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Prospective risk factors for traumatic event reexposure in community syringe exchange participants

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Abstract

Background—Traumatic event reexposure in injecting drug users is associated with increased drug use and potential for psychiatric symptoms. This is the first study to examine fixed and time-varying factors that are prospectively associated with new traumatic event reexposure in injecting drug users.

Methods—Injecting drug users registered in a syringe exchange program were enrolled in a 16-month parent study comparing strategies to increase drug abuse treatment enrollment. Participants (N = 162) completed baseline measures of demographics, psychiatric treatment history, and lifetime traumatic event exposure. Monthly follow-ups assessed past-month traumatic event exposure, days of heroin and cocaine use, criminal activity, and drug abuse treatment participation. Generalized Estimating Equations models tested the influence of fixed baseline and time-varying factors on traumatic event reexposure in the same month, the following month, and two months later.

Results—Significant fixed risk factors for traumatic event reexposure include female gender and past psychiatric treatment. In addition, each past traumatic event exposure was associated with an increased likelihood of reexposure. After accounting for all other factors, each day of cocaine use was associated with a small but persistent increased risk of traumatic event reexposure.

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Contributors

Author Peirce designed the study. Authors Peirce, Brooner, and Kidorf wrote the protocol and collected the data. Author Peirce conducted the statistical analysis and wrote the first draft. All authors contributed to substantial revisions of the manuscript and have approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

Reexposure to a traumatic event in the prior month more than doubled the risk of subsequent reexposure.

Conclusions—Injecting drug users experience a pattern in which drug use is associated with increased risk of subsequent traumatic event reexposure, and traumatic event reexposure is associated with further drug use and continued reexposure. Implications for addressing these concerns in injecting drug users are presented.

Keywords

traumatic event; risk; gender differences; cocaine; syringe exchange; injecting drug users

1. INTRODUCTION

While it has been well-established that injecting and non-injecting drug users have significant histories of traumatic event exposure (Gil-Rivas et al., 2009; Mills et al., 2005; Peirce et al., 2008), more recent research has demonstrated that over 25% of injecting drug users are *reexposed* to a new traumatic event each month (Peirce et al., 2012). This reexposure rate is far higher than the 20% to 40% rate over three- to five-year follow-ups general population studies (Breslau et al., 2008; Stein et al., 2002). Traumatic event reexposure places drug users at risk for developing or exacerbating psychiatric disorders (Breslau et al., 2013) as well as increased base rates of drug use and an increased desire for drug abuse treatment (Peirce et al., 2013). Identifying risk factors that lead to traumatic event reexposure would help to distinguish potential targets for prevention or intervention during a time of increased motivation for treatment.

Most extant information on the risk for traumatic event exposure is based on general population epidemiological samples not selected for drug use. Risk factors that have been identified with population-based samples include fixed factors (e.g., demographic and historical characteristics) and modifiable factors (e.g., drug use behaviors). Fixed factors are difficult or impossible to change and are therefore poor candidates for intervention, although they can identify subsets of drug users at higher risk for traumatic event reexposure and its negative sequelae. One commonly-studied fixed risk factor is gender, which has mixed evidence of a relationship to new traumatic event exposure. Most population-based studies suggest that men are at higher risk of exposure than women (Breslau et al., 1991, 1995; Frans et al., 2005), but work with drug user and urban samples has found similar rates of exposure across genders (Cottler et al., 2001; Goldmann et al., 2011), or that women are at greater prospective risk of reexposure than men (Peirce et al., 2012). Other fixed demographic factors most commonly found to be related to new traumatic event exposure in general population samples include African-American race (Breslau et al., 1995, 2004), living in an urban environment characterized by lower socioeconomic status (Breslau et al., 2006, 2004), and having less education or lower assessed intelligence (Breslau et al., 2006, 1991, 1995; Storr et al., 2007).

In addition to demographic characteristics, historical experiences can serve as risk factors for traumatic event reexposure. A history of at least one psychiatric disorder is a notable risk (Yen et al., 2002), with some studies finding anxiety disorders or specifically posttraumatic

stress disorder (PTSD; Breslau et al., 2008; Stein et al., 2002) associated with increased risk of traumatic event exposure. Past traumatic event exposure is also a consistent risk for future reexposure (Breslau et al., 1995). This relationship has been found with regard particularly to violent victimization in general population samples (Tharp et al., 2011; Widom et al., 2008) and in drug user samples (Cohen et al., 2013).

Perhaps most relevant of the modifiable risk factors in injecting drug users is drug use. Prospective studies in both general and drug user populations have shown that drug use measured at one visit is associated with increased risk for future new traumatic event exposure—often physical or sexual violence (Cohen et al., 2013; Epstein-Ngo et al., 2013; Gilbert et al., 2012; Stein et al., 2002; Wells and Graham, 2007). Similarly, people who display aggressive or externalizing behaviors are consistently at higher risk of exposure to traumatic events than those without such behaviors. Although much of this work has been done with children and adolescents (Breslau et al., 2006; Ranney et al., 2011; Storr et al., 2007, 2009), extremely high rates of traumatic event exposure have been shown in incarcerated adults as well (Crisanti and Frueh, 2011). This literature suggests that drug use and criminal behavior are likely to be associated with increased risk of traumatic event reexposure in drug users and, conversely, that interventions designed to reduce drug use and criminality may decrease their risk.

A major methodological limitation to the study of risk factors for traumatic event reexposure is reliance on general population samples and cross-sectional retrospective designs. At least one investigative team found different risk factors in retrospective and prospective studies (Breslau et al., 1999, 2008), suggesting that the study design can impact results significantly. Further, it is possible that risk factors for traumatic event *exposure* differ in type or magnitude from risk factors for *reexposure*, particularly in populations like drug users, who have extensive traumatic event histories. We are aware of no studies that examine prospective risk for traumatic event exposure or reexposure in drug users, and the putative risk factors found in population samples suggest that active injecting drug users would be at the highest risk.

The present study was designed to test both fixed and modifiable risk factors for traumatic event reexposure in a sample of active injecting drug users enrolled in a parent study of strategies to motivate drug abuse treatment participation. We expected that the following fixed factors would be associated with an increased risk of reexposure: female gender; minority race; lower education; lifetime psychiatric treatment; and lifetime number of traumatic events. A separate analysis was designed to test whether the following modifiable factors would be associated with traumatic event reexposure while controlling for the fixed risk factors: days of heroin and cocaine use; illegal activity or detention; recent traumatic event exposure; and less participation in daily drug abuse treatment.

2. METHODS

2.1. Participants

Participants were new enrollees in a syringe exchange program in Baltimore, Maryland, recruited from a parent study assessing three strategies to increase treatment enrollment: 1)

routine drug abuse treatment referral (Routine); 2) treatment referral with motivational enhancement (Motivated Referral Condition; MRC); and 3) treatment referral with motivational enhancement and incentives for attendance and enrollment (Motivated Referral Condition with Incentives; MRC+I; Kidorf et al., 2009, 2012). The MRC+I participants were more likely to enter treatment and had lower rates of heroin use than the other conditions. To be eligible for the parent study, individuals had to be: 1) new syringe exchange registrants; 2) currently opioid dependent; 3) under 60 years old; 4) not receiving drug abuse treatment; and 5) free of untreated/unstable current major mental illness (e.g., schizophrenia, bipolar disorder) or severe cognitive impairment that would compromise understanding and participating in study procedures (Kidorf et al., 2009, 2012). The parent study included 281 participants.

A subset of the parent study participants were administered the measures reported here. Data collection for these measures occurred from April, 2004 through March, 2007. Of 277 participants consented during this time period, 197 completed the parent study intake and were randomized to interventions. Participants were scheduled to attend one intake and 16 monthly follow-ups. Eighty-two percent (N = 162) of randomized participants attended at least one follow-up; this group comprises the current cohort study sample. All procedures in the parent study were approved by the Western Institutional Review Board and procedures in the current study were approved by the John Hopkins Medicine IRB.

2.2. Measures

As part of the intake procedure, participants completed a demographic interview that included a question about lifetime psychiatric treatment for a problem other than drug use (“Have you ever been treated for a psychiatric problem?”). Participants were also asked to report on days of heroin use, cocaine use, illegal activities, and criminal justice detention over the past 30 days. These last two variables were highly skewed, so were combined into one dichotomous variable (i.e., presence or absence of illegal activity or detention). Questions on drug use and illegal activities were repeated at monthly follow-ups. A purpose-made questionnaire assessed days of any type of drug abuse treatment participation at monthly follow-ups. Responses were converted to a dichotomous variable of “daily treatment” (i.e., ≥21 days per month vs. < 21 days per month). Daily treatment is the best practice treatment recommendation for opioid-dependent injection drug users (McLellan et al., 2000) and was therefore considered most likely to be associated with changes in risk for traumatic event exposure as opposed to short-term opioid detoxification, as an example.

The Traumatic Life Events Questionnaire (TLEQ; Kubany et al., 2000) was administered at intake to assess lifetime history of traumatic events. The TLEQ probes for exposure to 22 specific potential traumatic events and a 23rd “other” category, and includes questions to determine whether the event meets DSM-IV-TR Criterion A(2) for PTSD (i.e., a response of extreme fear, helplessness, or horror; American Psychiatric Association, 2000). All events reported here met Criterion A(2). The frequency of each event type ranges from 1 to 5 times, with a final category of “over 5 times,” which was coded as 6. The total number of lifetime traumatic events thus could range from 0 to 138. The TLEQ is considered a “gold standard” in traumatic event assessments (Gray et al., 2004; Weathers et al., 2007), and appears to

detect traumatic events better than other measures in drug user populations (Peirce et al., 2009). The TLEQ was used to assess new traumatic event exposures at each monthly follow-up and was modified by prefacing each event probe with "In the past 30 days…" Since the number of events occurring each month was rarely more than one, participant responses were dichotomized to any versus none.

2.3. Procedures

Potential participants self-referred or were referred from the syringe exchange program to a research vehicle parked near the syringe exchange program vehicle at two distribution sites in Baltimore. Potential participants were given the consent form to read and keep for reference, but were also read the consent form by research staff. Study intake measures were administered on the vehicle, which had one private room used for interviews. To minimize potential problems with reading comprehension, all measures were administered in interview format. No attempt was made to match participant gender, race, or ethnicity. When possible, follow-up visits were conducted in person on the research vehicle, but could also be conducted over the telephone if needed. Participants who missed one or more follow-up visits were asked retroactively about their experiences at the next attended visit. Participants were paid $15 per hour for completing assessments.

2.4. Data analysis

Predictor variables were first examined for changes over time with the results noted below. We have previously noted an overall decline in monthly rates of traumatic event exposure over time (Peirce et al., 2012), so included time in all models. Although parent study randomized condition was not previously found to be related to traumatic event reexposure, we included it in all models because the experience of a traumatic event was sometimes discussed as a motivation to enter treatment in the two motivational enhancement conditions.

For the core analyses, two proposed models predicting traumatic event exposure (Y/N) were tested using Generalized Estimating Equations (GEE; GENLIN procedure; Liang and Zeger, 1986). GEE are particularly useful to test prospective longitudinal designs in which some missing data are expected because all available data can be used without casewise elimination. The first model included the following fixed factors to predict traumatic event exposure in any month during the study: female gender (Y/N); age (years); education (years); minority race (Y/N); lifetime psychiatric treatment (Y/N); and lifetime number of traumatic events. The second model used time-varying modifiable predictors measured monthly to predict traumatic event exposure in the same month, one month later, and two months later, while accounting for all of the fixed factors from the first model. The time-varying modifiable predictor variables were: heroin use (days of 30); cocaine use (days of 30); daily treatment (Y/N); illegal activity or detention (Y/N); and previous month's traumatic event exposure (Y/N). Both models specified a binomial distribution with logit link. GEE provides parameter estimates for each variable in the form of adjusted odds ratios (AOR) with 95% confidence intervals (CI).

All participants had intake data, although one was missing drug use data. Of 2592 possible follow-ups (162 participants X 16 followups), 2140 had data on independent and dependent variables, with occasional missing data points. A GEE analysis determined that, aside from time, none of the fixed factors or covariates were associated with follow-up attendance (analyses not shown), suggesting that missing data were missing at random. No values were imputed.

3. RESULTS

3.1. Participant characteristics

The present study sample (N = 162) differed from the participants who attended intake only (n = 35) in two respects. The intake only group was more likely to endorse being White or an "other" category of race [51% Black, 34% White, 14% other; $\chi^2(2) = 8.05$; $p = 0.018$] and reported fewer days of cocaine use at intake [11.63(1.84); $t(194) = -2.08$; $p = 0.039$]. The current study sample did not differ from the larger parent study sample (Kidorf et al., 2012) on any demographic or drug use variable.

The study sample contained more men than women (69% men; n = 112), and more minorities than non-minorities [70% Black; 26% White; 4% other (multiracial and Latino)]. Participants had an average age of 42 years (SD = 7.92; range 22 - 58) and an average of 11 years (SD = 1.87; range 6 - 16) of formal education. Twenty-eight percent of the sample (n = 45) reported a lifetime history of non-drug psychiatric treatment. At intake, participants used heroin nearly every day [M(SD) = 27.83 (5.15) days in past month] and cocaine often [16.11 (11.72) days in past month]. Over 90% of participants reported at least one lifetime traumatic event (n = 147), with a sample average of 17 traumatic events (SD = 15.64; range 0 – 88). The most common categories of lifetime traumatic event were adult physical assault (76%) and unexpected death of a loved one (58%). Traumatic event reexposure during the study was the norm; 72% of the sample had experienced a new event by the end of the 16-month follow-up period. The most common traumatic event reexposures during the study were life-threatening illness, unexpected death of a loved one, injury/illness of a loved one, physical assault, and witnessing physical assault. See Peirce et al., 2012 for more detail on lifetime and ongoing traumatic event exposure in this sample.

3.2. Time-varying factor patterns

Days of using heroin declined by almost one day per month during the study across participants [B(SEM) = −0.90 (.10); $p < .001$]. Days of using cocaine decreased by about one-half day per month across participants [−0.60 (.08); $p < .001$]. The proportion of participants reporting daily drug abuse treatment was 9% in the first month of the study (n = 14). The likelihood of a participant being in daily treatment increased by about 6% per month [OR (95% CI) = 1.06 (1.02 – 1.09)]. The proportion of participants reporting any illegal activity or detention in the first month was 61% (n = 98), and the likelihood of illegal activity or detention decreased over time by about 7% per month [0.93 (.91 - .96)].

3.3. Risk of traumatic events

In the fixed-factor model, three factors positively predicted traumatic event reexposure (Table 1). Women were 66% more likely than men to experience a new traumatic event during the study, after accounting for the influence of all other fixed factors. Reporting a lifetime history of psychiatric treatment was associated with approximately double the risk of a new traumatic event, and every past traumatic event was associated with a 3% increase in risk of a reexposure.

In the second model of time-varying modifiable risk factors, both cocaine use and recent traumatic events predicted traumatic event reexposure, after adjustment for all other time-varying factors and all fixed factors (Table 2). Each day of cocaine use was associated with a 2% increased risk of a new traumatic event in the concurrent month and two months later. Recent traumatic events were by far the most powerful factor predicting reexposure, with the risk of a new traumatic event being more than doubled in the subsequent month. Notably, heroin use, participation in daily drug abuse treatment, and illegal activity were not associated with either increased or decreased risk for reexposure.

4. DISCUSSION

This is the first study to document a prospective relationship between cocaine use and subsequent traumatic event exposure in opioid-dependent injecting drug users. In this sample of heavy cocaine users, each day of cocaine use was associated with a 2% increase in risk of traumatic event reexposure in both concurrent and subsequent months. The finding that cocaine use, but not heroin use, was associated with traumatic event exposure may be due to a number of factors. In this opioid-dependent sample selected for their uniformly high heroin use, it is likely that cocaine use indexes a higher severity of overall polydrug dependence than does heroin use alone. Cocaine use is also associated with greater impulsivity and engagement in risky behaviors like sex trading and criminal activity (Wilson and Dehovitz, 1997) that result in more opportunities for traumatic event exposures. The shorter half-life of cocaine, as compared to heroin, also prompts more frequent drug-seeking which is likely to increase frequency of exposure to dangerous situations.

Particularly interesting is the persistent contribution of cocaine use to reexposure in the presence of the very strong predictor of recent traumatic event exposure. The present data support the well-established link between remote experience of traumatic events and risk for reexposure (e.g., Breslau et al., 1995), confirming this relationship in a sample of highly-exposed drug users. Moreover, the findings from this study extend this relationship to very recent exposure in the past month, which more than doubles the risk of reexposure in the subsequent month. For these injecting drug users, cocaine use and recent traumatic event exposure independently and together present a very high risk for ongoing exposure.

The expectation that participation in drug abuse treatment would decrease traumatic event reexposure, possibly by reducing drug use or by reducing contact with dangerous people or situations, was not confirmed. This may have been because participants were most often referred to methadone maintenance, which is highly effective in reducing heroin and other opioid use, but minimal direct effect on cocaine and other non-opioid drug use (Stitzer and

Sigmon, 2006). Indeed, cocaine use decreased very little during the study (Kidorf et al., 2013). Since cocaine and not heroin was associated with traumatic event reexposure, the lack of effect of treatment on cocaine use may have resulted in no primary effect of drug abuse treatment. Further, the vast majority of participants who participated in drug abuse treatment during the study would have been in the early phases of treatment, and may not yet have changed pervasive drug use patterns or social networks that put them at risk of traumatic event reexposure. While social networks that support drug use can change during treatment, such changes tend to emerge gradually over time (Litt et al., 2009). It may be that longer treatment episodes are necessary to effect the lifestyle changes that lower risk for traumatic event reexposure.

Many of the study limitations stem from the fact that the original study was not designed to include a comprehensive set of potential risk factors for traumatic event reexposure. For example, posttraumatic stress disorder (PTSD) is known to increase risk of future traumatic events (Breslau et al., 2008). Some PTSD symptom data were collected, but symptom assessment was too infrequent and produced too few observations to support its inclusion in the statistical models. Similarly, we used years of formal education as a rough proxy for intelligence, which has been correlated with risk for traumatic event exposure (Breslau et al., 2006). Education may be an inadequate representative of intelligence or the relationship may not be as strong in injecting drug users as it is in other populations. In addition, the relatively small sample size and low occurrence of any specific type of traumatic event in any given month limits the power to assess risks for specific events of interest such as physical assault. Future research will be able to expand upon the present work by collecting larger samples and including PTSD and other potential risk factors.

Coupled with our previous results (Peirce et al., 2013), the present findings indicate the presence of a cyclical pattern for injecting drug users in which drug use increases risk for traumatic event reexposure which, in turn, increases risk for both drug use and further traumatic event reexposure. Since drug use and traumatic events are also associated with serious psychiatric, medical, and social consequences in this vulnerable population, successful interventions to directly or indirectly interrupt this pattern could yield considerable individual and public health benefits. We are not aware of any prevention interventions specifically designed to reduce traumatic event reexposure in injecting drug users, but community- or hospital-based interventions shown to reduce violence reexposure in adolescents, injured adults, and sexually assaulted women (Smith et al., 2012; Vladutiu et al., 2011; Walton et al., 2010) could be adapted for the drug user population. For treatment-seeking drug users, adjusting early drug abuse treatment to focus on improving social networks and day-to-day activities in order to reduce exposure to dangerous environments and situations may also prove fruitful. Failure to address traumatic event reexposure in drug users will only perpetuate the cycle of risk and reexposure.

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Table 1

Association of fixed baseline factors with any traumatic event exposure during a 16-month period, adjusting for time and study condition (N = 162).

	AOR (95% CI)
Female gender (Y/N)	1.66 (1.03–2.68)*
Age (years)	1.00 (0.97–1.03)
Education (years)	0.98 (0.87–1.10)
Minority race (Y/N)	1.27 (0.78–2.08)
Lifetime psychiatric treatment (Y/N)	1.83 (1.17–2.84)*
Lifetime number of traumatic events	1.03 (1.01–1.05)*

* $p < .05$

Table 2

Association of time-varying factors with any traumatic event exposure in the same month and next two months, adjusting for time, condition, and all fixed factors (N = 162).

	Same month AOR (95% CI)	One month later AOR (95% CI)	Two months later AOR (95% CI)
Heroin use (days)	1.00 (0.98 – 1.01)	1.00 (0.99 – 1.01)	1.00 (0.98 – 1.01)
Cocaine use (days)	1.02 (1.00 – 1.03)*	1.01 (1.00 – 1.03)#	1.02 (1.01 – 1.04)*
Daily treatment (Y/N)	1.07 (0.81 – 1.43)	1.00 (0.72 – 1.38)	1.37 (0.97 – 1.94)
Illegal activity or detention (Y/N)	1.21 (0.97 – 1.51)	0.93 (0.74 – 1.18)	0.89 (0.67 – 1.17)
Previous month traumatic event exposure (Y/N)	--	2.39 (1.79 –3.18)*	2.72 (2.02 – 3.66)*

* $p < .05$;

$p = .102$

Note: A dash indicates no association could be tested because traumatic events were not assessed in the month prior to intake.