opiates, and other "party drugs" (e.g., ketamine, rohypnol).

The drug use questions included in the MSM supplement were generally modeled after the format employed in the National Survey on Drug Use and Health.[30] Consequently, the MSM supplement questionnaire allowed for a range of response options regarding the period of most recent use, so 6-month prevalence estimates could be derived for most substances.

After comparing the two samples on eleven different substance abuse measures and on a general measure of any illicit non-marijuana drug use, we investigated six general substance use measures as correlates of sexual behavior in each sample: Inhalants, ecstasy, stimulant drugs (a combined measure of six month cocaine/crack, methamphetamine, or other amphetamine use), depressant drugs (a combined measure of six month sedative, tranquilizer or opiate use), any illicit non-marijuana drug use, and heavy drinking. Any respondent who drank at least weekly (52 days/ year in the MSM supplement) and had on average five or more drinks on each drinking occasion was designated a "heavy drinker."

Statistical Methods

Methodological and sampling differences between UMHS and the MSM supplement preclude direct statistical comparisons. In order to correctly adjust for design effects,

point estimates and their associated standard errors were calculated within each sample using weighted data and the survey commands in Stata Release 9.[31] Prevalence estimates were calculated using the SVY: PROPORTION command and odds ratios were derived via the SVY: LOGISTIC algorithm. Predicted probabilities of risk behavior based on logistic regression equations were calculated using the *adjust* post-estimation command available in Stata. Once the point estimate and standard error for each of the two samples had been derived, they were compared by calculating a *z* score. Where analysis required multiple dependent comparisons (e.g., income), the Benjamini–Hochberg method[32] was employed to adjust *p* values in order to preclude inflation of Type I error.

RESULTS

Demographic Comparisons
The UMHS and MSM samples only partially overlapped geographically within Chicago. The UMHS study included a total of ten ZIP codes, only two of which were included in the MSM supplement sample (which consisted entirely of subjects from these same two ZIP codes). In order to evaluate the possible effect of differential residence on sample composition differences, we first compared UMHS participants residing in the two overlapping Chicago ZIP codes with UMHS participants residing in the other ZIP codes on the key demographic and risk variables displayed in Tables 1 and 2 (data not shown here). No significant differences were obtained, thus supporting the strategy of including all UMHS participants in our comparison group, irrespective of census tract residence.

Next, we compared the UMHS (1997) and MSM supplement (2002) on key characteristics (see Table 1). No differences were found for race/ethnicity, prevalence of sex with men, or HIV serostatus. With regard to the latter, of those able to provide definitive information about their HIV status (i.e., eliminating those who did not know their status or who had not been recently tested), 15.1% of the UMHS sample and 15.2% of the MSM supplement stated they were HIV positive.

Although the modal age group in both samples is 30–39 years old, there were slightly more UMHS participants in the youngest age group (18–29 years), and slightly more MSM supplement men who were 40 years old or older. The only statistically significant ($p<0.05$) difference, however, was with respect to income. The MSM supplement has a higher proportion of adult MSM earning more than \$60,000 compared with the UMHS ($Z=3.02$, $p<.05$).

Sexual Behavior and Serodiscordance
Global assessments of same-sex sexual behavior (reporting of multiple male partners, casual sex, and involvement in anal intercourse) were statistically similar across samples. In contrast, rates of unprotected insertive and receptive anal intercourse were higher among MSM supplement participants. Table 2 specifically contrasts these behaviors for the 288 sexually active, HIV-negative men in the UMHS sample with the 151 sexually active, HIV-negative men in the MSM supplement sample, after adjusting for age, race and education (insert Table 2 here). Although the proportion of sexually active men reporting multiple male partners is higher in the 1997 UMHS cohort than in the 2002 MSM supplement (69% vs. 59%), and the prevalence of casual sex increased (55% vs. 63%), neither difference achieved statistical significance. On the other hand, assessments of sexual risk

TABLE 1   Characteristics of the samples: weighted proportions

	UMHS ($N=414$)	MSM supplement ($N=216$)
Race/ethnicity		
White	81%	80%
Black	6%	7%
Hispanic	7%	7%
Other	6%	6%
Income		
<$20,000	6%	12%
$20,001–$40,000*	35%	20%
$40,001–$60,000	27%	22%
> $60,000*	32%	46%
Education		
No college degree	25%	31%
College degree	45%	41%
Post-graduate	30%	27%
Age		
18–29	26%	20%
30–39	44%	40%
40–49	20%	28%
50+	10%	12%
Sex with men[a]		
Yes	89%	85%
No	11%	15%
HIV test result		
Negative	76%	78%
Positive	14%	14%
Unknown or not tested	11%	8%

[a]UMHS: past year; MSM supplement: past 6 months
*$p<.05$

behavior (i.e., anal intercourse without a condom) exhibited significant increases in prevalence. The most marked difference was in exclusive non-condom use during anal intercourse where prevalence of that behavior among men who engaged in anal intercourse in the MSM supplement was more than double the rate reported earlier by the UMHS cohort (receptive 38% vs. 17%, insertive 29% vs. 10%).

Of the 288 HIV-negative men who were sexually active with other men in the UMHS sample, 68% reported having sex with partners having HIV positive or unknown status (i.e., serodiscordant sex) as compared with 38% of the 151 sexually active HIV-negative men in the MSM supplement sample ($p<.0001$). Follow-up analyses (not shown here) investigated whether this difference was obtained for sexually active HIV-negative respondents who did or did not report multiple partners or casual partners. Although the actual rates varied by subgroup, all four comparisons found that prevalence of serodiscordant sex significantly declined between 1997 (UMHS) and 2002 (MSM supplement). Similar results were obtained when controlling for age, race/ethnicity, education, or income.

Logistic regression analyses investigated the impact of serodiscordant sex on sexual risk behavior adjusting for age, race/ethnicity, education, and income separately for each cohort (see Table 3). Serodiscordant sex was significantly associated with lower odds of 100% non-condom use in both insertive and receptive

TABLE 2 Estimates of risky sexual behavior among sexually active HIV-negative MSM adjusting for age, race/ethnicity, and education

	UMHS[a]			MSM supplement[b]		
	N	Wt.%	95% CI[c]	N	Wt.%	95% CI[c]
All sexually active HIV negative	288			151		
Had multiple male partners		69%	62% 75%		59%	49% 68%
Had casual sex		55%	48% 62%		63%	54% 72%
Had insertive anal intercourse		67%	61% 73%		71%	63% 78%
Had receptive anal intercourse		57%	50% 64%		53%	44% 62%
Had Insertive Anal Intercourse (IAI)	190			104		
Had IAI without condom *		46%	38% 54%		65%	53% 75%
IAI: never used condom **		10%	6% 16%		29%	21% 38%
Had Receptive Anal Intercourse (RAI)	161			78		
Had RAI without condom **		42%	33% 51%		73%	61% 83%
RAI: never used condom *		17%	11% 25%		38%	28% 48%

[a]Behaviors assessed for past year
[b]Behaviors assessed for past 6 months
[c]Adjusted for sampling design effects
*$p<.01$; **$p<.001$ (Z test)

anal intercourse in both samples. Serodiscordant sex was also significantly associated with reduced odds of any unprotected receptive anal intercourse in the UMHS sample. The adjusted log odds ratios were then compared across the four variables in each sample to determine if the influence of serodiscordant sex on any of the four indices of sexual risk behavior had changed over time. None of the four between sample comparisons were significant.

In order to gauge the extent to which the differences between samples were potentially *mediated* by serosorting, we estimated the predicted probabilities (calculated by applying the obtained regression equation to the observed data) of each of the four risk behaviors in each of the samples and their respective 95% confidence intervals (see Table 4). These predicted probabilities, adjusted for serodiscordancy and demographic variables, correspond to the unadjusted prevalence rates reported in Table 2. After adjustment the MSM supplement sample still

TABLE 3 Predicting risky sexual behavior: effect of having risky partners ("serodiscordancy") adjusting for age, race/ethnicity, and education

	UMHS[a]			MSM supplement[b]		
	N	OR	95% CI[c]	N	OR	95% CI[c]
Had insertive anal intercourse (IAI)	190			103		
Had IAI without condom		0.94	0.42 2.09		0.57	0.24 1.39
IAI: never used condom		0.17	0.05 0.53		0.15	0.03 0.87
Had receptive anal intercourse (RAI)	161			78		
Had RAI without condom		0.38	0.17 0.85		0.52	0.15 1.80
RAI: never used condom		0.13	0.05 0.38		0.01	0.00 0.05

[a]Behaviors assessed for past year
[b]Behaviors assessed for past 6 months
[c]Adjusted for sampling design effects

TABLE 4   Estimates of risky sexual behavior among sexually active HIV negative MSM adjusting for serodiscordancy, age, race/ethnicity, and education

	UMHS[a]			MSM supplement[b]		
	N	Wt.%	95% CI[c]	N	Wt.%	95% CI[c]
Had insertive anal intercourse (IAI)	190			104		
Had IAI without condom *		46%	38% 54%		65%	52% 76%
IAI: never used condom *		8%	4% 14%		25%	16% 37%
Had Receptive Anal Intercourse (RAI)	161			78		
Had RAI without condom *		41%	32% 50%		73%	59% 83%
RAI: never used condom		12%	7% 20%		19%	10% 35%

[a]Behaviors assessed for past year
[b]Behaviors assessed for past 6 months
[c]Adjusted for sampling design effects
*$p<.05$ (Z test)

exhibited significantly higher prevalence rates for all outcome measures except one. Adjusted rates of 100% non-condom use in receptive anal intercourse were low in both samples (12% in the UMHS and 19% in the MSM supplement) and not significantly different, which indicates possible mediation.

In order to determine whether differences between samples on rates of risky behavior were possibly *moderated* by serodiscordant behavior, we ran stratified regression models within each of the samples to generate corresponding prevalence rates for each of the four risky outcomes (not shown here). The four risky outcomes were compared across samples within two strata: one stratum consisted of those who practiced only seroconcordant sex and the other of those who practiced serodiscordant sex. Prevalence of risk behavior was higher in the MSM supplement sample for all four risk behaviors in the seroconcordant stratum. In the serodiscordant stratum, there were no significant differences between the two samples on the two insertive intercourse measures. There was, however, a significantly higher rate in the MSM supplement sample for any unprotected anal intercourse. While this pattern suggests that serodiscordant behavior may moderate between sample differences, the reduction in sample sizes resulting from stratification and the consequent loss of statistical power suggests that such conclusions should be tempered with caution.

Substance Use and Risk Behavior
With respect to drug use in the past 6 months, men in the UMHS and MSM supplement samples had approximately similar rates of alcohol, marijuana, cocaine, methamphetamine, hallucinogen, tranquilizer/sedative, and "party drug" use (see Table 5). MSM supplement respondents reported a nominally reduced prevalence of inhalant use (19% vs. 27%, $p<.10$) compared with the UMHS cohort and significantly increased prevalence of heavy drinking (17% vs. 8%; $p<.01$), heroin/opiate (8% vs. 1%; $p<.01$), and any non-marijuana illicit drug use (28% vs. 17%; $p<.05$) and nominally increased prevalence of ecstasy use (13% vs. 6%; $p<.10$).

Our final analyses investigated the associations between substance use in the past six months and the four risk outcome measures for the sexually active men in each of the samples (Table 6). Twenty four logistic regression models adjusting for age, race/ethnicity, education, income, HIV status and serodiscordant behavior

TABLE 5   Comparing estimated prevalence of past six month substance use among sexually active HIV negative MSM

Substance	UMHS (N=285)		MSM supplement (N=151)	
	Wt. estimate	95% CI[a]	Wt. estimate	95% CI[a]
Alcohol	89%	85% 93%	93%	89% 97%
Heavy drinking**	8%	5% 12%	17%	11% 22%
Inhalants	27%	20% 33%	19%	14% 25%
Marijuana	38%	32% 45%	37%	28% 46%
Cocaine/crack	9%	5% 13%	12%	5% 19%
Methamphetamine/other amphetamines	6%	3% 10%	6%	1% 10%
Barbiturates/tranquilizers/sedatives	6%	3% 9%	10%	4% 15%
Heroin/opiates**	1%	0% 2%	8%	4% 12%
Hallucinogens	1%	0% 2%	2%	0% 4%
Ecstasy	6%	3% 9%	13%	6% 20%
"Party drugs"[b]	4%	2% 7%	4%	0% 7%
Any illicit non-marijuana*	17%	12% 22%	28%	19% 37%

[a]Adjusted for sampling design effects
[b]GHB, ketamine, flunitrazepam (Rohypnol)
*$p<.05$; **$p<.01$ (Z test)

regressed each of the four risk behavior measures on each of the five drug use measures separately for each sample. In addition, we investigated significant drug use by serodiscordant sex in each of the models. Inhalant use and any non-marijuana illicit drug use were associated with increased odds of any unprotected insertive anal intercourse and depressant use was associated with increased odds of any unprotected receptive anal intercourse in the UMHS sample. Although drug use was not directly associated with elevated risk behavior in the MSM supplement sample, a significant interaction suggested that drug users with serodiscordant partners had significantly elevated odds of engaging in unprotected receptive anal intercourse; other men in this sample who used non-marijuana illicit substances were not at increased risk for this behavior. Finally, it should be noted that z tests suggested that odds ratios evaluating the association between drug use and risk behavior were significantly elevated in the UMHS sample compared with the MSM supplement sample in two comparisons: the association between any non-marijuana illicit drug use and 100% non-condom use during insertive anal intercourse, and the association between depressant drug use and any unprotected receptive anal intercourse.

Building on our prior findings suggesting that serodiscordant sex was associated with more drastically reduced reporting of extreme risk behavior (100% non-condom use in receptive anal intercourse) among MSM supplement men, we conducted follow-up analyses evaluating the association between drug use and serodiscordant behavior among HIV-negative men in each of the samples. These analyses (not shown here) found that, compared to HIV-negative men in the MSM supplement, HIV-negative men in the MSM supplement who reported using any non-marijuana illicit substance during the past 6 months had 2.8 times the odds of having unprotected anal sex with a partner who was either HIV positive or of unknown serostatus (i.e., serodiscordant; 95% confidence interval: 1.38, 5.80). The comparable odds ratio for the UMHS sample was elevated (1.66) but not significantly different from 1 (95% C.I.: 0.83, 3.34).

TABLE 6   Effects of past six month substance use on risky sexual behavior by sample

	UMHS			MSM supplement		
	N	OR	95% CI	N	OR	95% CI
Any unprotected insertive anal intercourse	280			149		
Heavy drinking		1.74	0.57 5.29		1.10	0.48 2.54
Inhalants		2.14	1.08 4.26		2.39	0.97 5.90
Ecstasy		1.39	0.52 3.77		2.28	0.63 8.29
Stimulants[a]		1.79	0.73 4.35		1.50	0.45 5.04
Depressants[b]		1.70	0.60 4.82		0.62	0.20 1.94
Any illicit non-marijuana		2.31	1.23 4.35		1.32	0.68 2.57
Never used a condom during insertive anal intercourse[c]	188			103		
Heavy drinking		–	–		1.22	0.19 7.79
Inhalants		1.89	0.53 6.78		2.27	0.79 6.54
Ecstasy		–	–		0.92	0.31 2.72
Stimulants[a]		1.33	0.23 7.62		0.45	0.10 2.06
Depressants[b]		3.60	0.51 25.20		0.39	0.06 2.54
Any illicit non-marijuana*		3.02	0.86 10.55		0.61	0.26 1.47
Any unprotected receptive anal intercourse	280			149		
Heavy drinking		1.63	0.51 5.24		2.37	1.03 5.45
Inhalants		1.62	0.75 3.50		1.16	0.28 4.71
Ecstasy		1.96	0.64 6.04		1.54	0.35 6.86
Stimulants[a]		1.85	0.75 4.56		1.72	0.53 5.61
Depressants[b,*]		3.21	1.07 9.66		0.49	0.15 1.66
Any illicit non-marijuana*:		1.89	0.95 3.75		Significant interaction	
With serodiscordant partners		1.31	0.58 2.95		5.27	1.58 17.61
With no serodiscordant partners		3.59	1.08 11.95		0.43	0.14 1.28
Never used a condom during receptive anal intercourse[d]	158			77		
Heavy drinking		–	–		2.83	0.43 18.44
Inhalants*		1.30	0.40 4.21		0.68	0.03 15.76
Ecstasy		0.92	0.14 5.86		0.61	0.11 3.46
Stimulants [a]		1.99	0.47 8.46		1.03	0.35 3.09
Depressants[b]		4.13	0.73 23.25		–	–
Any illicit non-marijuana		2.13	0.67 6.78		0.80	0.17 3.83

Among sexually active HIV-negative men, adjusting for serodiscordance, age, education, and race/ethnicity
[a]Cocaine, crack, methamphetamine, or other amphetamines
[b]Barbiturates, tranquilizers, sedatives, or heroin and other opiates
[c]Among men who reported insertive anal intercourse
[d]Among men who reported receptive anal intercourse
*Significant difference between samples, $p(Z) < .05$

DISCUSSION

In two comparable samples of adult MSM living in Chicago assessed 5 years apart, we found increased rates of sexual risk behavior among sexually active HIV-negative men in the later study, but decreased rates of serodiscordant sex. Serodiscordancy did not appear to mediate risk behavior, with one exception: it appears that between sample differences in the probability of engaging in the most risky of the four outcome measures, 100% non-condom use in receptive anal intercourse, were mediated by

sample differences in reported serodiscordant sexual behavior. Additionally, there was preliminary evidence of serodiscordancy as a moderator of sample risk, since between group differences on risk behavior favoring the later MSM supplement cohort were not consistently present in the serodiscordant stratum. Of course, these conclusions can only be generalized to the sexually active HIV-negative men in both samples.

The shift in risk reported here is consistent with another recent analysis focused on San Francisco.[7] Contrary to our expectations, however, even though some forms of drug use were more prevalent in the MSM supplement sample, the overall pattern of findings suggests that recent (past 6 months) substance use was more likely to be associated with risk behavior in the UMHS sample than in the MSM supplement sample. At first glance, the significant interaction between drug use and serodiscordance in the prediction of unprotected receptive anal intercourse in the MSM supplement sample might provide evidence for drug facilitated norm abandonment. Nevertheless, the rate of co-occurring serodiscordant/non-marijuana illicit drug use behavior (not shown here) was not significantly different across the two samples. Thus, our data suggest that shifts in risk behavior across samples were not a consequence of changing (increasing) patterns of substance misuse, and there is no strong evidence supporting an increase in drug-facilitated norm abandonment in the early part of the decade.

While substance misuse patterns varied across samples, the epidemiological trends were not in a direction that suggested that substance use was consistently more problematic for men in the later sample. Nevertheless, we did uncover an important link between drug use and serodiscordant sex that was stronger in the 2002 MSM supplement sample than in the 1997 UMHS sample. That is, among sexually active HIV-negative MSM, drug use was associated with diminished risk management as indicated by an increased risk for having sex with a potentially risky partner (i.e., a partner who is HIV positive or whose status is unknown). This may be a consequence of the shift in the types of drugs used in the later sample (i.e., the increased use of heroin/opiates and ecstasy).

Our findings underscore the general point that behavior among MSM in the early part of this decade was increasingly characterized by risk management strategies. The data suggest that MSM took an increasingly calculating attitude toward partner selection in unprotected sex. Our study provides no evidence that safe sex norms were abandoned nor that risky sex was increasingly facilitated by the use of escape-facilitating substances.

The unreliable nature of partner HIV status reports, along with the potential for exposure to other STDs undermines the efficaciousness of any prevention strategy which involves unprotected sex.[33] Accordingly, as underscored in research investigating the dynamics of serosorting among HIV-positive and HIV-negative couples,[34] those designing prevention programs targeted to MSM need to adjust to the realities and nuances of increasingly common, albeit potentially risky, serosorting behavior. On the one hand, program designers need to reinforce the positive intentions behind this and all strategies deliberately carried out with the aim of minimizing the spread of HIV. On the other hand, program designers need to create messages that underscore that knowledge about partner status is often imperfect and unreliable. Messages targeted towards those engaged in sex with casual partners need to address the types of settings, contexts, and relationships where knowledge of HIV status is most limited. Recent research also underscores the potential importance of couple-focused intervention strategies for addressing risk associated with serosorting.[34]

We acknowledge several potential limitations to these data. Most importantly, findings come from surveys conducted by different survey organizations using differing modes of data collection. It is generally believed that interviewer-assisted modes of data collection, including telephone interviews, elicit fewer reports of sensitive behaviors, compared with self-administered methodologies such as ACASI, which afford respondents greater privacy,[35–38] although, generally speaking, the literature does not evidence consistent mode differences either across studies or across substances. Nevertheless, differences between the UMHS and MSM surveys may be in some part attributable to the differences in data collection modes between these two surveys. Thus, if one assumes that UMHS data on substance use prevalence are underestimations, then the significant increase in opiate and ecstasy use may be smaller than reported, and the trending decrease in the use of inhalants may be larger.

Some key measures were of necessity operationalized differently across the two surveys. In particular, serodiscordancy was measured using a general question about sexual partners in the MSM survey, whereas it was measured using a series of partner specific questions in the UMHS survey. These differences in measurement strategies may also account for the higher rates of serodiscordancy in the UMHS survey. In a similar vein, the necessity of creating parallel measures from different instruments led us to adopt measures that may be considered relatively crude. These limitations, of course, must be considered within the context of the study's strengths, including the facts that both surveys employed random probability sampling techniques and were administered by professional survey research organizations. In addition, the shorter retrospective time frame for assessing HIV risk behaviors in the MSM supplement vs. the UMHS (six months vs. 12 months, respectively) would have potentially deflated prevalence estimates in the later study. Our finding of higher prevalence rates in a study assessing a shorter retrospective time frame suggests that between sample differences, if anything, may be understated in our comparisons.

More research is needed to further elucidate whether the shifts in behavior identified in the early part of the decade have persisted. There is also a need for research which continues to investigate the correlates and consequences of serosorting and other attempts at risk management in MSM populations. Substance misuse may play a critical indirect role in risk. Research needs to further identify the specific drugs and circumstances which potentially lead to increased risk with respect to partner selection; this has not been systematically explored in prior research. Thus, while differences in drug use do not account for differences between samples, our findings regarding the role of drug use in partner selection underscore the importance of linking substance use prevention with HIV prevention programs.

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