

Research Article

SUBSTANCE USE AND SUICIDALITY: SPECIFICITY OF SUBSTANCE USE BY INJECTION TO SUICIDE ATTEMPTS IN A NATIONALLY REPRESENTATIVE SAMPLE OF ADULTS WITH MAJOR DEPRESSION

Shayna M. Cheek,* Bridget A. Nestor, and Richard T. Liu

Background: *Although several risk factors for suicidal ideation (SI) have been identified in the research literature, there is a pressing need for studies evaluating markers of risk differentiating ideators from people who have attempted. According to the interpersonal theory of suicide, habituation to painful or provocative experiences increases one's acquired capability for suicide, a necessary component for the transition from SI to attempts. This theory further posits that the acquired capability for suicide should be unrelated to risk for SI. This study tested this theory by examining injection drug use, relative to less painful means of drug use, in relation to SI, suicide plans, and suicide attempts. Methods: Data were drawn from the National Survey on Drug Use and Health (NSDUH), a nationally representative survey conducted annually. Participants included 10,203 adults with a history of injectable drug use and major depression. Results: Injection drug use was positively associated with suicide attempts (Odds Ratio [OR] = 1.66, 95% confidence interval [CI] = 1.18–2.34), but not SI or suicide plans in the full sample. Injection drug use was also associated with suicide attempts (OR = 1.64, 95% CI = 1.14–2.35), but not plans, among ideators. Lastly, injection drug use was associated with the suicide attempts among suicide planners (OR = 1.76, 95% CI = 1.01–3.06). All analyses included sex, age, race/ethnicity, family income, substance use disorder symptom severity for injectable drugs, and depressive symptom severity as covariates. Conclusions: Consistent with the interpersonal theory of suicide, injection drug use was associated with specific risk for suicide attempts but not SI or suicide plans. Depression and Anxiety 33:541–548, 2016. © 2015 Wiley Periodicals, Inc.*

Key words: *epidemiology; interpersonal theory of suicide; substance use; suicidal ideation; suicide attempts; suicide plans*

Alpert Medical School, Brown University, Providence, Rhode Island

Contract grant sponsor: National Institute of Mental Health; Contract grant number: R01MH101138.

Preparation of this manuscript was supported by the National Institute of Mental Health under Award Number R01MH101138. The authors report no conflict of interest. The research reported in this study has complied with the Code of Ethics of the World Medical Association (Declaration of Helsinki).

*Correspondence to: Shayna M. Cheek, Bradley Hospital, 1011 Veterans Memorial Parkway, East Providence, RI 02915. E-mail:

INTRODUCTION

In the United States, suicide is the 10th leading cause of death, accounting for approximately 12.6 per 100,000 deaths.^[1] Since 2000, rates of suicide have generally

shayna_cheek@brown.edu; Richard T. Liu, Bradley Hospital, 1011 Veterans Memorial Parkway, East Providence, RI 02915. E-mail: rtiupsych@gmail.com

Received for publication 31 March 2015; Revised 22 June 2015; Accepted 11 August 2015

DOI 10.1002/da.22407

Published online 22 September 2015 in Wiley Online Library (wileyonlinelibrary.com).

increased.^[2] Therefore, it is important to identify those at highest risk for engaging in suicidal behaviors and to improve intervention efforts for those individuals.

Most individuals who contemplate suicide never act on these thoughts. A population-based study indicated that of the individuals who reported any suicidal ideation (SI), only 7.4% went on to attempt suicide within the next 2 years.^[3] Furthermore, lifetime prevalence of SI is much higher than the lifetime prevalence of suicide attempts.^[4,5] Cross-national data from the World Mental Health Survey Initiative found that whereas 9.2% of respondents reported SI in their lifetime, only 2.7% reported actually making an attempt.^[6] Yet, most studies on risk factors of suicidality fail adequately to distinguish between individuals who attempt suicide and those who only consider it (i.e., pure ideators).^[7] Rather than cleanly observing the distinction between ideation and attempts, existing research on suicide-related risk factors tends to include those who have attempted suicide in analyses of ideators.^[5,7] The frequent neglect of this important distinction in the literature may be one reason for the limited progress in suicide prevention and related rise in death by suicide. Therefore, there has been increasingly a call for research differentiating risk for SI alone from attempting it.^[7]

One theory that may be helpful for differentiating risk factors specific to SI from those unique to suicide attempts is the interpersonal theory of suicide.^[8,9] This theory posits that the risk factors for suicidal desire and the ability to attempt suicide are relatively distinct. According to this theory, only those who experience reduced fear of death and increased tolerance for physical pain (i.e., acquired capability for suicide) will transition from SI to attempts. Individuals acquire the capability for suicide by experiencing painful or fear-provoking events that habituate them to further pain or the fear of death. The hypothesized association between the acquired capability for suicide and attempted suicide has garnered substantial empirical support.^[9] One study found that the number of suicide attempts was associated with higher levels of acquired capability for suicide.^[10] Furthermore, longer history of self-injury and the absence of pain during self-injury have been associated with greater likelihood of suicide attempts, a finding consistent with the possibility that past painful events lead to pain habituation.^[11]

Although the interpersonal theory of suicide conceptualizes the acquired capability for suicide, and its associated risk factors, as specific to suicide attempts relative to SI, this specificity has yet to be submitted to empirical investigation. Within this context, an examination of substance use may hold promise for adding to the empirical basis of the interpersonal theory of suicide. Substance use is a well-known risk factor for suicidality.^[12-14] Substance abuse and dependence put individuals at increased risk for SI,^[15,16] attempts,^[12,17] and death by suicide.^[13,14,18] Theoretically, we may expect a different pattern of risk depending on the method of drug use. More specifically, intravenous drug users (IDUs) may have a higher risk for

suicide attempts because of the pain associated with injecting drugs. Findings from a study comparing IDUs with other drug users are consistent with this possibility. Wilcox et al.^[14] found that the standard mortality ratio for suicide in IDUs was 18 times greater than expected, and the risk is greater for these individuals than those with alcoholism. Moreover, compared to individuals using other drugs at similar rates, IDUs are at heightened risk for suicide attempts.^[19,20]

Furthermore, and based on the conceptualization of the acquired capability for suicide within the interpersonal theory of suicide, IDUs should not be more likely than other drug users to consider suicide. However, existing empirical evidence on this matter is mixed. One study that compared IDUs to other drug users found that IDUs are more likely to have SI and plan a suicide attempt.^[19] Yet, another study found that after other factors were covaried, IDUs were no longer associated with greater risk for SI.^[21]

Certain methodological considerations could explain the inconsistencies between studies. As mentioned above, much of the existing empirical literature on SI fails to observe the distinction between pure ideators and ideators who also attempt suicide. Studies of the relation between substance use and suicidality are no exception in this regard. In these studies, some suicidal ideators have also engaged in suicidal behaviors. Hence, if the variable of interest is SI, and a proportion of the ideators has transitioned to suicidal behaviors, it is difficult to test whether the injection drug use is a risk factor for SI alone. That is, any observed relationship between these two variables may be largely an artifact of the presence of people with suicide attempts in the sample.

The current study aimed to address this limitation in providing a stringent empirical test of whether a risk factor for the acquired capability for suicide is specific to suicide attempts and not SI in a nationally representative sample of adults with major depression. Specifically, we examined injection drug use in relation to SI, plans, and attempts. Drawing on the interpersonal theory of suicide, we hypothesized that injection drug use would be positively associated with suicide attempts, but not SI or plans. Further, we hypothesized that among ideators, injection drug use would be associated with elevated risk for suicide attempts but not plans. Lastly, within the subsample of individuals who have made a suicide plan, injection drug use was hypothesized to be associated with increased odds of suicide attempts.

METHODS

SUBJECTS AND DATA SOURCE

Pooled data from the years 2008 to 2013 were drawn from the National Survey on Drug Use and Health, a nationally representative survey conducted annually by the Substance Abuse and Mental Health Services Administration to assess the prevalence of substance use and disorders. The study uses a multistage area

probability sampling design within all 50 states with participants aged 12 and older. For the purpose of this particular study, only data collected from adults (18+) with a lifetime history of major depression and use of an injectable substance were analyzed. Injectable substances included heroin, cocaine, and stimulants (particularly methamphetamine, Desoxyn, and Methedrine). In total, 10,203 participants (unweighted n) were included in analyses.

PROCEDURES

Interviewers administered all study items using computer-assisted personal interviewing and audio computer-assisted self-interviewing, which provide participants with privacy to answer potentially sensitive questions (e.g., those related to suicidality) and those regarding illegal behaviors (e.g., illicit substance use). This method of querying about sensitive behaviors has been associated with increased openness in responses.^[22]

STUDY VARIABLES

Participants were interviewed regarding their substance use, abuse, and dependence within the past 12 months. Those who endorsed having used heroin, cocaine, and stimulants were asked an additional question asking whether they had used a needle to inject that particular substance in their lifetime. They were also asked if they had injected any other drug at least once. Participants were included in the study if they had endorsed using any injectable substance regardless of whether they had injected the substance. The sample was restricted in this manner to allow for a direct comparison between IDUs and non-IDUs, thereby to avoid having type of drug used as a potential confound (e.g., “hard” vs. “soft” drugs). In addition, participants were asked about DSM-IV substance abuse and dependence symptoms to control for substance use disorder symptom severity.

To assess suicidality and depressive symptoms, items drawn from the depression section of the National Comorbidity Survey-Replication were used.^[23] Specifically, participants were included in the analyses if they met DSM-IV criteria for major depression in their lifetime. Suicidal ideation, plans, and attempts were assessed within the context of their major depressive episode.

DATA ANALYSES

Differences between IDUs and non-IDUs in sociodemographic and study variables were examined in a series of independent samples t -test and χ^2 tests. We conducted a series of multivariate logistic regression analyses to assess potential associations between injection substance use and SI, plans, and attempts. Family income, age, sex, race/ethnicity, substance use disorder symptom counts for injectable substances, and depressive symptom counts, with the exception of suicidality, were included as covariates. In addition to conducting analyses within the whole sample, we conducted similar analyses in subsamples of participants to assess the degree

to which injection use distinguished between different levels of severity in suicidality. More specifically, in the subsample of suicidal ideators, we tested the association between injection use and suicide plans and attempts. In the subsample of suicide planners, we tested the association between injection drug use and suicide attempts. All analyses were conducted using weighting procedures to accommodate the complex sampling frame of the survey.

So as to avoid confounding milder forms with more severe forms of suicidality (e.g., the possibility that an observed effect for SI is better accounted for by the presence of individuals with suicide attempts in the analysis), participants with more severe forms have been excluded from analyses involving milder manifestations of suicidality. Specifically, participants with suicide plans and attempts have been excluded from the full sample used in the analysis with SI as the criterion variable. Similarly, participants with suicide attempts have been excluded from the analyses involving suicide plans as the criterion variable in the full sample and in the subsample of ideators.

RESULTS

SAMPLE CHARACTERISTICS

In the full sample, the racial/ethnic composition was as follows: 81.58% non-Hispanic White, 4.93% non-Hispanic Black, 9.28% Hispanic, 1.61% Asian, Hawaiian, or Pacific islander, 0.81% Native American, and 1.79% multiracial. The average age was 25.46 (SE = 0.02), and 55.97% were female. Among the participants in the sample, 13.33% had a lifetime history of drug use by injection, 71.01% reported having experienced SI, 15.30% made a suicide plan, and 12.32% attempted suicide. Of the participants with SI, 21.56% had a suicide plan, and 17.37% made a suicide attempt. Among those with a suicide plan, 54.33% made a suicide attempt.

Sociodemographic characteristics of the IDUs and the non-IDUs in the full sample are presented in Table 1. Relative to non-IDUs, those with a lifetime history of injection drug use were more likely to be male, older, and come from a low-income background. IDUs experienced more severe depressive symptoms as well as abuse and dependence for each of the three types of injectable substances (i.e., cocaine, heroin, and stimulants). They were also more likely to be suicidal, form a suicide plan, and attempt suicide. No differences were found for race and ethnicity.

MULTIVARIATE ASSOCIATIONS BETWEEN INJECTION DRUG USE AND SUICIDAL IDEATION, PLANS, AND ATTEMPTS

Among participants with a history of major depression and injectable drug use, IDUs were more likely than non-IDUs to attempt suicide, but were no more likely to experience SI or to form a suicide plan (see Table 2). Specifically, the adjusted odds of a suicide attempt were

TABLE 1. Demographic and clinical characteristics of the total study sample ($n = 10,203$)

Characteristic	Injection substance users		Noninjection substance users		t/χ^2
	Mean (SE)	%	Mean (SE)	%	
Gender					36.88***
Female		40.17		58.40	
Male		59.83		41.60	
Age in years	25.79 (0.07)		25.41 (0.03)		5.47***
Race/ethnicity					0.68
Non-Hispanic White		82.59		81.43	
Non-Hispanic Black		4.14		5.05	
Hispanic		8.15		9.45	
Asian, Hawaiian/Pacific Islander		1.82		1.58	
Native American		1.61		0.68	
Multiracial		1.68		1.80	
Family income					7.18***
<\$20,000		31.52		21.29	
\$20,000–\$50,000		31.94		31.66	
\$50,000–\$75,000		16.11		16.62	
>\$75,000		20.42		30.42	
Cocaine abuse and dependence symptoms		0.61 (0.09)	0.18 (0.02)		4.90***
Heroin abuse and dependence symptoms	0.55 (0.07)		0.03 (0.01)		7.53***
Stimulant abuse and dependence symptoms	0.33 (0.58)		0.09 (0.01)		4.33***
Depression symptoms ^a	6.97 (0.07)		6.68 (0.02)		4.53***
Suicidal ideation		76.56		70.16	5.85*
Suicide plan		23.18		14.09	20.09***
Suicide attempt		18.45		11.38	13.99***

Note: CI, confidence interval; SE, standard error.

^aSuicidal ideation and behavior were excluded from the depression symptom count.

* $P < .05$; ** $P < .01$; *** $P < .001$.

approximately 1.7 times as high among IDUs as those who used drugs through other methods of administration (e.g., orally). The association between injection drug use and suicide attempts was robust, remaining significant after accounting for depressive symptom severity, substance abuse and dependence symptom severity, age, sex, race/ethnicity, and family income.

A similar pattern of findings was observed when analyses were restricted to the subsamples of participants with SI and suicide plans (Table 3). Among ideators, injection drug use was not associated with suicide plans. In contrast, injection drug use was positively associated with suicide attempts in the subsample of ideators, with the adjusted odds of a suicide attempt being approximately 1.6 times as high among those with a lifetime history of drug injection as among those who used the same substances through different methods. Drug use by injection was also associated with greater risk of suicide attempts in the subsample of participants with a suicide plan, with adjusted odds being approximately 1.8 as high for drug injectors as non-IDUs. Again, all observed associations were robust, even when accounting for depressive symptom severity, substance abuse and dependence symptom severity, age, sex, race/ethnicity, and family income.

To assess the importance of screening out more severe forms of suicidality (e.g., suicide attempts) in analyses of milder forms (e.g., suicide plans) as criterion variables, we conducted a separate series of logistic regression

analyses. Specifically, we repeated the multivariate analysis involving suicide plans regressed on to injection drug use in the full sample of participants with major depression, without first excluding individuals with suicide attempts from the sample. In contrast to results from the earlier analysis with people with suicide attempts excluded, drug use by injection was now positively associated with suicide plans (adjusted OR = 1.58, 95% confidence interval [CI] = 1.18–2.12, $P = .003$). Likewise, when people with suicide attempts were retained in the multivariate analysis involving suicide plans regressed on to injection drug use in the subsample of suicidal ideators, IDUs were more likely than non-IDUs to form a suicide plan (adjusted OR = 1.56, 95% CI = 1.12–2.17, $P = .009$).

DISCUSSION

The current study builds on the existing literature on the interpersonal theory of suicide^[8,9] by providing a particularly stringent test of this theory. Whereas previous tests of this theory have examined multiple putative risk factors in association with a single suicide-related outcome, the current study examined a single risk factor in association with multiple suicide-related outcomes. This theory posits that individuals who have attempted suicide may have a distinct set of risk factors compared with ideators or planners, relating specifically

TABLE 2. Multivariate associations of injection substance use with suicidal ideation, suicide plans, and attempts among substance-using participants with a history of major depression

Variable	Suicidal ideation ^b Odds ratio (95% CI)	Suicide plan ^c Odds ratio (95% CI)	Suicide attempt Odds ratio (95% CI)
Injection substance use	1.11 (0.79–1.55)	1.27 (0.81–1.99)	1.66 (1.18–2.34)**
Cocaine abuse and dependence symptoms	0.98 (0.93–1.04)	1.02 (0.93–1.12)	1.04 (0.98–1.11)
Heroin abuse and dependence symptoms	1.05 (0.97–1.13)	1.07 (0.98–1.17)	0.92 (0.87–0.97)**
Stimulant abuse and dependence symptoms	0.99 (0.92–1.09)	0.91 (0.82–1.02)	1.10 (1.03–1.18)**
Depression symptoms ^a	1.19 (1.11–1.28)***	1.38 (1.21–1.58)***	1.56 (1.36–1.80)***
Age	0.99 (0.95–1.03)	1.00 (0.95–1.05)	0.93 (0.89–0.97)***
Gender			
Female	0.83 (0.69–.99)*	0.90 (0.70–1.14)	1.37 (1.12–1.67)**
Male (reference)	1.00	1.00	1.00
Race/ethnicity			
Non-Hispanic Black	1.32 (0.88–2.00)	0.71 (0.41–1.24)	0.87 (0.56–1.36)
Native American	0.75 (0.44–1.29)	1.75 (0.71–4.32)	2.07 (1.06–4.04)*
Asian, Hawaiian, and Pacific Islander	0.84 (0.28–2.49)	0.70 (0.22–2.23)	0.60 (0.32–1.12)
Multiracial	1.43 (0.91–2.24)	1.11 (0.59–2.12)	1.17 (0.74–1.84)
Hispanic	0.83 (0.59–1.15)	0.84 (0.44–1.61)	1.14 (0.83–1.56)
Non-Hispanic White (reference)	1.00	1.00	1.00
Family income			
<\$20,000	1.00 (0.79–1.25)	1.07 (0.73–1.58)	1.56 (1.05–2.29)*
\$20,000–\$50,000	0.93 (0.74–1.18)	1.03 (0.74–1.44)	1.26 (0.96–1.67)
\$50,000–\$75,000	1.18 (0.90–1.54)	0.90 (0.59–1.40)	0.86 (0.55–1.33)
>\$75,000 (reference)	1.00	1.00	1.00

Note: Each column represents a separate multivariate logistic regression model. Total sample ($n = 10,203$). All n values are unweighted.

^aSuicidal ideation and behavior were excluded from the depression symptom count so as to avoid confounding the latter with the dependent variables.

^bExcluding participants with suicide plans or attempts (subsample $n = 7,930$).

^cExcluding participants with suicide attempts (subsample $n = 8,671$).

* $P < .05$; ** $P < .01$; *** $P < .001$.

CI, confidence interval.

to the acquired the capability for suicide. This capability arises from habituation to painful or fear-provoking experiences. With intravenous substance use as an example of a painful or fear-provoking experience, results supported differential associations between intravenous substance use and SI, plans, and attempts in a manner consistent with the interpersonal theory of suicide and the study hypotheses. Intravenous drug use was associated with suicide attempts but not SI or plans. Further, when we applied a more stringent test of the specificity of this relationship among a more restrictive sample of suicidal ideators, intravenous drug use was still associated with attempts but not plans. Lastly, in the most conservative test of the theory, among suicide planners, intravenous drug use predicted suicide attempts.

The findings of the current study corroborate earlier work that injection drug use is associated with suicide attempts among a sample of drug users.^[19,20] Importantly, the results of the current study clarify inconsistencies within the literature where injection drug use was found to be associated with SI or plans,^[19] but in some studies was not.^[21] Most prior research has not examined SI, plans, and attempts as discrete outcomes by excluding people with suicide attempts from analyses of people with ideation alone, which may be contributing to inconsistencies within the literature. More specifically, since SI, plans, and attempts tend to co-occur, the presence of

individuals who have attempted suicide among ideators may be driving the relationship found in some research between injection drug use and SI. By separating “pure” suicidal ideators, planners, and attempters, the current study avoids the possibility of confounding a risk factor specific to suicide attempts for a risk factor common to SI or plans. Illustrating this point, in our secondary analyses we found that if people who have attempted suicide were not excluded from the overall sample of adults with major depression or from the subsample of ideators, the association between injection drug use and suicide plans becomes significance.

Methodologically, the current study managed to eliminate the explanatory confound that the relationship between injection substance use and suicide attempts is driven by substance use severity in several ways. First, by including only users of injectable substances, we ensured that the relationship was not a function of the differences between IDUs and users of “soft” substances (e.g., differences between users of cocaine and marijuana). Also, since there tends to be a well-documented relationship between substance abuse and dependence and suicidality,^[12,15,17] we included substance abuse and dependence symptoms for all injectable substances as covariates in our analyses. Although we observed greater depression and substance use symptom severe among IDUs than non-IDUs, these

TABLE 3. Multivariate associations of injection substance use with suicide plans and attempts among substance-using participants with a history of major depression and suicidal ideation and suicide plans

Variable	Among participants with suicidal ideation (<i>n</i> = 7,379)		Among participants with suicide plans (<i>n</i> = 1,788)
	Suicide plan ^b Odds ratio (95% CI)	Suicide Attempt Odds ratio (95% CI)	Suicide attempt Odds ratio (95% CI)
Injection substance use	1.25 (0.78–2.02)	1.64 (1.14–2.35)**	1.76 (1.01–3.06)*
Cocaine abuse and dependence symptoms	1.03 (0.94–1.14)	1.05 (0.98–1.12)	1.03 (0.91–1.17)
Heroin abuse and dependence symptoms	1.05 (0.96–1.14)	0.90 (0.85–0.96)***	0.86 (0.76–0.96)**
Stimulant abuse and dependence symptoms	0.91 (0.81–1.03)	1.11 (1.03–1.20)**	1.27 (1.07–1.50)**
Depression symptoms ^a	1.27 (1.11–1.45)***	1.41 (1.23–1.60)***	1.34 (1.11–1.63)**
Age	1.01 (0.96–1.06)	0.93 (0.89–0.98)**	0.92 (0.86–0.98)**
Gender			
Female	0.94 (0.74–1.19)	1.44 (1.18–1.75)***	1.35 (0.99–1.84)
Male (reference)	1.00	1.00	1.00
Race/ethnicity			
Non-Hispanic Black	0.67 (0.38–1.18)	0.83 (0.53–1.31)	1.08 (0.60–1.94)
Native American	2.02 (0.81–5.06)	2.30 (1.08–4.89)*	1.09 (0.30–3.91)
Asian, Hawaiian, and Pacific	0.78 (0.25–2.44)	0.72 (0.43–1.20)	0.75 (0.24–2.31)
Islander			
Multiracial	0.98 (0.49–1.95)	1.06 (0.66–1.70)	0.87 (0.33–2.32)
Hispanic	0.92 (0.49–1.74)	1.26 (0.94–1.68)	1.52 (0.98–2.35)
Non-Hispanic White (reference)	1.00	1.00	1.00
Family income			
<\$20,000	1.07 (0.72–1.59)	1.57 (1.06–2.33)*	1.58 (0.89–2.81)
\$20,000–\$50,000	1.05 (0.74–1.49)	1.30 (0.98–1.73)	1.27 (0.79–2.01)
\$50,000–\$75,000	0.87 (0.57–1.33)	0.84 (0.53–1.33)	0.95 (0.52–1.75)
>\$75,000 (reference)	1.00	1.00	1.00

Note: Each column represents a separate multivariate logistic regression model. All *n* values are unweighted.

^aSuicidal ideation and behavior were excluded from the depression symptom count so as to avoid confounding the latter with the dependent variables.

^bExcluding participants with suicide attempts (subsample *n* = 5,863).

P* < .05; *P* < .01; ****P* < .001.

CI, confidence interval.

associations did not account for differences in suicide attempt rates.

Despite the methodological strengths of the current study, it is not without its limitations. First, due to the cross-sectional nature of the study, we cannot rule out the possibility that the suicide attempts preceded intravenous drug use. However, no previous theoretical or empirical work suggests that suicide attempts would increase the likelihood of injection substance use. Nonetheless, future directions would benefit from longitudinal data assessing for prospective relationships between injections substance use and SI, plans, and attempts.

Furthermore, other suicide risk factors, such as anxiety disorders and posttraumatic stress disorder (PTSD), were not included as covariates in these analyses. However, anxiety disorders have been found to be negatively associated with acquired capability for suicide,^[24] and PTSD has been demonstrated to be unrelated to substance use by injection.^[25,26] Nonetheless, future research may benefit from including a more comprehensive set of risk factors for suicidality.

The questions assessing injection substance use also constitute a limitation in the study design. The acquired

capability for suicide arises from habituation to painful experiences, not the presence of a single painful event. However, the use of dichotomous items assessing injection substance use does not indicate definitively whether pain habituation has occurred. Further, measurement of injection use as a dichotomous variable decreases both measurement precision^[27] and statistical power.^[28,29] Despite these limitations, the association between this behavior and suicide attempts was robust across several series of analyses in a theoretically consistent manner. Future research may yield a more nuanced understanding of suicide risk associated with injection substance use by incorporating a continuous measure of this behavior.

Another limitation of the current study is that other possible explanatory mechanisms that may underlie the relationship between injection substance use and suicide attempts were not tested. It may be suggested, for example, that impulsivity is a common underlying factor between IDUs and people with suicide attempts. Indeed, previous research has found impulsivity to be related to suicide attempts^[30–32] and drug abuse.^[33–35] It could be that since drug use by injection provides the quickest effects, impulsive substances users are more likely to adopt this means of administration. If this possibility

accounted for our results, we would expect IDUs to be less likely to have a suicide plan, as the more impulsive group would be also less likely to plan an attempt. The results of two multivariate models do not support this notion, as injection drug use was not associated with lower odds of suicide plans in the full sample or among ideators. Further, recent meta-analytic results suggest that the relationship between impulsivity and suicidality is relatively small.^[36]

Despite these limitations, the current study provides a nuanced and unique test of the interpersonal theory of suicide and has theoretical as well as clinical utility. Amidst a growing body of research, these results provide further empirical support for a theory that proposes distinct risk factors for suicide attempts. Such risk factors may improve precision for identifying individuals at highest risk for suicide attempts. Specifically, although substance users are traditionally at risk for suicidality, only a minority attempt suicide, making it challenging for mental health providers to identify those at highest risk. Although it is not currently a standard part of suicide screens with this population, method of drug use may be important to assess in this high-risk group. By identifying individuals who used injection as a method of drug administration, clinicians can very quickly and distinctly identify elevated risk for suicide attempt among an already high-risk population.

Acknowledgments. We acknowledge the Substance Abuse and Mental Health Services Administration (SAMHSA) for allowing the use of data from the National Survey on Drug Use and Health distributed by the Inter-University Consortium for Political and Social Research. Preparation of this manuscript was supported in part by the National Institute of Mental Health of the National Institutes of Health under Award Number R01MH101138 to the senior author. The content is solely the responsibility of the authors and does not necessarily represent the official views of the funding agency.

REFERENCES

- Xu J, Kochanek KD, Murphy SL, Arias E. Mortality in the United States, 2012. NCHS Data Brief 2014;168:1–8. Available at: cdc.gov/nchs/data/databriefs/db168.htm
- National Center for Injury Prevention and Control, Centers for Disease Control and Prevention. WISQARS Fatal Injuries: Mortality Reports. Atlanta, GA: Centers for Disease Control and Prevention; 2015. Available at: http://webappa.cdc.gov/sasweb/ncipc/mortrate10_us.html.
- Ten Have M, deGraaf R, Beekman A, et al. Incidence and course of suicidal ideation and suicide attempts in the general population. *Can Psychiatr Assoc J* 2009;54(12):824–833.
- Fergusson D, Beautrais A, Horwood L. Vulnerability and resiliency to suicidal behaviours in young people. *Psychol Med* 2003;33(1):61–73.
- Kessler R, Borges G, Walters E. Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. *Arch Gen Psychiatry* 1999;56(7):617–626.
- Nock M, Borges G, Williams D, et al. Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. *Br J Psychiatry* 2008;192(2):98–105.
- Klonsky E, May A. Differentiating suicide attempters from suicide ideators: a critical frontier for suicidology research. *Suicide Life Threat Behav* 2014;44(1):1–5.
- Joiner T. *Why People Die By Suicide* [e-book]. Cambridge, MA: Harvard University Press; 2005.
- VanOrden K, Witte T, Cukrowicz K, et al. The interpersonal theory of suicide. *Psychol Rev* 2010;117(2):575–600.
- VanOrden K, Witte T, Gordon K, et al. Suicidal desire and the capability for suicide: tests of the interpersonal-psychological theory of suicidal behavior among adults. *J Consult Clin Psychol* 2008;76(1):72–83.
- Nock M, Joiner T, Gordon K, et al. Non-suicidal self-injury among adolescents: diagnostic correlates and relation to suicide attempts. *Psychiatry Res* 2006;144(1):65–72.
- Borges G, Walters EE, Kessler RC. Associations of substance use, abuse, and dependence with subsequent suicidal behavior. *Am J Epidemiol* 2000;151:781–789.
- Cavanagh J, Carson A, Sharpe M, Lawrie S. Psychological autopsy studies of suicide: a systematic review. *Psychol Med* 2003;33(3):395–405.
- Wilcox H, Conner K, Caine E. Association of alcohol and drug use disorders and completed suicide: an empirical review of cohort studies. *Drug Alcohol Depend* 2004;76(Suppl. 7):S11–S19.
- Cottler L, Campbell W, Krishna V, et al. Predictors of high rates of suicidal ideation among drug users. *J Nerv Ment Dis* 2005;193(7):431–437.
- Pirkis J, Burgess P, Dunt D. Suicidal ideation and suicide attempts among Australian adults. *Crisis* 2000;21(1):16–25.
- Bernal M, Haro J, Alonso J, et al. Risk factors for suicidality in Europe: results from the ESEMED study. *J Affect Disord* 2007;101(1-3):27–34.
- Harris E, Barraclough B. Suicide as an outcome for mental disorders: a meta-analysis. *Br J Psychiatry* 1997;170(3):205–228.
- Dinwiddie S. Characteristics of injection drug users derived from a large family study of alcoholism. *Compr Psychiatry* 1997;38(4):218–229.
- Hakansson A, Bradvik L, Schlyter F, Berglund M. Factors associated with the history of attempted suicide: a criminal justice population examined with the Addiction Severity Index (ASI). *Crisis* 2010;31(1):12–21.
- Havens J, Sherman S, Sapun M, Strathdee S. Prevalence and correlates of suicidal ideation among young injection vs. noninjection drug users. *Subst Use Misuse* 2006;41(2):245–254.
- Turner C, Ku L, Rogers S, et al. Adolescent sexual behavior, drug use, and violence: increased reporting with computer survey technology. *Science* 1998;280(5365):867–873.
- Kessler R, Merikangas K. The National Comorbidity Survey Replication (NCS-R): background and aims. *Int J Methods Psychiatr Res* 2004;13(2):60–68.
- Silva C, Ribeiro J, Joiner T. Mental disorders and thwarted belongingness, perceived burdensomeness, and acquired capability for suicide. *Psychiatry Res* 2015;226(1):316–327.
- Hutton HE, Treisman GJ, Hunt WR, et al. HIV risk behaviors and their relationship to posttraumatic stress disorder among women prisoners. *Psychiatr Serv* 2001;52:508–513.
- Weiss NH, Tull MT, Borne MER, Gratz KL. Posttraumatic stress disorder symptom severity and HIV-risk behaviors among substance-dependent inpatients. *AIDS Care* 2013;25:1219–1226.

27. Ruscio A, Ruscio J. The latent structure of analogue depression: should the Beck Depression Inventory be used to classify groups? *Psychol Assess* 2002;14(2):135–145.
28. Cohen J. The cost of dichotomization. *Appl Psychol Meas* 1983;7(3):249–253.
29. MacCallum R, Zhang S, Preacher K, Rucker D. On the practice of dichotomization of quantitative variables. *Psychol Methods* 2002;7(1):19–40.
30. Brodsky B, Oquendo M, Ellis S, Haas G, Malone K, Mann J. The relationship of childhood abuse to impulsivity and suicidal behavior in adults with major depression. *Am J Psychiatry* 2001;158(11):1871–1877.
31. Dougherty D, Mathias C, Marsh D, et al. Laboratory measured behavioral impulsivity relates to suicide attempt history. *Suicide Life Threat Behav* 2004;34(4):374–385.
32. Maser J, Akiskal H, Clayton P, et al. Can temperament identify affectively ill patients who engage in lethal or near-lethal suicidal behavior? A 14-year prospective study. *Suicide Life Threat Behav* 2002;32(1):10–32.
33. Bickel W, Koffarnus M, Moody L, Wilson A. The behavioral- and neuro-economic process of temporal discounting: a candidate behavioral marker of addiction. *Neuropharmacology* 2014;76(Part B):518–527.
34. deWit H. Impulsivity as a determinant and consequence of drug use: a review of underlying processes. *Addict Biol* 2009;14(1):22–31.
35. Perry J, Carroll M. The role of impulsive behavior in drug abuse. *Psychopharmacology* 2008;200(1):1–26.
36. Anestis M, Soberay K, Gutierrez P, et al. Reconsidering the link between impulsivity and suicidal behavior. *Pers Soc Psychol Rev* 2014;18(4):366–386.