Published in final edited form as:

Am J Addict. 2013 November ; 22(6): 535–542. doi:10.1111/j.1521-0391.2013.12028.x.

Risky Sex in Rural America: Longitudinal Changes in a Community-Based Cohort of Methamphetamine and Cocaine Users

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Abstract

Background and Objectives—This study examined the longitudinal associations between stimulant use and sexual behaviors.

Methods—Data are from a 3-year community-based study of 710 rural stimulant users. Past 30-day crack cocaine, powder cocaine, and methamphetamine use and sexual behaviors (any sex, inconsistent condom use, and multiple sexual partners) were assessed through in-person interviews every 6 months.

Results—GEE analyses revealed that the odds of having sex remained steady over time, with crack cocaine and methamphetamine use positively associated with having sex. The odds of multiple sexual partners declined, but the odds of inconsistent condom use remained steady over time. Crack cocaine use was positively associated with multiple sexual partners, whereas powder cocaine use was negatively associated with inconsistent condom use.

Discussion and Conclusions—Many rural stimulant users could potentially benefit from safe sex educational programs. Such efforts could reduce the incidence of HIV and other STIs in rural America.

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Declaration of Interest:

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

BACKGROUND and OBJECTIVES

Lifetime prevalence rates for cocaine and methamphetamine use in the United States in 2008 were 14.7% and 8.5%, respectively, in a recent national survey,¹ and both methamphetamine and cocaine use continue to be a significant problem, particularly among some sub-populations in the US, including the Southeastern region^{2,3} and in rural communities where treatment access is particularly poor.^{2,4} Significant racial differences exist in stimulant use as well, with methamphetamine use more commonly reported by whites than African Americans in both rural and urban populations.^{5–7} Reports of racial differences in cocaine use are more mixed, with some finding that powder cocaine use is more common among whites⁷ and others finding no racial differences.⁵ Abuse of these drugs is associated with a host of medical sequelae, including cardiac dysrhythmia and hypertension, paranoia, and hallucinations.⁸ Abuse is also associated with an increase in high-risk sexual behaviors, and thus stimulant use is considered a significant risk factor for infection with HIV and other sexually transmitted diseases.^{9–12}

Both methamphetamine and cocaine have significant effects on sexual arousal and response. Both increase dopamine and norepinephrine levels in the brain and thus are associated with subjective experiences of intense pleasure and an increase in libido.¹⁰ Cocaine use is associated with increased sexual desire and arousal^{7,13} as well as enhanced orgasm,¹¹ but long-term use is associated with sexual dysfunction, particularly erectile dysfunction and delayed ejaculation.^{12,13} Methamphetamine use also increases sexual desire and arousal in both men and women,^{10,11} but long-term use is inconsistently associated with dysfunction, with some reports suggesting erectile and orgasm dysfunction,¹³ and others reporting significantly less dysfunction compared to cocaine users.^{11,14}

More consistent is the link between the use of either stimulant and sexual risk behaviors, including multiple sexual partners, low rates of condom use, having sex under the influence of drugs, and trading sex for drugs or money.^{9–12} Few racial or gender differences in sexual risk have been reported among methamphetamine users,⁵ but among cocaine users, women have been more likely than men to report multiple sexual partners and trading sex for money or drugs.^{15,16} This gender difference has been reported in at least one racially diverse sample of cocaine users (both in treatment and community-dwelling) to be more pronounced in African American women, who reported rates of trading sex for drugs or money and a number of sexual partners that were both higher than those reported by African American men and white or Hispanic women.¹⁶ Finally, although most studies of sexual risk among stimulant users have focused on urban samples, one study of sexual risk among rural stimulant users reported a high degree of risk behavior regardless of race or gender, and it also revealed that African Americans were more likely than whites to report trading sex for drugs or money but were not more likely to report having multiple partners.⁶

The longitudinal course of stimulant abuse is not well-documented, although some evidence of spontaneous “remission” does exist.¹⁷ Using data from the same study described in this article, Borders et al¹⁸ demonstrated that rural stimulant users reduced their use of powder and crack cocaine and methamphetamine over a 2-year period without formal drug treatment. There is evidence that cocaine and methamphetamine users reduce their sexual risk behavior after receiving drug treatment,^{19,20} but whether sexual risk behaviors decline concomitantly with drug use among users who are not in treatment is unknown. Should the reduction in sexual risk and drug use behaviors be closely linked, this association should be anticipated by program planners and researchers who are testing the effects of risk-reduction programs in drug-using populations. However, if sexual risk does not change relative to drug use in this population, this would suggest a critical need for public health and health promotion practitioners to develop approaches for promoting healthier sexual behaviors

among drug users and former users. This study provides new information to help address these questions, as it describes the longitudinal risk of multiple sexual partners and inconsistent condom use among a rural community-based sample of persons using powder cocaine, crack cocaine, and/or methamphetamine.

METHODS

Setting

Data are from the Rural Stimulant Study (RSS), a natural history study conducted among 710 stimulant users residing in selected rural counties (3 in each state) in eastern Arkansas, western Kentucky, and western Ohio. The 3 Arkansas counties were 49–57% African American, compared to 0–2% in Kentucky and 1–8% in Ohio. County eligibility criteria included being within 2 hours driving from the home universities of the researchers, evidence of cocaine or methamphetamine use based on local arrest reports and substance abuse treatment admissions data, and being rural, which was defined as a non-metropolitan area, or a county with 50,000 or fewer persons.²¹

Recruitment and Sampling

Baseline participant eligibility criteria were broad and included: 1) age 18 years or older and residence in the selected geographic areas; 2) self-reported crack cocaine, powder cocaine, or methamphetamine use by any route of administration within the past 30 days; and 3) no formal drug abuse treatment within the past 30 days. Because the sampling methodology has been described in detail elsewhere, it is highlighted here.^{4;18} Respondent-driven sampling (RDS), a variant of snowball sampling,²² was used to identify and recruit stimulant users. This type of non-probabilistic sampling is virtually essential for recruiting hidden populations, such as illicit drug users, and can theoretically yield a sample that is more representative of hidden populations than other non-probabilistic sampling methods, such as snowball sampling.^{22;23}

To initiate RDS, study staff members who were knowledgeable of local drug use handed out business cards to persons they knew used drugs and to persons they talked to at various places where drug users were thought to gather, such as bars, liquor stores, and county fairs. Potential participants called the study field offices to be screened and to schedule an appointment for an interview. The interviews required 2–3 hours to complete, but participants were given brief breaks and snacks and beverages during the interview to avoid participant burnout. Participants received \$50 as remuneration for their time and effort and \$10 for travel expenses. Study “seeds” that completed a baseline interview were asked to hand out coupons to “persons like them” who could then call the study office to be screened. Study participants received \$10 per referral that resulted in study participation with a maximum of 3 successful referrals. To help assure that persons would not fake criteria to enroll in the study for payment, specific eligibility criteria were not shared with participants.

All of the study sites had identical recruitment, interviewing, and measurement methods. Trained study staff members conducted the interviews face-to-face using a computer-assisted personal interview (CAPI) at study field offices. Urinalysis was conducted at each follow-up interview because simply collecting urine specimens has been shown to improve the veracity of self-reported drug use.²⁴ Because we did not have urinalysis data available from the baseline interview, we did not use urinalysis data in the analysis.

The study recruitment culminated in a sample of 710 stimulant users who agreed to participate in a longitudinal study with interviews conducted at 6-month intervals for 3 years. Extensive tracking information was captured at each interview to assist in locating participants for follow-up. Through the final 36-month interview, the study achieved a 73%

follow-up participation rate. Participation rates between successive interviews (eg, baseline to 6 months, 6 to 12 months, etc.) ranged between 80% and 99%. Most attrition occurred between the baseline and 6-month follow-up interviews. Attrition was more likely among younger persons (the mean age for persons in the 6-month follow-up was 33, whereas the mean age for persons not in this interview was 30), whites, men, unmarried individuals, and individuals with higher incomes.

The research was approved by the institutional review boards of the investigators' universities and written informed consent was obtained from all participants. To further protect participants' identify, the investigators obtained a Certificate of Confidentiality from the National Institute on Drug Abuse.

Dependent Variables

Sexual Behaviors—Selected items from NIDA's Risk Behavior Assessment (RBA)^{25,26} were administered and used to create 3 primary dependent variables (having any sex, more than one sexual partner, and inconsistent condom use in the past 30 days). Having any sex within the past 30 days was based on an item asking, "How many days in the past 30 days have you had vaginal, oral, and/or anal sex?" Participants reported the number of days, but we chose to dichotomize the variable because we were interested in comparing persons who did/did not engage in sexual activity. Those persons reporting past 30-day sexual activity were then asked, "During the past 30 days, how many different people have you had vaginal, oral, and/or anal sex with?" Similarly, although participants reported the number of persons they had sex with, we chose to dichotomize the responses to compare persons who did/did not have multiple sexual partners. Persons reporting past 30-day vaginal and anal sexual activity, respectively, were asked 2 separate questions about condom use. The first was, "When you had sex in the past 30 days, how often was a condom used when you had anal sex?" and the second was, "When you had sex in the past 30 days, how often was a condom used when you had vaginal sex?" Response options were never, less than half the time, about half the time, more than half the time, and always. If a participant answered anything less than always to either item, he/she was classified as having inconsistent condom use in the past 30 days.

Independent Variables

Substance Use—Selected items that have been administered in several prior studies of rural stimulant users²⁷ were used to create 3 primary independent variables of interest (self-reported past 30-day use of methamphetamine, crack cocaine, or powder cocaine). We chose to classify their responses to create dichotomous variables because a large percentage of persons remitted from using each of the drugs over time, thereby creating a large number of cases of 0 days. We also included binary variables indicating the past 30-day use of substances that were used by more than 10% of the sample at the baseline interview (marijuana, amphetamines, non-prescribed tranquilizers, and non-prescribed pharmaceutical opioids). Finally, we included a binary variable indicating if the respondent drank to intoxication in the past 30 days.

Demographic, Social, and Economic Factors—included age, gender, race, marital status, educational attainment, past year income, and the state of residence. Age was treated as a continuous variable. Gender was dichotomized as male versus female. Race was not distinguished from ethnicity, but was coded as black/African American, white, and a small number of other racial and ethnic groups, including Asians and Hispanics. Marital status was coded as married or living with a partner versus single or not living with a partner. Educational attainment was coded as some high school or less education, a high school degree or equivalency exam, and college or technical training. Self-reported past year

income was categorized as less than \$5,000; \$5,000–\$9,999; \$10,000–\$15,999; and \$16,000 or greater. Finally, to further adjust for the possible differences between participants residing in each of the 3 states where the study was conducted, we included dummy variables indicating if an individual resided in Arkansas, Kentucky, or Ohio.

Treatment History—At baseline, no participants were currently in any formal or informal substance abuse treatment, but they could have received treatment over the course of follow-up. Therefore, we included a binary variable indicating if the participant received any substance abuse services in the prior 6 months as assessed at the 6-, 12-, 18-, 24-, 30-, and 36-month interviews, including formal residential or outpatient treatment and attendance at Alcoholics Anonymous (AA) or Narcotics Anonymous (NA) meetings.

Statistical Analysis

The proportions of persons having any recent sex and, among those having recent sex, the proportions with multiple sexual partners and using condoms inconsistently, were calculated for the baseline and each follow-up interview. We chose to restrict the analyses of multiple sexual partners and inconsistent condom use to persons engaging in recent sex because those behaviors are relevant only to persons who are sexually active.

Because we had repeated measures collected among the same respondents over time, we conducted multivariate generalized estimating equations (GEE)^{28,29} using the PROC GENMOD commands in SAS/STAT® Version 9.3 (SAS Institute Inc., Cary, North Carolina). Another strength of GEE is that it includes all possible data in the analyses, rather than excluding subjects who had missing data for one of the 6 follow-up interviews. To determine if there were changes in the dependent variables over the follow-up period, time was treated as a linear variable. All of the independent variables described earlier were entered into each GEE model. With the exception of the state of residence, race, gender, and educational status, all of the independent variables were time varying, meaning that their values could have changed over the study period.

RESULTS

Sample Characteristics

Characteristics of the sample at baseline are reported in Table 1. Sample statistics are reported for the full sample (N=710) and the reduced sample of respondents (N=562) who reported having sex in the past 30 days. The full and reduced sample characteristics were similar. The full sample was rather young (mean age of 33 years), predominantly male (61%), mostly white (29% were African American), lowly educated (41% had only some high school or less education), economically poor (55% had past year income below \$5,000), and was approximately evenly split between the 3 states.

Percentage of Persons Engaging in Recent Sex and Risky Sexual Behaviors Over Time

Figure 1 portrays changes in any recent sexual activity and, among persons having recent sex, changes in having multiple sexual partners and inconsistent condom use. Table 2 shows the percentages of persons with past 30-day sexual activity and, among persons having sex, multiple sexual partners and inconsistent condom use. At baseline, 79% of respondents reported past 30-day sexual activity, which declined significantly to 72% at the 36-month follow-up. Among persons having sex, 29% reported having multiple sexual partners, which declined to 17% at the 36-months; 79% reported inconsistent condom use, which increased only slightly to 80% at 36-months.

Results From Longitudinal GEE Analyses of Any Recent Sex

Table 3 shows results from the GEE analysis of any recent sex among the full sample of respondents and, among persons engaging in recent sex, the odds of multiple sexual partners and inconsistent condom use. The odds of recent sex did not decline over the study period. Recent sexual activity was positively associated with crack cocaine (OR=1.53), methamphetamine (OR=1.39) and marijuana (OR=1.67) use, as well as drinking alcohol to intoxication (OR=1.44). Age (OR=0.97) and male gender (OR=0.75) were associated with lower odds of past 30-day sexual activity. Relative to whites, African Americans (OR=1.41) had higher odds of past 30-day sex. Relative to single persons, those who were married or living with someone (OR=2.34) had higher odds of past 30-day sex. Compared to persons with less than a high school diploma or equivalency, those who were high school graduates (OR=1.40) and those with college or technical degrees (OR=1.59) had higher odds of engaging in recent sex. Finally, relative to persons with past year incomes less than \$5,000, those with incomes of \$10,000–\$15,999 (OR=1.30) and incomes of \$16,000 or greater (OR=1.78) had higher odds of engaging in recent sex.

Results From Longitudinal GEE Analyses of Multiple Sexual Partners

The odds of having multiple sexual partners declined significantly over time (OR=0.95). Having multiple sexual partners was positively associated with crack cocaine use (OR=1.43), non-prescribed pharmaceutical opioid use (OR=1.25), and drinking alcohol to intoxication (OR=1.54). Age was negatively associated (OR=0.98), while male gender was positively associated (OR=1.68), with having multiple sexual partners. Compared to whites, African Americans had greater odds (OR=2.04) of multiple sexual partners. Respondents with past year income of \$10,000–\$15,999 had higher odds of multiple sexual partners relative to those with incomes less than \$5,000. Finally, Arkansas participants had greater odds than Ohio participants (OR=2.52) of multiple sexual partners.

Results From Longitudinal GEE Analyses of Inconsistent Condom Use

The odds of past 30-day inconsistent condom use did not change significantly over time. Powder cocaine use (OR=0.79), amphetamine use (OR=0.57), and drinking alcohol to intoxication (OR=0.81) were associated with lower odds of inconsistent condom use. In contrast to the findings for multiple sexual partners, males had lower odds than females (OR=0.73) and African Americans had lower odds than whites (OR=0.41) of inconsistent condom use. Finally, persons who were married or living with a partner had higher odds (OR=3.02) of inconsistent condom use than single persons.

DISCUSSION

In recent years, HIV/AIDS^{30;31} and cocaine and methamphetamine use⁴ have become substantial public health concerns in rural areas of the US. This study expands our understanding of how sexual behaviors change longitudinally among a rural community-based sample of powder cocaine, crack cocaine, and/or methamphetamine users.

We found that the majority of rural stimulant users remain sexually active over the course of 3 years. Among those sexually active, we found a significant reduction over time in the odds of multiple sexual partners, which is a positive occurrence in terms of STI risk. However, similar to prior research on the linkages between substance use and risky sexual behaviors,^{10;11;32–34} we found that persons using crack cocaine, non-prescribed pharmaceutical opioids, and alcohol to intoxication had greater odds of multiple sexual partners. In contrast to prior research among cocaine users,^{15;16} we found that men (relative to women) and African Americans (relative to whites) had higher odds of multiple sexual partners.¹⁶

Of greater concern, our findings indicate that many rural stimulant users continued to use condoms inconsistently. To some surprise, using powder cocaine as well as amphetamine and alcohol to intoxication were associated with reduced odds of inconsistent condom use. In contrast to the findings for having multiple sexual partners, African Americans lower odds of inconsistent condom use than whites, suggesting that there is not a consistent pattern of risky sexual behaviors across racial groups. Finally, persons who were married had higher odds of inconsistent condom use, but we must acknowledge that some persons who are married may be in a mutually monogamous and low HIV-risk relationship or may be trying to conceive a child and therefore may not consistently use condoms. On the other hand, inconsistent condom use among married couples who are not mutually monogamous has considerable HIV risk implications.

As discussed earlier, there is limited evidence about racial or gender differences in sexual risk behaviors among methamphetamine users, but female cocaine users have been shown to be more likely than their male counterparts to have multiple sexual partners.^{15;16} Because our research did not test for gender differences by drug type, we cannot directly compare our findings to prior research among only cocaine users, but the findings indicate some gender and racial differences among stimulant users.

Given that the use of selected substances was associated with increased odds of having multiple sexual partners and that the odds of inconsistent condom use did not change significantly over time, these findings collectively point to a potential need to expand sexual risk prevention programs among current or former stimulant users residing in rural areas, or at least in the rural areas where the study was conducted. Because substance abuse services in rural areas are frequently scarce and many stimulant users never receive any formal substance abuse treatment,³⁵ primary medical care providers may need to play a larger role in educating patients known to be past or current users of cocaine or methamphetamine about the risks of having multiple sexual partners or not using condoms.

Limitations

This study has several limitations. First, we did not assess the types of substances that were used during each sexual encounter, thus prohibiting us from pinpointing the exact substance or combinations of substances directly linked to making the decision to engage in sex, choose a new sexual partner, or not use a condom. Second, this study did not test for recent trading of sex for drugs, food, or other commodities, a high-risk behavior that is known to be associated with stimulant use. A third limitation is that we lost a small number of participants during the course of 3 years of follow-up, which could have biased the findings. Fourth, generalizability is potentially limited to the locales where the study was conducted. The relationships between stimulant use and risky sex could differ among residents of other rural or urban areas as well as other groups that were not well-represented in the study, such as wealthier individuals who may not have been interested in participating in the study. Finally, it is possible that other factors which were not examined in this study (eg, impulsivity) could explain sexual behaviors as well as general levels of risk taking.

Conclusions

In summary, this research provides new insight into the longitudinal trends in risky sexual behaviors among stimulant users residing in selected rural areas of the US. Rates of inconsistent condom use were alarmingly high in this study sample, and the majority of current or former stimulant users continued to use condoms inconsistently over the study period. Our findings point to a need for promoting condom use among current or former stimulant users in rural areas, or at least in the areas where this study was conducted. Such

efforts could contribute to a reduction in the incidence of HIV and other STIs in rural America.

Acknowledgments

This research was supported by grants R01 DA15363 (Dr. Booth) and R01 DA14340 (Dr. Siegal) from the National Institute on Drug Abuse, Bethesda, MD.

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Figure 1.
Frequency (%) of Recent Sex and Risky Sexual Behaviors Over Time

Table 1

Characteristics of the Full Sample and Sample Engaging in Recent Sex at the Baseline Interview

Variable	Full Sample (N=710) % or mean (SD)	Sample Engaging in Recent Sex ^a (N=562) % or mean (SD)
Substance use in past 30 days, %		
Any crack cocaine use	59.15	59.79
Any powder cocaine use	48.59	50.18
Any methamphetamine use	43.23	42.53
Marijuana use	80.99	81.32
Amphetamine use	12.39	12.28
Non Rx Tranquilizer use	26.66	27.05
Non Rx opioid use	45.63	46.98
Any drinking alcohol to intoxication	52.82	55.16
<i>Demographic, Social, and Economic Factors</i>		
Age, mean (SD)	32.56 (10.35)	31.73 (9.60)
Male (v. female), %	61.40	62.10
Race/ethnicity, %		
African American	29.30	30.43
Other	2.82	2.85
White	67.88	66.72
Married/live with other (v. single), %	15.77	17.26
Educational status, %		
Some high school or less	41.40	41.29
High school grad.	42.68	43.59
College/technical	15.92	15.12
Past year income, %		
<\$5,000	55.36	56.15
\$5,000–9,999	16.53	15.51
\$10,000–15,999	14.83	14.97
\$ \$16,000	13.28	13.37
State		
Arkansas	33.38	35.41
Kentucky	31.69	28.47
Ohio	34.93	36.12

^aDefined as past 30-day sexual activity.

Table 2

Respondents (%) Reporting Any Recent Sex and Risky Sexual Behaviors

Variable	Baseline	6 mo.	12 mo.	18 mo.	24 mo.	30 mo.	36 mo.
Recent (past 30-day) sex ^a	79.27	77.50	74.22	73.17	71.56	70.84	71.79
Among persons having recent sex							
Inconsistent condom use	78.52	76.39	76.68	78.21	77.78	77.92	80.44
Multiple sexual partners ^a	28.70	23.87	21.96	21.90	18.50	20.20	17.07

^a $P < .0001$, GEE analysis of changes over time (time entered as only independent variable).

Table 3

GEE Analysis of Any Recent (Past 30-Day) Sex and Multiple Sexual Partners

	Any Recent Sex		Among Persons Having Sex			
	OR	95% CI	Multiple Sexual Partners	Inconsistent Condom Use		
Time, continuous from 1–7	0.98	(0.94–1.02)	0.95	(0.90–0.99)	0.98	(0.94–1.03)
Substance use in past 30 days						
Crack cocaine use (v. none)	1.53	(1.24–1.90)	1.43	(1.09–1.87)	1.05	(0.80–1.39)
Powder cocaine use (v. none)	1.20	(0.96–1.49)	1.19	(0.94–1.51)	0.79	(0.62–0.99)
Methamphetamine use (v. none)	1.39	(1.10–1.75)	1.13	(0.86–1.48)	1.33	(0.96–1.84)
Marijuana use (v. none)	1.67	(1.39–2.01)	1.18	(0.92–1.52)	1.02	(0.81–1.30)
Amphetamine use (v. none)	0.98	(0.67–1.44)	1.06	(0.70–1.58)	0.57	(0.38–0.84)
Non Rx Tranquilizer use (v. none)	1.12	(0.92–1.36)	1.15	(0.91–1.45)	1.04	(0.80–1.35)
Non Rx opioid use (v. none)	1.02	(0.84–1.25)	1.25	(1.01–1.57)	1.04	(0.82–1.31)
Alcohol to intoxication (v. none)	1.44	(1.22–1.71)	1.54	(1.25–1.90)	0.81	(0.66–0.99)
Demographic, Social, and Economic Factors						
Age, years	0.97	(0.95–0.98)	0.98	(0.97–0.99)	1.01	(0.99–1.02)
Male (v. female)	0.75	(0.59–0.95)	1.68	(1.27–2.23)	0.73	(0.54–0.99)
Race/ethnicity (v. white)						
African American	1.41	(1.01–1.97)	2.04	(1.40–2.98)	0.41	(0.28–0.60)
Other	0.78	(0.40–1.52)	2.13	(0.96–4.70)	0.59	(0.24–1.50)
Married/live with other (v. single)	2.34	(1.82–3.00)	0.81	(0.60–1.09)	3.02	(2.16–4.21)
Educational status (v. < HS grad)						
HS grad	1.40	(1.09–1.80)	0.81	(0.60–1.09)	1.26	(0.93–1.72)
College/technical	1.59	(1.12–2.27)	1.45	(0.97–2.17)	0.99	(0.67–1.49)
Past year income (v. <\$5,000)						
\$5,000–9,999	1.13	(0.91–1.40)	0.93	(0.70–1.23)	1.28	(0.98–1.67)
\$10,000–15,999	1.30	(1.03–1.64)	1.35	(1.04–1.75)	1.26	(0.94–1.70)
\$ \$16,000	1.78	(1.39–2.28)	1.25	(0.90–1.74)	1.17	(0.84–1.64)
State (v. Ohio)						
Arkansas	1.17	(0.84–1.65)	2.52	(1.70–3.74)	0.68	(0.45–1.01)

	Among Persons Having Sex		
	Any Recent Sex	Multiple Sexual Partners	Inconsistent Condom Use
	OR 95% CI	OR 95% CI	
Kentucky	0.90 (0.67–1.21)	1.09 (0.74–1.59)	0.83 (0.55–1.23)
<i>Substance abuse TX^a</i> (v. none)	0.88 (0.71–1.12)	1.12 (0.80–1.57)	0.95 (0.68–1.33)

Significant ($P < .05$) odds ratios are italicized.

^a Defined as any formal substance abuse treatment or self-help group attendance in the past 6 months; at baseline, no participants were currently receiving any treatment.