HHS Public Access

Author manuscript

Suicide Life Threat Behav. Author manuscript; available in PMC 2016 October 14.

Published in final edited form as:

Suicide Life Threat Behav. 2010 February ; 40(1): 14–21. doi:10.1521/suli.2010.40.1.14.

Suicide Attempts within 12 Months of Treatment for Substance Use Disorders

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Abstract

There are limited prospective data on suicide attempts (SA) during the months following treatment for substance use disorders (SUD), a period of high risk. In an analysis of the Drug Abuse Treatment Outcomes Study (DATOS), a longitudinal naturalistic multisite study of treated SUDs, variables associated with SA in the 12 months following SUD treatment were examined. Participants included 2,966 patients with one or more SUDs. By 12 months, 77 (2.6%) subjects had attempted suicide. Multivariate logistic regression analyses were used to identify variables associated with SA. Variables collected at baseline that were associated with SA included lifetime histories of SA, suicidal ideation (SI), and depression, cocaine as primary substance of use, outpatient methadone treatment, and short-term inpatient treatment. Male sex, older age, and minority race/ethnicity were associated with lower likelihood of SA. After controlling for baseline predictors, variables assessed at 12 months associated with SA included SI during follow-up and daily or more use of cocaine. The data contribute to a small but growing literature of prospective studies of SA among treated SUDs, and suggest that SUDs with cocaine use disorders in particular should be a focus of prevention efforts.

Individuals with substance use disorders (SUDs) are at high risk for suicide and suicide attempts (SA). In a comprehensive empirical review, Wilcox, Conner, and Caine (2004) showed that in comparison to the general population, individuals treated for alcohol dependence are at (OR, 95% CI) 9.8 (9.0–10.7) times greater risk to die by suicide and those treated for opiate dependence are at 13.5 (10.5–17.2) times greater risk. Using a nationally representative survey, Kessler, Borges, and Walters (1999) estimated that individuals with alcohol dependence are at 6.5 (3.6 – 11.5) times greater risk for SA compared to individuals without an alcohol use disorder, and that individuals with drug dependence are at 5.8 (3.3 – 10.1) times greater risk. Accordingly, efforts to prevent suicidal behavior must include a focus on SUDs. Although there can be no argument that a focus on suicide is critical, it is also essential to address SA because it is a major cause of injury (Stanford, Soden, Bartrop, Mikk, & Taylor, 2007) and expensive service utilization (Goldberg, Ernst, & Bird, 2007).

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SA may also be the best single predictor of eventual death by suicide (Harris & Barraclough, 1997) and shares many commonalities with suicide (Beautrais, 2001) including intent to die (Silverman, Berman, Sanddal, O'Carroll, & Joiner, 2007).

Risk Factors for SA after Treatment for SUDs

Formerly, data on risk factors for SA among SUDs recruited from SUD treatment settings were generally based on cross-sectional reports, a limited research design. In recent years this problem has been addressed by several prospective reports of mixed samples of SUDs (Bakken & Vaglum, 2007; Ilgen, Harris, Moos, & Tiet, 2007; Wines, Saitz, Horton, Lloyd-Travaglini, & Samet, 2004) and in specific diagnostic populations including opiate use disorders (Darke, Williamson, Ross, & Teesson, 2005; Darke et al., 2007), alcohol use disorders (Preuss et al., 2003), and alcohol use disorder plus depression. These data overwhelmingly show that a prior history of SA is predictive of SA (Darke, Williamson, Ross, & Teesson, 2005; Darke et al., 2007; Ilgen, Harris, Moos, & Tiet, 2007; Preuss et al., 2003; Wines, Saitz, Horton, Lloyd-Travaglini, & Samet, 2004). Other variables shown to be associated with higher risk of SA in at least three prospective studies of this population, suggesting a robust association, include suicide ideation (SI) (Darke et al., 2005; Darke et al., 2007; Ilgen et al., 2007), social isolation (Darke et al., 2005; Darke et al., 2007; Preuss et al., 2003), polydrug use (Darke et al., 2005; Darke et al., 2007; Preuss et al., 2003), and alcohol use and dependence (Darke et al., 2005; Darke et al., 2007; Ilgen et al., 2007). Other variables have been identified as prospective correlates of SA with less consistency including younger age (Preuss et al., 2003), depression (Wines et al., 2004), dysthymia (Bakken & Vaglum, 2007), substance induced psychiatric disorders (Preuss et al., 2003), benzodiazepine dependence (Wines et al., 2004), and chronic cocaine use (Ilgen et al., 2007). Variability in findings may be attributable to differences in samples and methods including varying measures and follow-up periods, among other factors. Interestingly, lone reports suggested that interaction with the criminal justice system (Ilgen et al., 2007) and generalized anxiety disorder (Bakke & Vaglum, 2007) may be protective from SA.

Purpose of the Present Study

This study is a secondary analysis of data from the Drug Abuse Treatment Outcome Study (DATOS; Hubbard et al., 1997), a longitudinal naturalistic multisite investigation examining the effectiveness of community treatments for SUDs. Our aims were to: 1) determine the correlates of SA in the 12 months following treatment for SUDs, and 2) identify variables measured at follow-up that were associated with SA in the 12 months following treatment, after accounting for variables measured at baseline. Addressing this second purpose may help identify variables that contribute information relative to SA risk beyond what is available at treatment entry. The independent variables were selected based on the prospective literature on SA among SUDs reviewed above (Bakken & Vaglum, 2007; Darke et al., 2005; Darke et al., 2007; Ilgen et al., 2007; Preuss et al., 2003; Wines et al., 2004). DATOS is a superior dataset for this purpose because of the availability of most of the predictors identified in these reports. DATOS' 12-month follow-up period is also optimal because risk for SA is highest in the first year after SUD treatment and declines thereafter (Darke et al., 2007).

Method

Participants and Data Collection

DATOS treatment programs were selected to maximize generalization of findings to community-based programs in mid-to-large urban areas in the United States. Specific methods and a detailed description of the sample have been published (Flynn, Craddock, Hubbard, Anderson, & Etheridge, 1997; Hubbard et al., 1997). The full sample consisted of 10,010 patients from 96 programs in 11 cities. Participants received outpatient methadone treatment (OMT), long-term residential (LTR), outpatient drug-free (ODF), or short-term inpatient (STI) treatments. Participation was voluntary and patients were informed that their decision would not impact their treatment and their data would not be revealed to treatment providers. Two interviews were administered at intake and completed by 8,109 participants. Patients from programs with greater than 20 participants were eligible for the follow-up sample. The 4,229 participants remaining were stratified by program and treatment duration of less than or more than 3 months (1 month for STI). From each treatment modality, 1,000 participants were randomly chosen for follow-up interviews. A greater proportion was chosen from the over 3 month (1 month for STI) group in order to ensure that substantial treatment was received by the majority of participants. Follow-up interviews took place 12 months after treatment was completed, with the exception that a large number of OMT patients were still in treatment (N = 355) during the follow-up period, and they were interviewed approximately 24 months after admission. Seventy-four percent of participants were located for follow-up (N = 3,147). Of those located, 94.2% were interviewed (N = 2,966), 3.7% refused the interview (N = 117), and 2.0% had died (N = 64). Cause of death was not reported.

Measures

Standardized interviews were used to collect self-report data. A description of the development of the DATOS assessment instruments is presented in previous publications (Flynn, et al., 1997; Horton, 1993). Many items were drawn from widely used instruments including the Addictions Severity Index (McLellan, Luborsky, Woody, & O'Brien, 1980) and The Structured Clinical Interview for DSM-III-R (Spitzer, Williams, Gibbon, & First, 1989). All substance use variables and the majority of the behavioral measures had previously been used in the Treatment Outcome Prospective Study (TOPS, Hubbard, Marsden, Cavanaugh, Rachal, & Ginzburg, 1988; Hubbard et al., 1989). Validity and reliability of self-report measures of drug use, SI, criminal behavior and employment were established in TOPS (Hubbard, Marsden, & Allison, 1984). Additional validation of self-report measures of cocaine- and other drug use were conducted prior to DATOS (Flynn, Craddock, & Dunteman, 1995).

Independent Variables (Baseline)—Dichotomized measures included marital status (divorced, widowed, separated or never married vs. married or living as married) and presence or absence of criminal justice involvement, lifetime depression, and lifetime SI. The SI item asked, "In (time period), have you (ever) thought a lot about ending your life or committing suicide?" Treatment modality was categorized into OMT, LTR, STI, and ODF (Hubbard et al., 1997). Preferred drug use was categorized into heroin, alcohol, other, and

crack/cocaine (Hubbard et al., 1997). Primary crack/cocaine users, heretofore called "cocaine", formed the largest group (see Table 1). For each drug, frequency of use was categorized into none, less than daily, and daily or more. Age, number of different drugs used weekly, and number of drug treatments were assessed with continuous measures.

Independent Variables (Follow-up)—Variables assessed at 12-month follow-up included frequency of different types of substance use, a continuous variable, and categorical measures of presence or absence of depressed mood or anhedonia for over 2 weeks, SI, and 12-step or self-help group participation.

Dependent Variable—For all analyses, presence or absence of SA over the 12-month follow-up, assessed at 12 months, served as the dependent variable. The SA item, an adaptation of the suicide attempt item in the Addiction Severity Index (McLellan, et, al., 1980), asked "In (time period), have you (ever) attempted suicide?"

Statistical Analyses

We built two multivariate logistic regression models (Hosmer & Lemeshow, 2000). The first "baseline" model included only independent variables collected during the initial assessments. Univariate logistic regression analyses were used to identify variables that were associated with SA at an alpha level of $p < .05$ for initial inclusion in the multivariate analysis. Backwards elimination was used because it avoids the potential biases of forward selection procedures (Hosmer & Lemeshow, 2000). The Hosmer-Lemeshow statistic was used to evaluate model fit, and odds ratios with 95% confidence intervals were derived using the method of maximum likelihood (Hosmer & Lemeshow, 2000). The second "follow-up" model added independent variables assessed at 12 months that showed univariate associations with SA. In this model, all baseline predictors were forced into the model regardless of statistical significance. Follow-up variables were then trimmed using backwards elimination, yielding a final multivariate model.

Results

Univariate Analyses

Five hundred and forty eight (18.5%) participants reported a lifetime SA, and 77 (2.6%) reported SA in the 12 months following treatment. In univariate analyses of predictors of SA collected at baseline (see Table 1), lifetime SA, lifetime SI, lifetime depression, STI, daily or more cocaine use, and white race were associated with a higher probability of SA. Male sex, age, and minority race were associated with lower probability of SA. Univariate analyses also identified statistically significant associations between variables measured at follow-up and SA (OR, 95% confidence interval): SI (659.2, 91.4–4752.4), depressed mood or anhedonia (11.4, 5.67–22.96), cocaine use less than daily (4.01, 2.33–6.91), cocaine use daily or more (6.34, 3.26–12.32), alcohol use less than daily (2.76, 1.58–4.84), alcohol use daily or more (3.80, 1.79–8.06), and involvement in a 12-step or self-help group (1.65, 1.05–2.61).

Multivariate Analyses

In the baseline multivariate model (see Table 2), lifetime SA, lifetime SI, depression history, STI, OMT, and white race were associated with higher probability of SA. Male sex, older age, minority race, and preference for other substance use compared to primary cocaine were associated with lower odds for SA [X^2 (8) = 11.46, p = .18, Nagelkerke R^2 = .19]. Because preference for other substance use was protective compared to primary cocaine use, we re-ran the analysis and redefined the reference group as other substance use in order to illustrate the increased likelihood of SA associated with preference for cocaine use. This machination yielded an OR (95% CI) for primary cocaine use of 3.04 (1.20–7.71).

In the follow-up model, after accounting for baseline predictors (OR, 95% CI), SI in the 12 months after treatment (448.0, 60.2–3336.8), and daily or more crack/cocaine use (3.80, 1.51–9.51), were associated with increased probability of SA. The model provided an adequate fit [X^2 (8) = 13.87, p = .08, Nagelkerke R^2 = .54]. The magnitude of the association of SI and SA in the follow-up model is clearly an overestimation because SA's, compared to non-SA's, may be presumed to have better retrospective recall of SI. Therefore, we re-ran the model without SI. In this model, depressed mood or anhedonia was a statistically significant correlate (6.47, 3.01–13.92). Comparable to the model with SI, the results pertaining to daily cocaine use and SA were highly significant (5.18, 2.36–11.35). Moreover, less than daily cocaine use was also associated with SA at a statistically significant level (3.17, 1.70–5.92). Importantly, none of the other follow-up variables showed a statistically significant association with SA, supporting the robustness of the result that cocaine use at follow-up is associated with SA.

Discussion

The major findings of the study are the increased probability (OR, 95% CI) for SA associated with primary cocaine use assessed at treatment entry (3.04, 1.20–7.71) and daily use of cocaine during follow-up (3.80, 1.51–9.51). Cornelius et al. (1998) had previously shown that cocaine use increased risk for a history of SA in depressed alcoholics, and Ilgen et al. (2007) found that chronic cocaine use conferred prospective risk for SA in a sample of treated SUDs. Although more prospective studies of SA and cocaine use disorders are needed, a literature is beginning to emerge to suggest that cocaine use disorders are an especially potent SUD. Mechanisms by which cocaine use disorders may promote SA risk include cocaine's pharmacological effects, in particular its influence on depressive symptoms in the early stages of withdrawal or "crash" (Husband et al., 1996). Results from the current study do not imply causality because they are correlational. Potential "non-causal" explanations include shared associations among cocaine use disorders, SA, and third variables such as childhood trauma history (Roy, 2001). There is also a paucity of prospective research on risk for suicide deaths associated with cocaine use disorders (Wilcox et al., 2004), and so the generalizability of the current findings to suicide is unclear, underscoring the need for further inquiry.

Consistent with several prior reports, lifetime SA (Darke et al., 2005; Darke et al., 2007; Ilgen et al., 2007; Preuss et al., 2003; Wines et al., 2004) and lifetime SI (Darke et al., 2005; Darke et al., 2007; Ilgen et al., 2007) were associated with SA at follow-up. These findings

underscore the idea that suicidality is prone to recur among SUDs and that much can be accomplished towards SA clinical risk assessment by obtaining a history of SI and SA at treatment entry. Present findings pertaining to associations of SA with younger age, female sex, white race, and depression are consistent with the general epidemiological literature on SA (Kessler et al., 1999).

Interestingly, participants treated in STI and OMT showed a higher probability of SA when compared to ODF. As DATOS is not a randomized controlled trial and there may have been patient selection effects, it cannot be concluded that ODF reduces SA risk more than STI or OMT. Nonetheless, STI findings underscore that hospitalization is not a panacea for suicidal behavior risk (e.g., King, Baldwin, Sinclair, & Campbell, 2001; Lawrence et al., 2000; Meehan et al., 2006). Data also suggest the potential importance of targeting OMT settings in suicide prevention efforts. An advantage of OMT as a suicide prevention venue is the potential for regular, long-term contact with clients. Our findings could also be used to inform tailored prevention efforts. Individuals at elevated risk for SA, such as depressed patients with a history of SA, could be evaluated and monitored for risk on an ongoing basis.

Limitations

SA was assessed with a single item that may have lead to an underestimation of its prevalence, and details about the attempts (e.g., method and intent) were not available. The prevalence of SA of 2.7% was lower compared to other prospective studies of patients' who received treatment for SUDs wherein prevalence rates ranged from 4% to 19% observed over 30 days to 6 years (Bakken & Vaglum, 2007; Darke et al., 2005; Darke et al., 2007; Ilgen et al., 2007; Preuss et al., 2003; Wines et al., 2004). The reason for this discrepancy is not clear, and the studies are difficult to compare in light of differences in samples and methods. The relatively low number of SA at follow-up prevented post-hoc analyses exploring potential moderators of SA (e.g., sex). Generalization to untreated SUDs is unclear. Patients self-selected into treatments and OMT patients completed follow-up interviews 24 months after the start of treatment, indicating a different follow-up period, and so results pertaining to SA and treatment venue are difficult to interpret and compare. SA is an imperfect proxy for death by suicide and these results may not generalize to suicide deaths which show a different risk profile in some respects, particularly for sex, age, and method of suicidal behavior (Beautrais, 2001). Although numerous correlates of behavior relevant to substance abusers were examined, the list was not exhaustive, as one example, data on hopelessness were not available, a potentially important correlate (Beck, Weissman, & Kovacs, 1976; Beck, Steer, & McElroy, 1982).

Conclusion

This study was a secondary analysis of a large, multisite, prospective study of SUDs that examined risk factors for SA in the 12 months following treatment. Independent variables were carefully selected based on the available literature. Key findings were that primary cocaine users, as determined at treatment entry, and daily cocaine use during follow-up were associated with SA during the 12-month follow-up, after rigorously adjusting for other correlates. Findings underscore the importance of further study of chronic cocaine use and

dependence in SA and suicide and suggest that this population may require enhanced suicide prevention and intervention efforts.

Acknowledgments

This paper is based upon work supported in part by the Office of Research and Development, Department of Veterans Affairs, the Center of Excellence at the Canandaigua VA Medical Center, and United States Public Health Service grants R01AA016149 and T32 MH20061.

We thank Mark A. Ilgen, Ph.D. of the Serious Mental Illness Treatment Research and Evaluation Center (SMITREC) at the Ann Arbor VA Medical Center for his helpful comments.

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Table 1

Univariate Predictors of Lifetime SA at Baseline, and SA in 12 Months after Treatment (N=2,966)

Baseline Variables	Strata	N (%) or Mean (SD)	OR (95% CI)
Age (continuous)		33.6 (7.4)	.96 (.93–.99)*
Sex	Male	1,909 (64.4%)	.38 (.24–.61)
	Female	1,057 (35.6%)	1.00
Race/Ethnicity	Minority	1,764 (59.5%)	.50 (.32–.79)***
	White	1,202 (40.5%)	1.00
Married	Yes	977 (32.9%)	.69 (.44–1.09)
	No	1,984 (66.9%)	1.00
Criminal justice status	Yes	1,319 (44.5%)	.84 (.53–1.33)
	No	1,642 (55.4%)	1.00
Preferred drug	Heroin	748 (25.2%)	.77 (.44–1.37)
	Alcohol	286 (9.6%)	1.32 (.67–2.61)
	Other	491 (16.6%)	.56 (.26–1.20)
	Coke/Cocaine	1,369 (46.2%)	1.00
Cocaine use	Daily or more	841 (28.4%)	1.88 (1.02–3.48)*
	Less than daily	1287 (43.4%)	1.26 (.68–2.32)
	None	832 (28.1%)	1.00
Heroin use	Daily or more	767 (25.9%)	.84 (.49–1.44)
	Less than daily	224 (7.6%)	.64 (.23–1.78)
	None	1971 (66.5%)	1.00
Alcohol use	Daily or more	551 (18.6%)	1.52 (.75–3.07)
	Less than daily	1675 (56.5%)	1.32 (.73–2.38)
	None	731 (24.6%)	1.00
# Drugs used weekly or more (continuous)		1.81 (1.16)	1.02 (.84–1.24)
Treatment Modality	LTR	676 (22.8%)	1.15 (.53–2.49)
	STI	799 (26.9%)	2.42 (1.26–4.64)**
	OMT	727 (24.5%)	1.56 (.76–3.18)
	ODF	764 (25.8%)	1.00
# Drug treatments (continuous)		2.06 (3.78)	1.02 (.96–1.07)
Depression	Yes	1412 (47.6%)	4.50 (2.50–8.09)***
	No	1430 (48.2%)	1.00
SI ever	Yes	957 (32.3%)	5.48 (3.32–9.04)***
	No	1,999 (67.4%)	1.00
SA ever	Yes	548 (18.5%)	6.60 (4.16–10.50)***
	No	2,396 (80.8%)	1.00

Note. LTR = long-term residential, STI = short-term inpatient, OMT = outpatient methadone treatment, ODF = outpatient drug-free, SI ever = history of suicidal ideation, SA ever = history of suicide attempts.

* $p < .05$,

** $p < .01$,

*** p< .001

Table 2

Multivariate Logistic Regression of SA at 12 Month Follow-up Using Baseline Variables (N = 2731)

Variable	Strata	OR (95% CI)
Age (continuous)		.96 (.92–.99) *
Sex	Male	.50 (.30–.82) *
	Female	1.00
Race	Minority	.53 (.32–.90) *
	White	1.00
Preferred Drug	Heroin	.58 (.24–1.41)
	Alcohol	1.14 (.53–2.43)
	Other	.33 (.13–.83) *
	Cocaine	1.00
Treatment Modality	LTR	1.00 (.43–2.34)
	STI	2.42 (1.17–5.02) *
	OMT	2.94 (1.08–8.01) *
	ODF	1.00
Depression	Yes	2.27 (1.20–4.26) *
	No	1.00
SI ever	Yes	1.98 (1.06–3.70) *
	No	1.00
SA ever	Yes	3.43 (1.93–6.09) ***
	No	1.00

Note. LTR = long-term residential, STI = short-term inpatient, OMT = outpatient methadone treatment, ODF = outpatient drug-free, SI ever = history of suicidal ideation, SA ever = history of suicide attempts.

* p < .05,

** p< .01,

*** p< .001