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## Beliefs about Treatments for HIV/AIDS and Sexual Risk Behaviors among Men Who Have Sex with Men, 1997 to 2006

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### Abstract

Beliefs that HIV treatments reduce HIV transmission risks are related to increases in sexual risk behaviors, particularly unprotected anal intercourse among men who have sex with men (MSM). Changes in unprotected anal intercourse and prevention-related treatment beliefs were recently reported for surveys of mostly white gay men collected in 1997 and 2005. The current study extends this previous research by replicating the observed changes in behaviors and beliefs in anonymous community surveys collected in 2006. Results indicated clear and consistent increases in beliefs that HIV treatments reduce HIV transmission risks and increases in unprotected anal intercourse. These changes were observed for both HIV positive and non-HIV positive men. African American men endorsed the belief that HIV treatments protect against HIV transmission to a greater degree than White men. Results show that HIV prevention messages need to be updated to educate MSM about the realities of HIV viral concentrations and HIV transmission risks.

### Introduction

There are over 40,000 new HIV infections in the United States each year, with more than one-third occurring among men who have sex with men (MSM, Sanchez et al., 2006). Epidemiological studies show that unprotected anal intercourse is the principle mode of HIV transmission in MSM. After years of decline, rates of unprotected anal sex have increased among MSM in urban centers (CDC, 1999; Elford, Bolding, David, Sherr, & Hart, 2004; Yamey, 2001). Increases in unprotected anal intercourse have been accompanied by increases in sexually transmitted infections (STI) among MSM, particularly gonorrhea and outbreaks of syphilis (Chen et al., 2002). These observed changes in HIV risks occur in the context of increased access and acceptance of HIV antibody testing as well as changes in partner selection and HIV status disclosure practices (i.e., serosorting, Parsons et al., 2005).

Increases in HIV transmission risks are also associated with beliefs about the transmissibility of HIV. In a meta-analytic review, Crepaz et al. (2004) found that engaging in unprotected anal intercourse is reliably predicted by beliefs that HIV treatments reduce risks for transmitting HIV to sex partners. Beliefs that HIV treatments and their suppression of the virus to undetectable concentrations in blood plasma reduce risks for transmission may have disinhibiting effects on protective sexual practices (CDC, 2003; Ciesielski, 2003). Unfortunately, beliefs that HIV treatments and undetectable viral loads reduce HIV infectivity do not reflect the reality of the association between viral load in blood plasma and HIV concentrations in seminal fluids. Correlations between HIV viral load in blood plasma and semen average .45 and typically range between .20 and .60 (e.g., Kalichman et al., in press

a), with some studies finding no association between blood and semen viral loads (e.g., Kalichman et al., 2001). Thus, knowing one's blood plasma viral load can account for less than one-third of one's knowledge of their semen viral load (e.g., .45<sup>2</sup>). Beliefs regarding the protective benefits of having an undetectable viral load based on blood plasma can therefore increase rates of unprotected intercourse, which increase risks for exposure to other STI, which in turn increases HIV shedding in the genital tract (Cohen & Hosseinipour, 2005; Kalichman et al., 2002; Winter et al., 1999).

Studies show that beliefs about the prevention benefits of both antiretroviral (ARV) medications and undetectable viral load were prevalent among MSM in the middle-to-late 1990s, when effective HIV suppressive therapies first became available (Demmer, 2002; Halkitis & Zade, 2004; Huebner & Gerend, 2001; Kelly et al., 1998; Ostrow et al., 2002). We recently reported that beliefs that HIV treatments prevent HIV transmission have increased in the ten years since the advent of combination ARV therapies (Kalichman et al., in press b). In addition, observed changes in preventive beliefs parallel increases in unprotected anal intercourse and decreases in condom use. These findings have implications for HIV prevention because treatment beliefs can reduce motivation to practice safer sex, a key factor in initiating and maintaining risk reduction behavioral changes (Carey & Lewis, 1999; Fishbein & Ajzen, 1975). However, these findings are based on data collected at only two time points, limiting conclusions about the reliability of the findings. In addition, previous studies have sampled mostly white men despite the majority of new HIV infections occurring among non-white MSM (CDC, 1999).

The current study was conducted to replicate and extend previous research on HIV treatment beliefs and HIV risk behaviors. We surveyed MSM in Atlanta, GA in 1997, 2005, and 2006 using the same instruments and procedures at each time point (Kalichman et al., 1998; Kalichman et al., in press b). By having three data points we examined the reliability of changes over time. Also, because previous studies of HIV treatment beliefs and HIV risk behaviors among MSM have been predominantly among white men, we sought to racially diversify our sample. We hypothesized that changes in HIV treatment beliefs observed among white MSM would also be observed among African American MSM.

## Methods

### Participants, Settings and Procedures

Surveys were collected using venue intercept procedures that have been reported in previous studies (e.g., Halkitis & Zade, 2004; Hickson, Reid, Davies, Weatherburn, Beardsell, Keogh, 1997; Kalichman et al., 1998; Kelly et al., 1998; Venable et al., 2000). The same survey instrument was administered at three time points; June, 1997, June, 2005 and June/September, 2006. Potential participants were asked to complete a survey concerning HIV/AIDS as they walked through the exhibit areas gay pride festivals in Atlanta. We rented two booths in the exhibit area each year for the purpose of collecting the survey. Participants were told that the survey was about AIDS, contained personal questions about their behavior, was anonymous, and would take 15-minutes to complete. In each year, 75% of men approached agreed to complete the survey. Participant names were not obtained at any time. Participants in all three years were offered \$4 for completing the survey and in each year participants were given the option of donating their incentive payment to a local AIDS service organization.

Participants were 498 men surveyed at the Atlanta Gay Pride Festival in 1997 (sample overlaps with Kalichman et al., 1998), 448 men surveyed at this same event in 2005 (sample overlaps with Kalichman et al., in press b), and 503 sampled from two gay pride events in 2006. To racially diversify the 2006 sample, we collected surveys from the Atlanta Gay Pride Festival (June 2006, N=231), which was also surveyed in 1997 and 2005, as well as the Atlanta Black

Pride Festival (September 2006, N = 272); an annual event that attracts mostly African American MSM. We included an item asking men in the Black Pride Survey whether they had completed a survey at the June Pride Festival. A total of 54 men had completed both surveys and were removed from the Black Pride data set, therefore assuring that there were no duplicated participants.

## Measures

Participants completed self-administered anonymous surveys measuring demographic characteristics, substance use and sexual behaviors, HIV treatment beliefs, and perceptions of sexual risk in relation to HIV treatment status.

**Demographics**—Participants were asked their age, years of education, income, ethnicity, whether they identified as gay, bisexual, or heterosexual, whether they had been tested for HIV antibodies, and if so the number of times they were tested and the results of their most recent HIV test. We also asked if they were exclusively partnered, defined as being in a relationship with only one man for at least six months.

**Substance use**—Participants were asked if they had used alcohol, marijuana, nitrite inhalants (poppers), powder or crack cocaine, or methamphetamine in the past six months. Responses to these items were coded dichotomously, Yes/No.

**Sexual behavior**—Participants reported the number of times they had engaged in anal intercourse as the insertive and receptive partner, and with and without condoms in the past six months. Participants also recorded the number of sexual partners with whom they had engaged in each behavior. Open response formats were used for the sexual behavior measures to reduce response bias and to minimize measurement error. Proportion of condom use during anal intercourse was calculated using the formula frequency of protected acts / total frequency of acts. Measures similar to these have been found reliable in self-reported sexual behavior assessments (Schroder, Carey, & Venable, 2003).

**HIV treatment beliefs**—Participants responded to nine items assessing beliefs about HIV treatments, including beliefs about their effectiveness in treating HIV infection. Responses to each item were made on 4-point scales ranging from 1 = strongly disagree to 4 = strongly agree. For data reduction purposes, we replicated the varimax rotated principle components factor analysis reported by Kalichman et al. (1998, in press b). The same three factor structure that was previously observed emerged. In the current study, we examined only the first factor which we, labeled HIV Preventive -Treatment Beliefs (eigenvalue = 2.67): “HIV positive persons who take HIV drug cocktails are less likely to infect their sex partners during unsafe sex” (factor loading .79), “It is safe to have anal sex without a condom with an HIV positive man who has an undetectable viral load” (.78), and “New AIDS treatments make it easier to relax about unsafe sex” (.72). Factor scores with means of 0 and standard deviations of 1 represent orthogonal linear composites of weighted items, and are therefore by definition internally consistent.

**HIV-Treatment-related risk perceptions**—This measure directly examined risk perceptions as a function of HIV treatment status by asking men to rate the risk of HIV transmission when an HIV positive partner has an undetectable viral load. Participants were asked the following: “Imagine that an HIV negative man has sex with an HIV positive man who is being treated for his HIV infection and has an undetectable viral load. Please rate how risky you believe anal sex without a condom is when the HIV negative partner is bottom (receptive)”. Responses were made on a 5-point scale ranging from 1 = “very low risk” to 5 “very high risk”.

## Data quality assurances and data analyses

All surveys were examined for inconsistencies and invalid responses which were treated as missing values (less than 5%), resulting in slightly different cell sizes for analyses. Differences between survey years were first compared on demographic characteristics. Differences between survey years were examined using contingency table chi-square tests for comparisons on categorical variables and analyses of variance for continuous variables. These analyses identified potential sampling differences across the survey times.

We conducted additional descriptive analyses comparing the three surveys times on demographic and substance use characteristics. We then compared the three survey times and HIV status groups (HIV negative/unknown HIV status men and HIV positive men) on unprotected anal intercourse, condom use, and numbers of unprotected anal sex partners. Finally, treatment-related preventive beliefs and perceptions of HIV transmission risks were examined by comparing the three survey times and HIV status groups and partitioned by whether men had practiced unprotected anal intercourse in the previous six months. We used binary logistic regression for dichotomous sexual behaviors as the dependant variables and entered survey year, HIV status and the interaction between survey year and HIV status entered as independent variables. These analyses included participant race, education, sexual orientation, employment status, relationship status and the race by survey time interaction as covariates. For comparisons on continuous variables, including proportion of condom use, beliefs and perceptions, we performed multivariate analysis of variance (MANCOVA) controlling for the same variables included in the logistic regressions. Race effects in these analyses are reported in a separate section of the Results.

All variables were inspected for skew before conducting analyses. Only the sexual frequency variables demonstrated significant divergence from normal distributions and were transformed using the formula  $\log_{10}(x+1)$  (Winer, 1971). Statistical significance was defined as  $p < .05$ . We also report Cohen's (1988)  $d$  statistic as an index of effect size, where  $d$ 's less than .25 represent small sized effects,  $d$ 's greater than .75 represent large effects, and  $d$ 's near .5 indicate medium effect sizes.

## Results

Comparisons of men sampled across the three survey time points showed that the 2006 sample was significantly different on several demographic characteristics from the previous two surveys (see Table 1). The sampling strategy was therefore successful in diversifying the 2006 sample which had 58% minorities, was less likely to be gay identified, and less likely use inhalants. The 2005 sample was slightly less likely to be employed and more likely to be exclusively partnered than both the 1997 and 2006 samples. Both the 2005 and 2006 samples had slightly less education than the 1997 sample, although all three survey years represented well educated men. The three survey years did not differ in age, having been tested for HIV, number of men who had tested HIV positive, marijuana and methamphetamine use.

### Changes in sexual risk behaviors

Table 2 shows the number and percentages of HIV negative/unknown status and HIV positive men at each survey time who reported engaging in unprotected anal intercourse in the past six months, had two or more unprotected anal intercourse partners in that time period, and the mean (SD) percent of anal intercourse occasions protected by condoms. Logistic regressions indicated a significant effect for year of survey for all sexual behaviors; engaging in unprotected sex acts increased as did having multiple unprotected anal sex partners, whereas protected behaviors decreased over time. There were also significant effects of HIV status for unprotected insertive anal intercourse and total unprotected anal intercourse; more HIV negative men

reported these behaviors than HIV positive men. However, the interaction of survey year and HIV status was significant for insertive anal intercourse, total unprotected anal intercourse and condom use; HIV negative/unknown status men reported comparable levels of these behaviors over time, whereas HIV positive were more likely to engage in unprotected anal intercourse and were less likely to use condoms over time.

### Changes in prevention treatment beliefs and risk perceptions

Results of the ANOVA comparing survey times, HIV status groups, and men who had and had not engaged in unprotected anal sex on HIV prevention treatment beliefs indicated a main effect for year of survey,  $F(2, 1278) = 8.7$ ,  $p < .01$ ,  $d = .17$ ; beliefs that HIV treatments are protective increased over the years. Planned comparisons showed that men in 2006 endorsed the prevention treatment beliefs to a greater degree than men in both 1997 and 2005, and men in 2005 endorsed the beliefs more so than men in 1997. There was also a main effect for having engaged in unprotected anal sex,  $F(1, 1278) = 6.6$ ,  $p < .01$ ,  $d = .15$ ; men who engaged in unprotected anal sex increased their endorsement of these beliefs. None of the interactions were significant (see Figure 1).

The ANOVA comparing groups on the treatment-related risk perceptions showed a significant difference across survey times;  $F(1, 1278) = 4.1$ ,  $p < .01$ ,  $d = .12$ ; risk perceptions have decreased regarding anal sex with an HIV positive treated partner. Planned comparisons showed that men in 2005 and 2006 surveys endorsed less HIV risk perceptions than men in the 1997 survey. Also, results showed a significant difference between men who had and had not engaged in unprotected anal sex,  $F(1, 1278) = 20.4$ ,  $p < .01$ ,  $d = .26$ ; men who engaged in unprotected anal sex perceived significantly less risk when a partner is treated for HIV than men who do not engage in unprotected sex. Again, none of the interactions were significant (see Figure 2).

### Tests for race differences

We examined differences between white and minority men on sexual behaviors over the survey times controlling for HIV status, the interaction between survey year and HIV status entered as independent variables and education, sexual orientation, employment status, and relationship status as covariates. Results did not indicate any race differences or significant interactions of race and survey time for any of the sexual behaviors. For prevention treatment beliefs, there was a significant main effect for participant race,  $F(1, 1268) = 4.4$ ,  $p < .01$ ,  $d = .24$ ; in each survey year minority men endorsed greater beliefs that HIV treatments protect against HIV. There were no race differences for the risk perception variable. For all analyses, there were no race by time interactions, confirming our hypothesis that changes in behavior and beliefs among White men were observed among African American MSM.

### Discussion

Increases in high-risk sexual behaviors paralleled changes in prevention-related HIV treatment beliefs. These findings replicate and extend previous research that included the 1997 and 2005 data points (Kalichman et al., 1998, in press b). We observed very few differences between the survey findings from 2005 and 2006, replicating the observed changes in beliefs and behaviors reported by Kalichman et al. (in press b) are reliable. Changes in behavior and prevention-related treatment beliefs were, however, more pronounced for HIV positive men than for non-HIV positive men. Although it is likely that non-positive and HIV positive men are reducing risks for HIV transmission through a variety of sexual practices, particularly partner selection and HIV status disclosure strategies (e.g., serosorting), these risk reduction strategies are of unknown effectiveness. HIV positive men who engage in unprotected anal intercourse risk co-infections with other STI that can seriously complicate HIV disease

progression and increase their infectiousness (Cohen, 2004). In addition, there is considerable risk for HIV negative and unknown status men who use partner selection strategies for risk reduction because partners can unknowingly be infected with HIV for months between testing. The risks for HIV transmission among MSM therefore remains a significant public health concern.

The current study extends previous research by demonstrating changes in sexual risks and prevention beliefs in a racially diverse sample. Unlike previous research, we sampled men in 2006 from two gay pride events in the same city, with 58% of the sample representing African-American men. African American men were less likely to be gay identified and less likely to have used inhalant drugs than in previous years. The similar patterns of beliefs and behaviors that were observed in 2005 and 2006 suggest that changes are occurring across racial groups among MSM.

The current findings should be interpreted within the constraints of our study methods. These surveys were conducted using cross-sectional convenience samples of MSM attending large gay pride events in Atlanta. We therefore caution against generalizing the study findings to other cities and to populations other than MSM. Because our study was based on cross-sectional surveys we cannot infer causal associations between treatment beliefs and sexual risk behaviors. Our data do not allow us to rule out alternative explanations for the observed changes in behavior, such as prevention fatigue. We also cannot account for the nature of the observed changes in beliefs and perceptions, such as the factors that may motivate them. Our surveys also relied on self-report of sensitive experiences and behaviors. Although the potential for social desirability was minimized by anonymous procedures, surveys such as the one reported here can yield biased information, and such biases must be considered when interpreting our findings. Our study measures are also limited by the constraints of conducting venue-based self-administered surveys. For example, we did not collect data on the perceived or actual HIV status of participant's sex partners. Acknowledging these limitations, we believe that our findings have important implications for HIV prevention in MSM.

HIV prevention interventions have evolved beyond providing didactic risk-related information toward more skills building approaches. However, the importance of accurate information as it is related to beliefs should be periodically reassessed and adjusted. The patterns of beliefs and behaviors observed in this study indicate the need for community-wide education to correct misinformation and misperceptions of potential risks related to prevention-related HIV treatment beliefs. Multiple communication channels including mass and small media, community forums, and peer-based education programs can address the need for maintaining safer sex practices regardless of the treatment and viral load status of HIV positive sex partners. Educating men about the known hazards of unprotected anal intercourse outside of monogamous relationships that occur regardless of HIV treatment or viral load status of infected partners is therefore necessary for enhancing HIV prevention among MSM and should be considered a public health priority.

## Acknowledgments

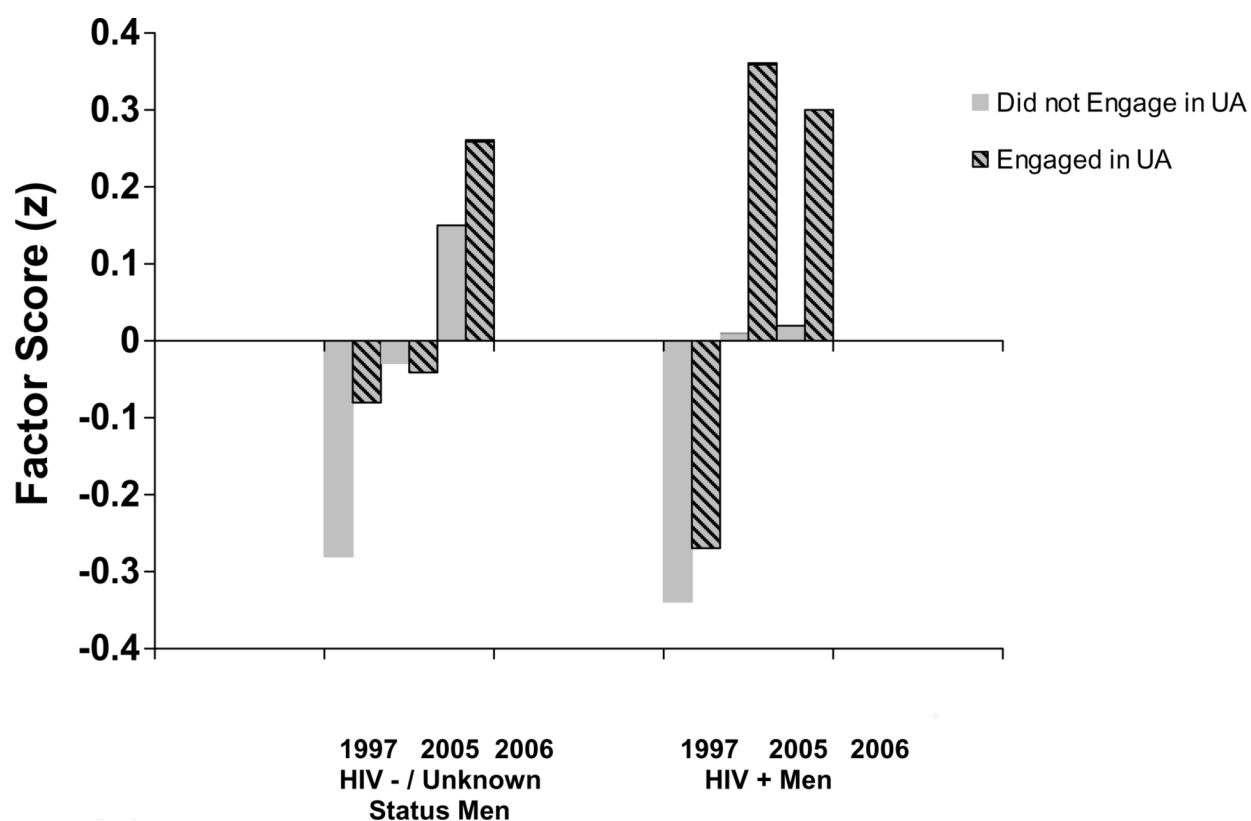
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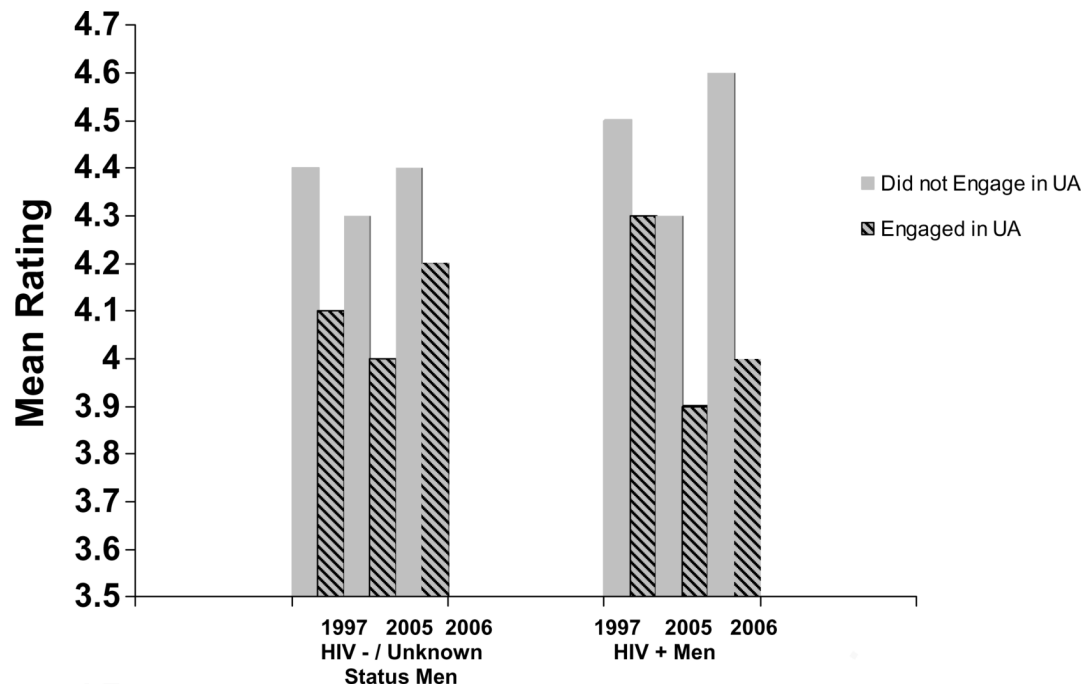
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**Figure 1.**  
Mean Factor Scores for Prevention Treatment Beliefs among HIV Negative/Unknown Status and HIV Positive Men Who Did Not and Who Did Engage in Unprotected Anal Intercourse, 1997, 2005, and 2006.



**Figure 2.**

Mean Perceived Risk for Engaging in Unprotected Receptive Anal intercourse with an HIV Positive Partner with an Undetectable Viral Load among HIV Negative/Unknown Status and HIV Positive Men Who Did Not and Who Did Engage in Unprotected Anal Intercourse, 1997, 2005, and 2006.

**Table 1**  
Characteristics of Men Surveyed at Atlanta Gay Pride Events, 1997, 2005, and 2006.

Characteristic	1997 (N = 511)			2005 (N = 473)			2006 (N = 449)		
	N	%		N	%		N	%	
Caucasian	430	85	374	81	171	39			
Minorities	81	15	99	19	278	61	340.5 <sup>b</sup>	1.11	
Gay identified	479	94	433	92	388	86	15.8 <sup>b</sup>	.22	
Employed	435	86	366	79	376	85	10.5 <sup>b</sup>	.18	
Exclusively partnered	217	43	236	51	175	40	11.5 <sup>b</sup>	.17	
Tested for HIV	435	87	405	89	385	90	2.3	.09	
Tested HIV positive	67	14	63	14	71	17	2.1	.10	
Marijuana use <sup>a</sup>	159	31	147	31	123	28	1.6	.07	
Inhalants use <sup>a</sup>	113	23	101	22	59	14	15.2 <sup>b</sup>	.22	
Methamphetamine use <sup>a</sup>	54	11	53	12	32	7	4.9	.12	

	M	SD	M	SD	M	SD	F	d
Age	33.6	8.4	34.3	10.4	34.8	10.1	1.7	.09
Education	15.2	1.9	14.7	2.0	14.6	2.0	7.7 <sup>b</sup>	.15

Note:

<sup>a</sup> behaviors in the past 6 months

<sup>b</sup> p < .01.

**Table 2**

Sexual Behavior in the Past Six Months among HIV Negative/Unknown Status and HIV Positive Men Surveyed Across Three Survey Times.

Sexual behavior	HIV negative or unknown status						HIV positive						Year × Status	
	1997 (N = 431)			2006 (N = 421)			1997 (N = 67)			2005 (N = 63)			Year	
	N	%	N	N	%	N	N	%	N	N	%	N	OR	OR
Unprotected anal intercourse														
Receptive	113	27	124	34	132	39	13	21	28	46	43	29	2.7**	1.7
Insertive	148	35	154	43	131	38	10	16	22	36	52	35	6.0**	6.7**
Total	183	43	186	51	169	49	16	25	31	50	61	41	4.8**	4.3**
2 + unprotected anal sex partners	39	9	64	19	57	18	6	9	18	33	39	24	3.1**	1.1
% condom														
protected (M, SD) <sup>a</sup>	56.7	43.0	56.2	40.5	52.8	41.2	82.1	28.9	50.2	39.2	38.1	42.0	15.7**	0.1

Note: all odds ratios (OR) adjusted for education, race, sexual orientation, employment, and relationship status

<sup>a</sup>F test for continuous variable percent of intercourse occasions protected by condoms

\* p < .05

\*\* p < .01.