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## An Electronic Daily Diary Study of Anal Intercourse in Drug-Using Women

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### Abstract

Women ( $N = 138$ ) with histories of illicit drug use were recruited into an electronic diary study that used Android smartphones for data collection. The diary was to be completed each day for 12 weeks using an “app” created in HTML5 and accessed over the Internet via smartphone. Data collection included information on sexual behaviors with up to 10 partners per day and contextual factors surrounding sexual behavior such as drug use before/after, type of sexual behavior (oral, vaginal, anal), and other activities such as using condoms for vaginal and anal intercourse and use of sexual lubricants. The sample was predominantly African American (58 %); 20 % Latina, 20 % White and 2 % reported as Other. Most women reported either less than a high school education (33 %) or having a high school diploma (33 %). The mean age was 39 years ( $SD = 11.78$ ). Anal intercourse occurred on days when women also reported using illicit drugs, specifically methamphetamine and cocaine. Anal intercourse was not an isolated sexual activity, but took place on days when vaginal intercourse and giving and receiving oral sex also occurred along with illicit drug use. Anal intercourse also occurred on days when women reported they wanted sex. HIV prevention interventions must address the risks of anal intercourse for women, taking into account concurrent drug use and sexual pleasure that may reduce individual harm-reduction behaviors.

### Keywords

Heterosexual anal intercourse; Women; Daily diary study; Electronic smartphone data collection

### Introduction

Heterosexual receptive anal intercourse (HRAI) in women has been associated with illicit drug use both injected and non-injected [1–10], alcohol use, especially binge drinking [11, 12], sex trading [13, 14], sexually transmitted infections [15–23], and participation in drug

treatment [24] in cross-sectional studies. Earlier age of sexual debut has also been associated with HRAI in women [25]. Cross-sectional studies are unable to ascertain the temporal context surrounding events that include both drug use and risky sexual behavior, and the sequencing of those behaviors because they can only provide macro level associations. For example, women who have ever taken methamphetamine are more likely to report anal intercourse [8]. But cross-sectional studies are not able to provide more precise temporal associations between positive prediction and risk precursors to outcome behaviors, such as anal intercourse. Anal intercourse is well-recognized as an human immunodeficiency virus (HIV) risk factor for women [15, 26–28], however HIV prevention messages and interventions for women seldom address risks associated with anal intercourse and continue to focus on vaginal intercourse [29].

The use of the Internet and Internet-based technologies have been used to gather information on sexual behavior in a wide variety of studies examining risks for HIV however, the majority have been conducted with men-who-have-sex-with-men (MSM) [30]. A recent review article details the use of the Internet, smartphones and texting by MSM for everything from seeking sex partners on-line to HIV prevention education and interventions [31]. Studies of HIV-positive individuals have used electronic and Internet technologies for medication adherence and sexual risk reduction [32].

Several studies of sexual behavior in women, though not focused specifically on drug-using women, have used Internet or smartphone-based approaches. These include studies of condom use among adolescent women [33, 34], hormonal contraception use [35], bleeding after intrauterine device insertion [36], hot flashes [37], pubic hair removal [38], prevalence of anal intercourse [39], prevalence of pain during anal intercourse, [40] and use of microbicides and other lubricants [41, 42]. Unlike the plethora of Internet-based studies of the intersection of drug use and sexual risk behaviors of MSM, far fewer of the Internet studies have focused on anal intercourse in women and its association with illicit drug use and other behaviors, using newer technologies. Event-level studies, in which data are collected on a much more intensive basis than cross-sectional studies, collect information concerning the context of sexual or drug using encounters by using daily diary data collection in which the data are entered very soon after the target event. Electronic data collection tools, such as smart phones, facilitate this self-disclosure of sex and drug use behaviors that are highly stigmatized [43, 44] and reduce recall bias because the data are entered on a micro or event level soon after the occurrence of the event. This increasing use of smartphones and other technology has also been termed “intensive longitudinal designs” and there are a large variety of research questions that can be addressed using these methods [45].

The purpose of this study was to investigate the temporal association between drug use and high-risk anal intercourse among women. We report on a smartphone-based data collection study that obtained daily diary data on both sexual behaviors and illicit drug use over a 12-week period from a sample of illicit drug-using women.

## Methods

Women with a self-report of illicit drug use who were also of reproductive age (18–45 years) were recruited into an electronic diary study using Android smart phones for data collection. The diary was to be completed each day for 12 weeks using an “app” created in HTML5 and accessed over the Internet via the smart phone. Women were recruited into the study based on their self-report of current illicit drug use, being at least 18 years of age, and being a biological female. Women completed a baseline assessment which included the risk behavior assessment (RBA) [46–48] or risk behavior follow-up assessment (RBFA) [49].

After baseline data collection, women were provided with a description of the daily diary study, including the requirement that they complete the diary once per day for 12 weeks, and the incentive schedule. If the woman indicated a willingness to participate in the diary study after reviewing and signing the California State University, Long Beach Institutional Review Board (CSULB IRB)—approved informed consent form, she received an orientation to the Android smart phone and received training on how to access the diary collection site via the smartphone. These smartphones were provided by the study to participants and all costs of connectivity (unlimited talk, text and Internet access) were covered by the project. After orientation to the smartphone, the participants received a unique 6-digit identification number for logging into the site and a 4-digit PIN number. Completion of the daily diary included weekly incentives: the women received \$5 each week for the first 8 weeks of diary completion, and \$20 each week for weeks 9–12. Receipt of the weekly incentives was predicated on completion of the diary at least 4 out of every 7 days, however participants were encouraged to complete the diary every day so that it became part of their daily routine. An additional incentive was that the women got to keep the smart phone at the end of the study.

Daily diary data collection included information on mood, sexual behaviors with up to 10 partners per day and contextual factors surrounding the sexual behavior such as drug use before/after, type of sexual behavior (giving and receiving oral, vaginal, anal), and other activities such as using condoms for vaginal and anal intercourse and use of sexual lubricants. Participants also reported on daily drug use from a menu of drugs including alcohol, nicotine (cigarettes), marijuana, cocaine (powered), crack, methamphetamine, heroin, and were provided with an open response option to note any drug used that was not included in the list.

The diary study employed a mixed approach integrating both interval and event-contingent data collection [38]. The specific approach can be found in Bolger and Laurenceau [45]. For example, the participants were asked to complete the daily diary on an interval basis, for example, each day; the participant was not restricted as to when diary completion should take place as diary data could be uploaded to the server 24/7. If there were no interactions with sexual partners that day, then the participants completed the interval-contingent questions concerning their mood and affect, and behaviors they engaged in without sexual partners, such as cigarette, alcohol and drug use; they could also report on non-sexual daily activities. The event-contingent element was based on whether a participant had an encounter with a sexual partner. If the woman answered “yes” to having an interaction with

a sexual partner or multiple sexual partners on any given day, she also completed the questions concerning these encounters (drug use before or during sex, type of sexual behavior (giving oral sex, receiving oral sex, vaginal and/or anal intercourse) and whether a condom or lubricant was used). Women could report on encounters with up to 10 sexual partners each day.

All protocols were approved by the California State University Long Beach, Institutional Review Board. Informed consent for the study included three separate phases: the first covered the baseline questionnaire, for which participants received \$25; the second was the diary study, for which participants received \$5 for each of weeks 1–8, and \$20 for each of weeks 9–12; and the follow-up interview for which participants received \$40. Only those participants who completed all 12 weeks of the diary study were eligible for the follow-up interview. Women could be dropped from the study for failing to complete the daily diary for two full consecutive weeks. Text messages and reminders were routinely sent to participants if they did not complete the diary each day. Phones that were lost, broken, or reported stolen during the course of the study were not replaced and participants were withdrawn if any of these events occurred. These details were covered in the informed consent form for the diary study. The follow-up interview consisted of all questionnaires administered at baseline, plus a brief questionnaire asking women to rate their satisfaction with the daily diary study and the use of the smart phones, diary app and website. Once a woman was enrolled into the smart phone study and received the smart phone, research staff were available Monday through Friday for additional in-person training and answering questions. They were also available by telephone. The larger study's goal was to recruit 200 drug-using women into the daily-diary study.

The purpose of this paper is to report on the variation in anal intercourse among the participants. According to Bolger and Laurenceau [45] “each person in an intensive longitudinal study (e.g., daily diary study) contributes her own set of observations to the dataset” (p. 29). One person will exhibit variance in the responses she provides over the course of the intensive data-collection period. This is the within-subjects' part of the process. However, because data were collected from more than one participant in the same intensive (daily) longitudinal manner, a multi-level analysis must also allow for “the possibility that there are between-subjects differences on the dependent variable” (p. 26). In other words, the within-subjects aspect is “how did participants differ over time?” The between-subjects aspect is how did participants differ from each other. For purposes of this paper, we hypothesized a within-subjects process whereby anal intercourse would occur on days when a respondent also used illicit drugs.

Missing data were treated as if they were missing at random [50]. In diary studies, the majority of missing data occurs because a participant fails to complete an entire diary entry, therefore both the outcome and the predictor variables are missing [45]. This assumption provides valid inferences when maximum likelihood estimation procedures are used, as was the case in our analysis using MPlus.

The statistical analysis was conducted using MPlus for the multilevel analysis. Specific code for implementation in MPlus can be found in Bolger and Laurenceau (2013, p. 121). SAS

9.3 was used only to create Fig. 2 using the SAS output delivery system (ODS). Code for producing the between subjects variation graphs using the SAS ODS can be found in Bolger and Laurenceau [45] (p. 106).

## Results

The majority of women were African American (58 %), followed by Latina (17 %), White (18 %), and Other/mixed race (6 %). Participants' mean age was 39.1 years ( $SD = 11.78$ ), 34 % reported that they never finished high school, and 44 % reported a high school education or equivalent. Table 1 provides demographic information on the participants. Zero participants had any prior experience using a smart phone prior to enrollment in the study though many had used regular cell phones and were familiar with texting. Mean participation in the diary study was 67 days (out of a total possible 84 days). There were a total of 6997 diary days; days that did not include a report of an interaction with a sex partner were not considered for subsequent analysis. This left 1606 diary days during which an interaction with a male sexual partner was reported—these were the event-contingent data, that is, data collected when the woman had an interaction with a sexual partner; of these 285 (285/1606; 18 %) included reports of anal intercourse. The women reported that their partner had been in jail or prison for 327 (20 %) of the partner interaction days.

Figure 1 shows the CONSORT flow chart for the participating women with respect to smart phones lost or stolen, and participants dropped because they did not meet study requirements [51]. The study recruited 184 women, not quite achieving the goal of 200. Because the study targeted women who were active illicit drug users, 35 women began the baseline interview, but were judged to be too high or incoherent to complete it; these women were not offered participation in the smart phone study. Six women refused to participate when the expectations associated with the study were explained to them, and one transgender woman was not enrolled due to being a biological male. Four women were not offered participation because they became hostile or abusive to research staff during the baseline interview.

A total of 46 participants were dropped from the study prior to the completion of the 12-week diary period because they did not meet study requirements. Nineteen participants were dropped from the study due to reporting to research staff that the smartphone had been stolen. Six participants reported that they had left the smartphone on a bus. Of the participants who completed the full 12 weeks of diary data submission part of the study, the majority completed the follow-up interview. A total of 84 follow-up interviews were completed 84/138; 61 %).

Table 2 shows the activities reported for those diary days that included male sex partner interactions. Table 3 presents the results of the multilevel logistic regression predicting daily anal intercourse with both the within- and between-subjects' parameters. With respect to the within-subjects' process, days on which a woman reported receptive heterosexual anal intercourse were also days on which she was more likely to report vaginal intercourse, using methamphetamine, using cocaine, giving oral sex, receiving oral sex and wanting sex. All variables were coded 1 = yes, 0 = no with the exception of relationship satisfaction and wanting sex, which were both measured on a Likert scale from 1 to 10, with higher scores

indicating more relationship satisfaction or greater wish for sex. In the between-subjects analysis, all of the within-subjects variables were significant except for giving oral sex. Time was not statistically significant either within or between women, suggesting that there was no increase or decrease in anal sex over time.

Figure 2 shows 30 examples of the between subjects variation in anal intercourse frequency over the course of the 12-week diary period. Each individual graph represents an individual participant in the study and we have included 30 examples to illustrate typical processes. The y-axis for each graph indicates 0 (anal intercourse was not reported) or 1 (anal intercourse was reported) and the x-axis is each day of the diary study. As can be seen from the graphs of our 30 examples, some participants had many days of diary completion as well as many days of anal intercourse (participant 236632); others had many days of diary completion and no anal intercourse (participant 540260) while others had varying amounts of participation and anal intercourse (participant 540699) or no anal intercourse reported over the days they completed the diary (544576).

Condom use for vaginal intercourse occurred for 27.5 % of the sexual encounters reported on the diaries and condom use was reported for 9 % of anal intercourse encounters; lubricant use was reported for 12.5 % of the anal intercourse encounters. Condom use for vaginal intercourse was significantly associated with condom use for anal intercourse ( $\chi^2(1) = 181.62, p < .0001$ ) and with lubricant use for anal intercourse ( $\chi^2(1) = 76.67, p < .0001$ ).

## Discussion

The increasing availability of smartphones with sophisticated Internet and other capabilities has seen electronic diaries being used in a wide range of medical, clinical and behavioral research. Uses include capturing risk behaviors for sexually transmitted disease and HIV infection among HIV-negative [34] and HIV-positive individuals [20], estimating the association between physical symptoms and psychological variables [52, 53], describing the impact of social anxiety on sexual encounters [54], treatment adherence in cancer patients [41], and relapse prevention in drug abusers [55]. This is the first study we know of that used smartphones and Internet technology in a daily diary study for low-income illicit drug-using women.

We hypothesized a within-subjects process wherein participants who reported anal intercourse would also report use of at least one illicit drug on the same day. This hypothesis was supported. We were also able to get a much richer idea of the interplay of drug use and sex in the daily lives of these women. Anal intercourse days were also those days on which they were more likely to report a variety of other sexual behaviors, including oral and vaginal sex. This is consistent with other studies that have reported that anal intercourse is seldom an isolated sexual event, but takes place within the context of other sexual behaviors and is also associated with positive mood [33]. These findings are also consistent with work reported by Lorvick et al., who found that methamphetamine-using women received pleasure from both the drug use and concurrent sexual activity [1].



Previous cross-sectional studies of drug-use and anal intercourse found associations between these two behaviors. These studies were limited to conclusions that women who used methamphetamine, cocaine, or injected drugs such as heroin were also likely to report anal intercourse. But these associations may only have indicated that illicit drug use was a proxy or descriptor of a group of women who were more likely to have anal intercourse. The drug use in the cross-sectional studies may have only occurred many days, weeks or months before or after the anal intercourse. In the current study, we are now able to demonstrate that *the days on which women took cocaine or methamphetamine were also the days on which they had anal intercourse*. This is a major step forward in understanding the relationship between drug use and oral sex and the outcome of anal intercourse.

In many ways, our study participants were similar to those in the study by Freedman et al. [55]. In that study, homeless crack-using adults were given cell phones for a period of 2 weeks, during which they recorded craving and drug-using episodes. That study used a much shorter reporting time period than the current study, so loss of cell phones and lack of compliance was not as marked. However, it is clear from the discussion, that had the study gone on longer, many of the challenges we encountered in keeping the women enrolled in our study would have been manifested. The chaotic lives of the participants in our study, including lack of stable housing, drug use, lack of resources, and the challenges of simply getting through each day were factors in the high numbers of women who were dropped from the study because they reported the smart phones to be lost or stolen. Despite a research assistant being available Monday through Friday to answer questions and help with using the smart phone and data collection app in person and over the telephone, many of the women expressed frustration at the learning curve they experienced in using this new technology. We were told by the women that they were not sure whether the data were actually uploaded to the server when they pressed the “submit” button at the end of each diary entry and many telephone calls that occurred were participants calling into ensure that their data had been received and that they were on track for that week’s incentive. Most participants came in each week to get their cash incentive and this provided a good opportunity for research staff to check with participants about several issues, including whether the smart phone was working properly.

Most participants who completed the 12-week diary study completed the diary at least once per day. Many women who dropped out of the study after 2 months expressed that the necessity of completing the diary every day was burdensome. The increase in the weekly incentive from \$5 to \$20 for weeks 9–12 was the reason many of the women completing the study gave for their continued participation. Without that additional cash incentive, it is likely that completion of the full 12 weeks would have been lower than it was. For many women, the study was received very well. They were very happy to have the opportunity to have the smart phone and to become familiar with its functionality. Many expressed that they had seen or heard about smart phones, but that owning one was beyond their means and they were thrilled to have the opportunity offered by the study. One unanticipated benefit for many of women in the study was the camera that was available on all of the phones. Many women in the study had criminal justice involvement and had lost custody of their children and only saw them on court-monitored visiting days. These women were able to photograph

their children using the smart phones and had the pictures on the phones to remind them of their children on days they did not have visits.

In conclusion, this study demonstrated the feasibility of using smart phones for data collection with a sample of drug-using women. Variations in anal intercourse frequency provide insight into this risky behavior that may inform the development of interventions to reduce the risks in the context of illicit drug use.

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## References

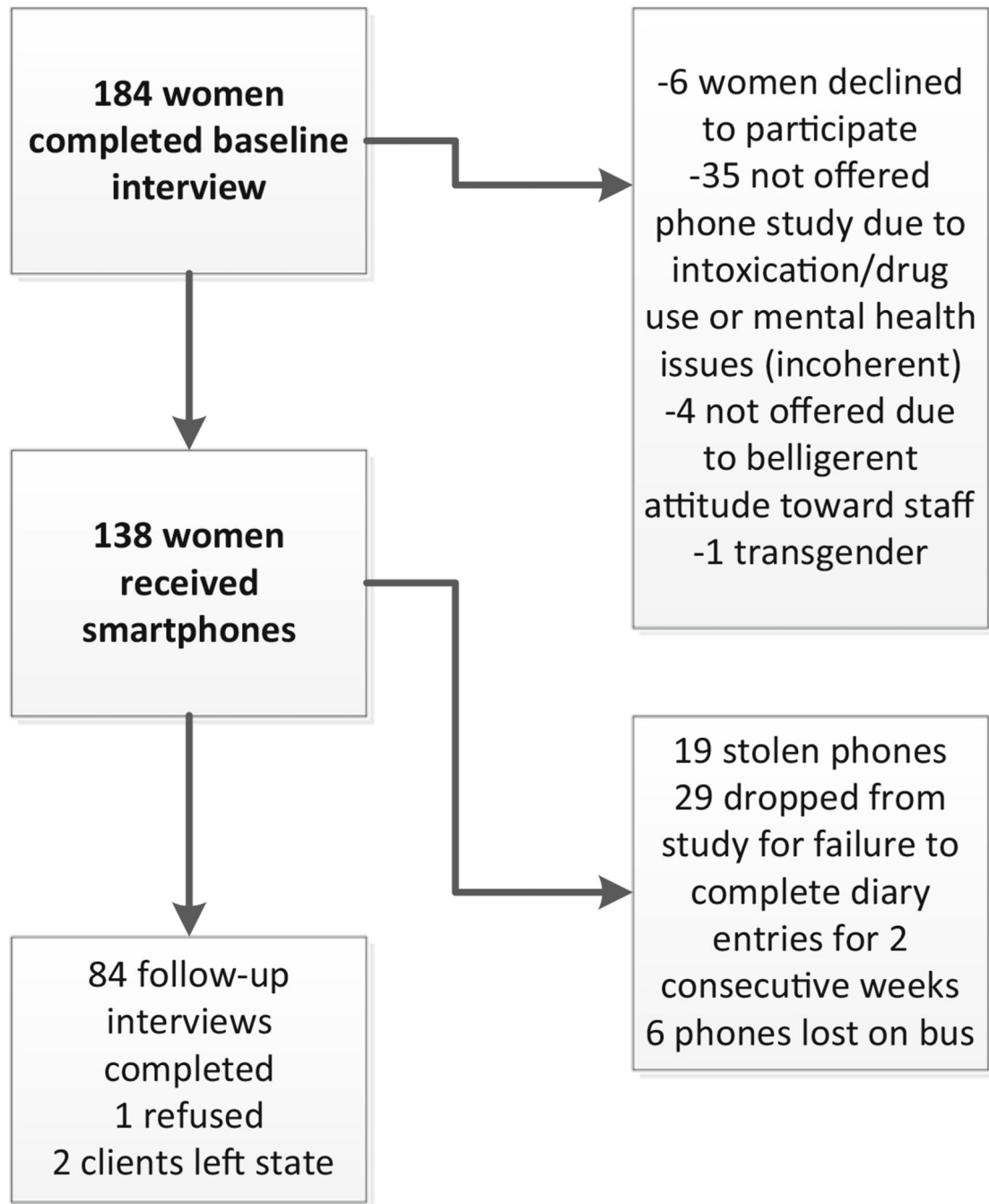
1. Lorvick J, Bourgois P, Wenger LD, et al. Sexual pleasure and sexual risk among women who use methamphetamine: a mixed methods study. *Int J Drug Policy*. 2012; 23(5):385–392. [PubMed: 22954501]
2. Lorvick J, Martinez A, Gee L, Kral A. Sexual and injection risk among women who inject methamphetamine in San Francisco. *J Urban Health*. 2006; 83(3):497–505. [PubMed: 16739050]
3. Reynolds GL, Fisher DG, Napper LE. Heterosexual anal intercourse among women receiving HIV prevention services in Los Angeles County. *Women's Health Issues*. 2010; 20(6):414–419. [PubMed: 21051000]
4. Risser JMH, Padget P, Wolverson M, Risser WL. Relationship between heterosexual anal sex, injection drug use and HIV infection among black men and women. *Int J STD AIDS*. 2009; 20:310–314. [PubMed: 19386966]
5. Cheng WS, Garfein RS, Semple SJ, Strathdee SA, Zians JK, Patterson TL. Differences in sexual risk behaviors among male and female HIV-seronegative heterosexual methamphetamine users. *Am J Drug Alcohol Abuse*. 2009; 35(5):295–300. [PubMed: 19591066]
6. Cheng WS, Garfein RS, Semple SJ, Strathdee SA, Zians JK, Patterson TL. Binge use and sex and drug use behaviors among HIV(–) heterosexual methamphetamine users in San Diego. *Subst Use Misuse*. 2010; 45(1–2):116–133. [PubMed: 20025442]
7. Ibanez GE, Kurtz SP, Surratt HL, Inciardi JA. Correlates of heterosexual anal intercourse among substance-using club-goers. *Arch Sex Behav*. 2010; 39(4):959–967. [PubMed: 20217224]
8. Koblin BA, Hoover DR, Xu G, et al. Correlates of anal intercourse vary by partner type among substance-using women: Baseline data from the UNITY study. *AIDS Behav*. 2008; 14(1):132–140. [PubMed: 18654844]
9. Reynolds GL, Latimore A, Fisher DG. Heterosexual anal sex among female drug users: U. S. National compared to local Long Beach, California data. *AIDS Behav*. 2008; 12(5):796–805. [PubMed: 17653843]
10. Zule WA, Costenbader EC, Meyer WJ, Wechsberg WM. Methamphetamine use and risky sexual behaviors during heterosexual encounters. *Sex Transm Dis*. 2007; 34(9):689–694. [PubMed: 17471112]
11. Hutton HE, McCaul ME, Santora PB, Erbeding EJ. The relationship between recent alcohol use and sexual behaviors: gender differences among sexually transmitted disease clinic patients. *Alcohol Clin Exp Res*. 2008; 32(11):2008–2015. [PubMed: 18782336]
12. McLellan-Lemal E, O'Daniels CM, Marks G, et al. Sexual risk behaviors among African American and Hispanic women in five counties in the Southeastern United States: 2008–2009. *Women's Health Issues*. 2012; 22(1):9–18.



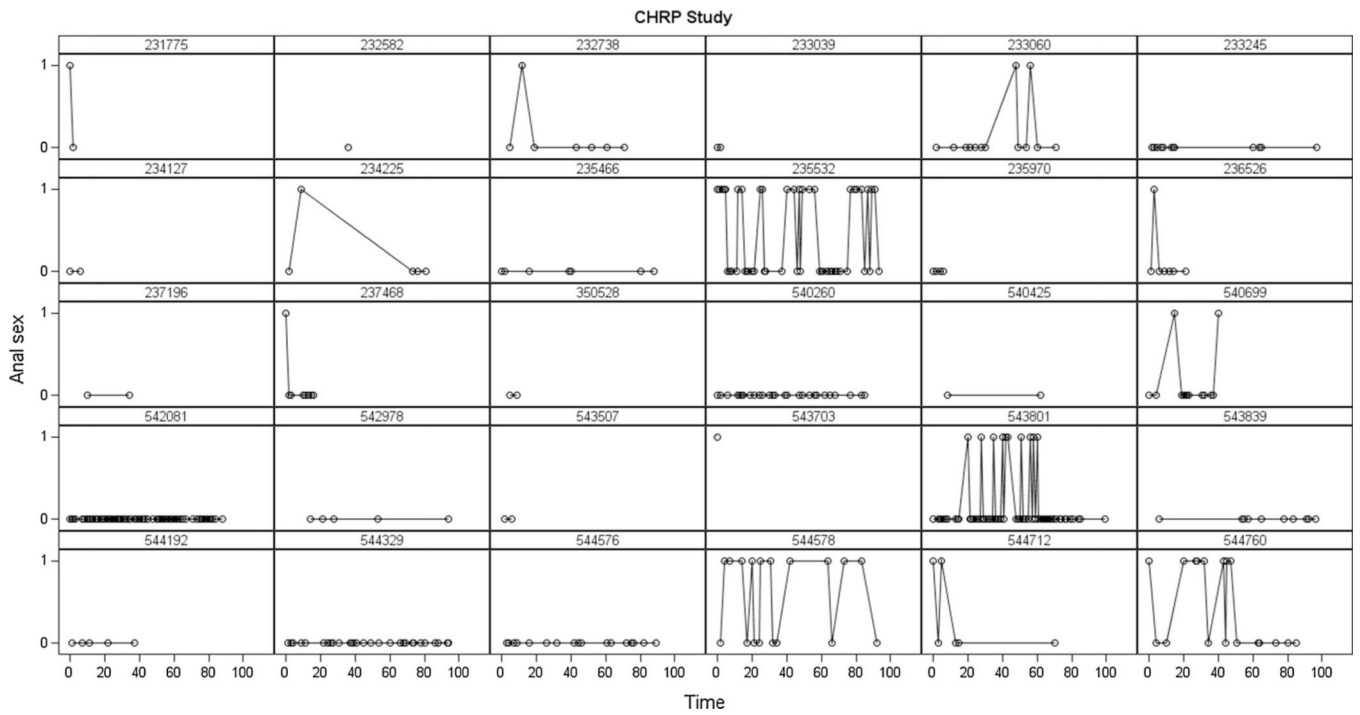
13. Brody S, Weiss P. Heterosexual anal intercourse: increasing prevalence, and association with sexual dysfunction, bisexual behavior and venereal disease history. *J Sex Marital Ther.* 2011; 37(4):298–306. [PubMed: 21707331]
14. Decker MR, Pearson E, Illangasekare SL, Clark E, Sherman SG. Violence against women in sex work and HIV risk implications differ qualitatively by perpetrator. *BMC Public Health.* 2013; 13:876. [PubMed: 24060235]
15. DiClemente RJ, Wingood GM, Crosby RA, et al. Anal sex is a behavioral marker for laboratory-confirmed vaginal sexually transmissible infections and HIV-associated risk among African American female adolescents. *Sex Health.* 2009; 6:111–116. [PubMed: 19457289]
16. Ding A, Challenor R. Rectal chlamydia in heterosexual women: more questions than answers. *Int J STD AIDS.* 2013; 25(8):587–592. [PubMed: 24352134]
17. Gorbach PM, Manhart LE, Hess KL, Stoner BP, Martin DH, Holmes KK. Anal intercourse among young heterosexuals in three sexually transmitted disease clinics in the United States. *Sex Transm Dis.* 2009; 36(4):193–198. [PubMed: 19265740]
18. Guler T, Uygur D, Uncu M, et al. Coexisting anal human papilloma virus infection in heterosexual women with cervical HPV infection. *Arch Gynecol Obstet.* 2013; 288(3):667–672. [PubMed: 23543269]
19. Hunte T, Alcaide M, Castro J. Rectal infections with chlamydia and gonorrhea in women attending a multiethnic sexually transmitted diseases urban clinic. *Int J STD AIDS.* 2010; 21(12):819–822. [PubMed: 21297090]
20. Jenness SM, Begier EM, Neaigus A, Murrill CS, Wendel T, Hagan H. Unprotected anal intercourse and sexually transmitted diseases in high-risk heterosexual women. *Am J Public Health.* 2011; 101(4):745–750. [PubMed: 20558790]
21. Tian LH, Peterman TA, Tao G, et al. Heterosexual anal sex activity in the year after an STD clinic visit. *Sex Transm Dis.* 2008; 35(11):905–909. [PubMed: 18685549]
22. Javanbakht M, Gorbach PM, Stirland A, Chien M, Kerndt P, Guerry S. Prevalence and correlates of rectal Chlamydia and gonorrhea among female clients at sexually transmitted disease clinics. *Sex Transm Dis.* 2012; 39(12):917–922. [PubMed: 23191945]
23. Ladd J, Hsieh YH, Barnes M, Quinn N, Jett-Goheen M, Gaydos CA. Female users of internet-based screening for rectal STIs: Descriptive statistics and correlates of positivity. *Sex Transm Infect.* 2014; 90(6):485–490. [PubMed: 24604333]
24. Calsyn DA, Hatch-Maillette MA, Meade CS, Tross S, Campbell AN, Beadnell B. Gender differences in heterosexual anal sex practices among women and men in substance abuse treatment. *AIDS Behav.* 2013; 17(7):2450–2458. [PubMed: 23321947]
25. Livak BS, Prachand NG, Benbow N. Anal intercourse and HIV risk among low-income heterosexual women: findings from Chicago HIV behavioral surveillance. *Open AIDS J.* 2012; 6:142–148. [PubMed: 23049662]
26. Boily MC, Baggaley RF, Wang L, et al. Heterosexual risk of HIV-1 infection per sexual act: systematic review and meta-analysis of observational studies. *Lancet Infect Dis.* 2009; 9:118–129. [PubMed: 19179227]
27. Baggaley RF, White RG, Boily MC. HIV transmission risk through anal intercourse: systematic review, meta-analysis and implications for HIV prevention. *Int J Epidemiol.* 2010; 39(4):1048–1063. [PubMed: 20406794]
28. Voeller B. AIDS and heterosexual intercourse. *Arch Sex Behav.* 1991; 20(3):233–276. [PubMed: 2059146]
29. Halperin D. Heterosexual anal intercourse: prevalence, cultural factors, and HIV infection and other health risks, Part I. *AIDS Patient Care STDS.* 1999; 13(12):717–730. [PubMed: 10743535]
30. Kasatpibal N, Viseskul N, Srikantha W, Fongkaew W, Surapagdee N, Grimes RM. Effects of Internet-based instruction on HIV-prevention knowledge and practices among men who have sex with men. *Nurs Health Sci.* 2014; 16(4):514–520. [PubMed: 24645824]
31. Grov C, Breslow AS, Newcomb ME, Rosenberger JG, Bauermeister JA. Gay and bisexual men's use of the Internet: research from the 1990s through 2013. *J Sex Res.* 2014; 51(4):390–409. [PubMed: 24754360]

32. Pellowski JA, Kalichman SC. Recent advances (2011–2012) in technology-delivered interventions for people living with HIV. *Current HIV/AIDS Report*. 2012; 9:326–334.
33. Hensel DJ, Fortenberry JD, Orr DP. Factors associated with event level anal sex and condom use during anal sex among adolescent women. *J Adolesc Health*. 2010; 46(3):232–237. [PubMed: 20159499]
34. Hensel DJ, Fortenberry JD, Harezlak J, Craig D. The feasibility of cell phone based electronic diaries for STI/HIV research. *BMC Med Res Methodol*. 2012; 12:75. [PubMed: 22691189]
35. Huber LR, Lyerly JE, Young AM, Dmochowski J, Vick TM, Scholes D. Comparison of prospective and retrospective measurements of frequency of sexual intercourse. *Matern Child Health*. 2013; 18(6):1293–1299.
36. Nippita S, Velasco MG, Oviedo JD, Westhoff CL, Davis AR, Castano PM. Text messages compared with monthly paper diaries: collecting bleeding data after intrauterine device insertion. *Obstet Gynecol*. 2014; 123(Suppl 1):S12–S13.
37. Simon JA, Chandler J, Gottesdiener K, et al. Diary of hot flashes reported upon occurrence: results of a randomized double-blind study of raloxifene, placebo and paroxetine. *Menopause*. 2014; 21(9):938–944. [PubMed: 24569618]
38. Herbenick D, Hensel DJ, Smith NK, et al. Pubic hair removal and sexual behavior: findings from a prospective daily diary study of sexually active women in the United States. *J Sex Med*. 2013; 10(3):678–685. [PubMed: 23237246]
39. Stulhofer A, Ajdukovic D. A mixed-methods exploration of women's experiences of anal intercourse: meanings related to pain and pleasure. *Arch Sex Behav*. 2013; 42(6):1053–1062. [PubMed: 23519588]
40. Stulhofer A, Ajdukovic D. Should we take anodyspareunia seriously? A descriptive analysis of pain during receptive anal intercourse in young heterosexual women. *J Sex Marital Ther*. 2011; 37(5):346–358. [PubMed: 21961443]
41. Tanner AE, Roof KA, Katz BP, Katschke A, Fortenberry JD, Zimet GD. A comparison of young women's actual and assigned timing of use of a microbicide surrogate. *Sex Health*. 2012; 9(4): 299–303. [PubMed: 22877587]
42. Gorbach PM, Mensch BS, Husnik M, et al. Effect of computer-assisted interviewing on self-reported sexual behavior data in a microbicide clinical trial. *AIDS Behav*. 2013; 17(2):790–800. [PubMed: 23054034]
43. Gribble JN, Miller HG, Cooley PC. The impact of T-ACASI interviewing on reported drug use among men who have sex with men. *Subst Use Misuse*. 2000; 35(6–8):869–890. [PubMed: 10847215]
44. Morrison-Beedy D, Carey MP, Tu X. Accuracy of audio computer-assisted self-interviewing (ACASI) and self-administered questionnaires for the assessment of sexual behavior. *AIDS Behav*. 2006; 10(5):541–552. [PubMed: 16721506]
45. Bolger, N.; Laurenceau, J-P. *Intensive Longitudinal Methods: An Introduction to Diary and Experience Sampling Research*. New York: The Guildford Press; 2013.
46. Dowling-Guyer S, Johnson ME, Fisher DG, et al. Reliability of drug users' self-reported HIV risk behaviors and validity of self-reported recent drug use. *Assessment*. 1994; 1(4):383–392.
47. Napper LE, Fisher DG, Johnson ME, Wood MM. The reliability and validity of drug users' self reports of amphetamine use among primarily heroin and cocaine users. *Addict Behav*. 2010; 35(4): 350–354. [PubMed: 20053503]
48. Needle R, Fisher DG, Weatherby N. Reliability of self-reported HIV risk behaviors of drug users. *Psychol Addict Behav*. 1995; 9:242–250.
49. Johnson ME, Fisher DG, Reynolds GL. Reliability of drug users' self-report of economic variables. *Addict Res*. 1999; 7(3):227–238.
50. Schafer JL, Graham JW. Missing data: our view of the state of the art. *Psychol Methods*. 2002; 7:147–177. [PubMed: 12090408]
51. Begg C, Cho M, Eastwood S, et al. Improving the quality of reporting of randomized controlled trials: the CONSORT statement. *JAMA*. 1996; 276(8):637–639. [PubMed: 8773637]

52. Klot JF, Auerbach JD, Veronese F, et al. Greentree white paper: sexual violence, genitoanal injury, and HIV: priorities for research, policy, and practice. *AIDS Res Hum Retroviruses*. 2012; 28(11): 1379–1388. [PubMed: 22953712]
53. Thompson NJ, McGee RE, Mays D. Race, ethnicity, substance use, unwanted sexual intercourse among adolescent females in the United States. *West J Emerg Med*. 2012; 13(3):283–288. [PubMed: 22900127]
54. Kashdan TB, Adams L, Savostyanova A, Ferssizidis P, McKnight PE, Nezlek JB. Effects of social anxiety and depressive symptoms on the frequency and quality of sexual activity: a daily process approach. *Behav Res Ther*. 2011; 49:352–360. [PubMed: 21463854]
55. Freedman MJ, Lester KM, McNamara C, Milby JB, Schumacher JE. Cell phones for ecological momentary assessment with cocaine-addicted homeless patients in treatment. *J Subst Abuse*. 2006; 30(2):105–111.



**Fig. 1.**  
Flow chart of the daily diary study



**Fig. 2.**  
Between-subjects variation in anal intercourse frequency

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**Table 1**Women enrolled into the daily diary study ( $N = 138$ )

| Variable   | <i>N</i> (%) |
|--|--------------|
| Ethnicity/race                                   |              |
| African American                                 | 79 (57)      |
| White, non-Hispanic                              | 26 (19)      |
| White, Hispanic                                  | 23 (17)      |
| Asian/Pacific Islander                           | 2 (1)        |
| Native American                                  | 2 (1)        |
| Other, mixed race                                | 6 (4)        |
| Education  |              |
| Less than high school                            | 50 (36)      |
| High school or equivalent                        | 53 (38)      |
| Some college                                     | 23 (17)      |
| College graduate                                 | 6 (4)        |
| Monthly income                                   |              |
| <\$500   | 75 (57)      |
| \$500–\$999                                      | 41 (31)      |
| >\$999   | 22 (16)      |
| Sexually abused as a child or adolescent         | 73 (54)      |
| Currently live with other adult friend or family | 54 (41)      |
| Sources of income                                |              |
| Paid job, salary                                 | 16 (12)      |
| Welfare or public assistance                     | 60 (46)      |
| Spouse, family or friend                         | 42 (32)      |
| Prostitution, sex trading                        | 26 (20)      |



**Table 2**Total diary days with sexual partner activities before/after any sex ( $N = 1606$  dairy days)

| Variable                       | % Yes     |
|--------------------------------|-----------|
| Vaginal intercourse            | 1272 (79) |
| Received oral sex from partner | 984 (61)  |
| Gave oral sex to partner       | 964 (60)  |
| Smoked cigarettes              | 814 (51)  |
| Used alcohol                   | 621 (39)  |
| Watched pornography            | 509 (32)  |
| Went to hotel/motel            | 499 (31)  |
| Used marijuana                 | 505 (31)  |
| Condom use vaginal intercourse | 436 (27)  |
| Anal intercourse               | 285 (18)  |
| Argued or fought               | 269 (17)  |
| Lubricant use anal intercourse | 194 (12)  |
| Used a sex toy                 | 198 (12)  |
| Condom use anal intercourse    | 139 (9)   |
| Used crack                     | 105 (7)   |
| Used methamphetamine           | 120 (7)   |
| Used cocaine (powered)         | 43 (3)    |
| Used heroin                    | 13 (<1)   |

All variables coded 1 = yes, 0 = no. Sample size is number of diary days when an interaction with a sexual partner occurred

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**Table 3**  
 Multilevel logistic regression with random intercept and fixed slope for female predictors of daily anal intercourse

|                                  | Coefficient (SE) | p      | OR     | 95% CI of OR |          |
|----------------------------------|------------------|--------|--------|--------------|----------|
|                                  |                  |        |        | Lower        | Upper    |
| <b>Model term-within</b>         |                  |        |        |              |          |
| Intercept                        | -3.09 (0.32)     | <0.001 | -      | -            | -        |
| Time                             | -0.01 (0.01)     | 0.50   | 0.99   | 0.984        | 1.009    |
| Want sex (within)                | 0.33 (0.14)      | 0.02   | 1.39   | 1.056        | 1.837    |
| Vaginal sex (within)             | 1.29 (0.18)      | 0.04   | 3.65   | 1.039        | 12.791   |
| Receive oral sex (within)        | 1.43 (0.41)      | <0.001 | 4.19   | 1.889        | 9.287    |
| Give oral sex (within)           | 0.71 (0.35)      | 0.045  | 2.02   | 1.016        | 4.032    |
| Meth use (within)                | 0.64 (0.32)      | 0.047  | 1.90   | 1.008        | 3.584    |
| Cocaine use (within)             | 1.49 (0.61)      | 0.014  | 4.46   | 1.357        | 14.641   |
| <b>Model term-between</b>        |                  |        |        |              |          |
| Want sex (between)               | -0.46 (0.34)     | 0.024  | 0.631  | 0.324        | 1.229    |
| Vaginal sex (between)            | 1.86 (0.94)      | 0.047  | 6.42   | 1.018        | 40.528   |
| Receive oral sex (between)       | 3.91 (0.90)      | <0.001 | 49.89  | 8.550        | 291.196  |
| Give oral sex (between)          | 0.49 (0.70)      | 0.485  | 1.63   | 0.413        | 6.436    |
| Meth use (between)               | 2.10 (0.93)      | 0.024  | 8.16   | 1.319        | 50.541   |
| Cocaine use (between)            | 4.82 (1.98)      | 0.015  | 123.96 | 2.559        | 6002.912 |
| <b>Random effect covariances</b> |                  |        |        |              |          |
|                                  | Estimate (SE)    | z      | p      | 95% CI       |          |
| <hr/>                            |                  |        |        |              |          |
| Level-2 (between-person)         |                  |        |        | Lower        | Upper    |
| Intercept variance               | 3.22 (1.06)      | 3.03   | 0.002  | 1.138        | 5.298    |

Interclass correlation for binary daily anal intercourse outcome is .58 (binary daily anal intercourse outcome is 1 = yes, 0 = no)