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Condomless anal intercourse among males and females at high risk for heterosexual HIV infection

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Abstract

Background—Understanding and addressing heterosexual HIV transmission requires attention to the range and context of heterosexual sexual behaviors. We sought to determine population-based prevalence of condomless anal intercourse (CAI) among individuals at increased heterosexual HIV risk in Baltimore and to identify demographic, behavioral, and health related correlates.

Methods—Data were from a cross-sectional study of 185 males and 198 females at increased heterosexual risk for HIV recruited using respondent driven sampling as part of CDC's National HIV Behavioral Surveillance Project in Baltimore, August-December 2010. Bivariate and multivariate logistic regression examined factors associated with heterosexual CAI.

Results—The sample was majority African-American, with mean age of 38 among men and 34 among women. Forty-two percent of men (95% C.I.: 30.9, 52.0%) and 38% of women (95% C.I.: 29.4, 47.2%) reported any CAI in the past year, with variance by partner type and gender. Among men, CAI was significantly associated with homelessness, casual and exchange partners, same sex partner in past year, and substance use. Among women, CAI was significantly associated with lower education, casual and exchange partners, same sex partner in past year, multiple partners, and substance use. In adjusted gender-specific models, males and females with increasing numbers of partners were more likely to engage in CAI.

Conclusions—It is important to recognize the efficiency of transmission of HIV and other STIs through CAI. There is a need to broaden heterosexual sexual health promotion and HIV/STI prevention to adequately and appropriately address risks and prevention strategies for anal intercourse.

Keywords

Heterosexual; condomless anal intercourse; HIV/AIDS; sexually transmitted infection; prevention

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INTRODUCTION

HIV cases attributed to heterosexual transmission remain a significant component of the U.S. HIV epidemic. Heterosexual transmission accounts for approximately 27% of new infections and approximately 30% of those living with AIDS.[1] The heterosexual HIV epidemic is disproportionately concentrated within communities of color, among individuals with low socioeconomic status, and among women.[2,3] In Baltimore, Maryland, HIV transmission remains high among heterosexuals, accounting for approximately 33% of new infections in 2012.[4] African-Americans account for approximately 90% of all heterosexual HIV cases in Baltimore.

Understanding and addressing heterosexual HIV transmission requires attention to the range and context of heterosexual sexual behaviors. Despite recognition of the efficiency of anal intercourse for transmission and association with seroconversion among heterosexuals,[5] researchers continue to document insufficient attention to heterosexual engagement in anal intercourse within mainstream discourse.[6,7] There is also little attention to anal intercourse in HIV prevention materials targeting heterosexual communities. Prevalence of anal intercourse among heterosexuals varies depending on the population, with more recent studies documenting higher prevalence.[7] It is estimated that between 25-38% of men and 16-33% of women have engaged in heterosexual anal intercourse in their lifetimes,[8,9] and prevalence of recent heterosexual anal sex ranges from 30-74% among populations considered at high risk for HIV, such as injection drug users, sex workers, and inner city youth.[6]

Less is known about engagement in condomless anal intercourse (CAI) among heterosexuals, a critical transmission mechanism for HIV and other infectious diseases. Compared to condomless vaginal sex, CAI carries much higher probability of HIV and STI infection.[10-12] Rectal mucosa does not include immune-protective hormones present in cervical secretions[13] and rectal walls are highly susceptible to abrasions that may facilitate transmission.[14,15] However, most indications are that condom use tends to be lower for anal intercourse than for vaginal sex, and lower among heterosexuals compared to men who have sex with men.[6,7] In a recent population-based study of low-socioeconomic status heterosexual women, 41% reported anal intercourse in the past year.[16] Thirty-eight percent reported any CAI in the past year, almost all of whom also reported condomless vaginal intercourse within the same time period. Likelihood of a recent sexually transmitted infection (STI) was almost three times higher among women who engaged in CAI compared to those who reported only condomless vaginal intercourse and more than four times higher compared to women reporting no condomless anal or vaginal intercourse, indicating an important indirect path for facilitating HIV transmission as well.

CDC's National HIV Behavioral Surveillance (NHBS) project, known as the Behavioral Surveillance Research (BESURE) Study in Baltimore, recruited individuals at increased risk for heterosexual HIV transmission in 2010 using respondent driven sampling. Based on extensive background research and evaluation of the social, behavioral, and geographic dynamics of heterosexual HIV infection,[2] NHBS defines those at high risk of heterosexual HIV transmission as people with low socioeconomic status who are socially connected to

areas with high prevalence of poverty and HIV and who have partners of the opposite sex. The purpose of the current analysis was to determine population-based prevalence of CAI among low socioeconomic status males and females at increased heterosexual risk for HIV in Baltimore and to identify demographic, behavioral, and health related correlates of CAI.

MATERIALS AND METHODS

Sampling design and recruitment

The BESURE Study in Baltimore is an HIV infection and behavioral risk cross-sectional survey among populations at high risk for HIV. The methods and sampling have been previously described in detail.[2] In August-December 2010, a sample of Baltimore residents at increased heterosexual risk for HIV was recruited using respondent driven sampling (RDS), a chain-referral sampling method used to enumerate hard-to-reach populations.[17,18] RDS begins with identification of initial individuals, referred to as “seeds”, who meet eligibility criteria and have strong contact with the target population. Thereafter, participants are offered coupons for peer recruitment. With several waves of recruitment, the sample achieves a stable composition, independent of the initial seeds. RDS estimates population proportions by accounting for chains of referral and the network size of each participant and combines this information with the RDS sample composition to generate weighted sample statistics.[17,19]

Eligible participants were 18–50 years old, Baltimore residents, able to complete the interview in English, and reported an opposite sex partner in the past year. Seeds were additionally required to be residents of one of the top 25% of high poverty and high HIV prevalence census tracts, ensuring that all survey participants were socially linked to geographic areas with increased transmission possibility. Those who met eligibility criteria were enrolled and provided informed consent prior to completing study procedures. Trained interviewers administered the 45-minute anonymous survey using handheld data collection devices and then a Maryland certified HIV counselor conducted HIV pre-test counseling. Participants were compensated $25 for survey completion, $25 for HIV testing, and $10 for each successful referral.

The protocol and all study materials were reviewed and approved by the Maryland Department of Health and Mental Hygiene and the Johns Hopkins Bloomberg School of Public Health Institutional Review Boards. From the initial ten seeds, 450 individuals were screened and 383 eligible individuals who reported having had sex with someone of the opposite sex in the past 12 months agreed to participate and completed study procedures.

Measures

The outcome was any CAI with an opposite sex partner within the past year. The variable was constructed from questions about condom use during sexual behavior in the past year, combining information about CAI with each of three types of partners (main, casual and exchange).

Three groups of covariates were used, based on prior research among low-income heterosexuals at risk for HIV.[16,20] Demographic characteristics included age (in years),

education (dichotomized as high school/GED or higher, vs. less than high school), marital status (ever vs. never married), income (less than $10,000 per year vs. at least $10,000), homelessness (in the past year), and police arrest (in the past year). Sexual partnering covariates included three binary variables any casual sex, any exchange sex, and any sex with someone of the same sex in the past year; and a categorical variable for number of past year partners. Drug use covariates were those known to be associated with sexual risk and with sufficient prevalence for analysis. For men, drug use covariates included past year crack, heroin and painkiller use. For women, due to overlap between crack and heroin use, a combined variable for any crack or heroin use was used instead.

Health status variables included HIV status; self-reported diagnosis of syphilis, gonorrhea, chlamydia, herpes, human papillomavirus, or other STI in the past year; and reported ever diagnosis of hepatitis B or C. HIV positive status among participants who agreed to HIV testing (98.7% of non-seeds) was defined as those whose blood samples were repeatedly reactive for HIV-1 antibodies using enzyme immunoassay (EIA) (Sanofi Diagnostics Pasteur, Chaska, MN, U.S.A.) confirmed with Western blot (Bio-Rad, Hercules, CA, U.S.A. or Epitope, Inc., Organon-Teknika Corporation, Durham, NC, U.S.A.).

Analyses

The software RDSAT version 7.1 was used to conduct a partition analysis on the binary variable CAI. Taking into account the individuals' network sizes and information about who recruited whom, this analysis generated a set of individual weights to adjust the sample so that it better reflects the population. Subsequent analyses including descriptive statistics and regression analyses incorporated these weights, using the svy package in Stata version 11. Analyses were conducted for men and women separately, using the sub-population option of svy commands.

Descriptive statistics were estimated and logistic regression was used to examine associations between the outcome CAI and covariates. Simple logistic regression examined unadjusted relationships between CAI and each covariate. Multiple logistic regression was implemented using the following model building sequence: First, all background variables were included in a model predicting CAI and were trimmed. Secondly, all sex partner variables were included in a model predicting CAI and were trimmed, before being combined with background variables. Thirdly, all drug use variables were included in a model predicting CAI and were trimmed, before being included in a grand model consisting of background, sex partnering and drug use variables. At each stage, trimming was based on several considerations. Covariates that did not contribute to explaining the outcome when controlling for others (i.e., those that were statistically non-significant and had an odds ratio close to 1) were dropped. Age was kept until the last model to account for evidence on age variation in sexual behavior [21]. Due to small sample size, we were conservative about dropping variables for lack of statistical significance, thus covariates that were statistically non-significant but with an odds ratio (OR) close to or greater than 2, or close to or smaller than 0.5 were retained in the model.

Analysis of health status variables proceeded separately, using the same sequence as above. Variables with an OR substantially departing from 1 were further examined in the presence of the set of covariates remaining in the grand model.

RESULTS

Sample characteristics

The analysis sample consisted of 383 non-seed individuals (185 men and 198 women). Sample characteristics are included in Table 1, both in crude form without weighting the data, and in weighted estimates with 95% confidence intervals (CIs).

Ninety-five percent of the sample identified as African-American. On average, men were older (mean age 37.7 in men and 33.8 in women). Less than one third (31.6% men and 29.2% women) had ever been married. More than half had high school /GED or higher education (53.1% men and 54.4% women). More than half (56.3% men and 55.8% women) reported income less than $10,000 per year. Homelessness in the past year was also high – reported by more than a third (37.0% men and 38.9% women). In the past year, a majority (74.6% men and 60.8% women) had casual sex partners and about one-fifth (20.6% men and 18.9% women) had exchange partners; a small percentage (6.4%) of the men and a substantial percentage (26.9%) of the women also had sex with same-sex partners. Approximately one quarter of men and women reported only one partner (25.0% and 28.9%) and less than 20% reported the highest category of multiple partnerships (18.5% and 11.0%). In the past year, 15% of the men used crack, 21.8% used heroin, and 16.5% used painkillers; 24.3% of women used crack or heroin, and 20.9% used painkillers.

The prevalence of any past year CAI with opposite sex partners in this sample is high: 41.5% among men and 38.3% among women. Engagement in anal intercourse varied by partner type and gender: 33% of men and 36% of women reported anal sex with main partners, 29% of men and 18% of women reported anal sex with casual partners, and 10% of men and 12% of women reported anal sex with exchange partners. Among those with only opposite sex partners in the past year, CAI prevalence was 37.8% (95% CI=27.1%, 48.4%) among men (n=171, 92% of males) and 28.6%, 95% CI=(19.2%, 38.1%) among women (n=148, 75% of females).

Factors associated with CAI among men

Table 2a presents the evolution of models predicting CAI among men. Among background variables, homelessness was a consistent predictor of CAI through the different models. In the final model, those who were recently homeless had an odds of CAI 3.2 times higher (95% CI 1.23 - 8.22, p-value=0.02) than others. Education seemed to be a protective factor, and lower income a risk factor, albeit not statistically significant. Age was not a predictor of CAI.

All four sexual partnering variables were statistically significant in simple logistic regression. The final model retained number of sex partners (ORs=1.66, 5.58, 7.59; p-values=0.46, 0.01, 0.004, comparing the 2-3 partners, 4-7 partners and 8+ partners categories to having one partner only), and having sex with men (OR=16.8, 95% CI 1.3 -

216.4, p-value=0.03). One decision in the model building process should be noted here: In model 3, number of partners, casual and exchange were not statistically significant due to collinearity – those who had more partners were more likely to also have casual/exchange partners. We explored several variations before selecting model 4, retaining number of partners but not casual or exchange partners. The competing model also included sex with men, but instead of number of partners, included casual (OR=3.83, p-value=0.02) and exchange (OR=2.52, p-value=0.08) partners. We chose the model with number of partners, because the clear gradient in the odds of CAI associated with increasing partner numbers provides for meaningful interpretation.

All drug use variables had ORs greater than 1 in simple logistic regression, and two were statistically significant – heroin and painkiller use. In multiple regression, however, none of these variables were statistically significant. The final model retains heroin use for an OR close to 2 (1.96) but not statistically significant (p-value=0.16).

The same series of models among males with only opposite sex partners in the past year showed little substantive change. CAI remained significantly associated with homelessness (OR=3.36, p-value=0.01) and increasing numbers of partners (4-7 partners OR=5.54, p-value=0.01; 8+ partners OR 7.82, p-value=0.00).

Factors associated with CAI among women

Table 2b presents the evolution of the model predicting CAI among women. Among background variables, education was a protective factor (OR=0.28, p-value=0.01 in the final model). Unlike men who were more likely to have had CAI if they had been homeless, women were less likely to have had CAI if they had been homeless (OR=0.32, p-value=0.02 in the final model).

Among sexual partnering variables, the final model retained number of partners and having exchange partners. Having 2-3, 4-7 and 8+ partners increased the odds of CAI 3.74, 7.23 and 7.77 times compared to having only one partner (p-values=0.04, 0.01, 0.02). Having had exchange sex with heterosexual partners increased the odds of CAI 2.78 times, but this was not statistically significant (p-value=0.11).

Both crack/heroin and painkiller use were statistically significant in simple logistic regression. In the final model, the effect of crack/heroin use was stronger (OR=3.22, p-value=0.014); the effect of painkillers was positive but not statistically significant (OR= 1.97, p-value=0.15).

In the same series of models among females with only opposite sex partners in the past year, CAI was significantly associated with less than high school graduation (OR=0.29, p-value=0.038) and increased number of partners (4-7 OR=6.58, p-value=0.028); associations with homelessness and drug use were attenuated (OR 0.40, p-value=0.107 and OR 2.36, p-value 0.162).

Association between CAI and HIV, STI, and Hepatitis

There was no statistically significant association with recent STI diagnosis among men (OR=2.02, p-value=0.274) or women (OR=0.79, p-value=0.640) or with hepatitis B or C diagnosis among men (OR=0.50, p-value=0.331) or women (OR=0.83, p-value=0.774) in bivariable or multivariable analysis. Analysis of HIV status was limited by cell size: only 2 of 14 or 14% of HIV-positive men engaged in CAI, compared to 43% of HIV-negative men; and only 3 of 10 or 30% of HIV-positive women engaged in CAI, compared to 41% of HIV-negative women.

DISCUSSION

This study confirms prior reports of high prevalence of anal intercourse and, importantly, of CAI among heterosexuals at high risk of HIV. Jenness and colleagues[16] examined rates of CAI among female NHBS participants in New York City, using the exact methodology as the current study. It is noteworthy that the population-adjusted proportion of CAI among women is identical (38%) in both studies, despite different study locations. Their study did not report prevalence among men, but our findings show similar proportions among men compared to women: 41% versus 40% in the sample and 42% versus 38% with population-adjustment.

Respondent driven sampling allowed us to enumerate a sample of close to 400 individuals at high heterosexual risk for HIV in Baltimore, and the RDS-adjusted estimates can be generalized to the broader population of individuals at high heterosexual risk for HIV in the city. In Baltimore City, close to 70% of census tracts could be considered high poverty and high HIV prevalence areas based on the NHBS definition; poverty among those residents ranges from 16-67%, with a median of 27% of residents living under the poverty line.[22] Therefore, these findings have broad relevance. It is worth noting that this sample of individuals at increased heterosexual risk also includes women and men who report same sex partners and who do not report heterosexual identity, but our findings did not differ by these dimensions. There remains a need to appreciate the complex intersections between sexual behavior and sexual identity in HIV and STD transmission pathways.

The study is limited by its cross-sectional nature, which disallows the ability to assess temporality or directions of associations. Reliance on self-report also introduces the possibility of reporting and recall bias. Also, we did not distinguish between insertive and receptive anal intercourse. Despite limitations, it is clear that CAI is common among people at high heterosexual risk for HIV, as others have noted, and deserving of attention within sexual health research and disease prevention among heterosexual populations.

Anal intercourse itself is not inherently a concern for public health, nor does CAI always carry risks of disease transmission. However, it is important to recognize the efficiency of transmission of HIV and other STIs through CAI,[15] and thus to appreciate the contexts in which transmission may be heightened. CAI was reported less frequently among HIV positive respondents, which is a promising finding. However, 30% of HIV-positive women reported CAI and the margin of difference between those who were HIV-positive and negative was smaller among women, which may be worth prevention attention. In this

study, anal sex was most commonly reported with main partners compared to casual and exchange partners; however CAI was strongly associated with having casual and exchange partners and multiple partners among both men and women. The current study did not find significant associations between CAI and HIV status or recent STI or hepatitis diagnosis, but the analysis of HIV status may have been hindered by low numbers of HIV positive participants. There remains a need for more nuance in understanding the scope of risk behavior engagement and transmission potential.

Relatively little is known about socio-demographic characteristics of heterosexual men who engage in CAI. With adjustment for the small proportion who engaged in same-sex behavior, as well as multiple partners and drug use, we found that men who reported past year homelessness were more than three times more likely to report CAI. There is a strong and consistent association between homelessness and HIV risk behavior [23,24] and this study further supports the critical need for attention to this issue in prevention activities for men. Among women, the association between CAI and homelessness was reversed though the association with lower education suggests some relationship with socio-economic status. CAI was strongly associated with crack or heroin use, having multiple partners, and exchange sex, as prior studies have shown. CAI was also much more common among women who reported same-sex behavior. Although this association did not persist in multivariable analysis, it is worthy of further exploration.

Overall, these findings point to a need to better understand the behavior of anal sex within partnerships and other social contexts. A small body of research suggests that women engage in heterosexual anal sex for pleasure, for emotional intimacy, to please partners, and to avoid violence,[25] often at the initiation of male partners and with little prior discussion, [26] but little is known about male engagement and decision-making between partners. One study found that heterosexual anal intercourse was more likely in partnerships where men make the decisions about sex.[27] Future research should examine partnership dynamics and sexual decision making among those who have experienced homelessness and for women who have both male and female partners, especially those of low socio-economic status.

Many prior researchers have suggested a need to broaden heterosexual sexual health promotion and HIV/STI prevention to adequately and appropriately address risks and prevention strategies for anal intercourse. This study reinforces this need and indicates that inclusive strategies may be especially relevant for men and women of low socio-economic status who are connected to areas of high poverty and high HIV prevalence. Within Baltimore, as in many U.S. cities, this description could be applied to the majority of city residents.

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Table 1

Demographic and behavioral characteristics among men and women at increased heterosexual risk for HIV in Baltimore (n=383)

	Crude-sample mean (SD) or proportion		RDS-based weighted mean or proportion (95% CI)	
	men (n=185)	**women (n=198)**	**men (n=168.7)**	**women (n=214.3)**
Outcome of interest (in past 12 months)				
Unprotected anal sex	40.5%	40.4%	41.5% (30.9, 52.0%)	38.3% (29.4, 47.2%)
Demographics				
Age (years)	36.8 (12.6)	34.3 (11.3)	37.7 (34.8, 40.5)	33.8 (31.9, 35.6)
Highschool graduation/GED or higher	58.9%	56.1%	53.1% (42.3, 63.8%)	54.4% (45.3, 63.6%)
Ever married	30.3%	28.8%	31.6% (21.4, 41.9%)	29.2% (21.0, 37.4%)
Income less than 10,000 USD per year	53.9%	51.8%	56.3% (45.6, 67.0%)	55.8% (46.6, 64.9%)
Homeless any time in past 12 months	37.8%	39.9%	37.0% (26.7, 47.3%)	38.9% (30.0, 47.8%)
Arrested in past 12 months	36.2%	12.7%	36.2% (25.8, 46.5%)	11.0% (5.7, 16.3%)
Sexual relations (in past 12 months)				
Same-sex sex	4.3%	25.3%	6.4% (0.8, 11.9%)	26.9% (18.6, 35.1%)
Casual sex with heterosexual partner(s)	70.3%	61.1%	74.6% (66.2, 83.0%)	60.8% (51.7, 69.9%)
Exchange sex with heterosexual partner(s)	23.2%	22.7%	20.6% (12.5, 28.7%)	18.9% (11.7, 26.0%)
Number of sex partners				
1 partner	24.3%	28.8%	25.0% (16.2, 33.7%)	28.9% (20.6, 37.2%)
2-3 partners	28.7%	33.3%	28.0% (17.7, 38.2%)	36.3% (27.4, 45.2%)
4-7 partners	25.4%	22.7%	28.6% (18.9, 38.2%)	23.7% (15.6, 31.9%)
8+ partners	21.6%	15.2%	18.5% (10.5, 26.5%)	11.0% (6.0, 16.1%)
Drug use behavior (in past 12 months)				
Crack use	15.7%	17.3%	15.0% (7.5, 22.5%)	17.5% (10.6, 24.3%)
Heroin use	28.1%	22.8%	21.8% (14.0, 29.6%)	21.7% (14.3, 29.1%)
Use of painkillers	26.0%	21.8%	16.5% (10.4, 22.6%)	20.9% (13.5, 28.3%)
Crack OR heroin use		24.9%		24.3% (16.5, 32.1%)

Table 2a

Correlates of condomless anal sex among men at increased heterosexual risk for HIV in Baltimore (n=185)

		Adjusted odds ratios (95% CI)									
	Unadjusted odds ratios (95% CI)	**Model 1: Background variables (all)**	**Model 2: Background variables (trimmed)**	**Model 3: Sexual behaviors (all)**	**Model 4: Sexual behaviors (trimmed)**	**Model 5: Background + sexual behaviors**	**Model 6: Drug use behaviors (all)**	**Model 7: Drug use behaviors (trimmed)**	**Model 8: Putting everything together**	**FINAL MODEL**	
										AOR (95% CI)	**p-value**
Age (years)	1.02 (0.98,1.06)	1.02 (0.98,1.06)	1.02 (0.98,1.06)			1.02 (0.99,1.06)			1.02 (0.97,1.07)		
Highschool grad, GED or higher	0.95 (0.38,2.18)	0.77 (0.32,1.84)	0.78 (0.32,1.87)			0.84 (0.32,2.25)			0.84 (0.31,2.26)		
Ever married	1.52 (0.89,3.93)	0.99 (0.37,2.66)									
Income less than $10,000 per year	1.75 (0.72,4.25)	1.53 (0.64,3.69)	1.54 (0.64,3.73)			1.31 (0.53,3.24)			1.33 (0.54,3.31)		
Homeless any time in past 12 months	**2.85** (1.19,6.83)	**2.90** (1.22,6.88)	**2.87** (1.19,6.88)			**3.23** (1.30,8.01)			**3.10** (1.21,7.91)	**3.20** (1.23,8.33)	0.018
Arrested in past 12 months	1.05 (0.42,2.59)	0.96 (0.39,2.37)									
Same-sex sex	**42.06** (4.52,391.1)			**18.73** (1.62,216.5)	**18.70** (1.94,180.0)	11.09 (0.79,155.1)			11.34 (0.72,177.9)	**16.80** (1.30,216.4)	0.031
Casual sex with het. partner(s)	**3.74** (1.40,9.97)			2.85 (0.45,18.00)							
Exchange sex with het. partner(s)	**4.04** (1.39,11.73)			1.67 (0.51,5.42)							
Number of sex partners											
1 partner	Ref			Ref	Ref	Ref			Ref	Ref	
2-3 partners	1.61 (0.41,6.24)			0.70 (0.09,5.35)	1.61 (0.41,6.24)	1.73 (0.48,6.28)			1.66 (0.43,6.33)	1.66 (0.43,6.33)	0.457
4-7 partners	**6.21** (1.84,20.94)			2.02 (0.25,16.25)	**5.29** (1.52,18.41)	**7.30** (2.02,26.44)			**6.44** (1.68,24.68)	**5.58** (1.52,20.46)	0.010
8+ partners	**8.85** (2.24,35.01)			2.26 (0.24,21.34)	**6.50** (1.66,25.51)	**7.56** (1.67,34.31)			**6.99** (1.50,32.52)	**7.59** (1.90,30.27)	0.004
Crack use	2.23 (0.66,7.51)						1.32 (0.37, 4.77)				
Heroin use	**2.54** (1.02,6.33)						2.10 (0.72, 6.09)	2.38 (0.93, 6.05)	1.57 (0.42,5.86)	1.96 (0.76,5.04)	0.164

		Adjusted odds ratios (95% CI)									
	Unadjusted odds ratios (95% CI)	**Model 1: Background variables (all)**	**Model 2: Background variables (trimmed)**	**Model 3: Sexual behaviors (all)**	**Model 4: Sexual behaviors (trimmed)**	**Model 5: Background + sexual behaviors**	**Model 6: Drug use behaviors (all)**	**Model 7: Drug use behaviors (trimmed)**	**Model 8: Putting everything together**	**FINAL MODEL**	
										AOR (95% CI)	**p-value**
Use of painkillers	**2.58** (1.06,6.26)						2.36 (0.95, 5.82)	2.38 (0.97, 5.85)	1.40 (0.44,4.42)		

Table 2b

Correlates of condomless anal sex among women at increased heterosexual risk for HIV in Baltimore (n=198)

		Adjusted odds ratios (95% CI)								
	Unadjusted odds ratios (95% CI)	**Model 1: Background variables (all)**	**Model 2: Sexual behaviors (all)**	**Model 3: Sexual behaviors (trimmed)**	**Model 4: Background + sexual behaviors**	**Model 5: Background + sexual behaviors (trimmed)**	**Model 6: Drug use behaviors (all)**	**Model 7: Putting everything together**	**FINAL MODEL**	
									AOR (95% CI)	**p-value**
Age (years)	1.01 (0.98,1.04)	1.02 (0.98,1.06)			1.02 (0.97,1.08)	1.02 (0.98,1.07)		0.98 (0.92,1.05)		
Highschool grad, GED or higher	**0.38** (0.17,0.82)	**0.40** (0.17,0.93)			**0.31** (0.12,0.83)	**0.31** (0.12,0.81)		**0.27** (0.10,0.70)	**0.28** (0.11,0.73)	0.010
Ever married	0.55 (0.24,1.28)	0.53 (0.21,1.35)			0.65 (0.21,2.00)	0.65 (0.22,1.96)		0.62 (0.20,1.93)	0.55 (0.18,1.66)	0.290
Income less than 10,000 USD per year	1.59 (0.73,3.44)	1.57 (0.71,3.49)			1.24 (0.47,3.32)					
Homeless any time in past 12 months	0.81 (0.38,1.75)	0.64 (0.28,1.47)			**0.34** (0.13,0.91)	**0.34** (0.13,0.89)		**0.31** (0.12,0.83)	**0.32** (0.12,0.85)	0.022
Arrested in past 12 months	1.28 (0.43,3.82)	1.53 (0.51,4.58)			0.90 (0.23,3.57)					
Same-sex sex	**4.55** (1.87,11.05)		1.99 (0.62,6.34)	1.81 (0.57,5.79)	1.82 (0.57,5.82)	1.94 (0.63,5.95)		1.48 (0.40,5.47)		
Casual sex with heterosexual partners	**2.55** (1.11,5.85)		1.36 (0.46,4.03)							
Exchange sex with heterosexual partners	**6.47** (2.31,18.08)		**3.33** (1.02,10.94)	3.12 (0.92,10.64)	3.66 (0.76,11.32)	3.28 (0.87,12.40)		2.79 (0.79,9.88)	2.78 (0.79,9.74)	0.111
Number of sex partners										
1 partner	Ref		Ref	Ref	Ref	Ref		Ref	Ref	
2-3 partners	**3.98** (1.32,12.05)		2.74 (0.79,9.55)	**3.44** (1.12,10.56)	3.66 (0.95,14.05)	3.77 (0.99,14.38)		3.36 (0.89,12.65)	**3.74** (1.06,13.14)	0.040
4-7 partners	**9.32** (2.80,30.95)		3.37 (0.64,17.73)	**4.53** (1.14,17.98)	**6.23** (1.16,33.63)	**6.56** (1.33,32.28)		**5.49** (1.02,29.69)	**7.23** (1.62,32.16)	0.010
8+ partners	**12.50** (3.03,51.58)		2.51 (0.36,17.59)	3.61 (0.54,24.24)	6.72 (0.64,70.50)	6.67 (0.66,67.78)		4.84 (0.57,41.27)	**7.77** (1.35,44.77)	0.022
Crack or heroin use	**3.65** (1.58,8.45)						**2.93** (1.23,6.97)	**4.19** (1.08,16.22)	**3.22** (1.27,8.20)	0.014

		Adjusted odds ratios (95% CI)								
	Unadjusted odds ratios (95% CI)	Model 1: Background variables (all)	Model 2: Sexual behaviors (all)	Model 3: Sexual behaviors (trimmed)	Model 4: Background + sexual behaviors	Model 5: Background + sexual behaviors (trimmed)	Model 6: Drug use behaviors (all)	Model 7: Putting everything together	FINAL MODEL	
									AOR (95% CI)	p-value
Use of oxycontin or painkillers	**3.47** (1.42,8.49)						**2.66** (1.07,6.63)	1.81 (0.67,4.90)	1.97 (0.78,4.99)	0.152