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# Differences in impulsivity and sexual risk behavior among inner-city crack/cocaine users and heroin users

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**Abstract**

The current study utilized a sample of 123 inner-city drug users in residential treatment, comparing sexual risk behavior (SRB) across primary users of (a) heroin and not crack/cocaine, (b) crack/cocaine and not heroin, and (c) both heroin and crack/cocaine. Additional analyses also examined impulsivity as a mediator of drug choice and SRB. Results indicated that SRB was higher in primary crack/cocaine users than in primary heroin users, with those using both drugs evidencing intermediate levels of SRB. Beyond differences in SRB, a similar pattern across drugs was found for impulsivity. Finally, impulsivity mediated the relationship between drug choice and SRB. Although further research is necessary to establish causal relationships, these results support a relationship between SBR and crack/cocaine, and suggest that disinhibition processes including impulsivity may underlie this relationship.


*Keywords:* Sexual risk behavior; Impulsivity; Crack/cocaine; Heroin

## 1. Introduction

Although advances have been made in targeting and preventing behaviors that leave one vulnerable to contracting HIV, more then 700,000 Americans have been diagnosed with AIDS and almost 50,000 more continue to contract HIV infection each year (Centers for Disease Control and Prevention [CDC], 1999). Researchers have identified inner-city drug users as being particularly vulnerable to HIV infection (e.g., Kral et al., 1998). In combination with the risks of intravenous (IV) drug use, inner-city drug users also evidence elevated levels of sexual risk behavior (SRB) including sexual contact with individuals who are at elevated risk for seropositivity (e.g., IV drug users) as well as exchange of sex for drugs/money (Joe and Simpson, 1995; Kral et al., 1998).

Evidence indicates that elevated levels of SRB may be related to level of crack/cocaine use (e.g., DeHovitz et al., 1994; El-Bassel et al., 2000; Hoffman et al., 2000; Ross et al., 2002; Booth et al., 2000; Bux et al., 1995; Camacho et al., 1996; Falck et al., 1997; Grella et al., 1995; Joe and Simpson, 1995; Sanchez et al., 2002). Further, several studies have focused on differences in SRB as a function of a particular drug choice. In most cases, these studies have examined crack/cocaine use among heroin-dependent individuals, with data indicting a positive relationship between level of crack/cocaine use and SRB (Bux et al., 1995; Camacho et al., 1997; Grella et al., 1995; Joe and Simpson, 1995). Despite initial evidence of a unique relationship between SRB and crack/cocaine use, several unanswered questions remain. First, because most studies examining a relationship between SRB and drug choice compare levels of crack/cocaine use among heroin-dependent participants (e.g., Bux et al., 1995; Camacho et al., 1997; Grella et al., 1995; Joe and Simpson, 1995), it is unclear whether elevated SRB is a function of crack/cocaine use specifically, or the additional use of another drug class (i.e., heroin *and* crack/cocaine use). Indeed, a true test of the role of drug choice in SRB requires more independent groups for interpretation of resulting differences

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(e.g., primary crack/cocaine users versus primary heroin users).

As a second unanswered question, few studies have examined potential mediators of the relationship between increased levels of SRB and drug choice. One variable that may shed light on this relationship is impulsivity. The focus on this personality variable is supported by indicating that impulsivity is related independently to both SRB (e.g., Hoyle et al., 2000) and overall drug use severity (e.g., Moeller et al., 2002; Howard et al., 1997). Specific to drug choice, past research has indicated that crack/cocaine users to be higher in impulsivity than heroin users (Donovan et al., 1998). Further, studies have compared characteristics of crack/cocaine and heroin users, with a focus on disorders that include reference to impulsivity within their DSM-IV diagnostic criteria (i.e., antisocial, borderline personality disorder). Results of these studies indicated a higher prevalence of personality disorders in crack/cocaine rather then heroin groups (Craig and Olson, 1990; Flynn et al., 1995; Mirin et al., 1988; Raimo et al., 2000). Although it is important not to mistakenly infer causation from these findings, they do argue for further research examining the interrelationship of drug choice, SRB, and impulsivity.

Taken together, the current study attempted to provide further clarification regarding the relationship among drug choice, SRB, and impulsivity. Extending previous research, we focused our examination of drug choice on inner-city drug users in residential treatment who were: (a) primary crack/cocaine users defined as those who reported using crack/cocaine at least 2–3 times per week over the past year prior to treatment and who also reported using heroin less than 2–3 times per week over the past year prior to treatment; (b) primary heroin users, defined as those who reported using heroin at 2–3 times per week over the past year prior to treatment and who also reported using crack/cocaine less than 2–3 times per week over the past year prior to treatment; (c) both primary crack/cocaine and heroin users defined as those who reported using both drugs 2–3 times per week over the past year prior to treatment. Based on the current literature, we hypothesized that primary crack/cocaine users would evidence greater levels of SRB and impulsivity than primary heroin users. In line with literature suggesting greater level of impulsivity and risk taking as a function of polysubstance use (Conway et al., 2003; O'Connor et al., 1995; Ramklint et al., 2001), those using both dugs might be predicted to evidence greater levels of SRB and impulsivity compared to individuals primarily using only one of these drugs. Yet conversely, it might also be predicted that the primary use of heroin combined with the primary use of crack/cocaine might lead to levels of SRB and impulsivity falling somewhere between the two single drug groups. Given these possibilities, no specific prediction was made for the cocaine and heroin group in relation to the two single drug groups. Finally, we hypothesized that if impulsivity is the underlying mechanism in the relationship between drug choice and SRB, then this relationship would be mediated by levels of impulsivity.

## 2. Method

### 2.1. Participants

Participants were 123 individuals (*M* age = 42.52; S.D. = 6.18; 62% male; 90% African American) in a substance use residential treatment facility located in a large urban setting in an East Coast US City. Treatment at this center involves a mix of strategies adopted from Alcoholics and Narcotics Anonymous as well as group sessions focused on relapse prevention and functional analysis. Complete abstinence from drugs and alcohol is required upon entry into the center and through the duration of the program, with the exception of caffeine and nicotine; regular drug testing is provided and any drug or alcohol use results in immediate dismissal from the center. When needed, detoxification from an outside source is required prior to entry into the center. Typical treatment lasts between 30 and 180 days and aside from scheduled activities (e.g., group retreats, physician visits), residents are not permitted to leave the center grounds during treatment.

Participants included: (a) 55 primary crack/cocaine users defined as those who reported using crack/cocaine at 2–3 times per week and who reported using heroin less than 2–3 times per week over the past year prior to treatment; (b) 35 primary heroin users, defined as those who reported using heroin at least 2–3 times per week and who reported using crack/cocaine less than 2–3 times per week over the past year prior to treatment; (c) 33 primary crack/cocaine and heroin users defined as those who reported using both drugs at least 2–3 times per week over the past year prior to treatment.[1] Drug use was assessed using a self-report measure modeled after the alcohol use disorders identification test (AUDIT; Saunders et al., 1993), with frequency assessed both in terms of past year use as well as heaviest lifetime use. Although a formal diagnostic interview was not completed, characterizing primary drug groups based on use of the drug at least 2–3 times per week was chosen to be consistent with that used in the substance dependence section of the structured clinical interview for DSM-IV (SCID-IV; American Psychiatric Association, 1994). In addition to crack/cocaine and heroin, frequency also was taken for the following drug classes: (a) alcohol, (b) marijuana, and (c) hallucinogens including PCP. This final sample of 123 individuals did not include 52 other individuals in the center who did not evidence primary use of either crack/cocaine or heroin.

Consent forms were obtained for each participant. Participants received $ 10 in financial compensation for participation. Data from the current study come from a larger study examining predictors of treatment drop-out in the center, which included variables such as mood, motivation for treatment, coping, and risk taking behaviors. The data reported in

[1] We also considered creating groups based on daily use (more chronic) or weekly use (less chronic) as opposed to 2–3 times per week. The significant findings in the following analyses do not change when taking either alternative approach.

the current manuscript do not appear in any other published work.

### 2.2. Measures

#### 2.2.1. Assessment of HIV-risk behaviors

The 5-item sexual risk behavior subscale of the HIV-risk-taking behavior scale (HRBS-SRB; Darke et al., 1991) was used as an index of engagement in SRB. For each item on the HRBS-SRB, participants provided answers on a six-point scale, with higher scores indicating higher risk. Specific questions address total number of sexual partners, the frequency of risky sexual behavior including condom non-use with regular partners as well as with acquaintances, condom non-use when money/drugs were exchanged, and total instances of anal sex. Due to a mid-study change in the protocol for the larger study from which these data were taken, the first 44% completed the 1 month version and the remaining 56% completed the 1 year version. Although the potential influence of timeframe was considered in the subsequent analyses, there was no reason to expect that this variable would affect the relationship between drug choice, SRB, and impulsivity. In each version, the timeframe was clearly stated as "prior to beginning of treatment." The reliability and validity for this measure have been well established (Darke et al., 1991) and reliability in the current study was acceptable across both the past-month ($\alpha = 0.69$) and past-year versions ($\alpha = 0.77$).

#### 2.2.2. Eysenck impulsiveness scale

To measure impulsive behavior across cognitive and behavioral domains, participants completed the impulsivity subscale of the *Eysenck impulsiveness scale* (Eysenck et al., 1985). Representative items include "Do you usually make up your mind quickly?" and "Do you often do things at the spur of the moment?" The 19-item subscale (scores range from 0 to 19, with higher scores indicating higher levels of impulsivity) has good internal consistency with an $\alpha$ coefficient equaling 0.84 (Eysenck et al., 1985). The $\alpha$ in the current sample was 0.76.

## 3. Results

### 3.1. Demographic characteristics and other drug classes

As shown in Table 1, drug choice groups (i.e., primary crack/cocaine, primary heroin, and both) were compared on several demographic characteristics and other drug use which was defined as the number of drug classes currently used at least 2–3 times per week across alcohol, marijuana, and hallucinogens including PCP with a total score ranging from 0 to 3. For demographics, drug choice groups differed as a function of gender ($P = 0.004$), but not age, education, income, or marital status; a lack of ethnic/racial diversity prevented a meaningful analysis of this variable. The primary crack/cocaine group evidenced a higher percentage of women than either the primary heroin group ($P = 0.002$) or the group using both drugs ($P = 0.031$), with no difference between these latter two groups. Drug choice group did not differ across use of any particular drug across alcohol, marijuana, or hallucinogens including PCP. However, a significant drug choice group effect was observed when these groups were compare on the other drug use composite score ($P = 0.026$). Specifically, primary heroin users reported using fewer other drug classes than primary crack/cocaine users ($P = 0.11$) and users of both crack/cocaine and heroin ($P = 0.031$), with no difference between these latter two groups. Given these differences, this other drug use composite score was used as a covariate in subsequent analyses.

Relationships between these demographic and drug use variables as well as both SRB and impulsivity also were examined to identify possible covariates that might increase the power to detect drug choice group effects on SRB and impulsivity (Miller and Chapman, 2001; see Table 2). A significant

Table 1
Demographics and other drug use across primary drug group

| | Crack/cocaine ($n = 55$) | Heroin ($n = 35$) | Both ($n = 33$) |
|---|---|---|---|
| Demographics | | | |
| Age | 41.3 (5.8) | 43.3 (9.8) | 42.5 (5.2) |
| Gender | 48% male[a] | 79% male[b] | 70% male[b] |
| Education | 36% < HS; 26% > HS | 27% < HS; 24% > HS | 30% < HS; 35% > HS |
| Income | $ 22,800 ($ 24,800) | $ 24,400 ($ 23,700) | $ 21,600 ($ 21,900) |
| Marital status | 66% single | 65% single | 74% single |
| Other drug use | | | |
| Alcohol | 44% ≥ weekly | 24% ≥ weekly | 45% ≥ weekly |
| Marijuana | 17% ≥ weekly | 6% ≥ weekly | 16% ≥ weekly |
| Hallucinogens | 11% ≥ weekly | 6% ≥ weekly | 6% ≥ weekly |
| Composite # (0–3) | 0.72 (0.66)[a] | 0.34 (0.48)[b] | 0.68 (0.79)[a] |

*Note*: Differing letters (e.g., a vs. b) indicate significant differences, whereas identical letters or the absence of a letter indicates no difference. Education is categorized here as less than a high school degree (< HS), a high school degree or GED, and some college or more (> HS); marital status is categorized here as: (a) currently single, (b) currently married or living with a partner as married; other drug use composite # was computed as the number of drug classes including alcohol, marijuana, and hallucinogens other than PCP currently used at least 2–3 times per week (range = 0–3).

Table 2
Correlations of sexual risk behavior (SRB) and impulsivity with demographics and other drug use

| | SRB | Impulsivity |
|---|---|---|
| Age | −0.20* | −0.03 |
| Gender | 0.13 | 0.24** |
| Education | 0.04 | −0.25** |
| Income | −0.08 | −0.08 |
| Marital status | 0.07 | −0.01 |
| Other drug use | 0.17 | 0.13 |

*Note*: Gender was coded as male = 1 and female = 2; education was coded as less than high school degree or GED = 1, high school degree or GED = 2, and any college or beyond = 3; marital status was coded as currently single = 1 and currently married or living with a partner as married = 2; other drug use includes the number of drug classes currently used at least 2–3 times per week across alcohol, marijuana, and hallucinogens including PCP (range = 0–3). * Indicated $P < .05$; ** indicates $P < .01$.

correlation was observed between SRB and age ($r = -0.20$, $P = 0.024$), such that older participants reported decreased SRB. For impulsivity, significant correlations were observed with gender ($r = 0.24$, $P = 0.007$) and education ($r = -0.25$, $P = 0.005$), indicating that women reported increased impulsivity and impulsivity decreased with increasing education.

### 3.2. Sexual risk behavior (SRB) among drug groups

A factorial ANCOVA was conducted to examine differences among drug choice groups on SRB. Specifically, drug choice group (primary crack/cocaine versus primary heroin versus both) and SRB timeframe (1 month versus 1 year) were included as independent variables (see Fig. 1). Age, gender, education, and other drug use were included as covariates based on analyses reported above (Section 3.1). As expected, a significant effect of timeframe was observed, $F(1, 107) = 5.57$, $P = 0.022$, ES = 0.05, with higher scores on SRB over the preceding 1 year timeframe versus the 1 month timeframe. However, timeframe did not interact with drug choice group, $F(2, 107) = 0.20$, $P = 0.841$, ES = 0.00, which indicates that pattern of SRB scores within the drug choice groups did not vary regardless of the timeframe in which SRB was assessed. The absence of an interaction also argues for the appropriateness of comparing individuals together across the two timeframes of the HRBS-SRB.[2] Most importantly, a significant effect of drug choice group was observed, $F(2, 107) = 3.32$, $P = 0.040$, ES = 0.06. Follow-up LSD contrasts indicated that the primary crack/cocaine group reported significantly higher SRB scores than the primary heroin group ($P < 0.001$). The group using both drugs reported intermediate SRB composite scores that were significantly higher than the primary heroin group ($P = 0.017$) and non-significantly lower than the primary crack/cocaine group ($P = 0.295$).[3]

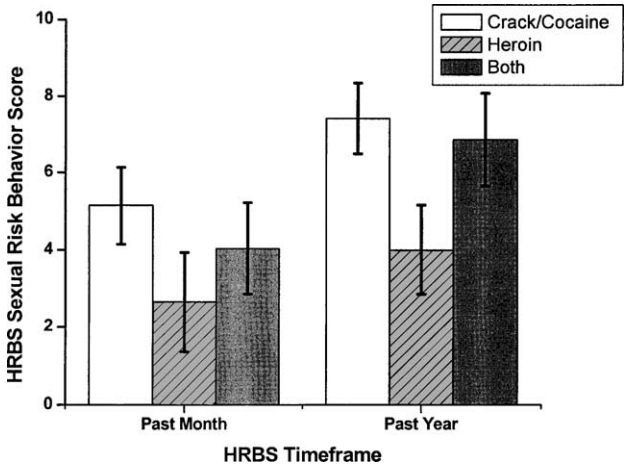


Fig. 1. Score on the sexual risk behavior subscale of the HIV-risk behavior scale as a function of primary drug group across past-month and past-year timeframes. Vertical bars represent standard errors of the mean.

Comparable analyses were conducted for each of the five individual items on the HRBS-SRB. Significant main effects of drug choice group were observed for instances of anal sex ($P = 0.020$; ES = 0.07) and infrequency of condom use when money was involved ($P = 0.020$; ES = 0.07) with an additional trend toward an effect for number of partners ($P = 0.099$; ES = 0.04).

### 3.3. Impulsivity among drug choice groups

A factorial ANCOVA was conducted with impulsivity as the dependent variable, drug choice group and timeframe as independent variables, with age, gender, education and other drug use included as covariates (see Fig. 2). A significant effect of drug choice group was observed for impulsivity [$F(2, 114) = 4.16$, $P = 0.018$, ES = 0.07].[4] Follow-up LSD contrasts indicated that the primary crack/cocaine group reported significantly higher impulsivity scores than did either the primary heroin group ($P < 0.001$) or the group using both drugs ($P = 0.013$), with no significant difference reported between these latter two groups ($P = 0.305$). As expected, no significant timeframe main effect or interaction was observed.

### 3.4. Mediation of sexual risk behavior by impulsivity

A significant positive correlation was observed between overall SRB across timeframes and impulsivity ($r = 0.29$, $P = 0.001$, ES = 0.08) with comparable correlations observed

[2] As indicated by the absence of a significant interaction of drug use group × timeframe, simple effect tests of drug choice group on SRB within each of the two timeframes reveal comparable results (i.e., ordering of means are equivalent and effect sizes are comparable). However, neither simple effect is significant due to the dramatically reduced power resulting from dividing the sample in approximately half.

[3] SRB analyses also were conducted with drug choice group based on lifetime heaviest use to address the consistency of these drug choice effects over participants' entire drug use history. Results from these analyses replicate results reported for drug choice based on current use. This is not surprising given that distributions for current and lifetime drug choice variables are strongly related, $\chi(4) = 106.55$, $P < 0.001$.

[4] As with SRB analyses, impulsivity analyses were replicated with drug choice based on lifetime heaviest use. The pattern of means for impulsivity across lifetime drug choice groups matched that reported for current drug choice, although the *P*-value for this effect was trend-level ($P = 0.097$).

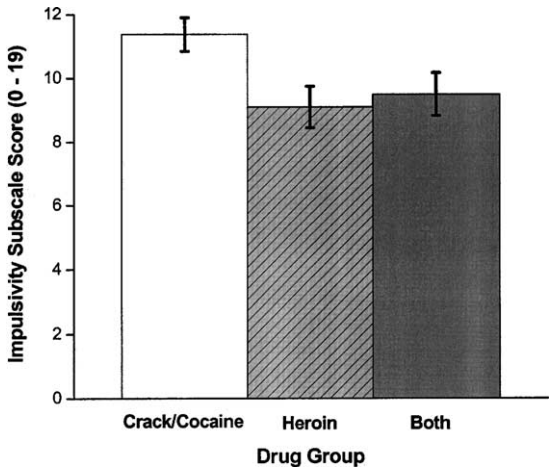


Fig. 2. Score on the impulsivity subscale of the Eysenck impulsiveness scale as a function of primary drug group. Vertical bars represent standard errors of the mean.

regardless of timeframe (*r*'s of 0.25 & 0.32, *P*'s < 0.05, for 1 month and 1 year, respectively). Given this demonstration of a significant relationship between SRB and impulsivity, and the above documented differences in impulsivity between the drug choice groups, it appears that impulsivity may account for (i.e., mediate) the differences in SRB observed among the drug choice groups. Baron and Kenny (1986) outline the three steps to formally demonstrate mediation. First, the independent variable (drug choice group) must significantly predict the dependent variable (SRB). This was demonstrated in Section 3.2. Second, the independent variable (drug choice group) must significantly predict the mediator (impulsivity), also demonstrated above (Section 3.3). Finally, when both the independent variable and the mediator are included in the same model to predict the dependent variable, the mediator must still significantly predict the dependent variable. If these criteria are met, then the effect of the independent variable must be reduced. If the effect of the IV is reduced to zero, full mediation has been established. To accomplish this third step, impulsivity was added as a covariate to the previously described drug choice group × timeframe ANCOVA on SRB. The previous covariates (age, gender, education and other drug use) also were retained. A significant effect of impulsivity was observed, $F(1, 106) = 5.54$, $P = 0.020$, ES = 0.05, which establishes impulsivity as a mediator. Moreover, the effect of drug use group was reduced and was no longer significant, $F(2, 106) = 2.16$, $P = 0.120$, ES = 0.04).

## 4. Discussion

In a sample of 123 chronic, inner-city drug users, we examined the relationship between SRB (as evidenced by HRBS-SRB score) and drug choice (primary crack/cocaine, primary heroin, and both drugs), and the role of impulsivity as a mediator of this relationship. Results indicated that SRB was significantly higher in the primary crack/cocaine group than in the primary heroin group, with the group using both drugs evidencing intermediate levels of SRB. Beyond differences in SRB, a similar pattern across groups was found for impulsivity, such that impulsivity was significantly higher in the primary crack/cocaine group than in the primary heroin group, with the group using both drugs evidencing intermediate levels of impulsivity. Data from this sample are consistent with other research examining the relationship of drug choice and SRB (e.g., Bux et al., 1995; Camacho et al., 1997; Grella et al., 1995; Joe and Simpson, 1995), and more clearly establish a difference between distinct groups of crack/cocaine and heroin users. Specifically, these data suggest that elevated impulsivity and SRB are unique to crack/cocaine as compared to heroin, and not simply the additive effects of additional drugs as represented by the group using both drugs. That is, although one may have expected users of both crack/cocaine and heroin to be most impulsive and engage in the highest levels of SRB, the current data suggest that crack/cocaine alone was most related to elevated levels of impulsivity and SRB.

In addition to clearly differentiating crack/cocaine and heroin users, the other primary contribution of the current paper is the examination of impulsivity as a mediator of the relationship between drug choice and SRB. Following from the finding that drug choice was significantly related to both impulsivity and SRB, a mediational analysis clearly indicated that the relationship between drug choice and SRB was mediated by impulsivity, whereas the relationship between impulsivity and SRB was not mediated by drug choice. Although causal inferences are limited by the cross-sectional design and lack of an experimental manipulation of variables, the mediational approach utilized does allow for the identification of plausible models for further exploration in future studies. Based on the current literature and data from the current study, two models are worthy of future consideration. In the first model, impulsivity can be considered to exist at a genetic trait-like basis, presenting a vulnerability to both SRB and the preference of stimulant drugs such as crack/cocaine over other types of drugs such as heroin (e.g., Krueger et al., 2002). Alternatively, in a second model the pharmacological effects of crack/cocaine may lead to increased impulsivity, which then may increase the likelihood of SRB (e.g., Brady et al., 1998). Of course other iterations of these models are possible, yet they lack the intuitive appeal and/or empirical support evident for the models outlined above.

In developing lines of research to further pursue the relationships identified in the current study, more sophisticated measurement and sampling strategies are necessary. For example, the current study utilized a simple frequency measure of drug use rather then a more comprehensive diagnostic interview, thus limiting detail and precluding any conclusive statements about the role of substance *dependence* in the relationship between drug choice and SRB. Indeed, grouping participants on dependence as opposed to frequency of use may provide somewhat different relationships (cf. Baseman et al., 1999) and therefore is worthy of investigation to determine the generalizability of these results to dependent indi-

viduals. Also as an issue of generalizability, the sample was comprised almost exclusively of inner-city African American drug users already in residential treatment. Although this is an underserved population for which this type of research has many clear implications, it is unclear in what ways these findings apply to other groups of drug users.

Regarding the measurement of SRB and impulsivity, future studies will benefit from the use of more multidimensional, context-sensitive measurement strategies. First, it has been argued that useful measures of SRB must move beyond global assessment strategies and take contextual variables (e.g., intoxication) into account (Chawarski et al., 1998). Thus, the use of global measure of SRB (i.e., HRBS-SRB) in the current study precludes definitive statements as to whether SRB occurred in the context of drug use, or whether crack/cocaine users are generally prone to sexual risk independently of the pharmacological effects of the drug. Given the concern over this latter issue in studies of the relationship between alcohol use and SRB (cf. Leigh and Stall, 1993), future studies would benefit form the use of situational association measures that consider to what extent SRB occurs in and out of the context of drug use.

Relatedly, multiple studies have argued for more sophisticated measurements of impulsivity that accommodate its multidimensional nature (Evenden, 1999). Because the current study assessed impulsivity using only the Eysenck I-7 questionnaire, which focuses on the future non-planning aspect of impulsivity, it is thus difficult to speculate on the generalizability of the results across other dimensions of impulsivity (e.g., delay discounting, behavioral inhibition). Further, because the measure does not differentiate impulsive behaviors occurring in and out of the context of drug use, the relative contribution of impulsivity as a personality trait influencing drug choice and the acute and long-term differential drug effects of crack/cocaine and heroin on impulsivity are further obscured.

As an additional limitation, the current study did not control for several factors that have been linked to the variables in question. First, the presence of impulsivity-related psychopathology such as an antisocial or borderline personality disorder was not assessed. This is a concern, as individuals with ASPD and BPD are likely to engage in both crack/cocaine use as well as demonstrate elevated levels of SRB (e.g., Compton et al., 1995). Future studies should aim to examine and/or control for the presence of impulsivity-related character pathology and determine if yet another common factor across character disorders may influence drug choice and SRB. In addition to psychopathology, the current study also did not include the assessment of other relevant personality traits shown to be related to SRB and drug choice such as sensation seeking (Galizio and Stein, 1983; Milin et al., 1992; Compton, 2000). Although impulsivity is an important and relevant variable in its own right, the future development of sound conceptual models will require the examination of several mediators in a more comprehensive analysis.

Taken together, the current study represents an important step in the identification of individuals most vulnerable to engaging in SRB. Improving on the limitations of the current study, future work should further investigate the interactive role of drug choice and impulsivity in SRB, including a more comprehensive assessment of relevant variables across personality, developmental, and environmental domains. Most importantly, there is great need to develop the clinical implications of this work including its relevance for the development of targeted HIV prevention and treatment efforts focused on drug use and SRB (Kelly and Kalichman, 2002).

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