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Sex Differences in Cocaine/Heroin Users: Drug-Use Triggers and Craving in Daily Life

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Abstract

Background—Studies of sex differences have shown that men and women with drug-use disorders differ in course and outcome and in cue-induced activation of putative brain “control network” areas. We evaluated sex differences in daily functioning and subjective events related to drug use with Ecological Momentary Assessment (EMA).

Methods—EMA data were collected from cocaine- and heroin-using outpatients (72 men; 42 women) in methadone maintenance in 2–5 randomly prompted (RP) entries per day and in participant-initiated entries for heroin or cocaine use or craving, for up to 25 weeks. Urine drug screens were conducted three times weekly. Data were analyzed via repeated-measures logistic regression, using sex as a predictor of responses.

Results—In RP reports, women and men reported significantly different patterns of drug-cue exposure, with women significantly more likely to report having seen cocaine or been tempted to use in the past hour. Women also had higher craving after past-hour exposure to drug cues. In reports of drug use, women, compared to men, were more likely to report that they had used more cocaine than they had meant to, tended to feel guilty more often after drug use, and to have used despite trying not to use.

Conclusions—These findings provide real-time behavioral evidence that women respond differently than men to exposure to drug cues and to drug use, consistent with laboratory and brain-imaging findings. This information may be useful for development of sex-specific treatment strategies.

Keywords

ecological momentary assessment; sex differences; craving; cocaine; heroin; drug cues; gender; methadone treatment

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1. INTRODUCTION

Sex differences have been found in likelihood of drug-use initiation, progression to abuse and dependence, and responsiveness to treatment. Although prevalence of past-30-day use of illicit drugs is higher for males than females (11.2% vs. 6.8%; SAMHSA, 2011), women progress more quickly from initiation to addiction (Anglin et al., 1987b; Brady, 1999; Lynch et al., 2002) and enter treatment sooner than men (Anglin et al., 1987a; Hernandez-Avila et al., 2004).

Acutely, women and men respond differently to drug-associated cues. For example, in laboratory settings, cocaine-dependent women sometimes report more cue-induced craving than cocaine-dependent men (Elman et al., 2001; Robbins et al., 1999); the same is true in heroin dependence (Yu et al., 2007). These findings are complemented by sex differences in cue-induced brain activity (Kilts et al., 2004; Seo et al., 2011; Volkow et al., 2011). Sex differences in response to cocaine itself vary across laboratories and possibly across routes of administration (Collins et al., 2007; McCance-Katz et al., 2005; Mendelson et al., 1999; Sofuoglu et al., 1999); some studies have shown an effect of menstrual phase (Evans and Foltin, 2006; Sofuoglu et al., 2002).

Outside the laboratory, transient mental states are more difficult to measure. Probably the most sensitive method is Ecological Momentary Assessment (EMA), which minimizes recall bias by having participants report experiences and behaviors in real time (Shiffman et al., 2008). In nonclinical samples, EMA studies have shown only modest sex differences in emotion: emotional responses to work strain were similar across sexes (Matthews et al., 2000), overall emotional intensity was only slightly greater in women, and only on some measures (Barrett et al., 1998), and, in healthy individuals with work or marital stress, self-reported coping strategies showed expected sex differences on trait-level questionnaires but not on EMA reports of actual “momentary” experience (Porter et al., 2000).

We know of only one EMA study of sex differences in addiction, an examination of cigarette smokers (173 women, 131 men). The only sex differences found were that (contrary to hypothesis) women’s smoking was less driven by negative affect and more driven by craving than men’s, and (as hypothesized) women were more responsive to posted smoking prohibitions (Shiffman and Rathbun, 2011).

We used EMA in a large sample of methadone-maintained cocaine and heroin abusers. Our previous analyses of our EMA data have focused on craving and use patterns (Epstein et al., 2009; Preston et al., 2009), periods of use and abstinence (Epstein and Preston, 2010), and stress (Preston and Epstein, 2011). In the analyses reported here, we examined sex differences in activities, moods, drug use, and responses to drug use.

2. METHODS AND MATERIALS

2.1 Participants and setting

Participants were cocaine- and heroin-using outpatients. Inclusion criteria were: (1) age 18–65, (2) physical dependence on opioids, (3) cocaine use. Exclusion criteria were: (1) current DSM-IV psychotic disorder, history of bipolar disorder, current major depressive disorder, (2) current dependence on alcohol or sedative-hypnotics, (3) cognitive impairment severe enough to preclude informed consent or valid self-report, and (4) medical illness that would compromise participation.

Methadone maintenance began at enrollment and continued for up to 28 weeks at a treatment research clinic in Baltimore, MD. Participants attended daily for oral methadone (target dose, 100 mg/day); individual counseling was provided weekly, and urine was tested

thrice weekly. The IRB of the NIDA Intramural Research Program approved the study. Participants gave written informed consent.

2.2 Study design

The study was designed to assess craving and lapse. At the end of the third week, each participant received a personal digital assistant (PDA; i.e., Palm Zire or Palm Zire 21, Palm, Inc., Sunnyvale, CA) running our electronic-diary software (Vahabzadeh et al., 2004). EMA began at week 3 of the study to allow for stabilization of methadone and acclimatization to treatment. Participants were informed that none of their EMA responses would be seen by their counselors, though counselors could monitor their compliance.

Participants were instructed to make two types of entries: randomly prompted and event-contingent. Random prompts occurred 2–5 times per day for up to 25 weeks during each participant's typical waking hours. Participants were asked to initiate an event-contingent entry whenever they used cocaine, heroin, or both, or craved without using. For all entries, participants reported where they were, whom they were with, and what they were doing. Mood was assessed in random prompts with adjectives (happy, relaxed, tired, irritated, stressed, and bored) in six items worded "Right now, do you feel..." and rated on a four-point scale. Craving for cocaine, heroin, and tobacco was assessed on the same scale and worded: "Right now, do you crave ...?".

At each random prompt, participants also answered a series of questions beginning with, "In the past hour...", which were designed to assess exposure to putative triggers of drug craving or drug use (Epstein et al., 2009). The questions were originally derived from post-relapse interviews (Heather et al., 1991; Marlatt, 2005). We administered the same "trigger" items in drug-use and craving (event contingent) entries with the wording "I think it happened because..." to assess participants' attributions for those events in their immediate aftermath.

2.3 Data Analysis

Demographics were compared across sexes with t-tests or chi-squares. Study retention across sexes was analyzed by survival analysis (SAS Proc Lifetest). Random-prompt compliance was compared across sexes by t-test.

EMA responses were compared across sexes using repeated-measures linear regression (SAS Proc Mixed) for continuous dependent variables, or repeated-measures logistic regression (SAS Proc Glimmix) for categorical dependent variables. Sex was the only between-subjects predictor in each model. An autoregressive error structure was used. In some additional Proc Mixed models, we tested for sex differences in cocaine craving and stress "right now" in random-prompt entries as a function of past-hour exposure to putative triggers, with past-hour exposure reported retrospectively in the same entries. In those models, the between-subject predictors were sex, past-hour trigger exposure, and (of greatest interest) their interaction.

Because men were significantly more likely than women to be employed, we reran our analyses of some of the EMA data, using current employment status (full-time, part-time, or unemployed) as a time-varying covariate. We restricted these supplementary analyses to EMA variables that would logically be expected to vary with employment status (location, activities, companions, and past-hour exposure to putative triggers). Current in employment status was inferred from reviews of counselors' weekly progress notes. It was sometimes difficult to assign such changes to precise time points. Nonetheless, these supplementary analyses provided some assurance that our observed sex differences were not artifacts of differences in employment status.

Urine-screen data for cocaine and heroin (up to 80 urine specimens per participant across 27 weeks) were analyzed similarly in Glimmix models, with sex as the only between-subjects predictor.

Alpha was set at .05, with trends noted at .10. To adjust for multiple tests of significance (142 in all for the EMA-response comparisons, not all shown here), we entered all obtained *p* values into the SAS procedure Multtest to obtain false-discovery rate (FDR) *p* values, which are the ones we report here. FDR correction reduced the number of *p* values .05 from 65 to 57, and reduced the number of additional *p* values .10 from 11 to 7. All tests were two-tailed.

3. RESULTS

3.1 Demographics, Drug Use, and EMA Compliance

A total of 130 participants (84 men, 46 women) enrolled; 114 (72 men, 42 women) provided sufficient data for the analyses reported here. All met DSM-IV criteria for cocaine dependence by structured interview (Robins et al., 1995) at study intake, though this was not an inclusion criterion.

There was no significant sex difference on any of the drug-related intake variables (Table 1). Women were more likely to be unemployed ($\chi^2 = 7.38$, *df* = 2, *p* = .025) and were marginally more likely to be married ($\chi^2 = 5.47$, *df* = 2, *p* = .065) and nonwhite ($\chi^2 = 3.24$, *df* = 1, *p* = .072; Table 1).

During the first 27 weeks of treatment, women had fewer cocaine-negative urine specimens (20%, CL95 19% to 25%) than men did (33%, CL95 29% to 37%), $F(1,112) = 14.1$, *p* = .0003. There was no sex difference in frequency of opiate negatives (62% for women, 66% for men). There was no sex difference in treatment retention (log-rank chi-square = 0.04, *df* = 1, *p* = .84).

Participants made 26,734 random-prompt entries, 2,589 event-contingent entries (710 cocaine use, 663 cocaine craving, 66 heroin use, 288 heroin craving, 232 use of both, and 630 craving for both). The number of entries generally did not differ by sex, except that men reported more episodes of “craving both drugs” than women did (Table 2). This difference was mostly attributable to large numbers of craving reports in three men. The mean compliance rates for random prompts were 74% (SEM 3%, range 8 to 98%) for women, 75% (SEM 2%, range 28% to 97%) for men; these rates were not significantly different, *t* = -0.27, *p* = .79.

3.2 Random-Prompt Entries

When asked “Where were you when the beep occurred?” (Table 3), men and women differed on 6 out of 12 possible responses. Men were more likely than women to report being at a bar/club, at work, or in a vehicle. Women were more likely than men to report being at an “other” location, waiting for a ride or bus, or being at home. When asked “Who were you with when the beep occurred?” (Table 3), men and women differed on 6 out of 9 possible responses. Men were more likely than women to report being with coworkers or other family. Women were more likely to report being with strangers, a child, their spouse, or clinic staff/patients.

When asked “What were you doing when the beep occurred?” (Table 3), men and women differed on 19 out of 23 possible responses. Men were more likely than women to report being engaged in hustling for money, drinking, working, illegal activities, sports/games/recreation, or, at trend level, copping (acquiring drugs). Women were more likely to report

being involved in child or elder care, doing chores/hygiene, using the Internet, walking, talking/socializing, shopping or doing errands, watching TV, thinking, reading, listening to music, “other,” waiting, or eating.

Men and women also differed in their reported exposure to or experience of 6 of 16 putative drug-use triggers in the hour before the random prompt (Figure 1). Women were more likely to report having seen cocaine and, at trend level, having seen heroin. Women were also more likely to report that they had been testing their self-control (“I wanted to see what would happen if I used just a little”) with cocaine (OR 1.53; CL95 1.31–1.79; $p < .0005$) or heroin (OR 1.34; CL95 1.08–1.65); $p < .05$). Women reported feeling “tempted out of the blue” to use cocaine (OR 1.86; CL95 1.64–2.12; $p < .0005$) more often than men. Women were less likely than men to have felt bored or that others were critical of them during the past hour.

There was no sex difference in craving “right now” for heroin, cocaine, or tobacco, or in ratings of feeling happy, stressed, tired, bored, relaxed, or irritated (data not shown).

When we compared ratings of cocaine craving and stress “right now” on the basis of past-hour exposure to putative relapse triggers, we found significant interactions between trigger exposure and sex (Figure 2). In these analyses, to reduce the number of comparisons, we grouped some triggers together: “cues” reflected endorsement of “saw drug,” “saw someone using drug,” “was offered drug,” or “handled \$10”; “negative-affect triggers” included “frustrated,” “physically uncomfortable,” “bored,” “worried,” “sad,” or “criticized by others.” Irrespective of sex, cocaine craving was higher in the presence of all five categories of triggers: cues, negative affect, testing self-control, temptations, and good mood. Sex-by-trigger interactions were found for four triggers (all except negative affect), with women having a larger differential cocaine-craving rating after trigger exposure. Ratings of stress were also higher in the presence of four of the categories of triggers (all except good mood). For stress, a sex-by-trigger interaction was seen only for negative-affect triggers, with women having a larger differential stress rating after exposure.

3.3 Participant-initiated Entries on Drug Use and Craving

Men and women differed on only 2 of 16 possible responses when asked why they had just used cocaine or heroin. Women were more likely to report having used because they had been testing self-control, and men were more likely to report having used because they felt physically uncomfortable (Figure 3).

Women and men differed on 3 of 11 drug-use items in the immediate aftermath of use (Table 4). There was no difference in the mean amount of heroin or cocaine used, reported in \$10 increments (“dimes”). Nonetheless, women gave stronger endorsements to a 4-point item asking whether they just used more cocaine than they had meant to use. They also tended to give stronger endorsements to two other items after drug use: feeling guilty about using and having just used when they had been trying not to use.

In craving-event entries, men and women differed on 5 of 16 possible responses on the item “I think it happened because...”. All 5 items were endorsed more by men than women; no item was endorsed more by women than by men. Men were significantly more likely than women to report that the craving had been caused by seeing someone use heroin, being offered heroin, feeling tempted out of the blue, testing self-control, or feeling bored (Figure 4).

4. DISCUSSION

We found sex differences in most of categories of responses that we looked at, such as locations and activities at random moments, past-hour-exposure to putative triggers of craving and use, and reactions to actual episodes of use.

4.1 Drug-Use Entries

There was no sex difference in average amount of heroin or cocaine use per episode, nor in the degree of enjoyment of use. These negative findings are not surprising, given the complexity of prior findings on sex differences in cocaine responsiveness and the fact that such differences may depend on menstrual phase (Sofuoglu et al., 1999). In our urine data, we did find evidence for more frequent cocaine use in women than in men, a difference that was not mirrored in the EMA data. This may be attributable to a limitation of our EMA data: in this study, we placed no contingencies on the completeness of EMA drug-use reports. In this paper, as in all the papers we have published from this dataset, we have avoided any analyses that assume completeness in the drug-use reports. What is clear is the pattern of sex differences (and lack thereof) in the reports we have.

The most prominent of those differences was the greater frequency with which women reported that the amount of cocaine they had just used was more than they had meant to use and, at trend level, that they had been trying not to use, despite there being no sex difference in amount of use reported. These results suggest that women may have more difficulty controlling their cocaine use. A PET study in women and men exposed to cocaine cues showed that, although craving ratings did not differ by sex, women had lower glucose metabolism in brain areas described as a “control network”: the prefrontal, cingulate, and inferior parietal cortices and thalamus (Volkow et al., 2011). Our findings may suggest a daily-life concomitant of that difference.

Other reports in the immediate aftermath of drug use suggested another sex difference: at trend level, women were more likely to say that they felt guilty about having just used and that they had been trying not to use. Our finding of greater post-use guilt in women contrasts with retrospective survey results showing that during cocaine intoxication, women experience a greater *decrease* in guilt than men do (Griffin et al., 1989). Our findings suggest that the aftermath of the high may be a time of greater self-recrimination for women than for men. This seems consistent with findings that women are prone to a ruminative style of responding to events (Nolen-Hoeksema and Jackson, 2001; Nolen-Hoeksema et al., 1993; Yoder and Lawrence, 2011). Rumination is considered less adaptive than cognitive reframing or active coping and has been shown to predict drinking in alcohol abusers (Caselli et al., 2010).

We found only two sex differences in the triggers to which our participants attributed their having just used drugs. Men were more likely to say that they had used because they had felt “ill, in pain, or uncomfortable.” This is an interesting contrast to a large body of literature suggesting that men report higher tolerance for pain than women do (Riley et al., 1998). The other difference was that women were more likely to report that they were testing their self-control. As we mention below, women were also more likely than men to report having felt curious about their self-control during random-prompt entries. We know of no prior findings of a sex difference in propensity to test self-control, but one study has shown that, among cocaine and alcohol abusers, women exceed men in their belief that they can do it successfully, i.e., use a small amount without relapsing to heavy use (though this finding did not survive correction for multiple comparisons; Sklar et al., 1999).

In a retrospective study of methadone-maintained patients, women were particularly likely to continue using illicit drugs if their spouses/partners were still using (Anglin et al., 1987a). That finding was not reflected at a “momentary” level in our EMA data; women in our sample did not disproportionately attribute their use episodes to another person’s use in their presence.

4.2 Drug-Craving Entries

In drug-craving entries, no attributional item was endorsed more frequently by women than by men, whereas several were endorsed less frequently. This suggests that our taxonomy of triggers (Heather et al., 1991; Marlatt, 2005) did not include those that are most salient for craving in women. The taxonomy was drawn from interviews with a sample consisting mostly of heroin addicts and alcoholics, along with some cigarette smokers, overeaters, and gamblers (Marlatt, 2005). The sample included women, but only within the group of overeaters (Cummings et al., 1980). Our findings suggest a need for additional qualitative research with female cocaine and heroin addicts.

4.3 Random-prompt entries: Past-Hour Triggers

Despite extensive differences in location, activities, and companions (discussed below), men and women did not differ on most of the items assessing past-hour exposure to triggers. For example, although men were more likely to be outside the home and engaging in illegal activities (Table 3), there were very few differences in reports of seeing drugs, seeing someone using drugs, or being offered drugs (Figure 1). In fact, seeing cocaine or paraphernalia was the only drug-cue trigger that differed by sex, with women reporting it more than men.

Women were more likely to report having been “tempted out of the blue” in the past hour. This item is meant to assess craving in the absence of any obvious cue or stressor (Marlatt, 2005). It accords with our finding that women tested positive for cocaine more often than men, and perhaps with prior findings that women remained depressed longer than men after cessation of cocaine misuse (Griffin et al., 1989), a state that may be accompanied by continued craving. A partly biological basis for the sex difference in craving propensity is supported by findings in rodents: female rats, but not male rats, showed a marked increase in progressive-ratio responding for cocaine after abstinence (Lynch and Taylor, 2004).

The sex differences we found on past-hour temptation and trigger exposure were not explained by differences in employment. We have previously found that the workplace was actually a less stressful environment than most nonwork environments for our participants (Epstein and Preston, 2012), but our current findings were unchanged in supplementary analyses controlling for current employment status.

4.4 Random-prompt entries: Location, Activities, and Companions

In random-prompt entries, women were more likely to be with a child or spouse, engaged in childcare, shopping, or doing chores, and at home. The accordence of these findings with traditional gender roles is inescapable. Drug-dependent women report concerns about maintenance of a parenting role (Ehrmin, 2001; Klee et al., 1991), perhaps reflecting a real sex difference among addicts in the likelihood of loss of one’s children (Hser et al., 2005). Prior retrospective work has shown a (nonsignificant) tendency for women, more than men, to enter addiction treatment for parenting-related reasons (Anglin et al., 1987a).

Women were less likely than men to be employed, as in other samples of cocaine addicts (Griffin et al., 1989). The employment difference was reflected in the random-prompt finding that women were less likely to report being with coworkers or in the workplace.

Women were also less likely to be engaged in sports, hustling for money, and crime. Other studies have also shown that women who use drugs tend to be less involved in criminal activity, particularly drug dealing, than men (Anglin and Hser, 1987; Shand et al., 2011). In one study that did not show a sex difference in overall criminal activity, there was a sex difference in the type of crimes committed: more robberies by men, more forgeries by women (Hser, 1987).

4.5 Random-prompt entries: Mood and Craving “Right Now”

We found no overall sex differences in mood or craving “right now.” This is consistent with EMA findings in nonclinical samples; in those samples, responses differed by sex when participants were retrospectively summarizing their emotional lives, but not when they were reporting on their emotions “right now” (Barrett et al., 1998). One interpretation is that presumed emotional differences between men and women are more the product of appraisal of one’s past behaviors than of true differences in the moment (Barrett et al., 1998).

Interesting sex differences did emerge when we examined stress and cocaine craving “right now” as a function of past-hour exposure to triggers. Women appeared prone to crave cocaine more strongly after recent exposure to most types of triggers, especially drug-associated cues. The specificity of this finding is supported by the relative absence of sex differences in stress ratings after trigger exposure. The post-exposure sex difference in craving in our sample is consistent with prior laboratory findings (Elman et al., 2001; Lynch et al., 2002; Robbins et al., 1999; Yu et al., 2007) and, most intriguingly, with the previously cited PET finding of a sex difference in activation of a brain “control network” after cue exposure (Volkow et al., 2011).

4.6 Limitations

As we mentioned, on the evidence of our urine screens, we know that our EMA reports of drug use are not complete. In our ongoing work, we have largely eliminated this problem by incentivizing agreement between EMA and urine results. Here, we rely on the assumption that the types of drug-use episodes that went unreported did not *systematically* differ between men and women, so that the extant entries can be validly compared across sex.

We did not ask our participants to report the route of administration for each episode of use (though we did collect baseline data on each participant’s preferred routes of administration). This limits our findings to some degree because sex differences in cocaine effects might themselves differ by route of administration (Collins et al., 2007; McCance-Katz et al., 2005; Mendelson et al., 1999; Sofuoglu et al., 1999). Our findings are also limited by our not having collected menstrual-phase data, which might have increased our power to detect sex differences (Sinha et al., 2007; Sofuoglu et al., 2002, 1999).

Like most studies of sex differences in humans, this one cannot distinguish the extent to which any of the differences found were mediated by innate biological differences or by cultural differences. Our data should be seen as a detailed, real-time field assessment of *how* men and women may differ during addiction treatment, but not *why* they differ.

4.7 Conclusions and Recommendations

We found that women reacted differently than men to individual instances of cocaine use during attempts at abstinence, and that women are more prone to test their self-control. Our findings also suggest that existing taxonomies of reasons for drug craving may not adequately capture the experiences of women.

Randomized trials of sex-specific treatment interventions for addiction are surprisingly few (Greenfield et al., 2007). There is some evidence, mostly from demonstration projects and retrospective analyses, that female addicts can benefit from women-only programs or from programs with women-focused content (Greenfield et al., 2007). Our findings suggest a need for more formative research and for more randomized trials based on such research. Those trials are likely to be especially informative if EMA is among their outcome measures.

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Figure 1.

Responses to random-prompt items assessing putative triggers experienced “in the past hour.” The forest plot shows odds ratios and 95% confidence intervals. The p-values are FDR-adjusted. In supplementary analyses controlling for current employment status as a time-varying covariate, all the sex differences remained similar in magnitude and remained statistically significant (data not shown).

Figure 2.
Ratings of cocaine craving (top panels) and stress (bottom panels) in the presence (solid bars) and absence (open bars) of past-hour exposure to relapse triggers for men and women. Standard errors are indicated by brackets.

Figure 3. Responses to the drug-use-entry item “I think it happened because...”. The forest plot shows odds ratios and 95% confidence intervals. The p-values are FDR-adjusted.

Figure 4. Responses to the drug-craving-entry item “I think it happened because...”. The forest plot shows odds ratios and 95% confidence intervals. The p-values are FDR-adjusted.

Table 1

Clinical and demographic characteristics of 114 heroin- and cocaine-dependent methadone-maintained outpatients, by sex.

	Women	Men	FDR-adjusted p
N	42	72	
Age	41.2 (SD 6.9)	40.7 (SD 8.7)	n.s.
Nonwhite race	74%	57%	.07
Employment status	unemployed: 55%	unemployed: 29%	
	full-time: 26%	full-time: 39%	
	part-time: 19%	part-time: 32%	.025
Marital status	never: 55%	never: 68%	
	sep/divorced: 29%	sep/divorced: 28%	
	married: 16%	married: 4%	.06
Education (years)	11.8 (SD 1.3)	11.8 (SD 1.5)	n.s.
Heroin Use Past 30 days	29.4 (SD 1.8)	29.2 (SD 3.8)	n.s.
Heroin Use (years)	14.7 (SD 9.2)	13.0 (SD 8.1)	n.s.
Heroin Route of Administration	intravenous: 55%	intravenous: 64%	n.s.
	intranasal: 45%	intranasal: 36%	
Cocaine Use Past 30 days	19.6 (SD 9.4)	20.2 (SD 9.0)	n.s.
Cocaine Use (years)	12.3 (SD 8.7)	11.1 (SD 8.6)	n.s.
Cocaine Route of Administration	smoked: 62%	smoked: 42%	
	intravenous: 31%	intravenous: 48%	
	intranasal: 7%	intranasal: 10%	n.s.
# of Drug Abuse Treatments	2.31 (SD 2.2)	2.18 (SD 2.5)	n.s.
Money Spent on Drugs	\$1762 (SD \$1220)	\$1968 (SD \$1236)	n.s.
Methadone Dose (mg)	97.9 (SD 7.8)	97.2 (SD 7.4)	n.s.

Table 2

Summary of EMA data by sex; data reported are participant means (SD).

	Women	Men	FDR-adjusted p
Weeks of EMA completed	17.8 (SD 8.5)	19.9 (SD 7.7)	n.s.
Number of random-prompt entries	225.9 (SD 137.7)	242.9 (SD 104.8)	n.s.
Number of participant-initiated entries			
Heroin uses	0.8 (SD 2.5)	0.5 (SD 0.9)	n.s.
Cocaine uses	5.8 (SD 9.8)	6.6 (SD 10.3)	n.s.
Use of both drugs	2.0 (SD 4.3)	2.2 (SD 4.0)	n.s.
Heroin craving events	1.9 (SD 3.8)	2.9 (SD 7.9)	n.s.
Cocaine craving events	6.3 (SD 8.8)	5.8 (SD 9.2)	n.s.
Craving both drugs events	3.2 (SD 4.4)	7.1 (SD 13.0)	.019

Table 3

Random Prompt Responses: Where, Who, What.

	Odds Ratio *	95% CL	RFD-adjusted p
“Where were you when the beep occurred?”			
bar/club	0.38	0.32 to 0.44	p<.0005
work	0.44	0.24 to 0.80	p<.05
in a vehicle	0.73	0.64 to 0.82	p<.0005
at home	1.27	1.19 to 1.37	p<.0005
waiting for a ride or bus	1.37	1.23 to 1.53	p<.0005
“other” location	1.72	1.45 to 2.05	p<.0005
“Who were you with when the beep occurred?”			
coworkers	0.38	0.32 to 0.45	p<.05
other family	0.79	0.72 to 0.87	p<.05
clinic staff/patients	1.36	1.17 to 1.58	p<.0005
spouse	1.75	1.58 to 1.94	p<.0005
child	1.99	1.75 to 2.26	p<.0005
strangers	2.61	2.26 to 3.02	p<.0005
“What were you doing when the beep occurred?”			
hustling for money	0.15	0.08 to 0.31	p<.0005
drinking	0.31	0.22 to 0.44	p<.0005
working	0.34	0.29 to 0.38	p<.0005
illegal activities	0.62	0.42 to 0.92	p<.05
sports/games/recreation	0.73	0.57 to .93	p<.05
eating	1.27	1.16 to 1.39	p<.0005
waiting	1.28	1.14 to 1.44	p<.0005
“other”	1.31	1.13 to 1.52	p<.005
listening to music	1.32	1.16 to 1.50	p<.0005
reading	1.35	1.15 to 1.58	p<.001
thinking	1.36	1.21 to 1.52	p<.0005
watching TV	1.39	1.29 to 1.49	p<.0005
shopping/doing errands	1.45	1.28 to 1.65	p<.0005
talking/socializing	1.55	1.43 to 1.68	p<.0005
walking	1.96	1.70 to 2.25	p<.0005
using the Internet	2.04	1.43 to 2.91	p<.0005
doing chores/hygiene	3.06	2.76 to 3.40	p<.0005
child or elder care	3.09	2.54 to 3.76	p<.0005

* Reference group – Men. In supplementary analyses controlling for current employment status as a time-varying covariate (excluding analyses of “work” for location, “coworkers” for companions, and “working” for activity), nearly all the sex differences remained similar in magnitude and remained statistically significant (data not shown). The only ones that were no longer statistically significant were one companionship variable (“with clinic staff/patients”) and three of the 17 activity variables (“eating,” “reading,” and “thinking”).

Table 4

Mean EMA responses to cocaine and heroin use event questions.

EMA Question *	Women	Men	F [degrees of freedom]	FDR- adjusted p
I enjoyed using.	1.26 (SD 0.15)	1.30 (SD 0.11)	n.s.	n.s.
After using, I felt guilty.	2.52 (SD 0.13)	2.17 (SD 0.09)	F[1,84] = 5.08,	.064
After using, I felt like giving up my efforts to stop using.	0.67 (SD 0.11)	0.64 (SD 0.08)	n.s.	n.s.
After using, I felt encouraged about my ability to keep from using again.	2.19 (SD 0.13)	1.91 (SD 0.09)	n.s.	n.s.
My answers may be unreliable because I'm still high.	0.70 (SD 0.13)	0.76 (SD 0.09)	n.s.	n.s.
My answers may be unreliable because I'm coming down.	0.69 (SD 0.12)	0.74 (SD 0.09)	n.s.	n.s.
Had you been trying not to use?	2.52 (SD 0.11)	2.23 (SD 0.08)	F[1,112] = 4.64	.081
How many dimes of heroin did you use?	1.60 (SD 0.13)	1.52 (SD 0.10)	n.s.	n.s.
Was that more heroin than you meant to use?	1.90 (SD 0.19)	1.47 (SD 0.14)	n.s.	n.s.
How many dimes of cocaine did you use?	1.76 (SD 0.10)	1.65 (SD 0.07)	n.s.	n.s.
Was that more cocaine than you meant to use?	1.87 (SD 0.14)	1.38 (SD 0.10)	F[1,112] = 7.68	.019

* Questions were rated on a 4-point scale (NO!! no?? yes?? YES!!) corresponding to 0, 1, 2, 3, except quantities of heroin and cocaine, which were reported in ten-dollar units ("dimes").