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# Feasibility and Acceptability of Cell Phone Diaries to Measure HIV Risk Behavior Among Female Sex Workers

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# Abstract

Individual, social, and structural factors affecting HIV risk behaviors among female sex workers (FSWs) are difficult to assess using retrospective surveys methods. To test the feasibility and acceptability of cell phone diaries to collect information about sexual events, we recruited 26 FSWs in Indianapolis, Indiana (US). Over 4 weeks, FSWs completed twice daily digital diaries about their mood, drug use, sexual interactions, and daily activities. Feasibility was assessed using repeated measures general linear modeling and descriptive statistics examined event-level contextual information and acceptability. Of 1,420 diaries expected, 90.3 % were completed by participants and compliance was stable over time (p > .05 for linear trend). Sexual behavior was captured in 22 % of diaries and participant satisfaction with diary data collection was high. These data provide insight into event-level factors impacting HIV risk among FSWs. We discuss implications for models of sexual behavior and individually tailored interventions to prevent HIV in this high-risk group.

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#### Keywords

Female sex workers; Daily diaries; HIV risk behavior; Feasibility; Sexual events

# Introduction

Globally, female sex workers (FSWs) have 14 times the risk for HIV relative to same age women in the general population [1]. They have increased likelihood of exposure to HIV because of the social context in which they operate (i.e. drug use, poverty, homelessness), through sexual contact with injection drug users, and through economic dependence on multiple concurrent sexual partners which limits their ability to successfully negotiate condoms [2–9]. Understanding the situations and sexual partner types (e.g., new client, regular/recurring client, drug dealer, pimp, boyfriend/spouse, etc.) in which FSWs are most likely to engage in HIV risk behavior has important implications for intervention design [10].

Research has shown situational phenomena are associated with FSWs' HIV risk behavior. These studies offer important insights into facilitators (e.g., workplace norms and availability of condom use) [8, 11] and barriers (e.g., drug addiction or working away from main streets to avoid police) to condom use. [6, 12] In general, these models of behavior are potentially biased by their reliance on retrospective surveys methods which capture relatively distal determinants of behavior. Reporting frequently occurring behavior may threaten recall accuracy and result in reporting "typical" response patterns that under/over estimate the true frequency of risk/protective behavior [13, 14]. A study by Blair and Burton [15] found that when participants reported more than five events spanning 2 weeks to 6 months, only 15 % used episode enumeration (e.g. recalling and counting the number of times the behavior in question actually occurred) [15]. When there were ten or more episodes to recall or a longer recall window, virtually all participants used estimation rather than enumeration. The potential bias resulting from over/under estimation introduces noise into our behavioral models and may render them insensitive to the events most associated with risk.

As an example of the potential magnitude of recall bias introduced by retrospective reports of sexual behavior by FSWs, we draw upon data from three studies conducted in the United States. In these papers, the average number of clients served by a FSW per month ranged from 18 to 61 [16–18] Using a hypothetical 1- or 6-month retrospective survey period, FSWs would be asked to recall their behavior during 18–366 sexual events, respectively. Reporting typical behavioral patterns may fail to capture important situational factors most proximally affecting decision-making and risk. Thus, novel approaches that elicit highly-specific information about sexual events and their contexts are needed.

Electronic diaries, a type of ecological momentary assessment (EMA), are a method for capturing highly-specific event-level data [19]. Cueing participants to complete behavioral reports (diaries) multiple times per day, diary studies, like SMS studies, capture large volumes of individualized data in close proximity to its occurrence via self-administered questionnaires. These techniques have been found to minimize the likelihood of socially

desirable reporting, such as overestimating condom use or underestimating the number of sexual partners or drug use [20, 21]. Both SMS texts and diary data entry can be done via a variety of personal communication devices, including cell phones [22, 23] However, diary and SMS test methods are not the same. Diaries are completed via a customized web-based system that allows a combination of response types (e.g., text fields, single characters, specific response options, etc.) to be entered via an encrypted connection. This provides considerable flexibility in item design and an extra layer of data security and protection for human subjects.

To date, no study has assessed the feasibility of using cell phone diaries to capture HIV risk behavior among FSWs. These important within-person data may pinpoint how changing situational factors (e.g. drug craving; mood; relationship to sexual partner; day, time or location of sex) impact HIV risk at the event-level [19, 20, 24, 25]. While there is no one theory designed explicitly to explain event-level phenomena, we draw upon sexual script theory as a theoretical foundation for probing the organization of sexual behavior. Script theory suggests that social rules regarding sexual and romantic behavior are reinforced via culturally shared scripts or norms [26, 27]. Situational cues may interact with other features of a sexual script to shape the person's perception of the event (e.g., perceived risk of infection if sex occurs and decisions to use condoms). To understand the impact of situational context on HIV risk behavior, we assessed reports of sexual interactions over time, measured partner characteristics, and located these sexual events within a range of sexual spaces such as the participants' home, a car, or bar. Here, we describe the feasibility and acceptability of this technologically-advanced methodology and discuss how these data provide insight into how individual, dyadic and environmental factors, operating at the event-level, impact HIV risk behavior among FSWs.

# Methods

### **Study Design**

Data were collected as part of a four-week prospective cohort study examining HIV risk behavior and associated contexts among FSWs in Indianapolis, Indiana, US (pop. 800,000). There were four modes of data collection: (1) a computer assisted self-interview (CASI) administered at baseline measuring demographics, physical health, depression using the 9item PHQ depression diagnostic and severity measure [28], criminal activity, sexual history and drug use; (2) twice daily electronic diaries, delivered via cell phone, that monitored event-level determinants of HIV risk (e.g., drug use, sexual behavior, partner type and location of partnered sexual interactions); (3) weekly interviews consisting of open-ended questions exploring situational characteristics of sexual events; and (4) an exit CASI assessing the overall participant experience. Data for this paper are quantitative, taken from the twice daily diaries and exit CASI.

### **Participants and Recruitment**

To be eligible for the study, women at least 18 years of age had to (1) report engaging in sex in exchange for drugs, money or items of daily living (e.g. food, shelter or transportation) within the preceding 90 days; [29] (2) indicate a likelihood that sex exchange would occur

again within 30 days; and (3) report they were capable of safely storing and charging a cell phone regardless of housing or personal situation. A three-prong recruitment strategy was utilized to identify participants, including: (1) targeted outreach (by partnering with a mobile HIV prevention outreach program that targeted street-based sex workers), (2) venue-based recruitment (by attending an educational course for women recently arrested for prostitution and also through referral from an agency serving women in active addictions recovery), and (3) incentivized peer referral (by allowing women who qualified for the study to recruit up to three peers) [30]. All three recruitment methodologies (outreach, targeted recruitment and incentivized peer referral) were initiated simultaneously between May and June 2012 and continued until the remainder of the sample was complete (approximately 45 days). The study protocol was approved by the Indiana University Institutional Review Board. All participants provided written informed consent.

#### **Diary Data Entry**

Participants were asked to complete two digital diary entries per day via a study-provided internet-enabled cell phone, the Samsung Conquer<sup>®</sup> (see Fig. 1). Each day at 09:00 and 21:00, participants received a text message informing them the data entry window was open. The window remained open for 4 h (until 13:00 and 01:00, respectively) and participants could initiate data entry any time. To initiate data entry, participants logged into a password-enabled, custom-built, ASP.net website that was accessed via mobile web browser. Data were entered directly onto a secure server. No personal information or survey responses were stored on the phone itself. If diary entry was not completed within 3 h, a second reminder message was sent signaling that 1 h remained in the data entry window. In order to maintain a standard recall period for reporting, retrospective data entry was not permitted. Thus, if the 4-h window elapsed without survey completion, the diary session was considered incomplete. Participants did not receive remuneration for incomplete or missing diary entries.

#### **Compliance Monitoring**

Because the database was updated in near real time, monitoring of diary compliance was possible. Participants with more than two consecutive missed diary entries were contacted by text message to troubleshoot data entry problems and encourage compliance with the diary schedule. Direct telephone contact was made if missed entries continued or if more than 20 % of entries were missed during any given 3-day period. If a researcher was unable to contact the participant regarding diary completion, the participant's cell phone service was suspended for 72 h. If the participant contacted a researcher within the 72-h period and indicated a willingness to continue in the study their service was reinstated. The days in which service was interrupted did not count toward the participant's 30-day enrollment period. Each participant was allowed two 72-h periods of non-compliance without being dropped from the study. When a third period of less than 80 % completion occurred, participants were dropped from the study.

#### Compensation

Participants were provided with a cell phone and service plan that included unlimited telephone calls and text messages to domestic numbers, and internet service; a value of

approximately \$90. They were compensated \$20 for the baseline interview and each of four follow-up interviews (maximum: \$100); \$0.75 for each completed diary (maximum: \$45); and \$5 for each peer recruited (maximum: \$15). Payments were made in cash after each weekly interview appointment. Participants were financially responsible for any costs associated with downloading games, music, or making operator-assisted/international telephone calls and were informed these costs would be deducted from study compensation during the informed consent process. Upon completing the study, participants were able to keep their study phone and transfer service to it at their cost.

#### **Diary Measures**

Diaries queried a variety of situational determinants previously suggested to play a key role in HIV transmission [12, 31–33]. Using closed-ended survey questions, each diary entry assessed mood, and the occurrence of any partnered sexual interaction. For mood, participants were asked to rate the following since their last diary prompt; feeling: happy, friendly, and cheerful (positive mood; ( $\alpha = 0.86$ ); unhappy, angry, irritable, stressed, tired and board (negative mood;  $\alpha = 0.85$ ) on a 5-point Likert scale from "not at all" to "very". A mean score for negative and positive mood were calculated for each diary entry. To account for variation in partnered sexual activity, we created a 3-path system to direct data flow (Fig. 2).

When participants reported engaging in sexual behavior, they were directed through a series of questions assessing the contextual details of each sexual event (diary paths A & B of Fig. 2). Participants described the time, day, and location of each sexual event; they characterized the nature of their relationship with their sexual partner (e.g., stranger, regular client, drug dealer, friend, boyfriend/girlfriend and fiancé/spouse); indicated which sexual behaviors occurred (e.g., kissing, anal, oral or vaginal sex), condom use, drugs/alcohol use by both the participant and their sexual partner, the amount and type of compensation received (e.g. money, drugs, items of daily living), and any adverse outcome(s) associated with the event (e.g., verbal assault, left stranded without a ride, threatened with physical violence, physically assaulted, sexually assaulted or theft). For each sexual event, partner information was captured by asking participants to "name" and describe each partner (e.g., relationship type). Partner nicknames were automatically stored and auto-populated the sexual behavior section of the survey. Each time sexual behavior was reported, participants "named" their partner by checking the name of her previously entered partner or creating a new partner profile.

Diary path C (Fig. 2) was completed during periods of sexual abstinence and included daily activities questions (e.g., spending time with friends or family, providing childcare, doing household chores, etc.), financial need, and income-generating activities (e.g., non-sexual work, borrowing/stealing money, unsuccessful attempts at engaging in transactional sex). Regardless of the path, diary assessments were designed to take approximately the same amount of time to complete so as to encourage accurate reporting.

#### Measures from Exit CASI

At their final study visit, participants completed an exit interview that included rating the acceptability of data collection methods. Twelve Likert items (five-points from strongly disagree to strongly agree) measured subjective experience of participation, comfort with daily diaries, appropriateness of time required to complete study-related activities, and desire to participate in future diary studies of sexual behavior. Finally, we assessed for reactivity by asking participants to indicate whether their behavior changed as a result of study participation.

#### Analyses

The number of expected diaries was calculated by multiplying enrollment period for each participant by two and subtracting any periods of service suspension. Data from incomplete surveys (3.3 % of surveys) were removed prior to our feasibility analysis. The majority of diary data (93.9 %) were collected during 4 consecutive weeks. The diary entries (n = 78) that occurred after week 4 occurred as a result of service suspension or scheduling difficulties. This equates to 16 FSWs in week 5 (number of diaries entered ranges from 1 to 14) and 1 FSW in week 6 (2 diaries entered). The mean number of diaries per participant not completing the study in 4 weeks was 4.8 (SD = 3.9). Sensitivity analyses done with and without data from weeks 5 to 6 showed no significant differences in compliance between the two periods. Thus, we combined these data and refer to them as 'week 4+' throughout the remainder of the manuscript.

Descriptive statistics were used to examine participant socio-demographics (see Table 1), attrition, duration of participation, episodes of non-compliance (and related service suspension), incidence of lost/damaged equipment, service overage charges, and study costs. Feasibility of the cell phone diaries to measure sensitive behaviors over time was assessed at two levels (study and participant) using repeated measures general linear model. At the study-level, feasibility was the number of completed diaries divided by the number of those expected. Completion time was calculated as the number of minutes elapsed from diary initiation (e.g. logging onto the server) to synchronization with the server (e.g. when participant records response to the final diary question).

At the participant-level, we examined the feasibility in three ways. First, we aggregated the number of participants reporting partnered sexual activity each week. Second, we aggregated participants and their reported partners to the week level and calculated the mean number of unique sexual partners reported each week. Third, we assessed the volume of sexual behaviors (reports of kissing, receptive oral sex, performing oral sex, coitus, and anal sex) and compared responses over time using repeated measures general linear model.

At the event-level, we examined the breadth of situational information (partner type, venue and substance use) reported by participants using descriptive statistics (Table 3). Rarely (<2 % of completed diaries), participants selected 'prefer not to answer' in response to a query about sexual behavior and/or condom use. These responses were not included in this analysis. Due to programming errors (and not relating to participant response), a number of substance use-related diary questions were never asked. These questions were not

selectively omitted based on particular participants or reported behaviors (e.g., data are missing at random). The resulting decreased number of substance use-related questions is indicated in Table 3. Finally, the proportion of individuals responding "agree"/"strongly agree" to each acceptability question is described. All analyses were performed using SPSS v19.0 [34].

# Results

#### Sample Description

Twenty-six FSWs were recruited via targeted outreach (n = 2), venue-based recruitment (n = 5), and peer referral (n = 19). Their self-reported race/ethnicities were Black (77 %), Latina (10 %) and White (13 %); median age was 43.5 years (Table 1). Most participants (61 %) reported engaging in sex work at least 1–5 times per week and receiving income from non-sex work employment in last 90 days (58 %). They also reported a variety of individual factors associated with increased risk of HIV acquisition including current homelessness (23 %), illicit drug use within the prior 90 days (88 %), childhood history of sexual abuse (81 %), and high rates of lifetime arrest and incarceration (58 %). The majority (66 %) reported being in good to excellent health and 70 % had scored in the mild to severe range for depression.

### Attrition

The mean participation period was 29 days (SD = 3 days). Across all study participants, there were eight episodes of 75 % diary completion which resulted in temporary service suspension; the mean number of days with service interruption for all participants was 1.4 days (SD = 2.6 days). All but one participant completed the study; she was dropped from the study after two episodes of less than 75 % compliance with diary protocol. Over the course of the study, five phones were replaced as lost, stolen, or broken. No participants incurred charges associated with utilization of services not covered by the study (e.g., downloading games, music, or making operator assisted/international telephone calls).

# Feasibility

Participants completed 90.3 % of 1,420 expected surveys. Another 3.3 % (N = 45) surveys were initiated but not completed. Weekly compliance was high throughout the study period, each participant completed an average of 11.6 diaries in week 1 and 13.9 diaries in the final week (Table 2). While participants became more adherent to diary protocol as the study progressed, compliance did not improve significantly over time (p = 0.08).

Participants were allowed upto 240 min to complete diary entries regardless of diary path. For participants reporting sexual behavior (Path A/B), the mean time to completion was 19.6 min. Diaries containing no sexual behavior data (Path C), took less time (mean: 11.3 min). The maximum time for survey completion was 228.4 and 189.1 min for Path A/B and Path C, respectively. Despite our attempt to standardize the time required to complete diary entries whether or not sexual behavior was reported, completion times were longer for Path A/B than for path C (p = 0.02). Regardless of path, participants became more efficient at

Participants submitted 275 diary entries indicating partnered sexual behavior (22 % of completed diaries). These diaries are from 65 of 103 participant weeks, meaning participants reported no sexual behavior during 36.9 % participant weeks. Participants reported a diverse sexual repertoire. Not all behaviors were reported during each sexual interaction. Vaginal sex was reported most frequently, occurring in 92.3 % of participant sex weeks. Kissing, giving oral sex, and receiving oral sex occurred in approximately three-quarters of the weeks in which sexual behavior was reported; anal sex was reported much less frequently (8 % of weeks).

#### **Participant-Level Sexual Behavior**

At the participant level, 25 of 26 participants reported at least one episode of partnered sexual activity. Of these, 96.1 % FSWs reported at least one act of engaging in vaginal sex, 100 % reported receiving oral sex, 84.7 % reported giving oral sex and 19.2 % reported engaging in anal sex. Including all partner types, participants reported using condoms 39.2 % of the time when 'giving oral sex', nearly half (45.5 %) of the time during vaginal sex, and most of the time (83.3 %) when engaging in anal sex. The absolute number of FSWs reporting partnered sexual activity decreased over time (21 and 12 FSWs in weeks 1 and 4, respectively; p = 0.02). The mean number of FSWs reporting any sexual behavior decreased from 2.5 to 1.92 over the same period (p = 0.02). However, the mean number of unique sexual partners reported by each participant did not decrease statistically over time (p = 0.09).

Reports of sexual behavior also varied over time. The mean number of giving oral sex acts and vaginal sex acts decreased over time (p = 0.04 and 0.03, respectively). However, there was no change over time in reports of kissing, receiving oral sex, or engaging in anal sex.

#### **Event-Level Context of Sex Events**

Contextual aspects of partnered sex events are described in Table 3. Participants reported less negative mood during non-paid/traded sexual events (2.5, SD = 0.9) compared to those that were traded (2.63, SD = 0.9). Nearly half of events occurred with a "friend" regardless of payment. Among paying partners, regular clients ranked second (30 %), followed by strangers (9 %), drug dealers (7 %), and romantic partners (4 %). When payment was not indicated, most events occurred with romantic partners (45 %), followed by regular clients (11 %), and drug dealers (2 %). The location of events varied by transaction type. The majority of transactional (54 %) and non-transactional sex events (76 %) occurred in the participant's or her partner's home. More paid/traded events occurred in cars, hotels/motels, and abandoned buildings. However, more non-traded sexual events occurred in parks or other public spaces. Substance use at the event-level was common by both the participant and her partner. Participants reported being drunk or high nearly two-thirds of the time. They reported their sexual partner was drunk or high approximately 50 % of the time. They were unsure whether their partner was drunk or high in 1.1 and 0.4 % of events, respectively.

#### Acceptability

Participant responses indicated that it is acceptable to use cell phone-based electronic diaries to collect sensitive information. They were comfortable answering questions about sexual behavior, disclosing locations of sexual activities, and drug and alcohol use (84.6, 73.1, and 73.1 %, respectively). They indicated the amount of time necessary to complete diaries was appropriate (84.6 %). The majority of participants enjoyed being a part of the study (84.6 %) and reported that they did not change their behavior as a result of their participation (61.5 %). Participants were willing to continue in this study if it were longer (84.6 %) or to participate in another study in the future (84.6 %).

#### Time and Cost

The average cost per participant was approximately \$250. Because of an agreement between the academic division and cell phone provider, there was no cost associated with the cell phone itself (valued at about \$90). Recruitment occurred over the course of 5 weeks and data collection lasted approximately 8 weeks using three waves of recruitment.

#### Discussion

This is one of the first studies to examine whether cell phone-based daily diaries can be used to collect information about FSWs' HIV risk behaviors. Our findings demonstrate that it is feasible to engage and retain FSWs for 1 month in a technologically-advanced study to characterize risk contexts of sexual events. Further, compliance to study protocol was high, demonstrating that the participants were willing to disclose information about sensitive behaviors over time. Participant responses during the exit survey indicate event-level monitoring using cell phone based diaries was acceptable and that they enjoyed participating.

Our diary completion rate is commensurate, if not slightly higher, than other studies using EMA with vulnerable populations [22, 24]. EMA has been used to study sensitive behaviors including relapse processes among individuals undergoing addictions treatment, [24, 35, 36] and adult men and women in a clinical study of sexual risk behavior and incident STI [22]. In this study, our high rates of compliance and retention are noteworthy. At baseline, participants reported a variety situational factors that we anticipated would negatively impact compliance (e.g. homelessness, income \$10,000/year and illicit substance use). However, they adapted quickly to the methodology and took care of their study phones. Relatively little equipment was lost, stolen or broken; five phones were replaced throughout the study. It is likely that providing 1 month of free service, allowing participants to keep their cell phone upon study completion, providing compensation for diary entry, and contacting participants with <75 % compliance to address technical difficulties, influenced both the high rate of compliance and the low rate of damaged equipment. While it is possible that our protocol inflated compliance, we have seen that when participants are not given strict guidelines to follow, compliance suffers and equipment is lost/damaged at higher rates [37]. Most participants responded at a high rate without prompting (mean compliance per week was upwards of 89 %). Finally, participants had access to research staff 24/7 for questions relating to data entry, technical and equipment issues, such as

inability to log into the server or synchronize data, random equipment failure or equipment loss/theft. As a result, there were high levels of interaction between participants and staff, perhaps contributing to an overall positive participation experience and, thus, high compliance and retention.

Importantly, compliance rates in this study were similar to another cell phone based study of sexual behavior in which authors reported FSWs became more interested in reporting sexual behavior over time [38]. It is difficult to draw a direct comparison between this cell phone study conducted in Bangalore (India) and the present study because of considerable methodological differences (e.g. daily phone interviews to assess sexual activity, larger sample size, limited drug/alcohol use by study participants in India). However, it appears cell phone-based data collection is a promising approach that can be adapted for use in international and US settings.

We hope our findings have implications for investigators interested in using cell phone methodologies to study frequent and/or habitual behavior with other hard-to-reach and follow populations. While compliance to study protocol was high throughout the study period the number of women reporting sexual behavior decreased over time. We do not believe this finding indicates underreporting or that the participants found the method unacceptable. Rather, it may relate to over-reporting in the first week due to the novelty of the project. Further, 62 % of participants indicated during the exit survey that they had not changed their behavior secondary to participating in the study.

# Limitations

Our findings should be considered within the limits of the study design. The small sample is not representative of FSWs in Indianapolis. Our recruitment methods-including targeted and incentivized peer referral-introduce bias such as homophily (e.g. participants may share common traits within a peer network). While the seeds were recruited from various agencies serving FSWs (e.g. a judicial setting, an addictions recovery program, and a mobile HIV outreach program targeting FSWs) and three distinct geographic areas of Indianapolis, most respondents were referred by a peer (73 %). Thus, they represent overlapping social networks and potentially common approaches to sex work, and even a common set of customers and risks. This may prohibit broad generalization of our findings to other populations; however, it does not necessarily limit our findings relating to feasibility. Rather, it highlights the importance of very specific inclusion criteria. In this project, our inclusion criteria may have required modification in order to reach the highest risk group of workers. For example, we could have required a minimum number of paid sexual partners per month or excluded women only reporting sex for items of daily living such as rent. Additionally, in this study, approximately 5 % of initiated diaries were incomplete. We cannot reconstruct data to detect which are related to user error or technical difficulties such as low signal or service interruptions. Future studies should track the number of attempts made to complete diary and/or participant communication with research staff regarding technological issues. Our team's prior experience suggests that participants who "drop out" often do so passively (e.g., stopping data entry due to unforeseen circumstances such as incarceration, hospitalization or unexpected travel may also interrupt data collection and

follow-up.) and within a few days of initiation of diary keeping. Thus, we implemented a tiered diary compliance strategy to monitor all forms of diary non-completion, even for those outside of control of the participant. We chose to use a high level of support to maintain compliance because we already know that lack of support equals lesser compliance to research protocols and consumption of important research resources without contribution to the research aims. It is possible that the high level of contact with staff encouraged high rates of compliance and biased our results. Nearly 62 % of women (16/26) did not complete the diaries within the 4-week period. The number of diary days occurring beyond the 4 week enrollment period ranged from 2.5 to 4.5 days per participant. Diary days beyond the 4-week period could be different than those reported during the initial enrollment period (e.g. more or less sex or intoxication could have been reported). However, our sensitivity analyses indicate this did not impact feasibility as patterns of compliance were similar on days within and beyond the 4-week submission period. Other investigators interested in using cell phone methodologies would be wise to anticipate data collection will take some participants more time than others due to unforeseen various life events. The main feasibility issue is the flexibility in time needed to collect this intensive data. Importantly, sensitivity analyses should be done to differentiate whether these data (or people taking additional time) are in some way different. We encountered programming errors that impacted participant response on several items. Review of the programming code and our data indicate these questions were missing at random and therefore, do not affect the feasibility of using this method with FSWs.

# Conclusion

Our findings indicate FSWs are willing report sensitive information twice-daily via cell phone-based digital diaries for the period of 4-weeks. A main strength of the diary method is its ability to identify potential social, psychological and physical reasons (e.g., negative mood or withdrawal symptoms) associated with lesser or more risky sexual events. Further analysis of the antecedents of high-risk events may identify situations or venues that are amenable to intervention. For example, if drug craving or depressed moods are identified antecedents, addressing substance use issues and optimally managing depression may help reduce risk. Reports of increasing negative mood or withdrawal could contribute to a text message intervention that provides psycho-social support to reduce stress-related drug seeking among illicit drug users. Likewise, if particular venues types predict risk, structural interventions to promote condoms may be more appropriate than individual risk counseling. In sum, it is feasible to use this technologically advanced event-level methodology with FSWs. Data will be used to identify proximal predictors of high-risk behavior and most importantly, determinants of within person variation.

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-	t scheduled prompt,
Since Check [inser	e your last science all the types of sexual contact you have had with t Partner Name]?
	Gave me oral sex
	Gave partner oral sex
H	Penis in vagina (vaginal sex)
F	Penis in butt (anal sex)
H	Other
	other, please specify:
	At the time of this event, how much did you trust nu- [insert Partner Name] would not give you a sexually transmitted disease?
	None at all
	A little
	O Some
10	U MIII

**Fig. 1.** Example of cell phone diary questions



**Fig. 2.** Diary paths

# Table 1

# Sample Description

	N	%
Demographic		
Age (years)		
20–29	3	12
30–39	4	15
40–49	13	50
50–59	6	23
Race		
White	3	13
Black	20	77
Latina	3	10
Highest level of education		
Less than high school	9	34
High school or equivalent	8	31
Some college	9	35
Relationship status		
In a relationship	14	54
Homeless	6	23
Socioeconomic		
Household income <\$10,000	21	81
Received public assistance in last year	20	77
Employment within 90 days	15	58
Physical & mental health		
Overall health		
Excellent	3	12
Very good	5	19
Good	9	35
Fair	6	23
Poor	3	12
Depression		
None	8	31
Mild	7	27
Moderate	6	23
Moderately severe to severe	5	20
Sexual health		
History of sexual abuse <13 years old	21	81
Sexually transmitted infection at baseline	8	31
Commercial sexual behavior		
Age of first commercial sex (years)		
<15	8	31

16–20
21–30
>30
Frequency of sex work in last 90 days
Only a few times
1–3 times per month
1–5 times per week
About everyday
More than once a day
Substance use
Alcohol use in last 90 days
Any illicit drug use in last 90 days
Drug use in last 90 days by type
Cannabis
Cocaine
Prescription stimulants
Methamphetamine
Sedatives or sleeping pills
Hallucinogens
Opioids
Criminal history
_
No. lifetime prostitution arrests
0
1
2–3
4 or more
No. lifetime drug/alcohol arrests
0
1

Only a few times	5	19
1–3 times per month	5	19
1–5 times per week	11	42
About everyday	1	4
More than once a day	4	15
Substance use		
Alcohol use in last 90 days	24	92
Any illicit drug use in last 90 days	23	88
Drug use in last 90 days by type		
Cannabis	18	69
Cocaine	20	77
Prescription stimulants	5	19
Methamphetamine	4	15
Sedatives or sleeping pills	7	27
Hallucinogens	2	8
Opioids	8	31
Criminal history		
-	-	-
No. lifetime prostitution arrests		
0	11	42
1	4	15
2–3	4	15
4 or more	7	27
No. lifetime drug/alcohol arrests		
0	11	42
1	4	15
2–3	4	15
4 or more	7	27
Incarceration		
Never incarcerated	11	42
Jail	1	4
Prison	11	42
Both jail and prison	3	12

N %

7 27

5 19

6 23

# Table 2

Diary submission patterns, completion time and sexual behavior summary, by week

	Week1	Week 2	Week 3	Week 4+	F	đ	Sig
No. participants completing each week	(N = 26)	(N = 26)	(N = 26)	$(N = 25)^d$			
Weekly diary adherence(Expected = 14)							
Mean (SD)	11.62 (2.35)	12.19 (2.90)	11.62 (3.76)	13.92 (5.36)	3.23	-	0.08
Median	12.5	13.0	13.0	13.5			
Completion time (minutes) by diary path							
Sexual contact (yes; Path A & B)							
Minimum	6.47	3.71	4.8	5.62			
Maximum	107.76	55.44	83.94	35.49			
Mean (SD)	32.38 (26.0)	17.58 (12.22)	17.50 (18.17)	12.16 (6.92)	7.64	-	0.02
Median	36.79	13.80	9.75	10.39			
Sexual contact (no; Path C)							
Minimum	13.84 (8.6)	12.74 (11.01)	12.43 (9.98)	9.64 (4.38)			
Maximum	9.55	8.75	8.05	8.77			
Mean (SD)	13.84 (8.6)	12.74 (11.01)	12.43 (9.98)	9.64 (4.38)	3.32	-	0.08
Median	9.55	8.75	8.05	8.77			
	Week1	Week 2	Week 3	Week 4+	F	df	Sig
No. FSW reporting partnered behavior	(N = 21)	(N = 16)	(N = 16)	(N = 12)	6.04	-	0.02
No. FSW reporting specific sex behaviors, $N(\%)$							
Kissing	11 (52.4 %)	15 (93.8 %)	12 (75.0 %)	8 (66.7 %)			
Received oral sex	17 (81 %)	10 (62.5 %)	11 (68.8 %)	9 (75.0 %)			
Gave oral sex	16 (76.2 %)	11 (68.8 %)	12 (75.0 %)	9 (75.0 %)			
Vaginal sex	20 (95.2 %)	14 (87.5 %)	15 (93.8 %)	11 (91.7 %)			
Anal sex	3 (14.3 %)	2 (12.5 %)	2 (12.5 %)	1 (8.3 %)			
Mean FSW reporting any partnered behavior by week (SD)	2.50 (2.1)	2.19 (2.50)	1.34 (1.62)	1.92 (3.15)	5.77	-	0.02
Mean sexual partners (SD)	3.04 (3.53)	2.20 (2.74)	1.68 (2.17)	1.88 (3.27)	3.07	1	0.09
Mean sex behaviors (SD)							
Kissing	0.41 (1.12)	0.48 (1.05)	0.27 (.70)	0.61 (1.09)	1.38	-	0.24
Received oral sex	1.92 (2.36)	1.0 (2.29)	.80 (1.15)	1.16 (2.84)	2.91	-	0.10

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Bold values are statistically significant (p < 0.05)

a = 25 after 1 participant was lost-to-follow-up

#### Table 3

### Contextual aspects of partnered sex events

Variable	Response	All sex acts	Paid/traded	Not paid/traded
Negative mod	od	N = 265	N = 138	N = 112
Mean (SD)		2.5 (0.94)	2.63 (0.93)	2.47 (0.92)
Partner type		N = 247	N = 138	N = 109
	Friend	45 %	49 %	41 %
	Regular date, trick or john	22 %	30 %	11 %
	Boyfriend/girlfriend	17 %	4%	34 %
	Fiancé/spouse	5%	0%	11 %
	Stranger	5%	9%	0%
	Drug dealer	5%	7%	2%
Venue		N = 246	N = 147	N = 109
	My home	37 %	18 %	62 %
	Partner's home	35 %	44 %	23 %
	Car	10 %	17 %	2%
	Friend or acquaintance's home	7%	8%	6%
	Hotel/motel	6%	9%	2%
	Park or other public space	4%	2%	5%
	Abandoned building	2%	3%	0%
Substance use		N = 133	<i>N</i> = 73	N = 60
Participant drunk		63.9	68.5	58.3
Partner drunk		50.4	50.7	50
Participant using drugs		66.9	65.8	68.3
Partner using drugs		48.1	52.1	43.3

Responses as "do not want to answer" were coded as missing (<3 % of responses) and not included in the denominator for calculated percentages reported