

Suicide Attempts Among Substance Use Disorder Patients: An Initial Step Toward a Decision Tree for Suicide Management

Quyen Q. Tiet, Mark A. Ilgen, Hilary F. Byrnes, and Rudolf H. Moos

Background: Little empirical data are available to develop profiles of patients who attempt suicide or to formulate a decision tree for suicide management. This study identifies profiles of patients who have a high risk of suicide attempt and takes a first step toward developing a decision tree to classify high-risk patients.

Methods: Based on a cross-sectional, nationwide cohort of substance use disorder patients ($N = 34,251$) in 150 Veterans Affairs (VA) facilities, a total of 5,671 patients who reported suicidal ideation in the 30 days before intake assessment were included in receiver operating characteristic (ROC) analyses to identify the 30-day risk of an actual suicide attempt. Clinical diagnostic and Addiction Severity Index interview data were used.

Results: Results provide an initial decision tree to classify high-risk patients with sensitivity ranging from 0.33 to 0.89, and specificity, from 0.42 to 0.87. The factors included in the decision tree encompass history of prior suicide attempts, current drinking to intoxication, current cocaine use, first occasion of suicidal ideation, and difficulty controlling violent behavior.

Conclusions: To our knowledge, this is the first attempt to use empirical data to provide information to eventually establish a decision tree for clinical management of patients with suicidal ideation. The findings show that profiles of patients who are at high risk of suicide attempts can be effectively identified using ROC, with relatively good sensitivity and specificity.

Key Words: Substance Use Disorder Patients, Suicide Attempt and Ideation, Clinical Management, Addiction Severity Index.

SUICIDE ATTEMPTS ARE common; about 765,000 suicide attempts occur each year (Arias et al., 2003), and the lifetime prevalence of suicide attempts is 4.6% in the United States (Kessler et al., 1999). About 10 to 15% of persons in contact with health care services as a result of a first suicide attempt eventually die by suicide (Cullberg et al., 1988; Maris, 1992), and suicide was the 11th leading cause of death in the United States in 2001 (Arias et al., 2003).

Specifying the risk of suicide or suicide attempt is one of the biggest clinical challenges for mental health providers, because their patients commonly present with suicidal ideation and these patients have a relatively high risk of

suicide attempt and suicide. Up to 3.4% of male and 4.4% of female substance use disorder patients may have attempted suicide in the 30-day period before their intake assessment for treatment (Tiet et al., 2006).

A number of factors have been associated with suicide attempts. Past suicide attempts are one of the strongest risk factors for future suicide attempts (e.g., Hjelmeland, 1996; Oquendo et al., 2002; Joiner et al., 2005). The WHO/Euro Multicentre Study on Parasuicide found that about 50% of individuals who attempted suicide had a history of at least one previous suicide attempt (Bille-Brahe et al., 1997). Prior suicide attempts may be associated with up to a 38-fold increase in suicide risk (Harris and Barraclough, 1997), and suicide victims with a history of a prior suicide attempt account for 20 to 65% of deaths by suicide (Dorpat and Ripley, 1967).

Alcohol and drug use predict subsequent suicide attempts (Borges et al., 2000). Autopsy studies have found the presence of alcohol in 20 to 50% of persons who die by suicide (Hayward et al., 1992). Although the empirical evidence is limited (Pirkola et al., 2000), drinking to intoxication may be important in assessing risk of suicide attempt (American Psychiatric Association, 2003). Substance use disorders generally increase the likelihood of a suicide attempt, but the association between specific types of drug use and suicide attempt risk is not clear

From the Center for Health Care Evaluation, VA Palo Alto Health Care System, Menlo Park, California.

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Reprint requests: Quyen Q. Tiet, Center for Health Care Evaluation, VA Palo Alto Health Care System, 795 Willow Road (MPD-152), Menlo Park, CA 94025; Fax: 650-617-2736; E-mail: Quyen.Tiet@va.gov or Tietq2@yahoo.com

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(Beautrais et al., 1998; Borges et al., 2000). Borges et al. (2000) found that current substance use, even in the absence of abuse or dependence, is a significant risk factor for unplanned suicide attempts among individuals who have suicidal ideation. With or without substance use, there is strong evidence for the role of impulsivity and aggressive behavior in suicide across diagnostic groups (Conner et al., 2001), and elevated levels of impulsivity and aggression are common in individuals with a history of attempted suicide (Brodsky et al., 2001; Mann et al., 1999).

Many psychiatric disorders are associated with suicide attempts, including mood disorders, substance-related disorders, psychotic disorders, anxiety disorders, and personality disorders (Regier et al., 1988; Weissman et al., 1989; Petronis et al., 1990; Clark and Goebel-Fabbri, 1999; Mann et al., 1999; Radomsky et al., 1999; Tiet et al., 2006). Between 23 and 55% of patients with schizophrenia report prior suicide attempts (American Psychiatric Association, 2003). Individuals with bipolar disorder may be 5 to 10 times more likely to attempt suicide during their lifetime as are individuals in the general population and at least 20 times more likely to attempt suicide than individuals with no history of psychiatric illness (Regier et al., 1988). Borderline and antisocial personality disorders are also associated with specific increases in suicide risk (Duberstein and Conwell, 1997).

A few studies (Goldstein et al., 1991; Pokorny, 1983, 1993) have attempted to empirically develop models to predict suicide or suicide attempt. Using a sample of 4,800 Veterans Affairs (VA) psychiatric inpatients to create a model that included history of suicide attempt, having been considered suicidal, schizophrenia, or mood disorder diagnoses, and being unmarried, Pokorny (1983) used stepwise discriminant analysis to identify 63 of 174 attempted suicides (sensitivity = 0.36); however, there were a large number of false-positive predictions (specificity not reported). Pokorny (1993) later reanalyzed the data using logistic regression; this model had high specificity (0.992–0.954), but low sensitivity (0.123–0.288), in predicting suicide.

Goldstein et al. (1991) tested a model on a sample of 1,906 inpatients with affective disorders, on whom death certificates were obtained between 2 and 12 years later. The model identified the number of suicide attempts, suicidal ideation, bipolar affective disorder, male gender, poorer outcome at discharge, and family history of mania as risk factors for suicide, but had very poor sensitivity (0.022 or lower).

Given the compelling risks posed by patients who attempt suicide, it is critical for clinicians to know when to intervene. However, current guidelines for managing suicidal patients are not easily translated into clinical practice. Several guidelines (e.g., Kral and Sakinofsky, 1994; Sanchez, 2001; American Psychiatric Association, 2003) including guidelines for the management of suicidal patients with substance use disorders (Weiss and Hufford,

1999) encompass a large number of risk factors (e.g., previous attempts, drug use). The factors identified by these guidelines are very common among psychiatric and substance use disorder patients, particularly those who report suicidal ideation, and most of these patients meet at least some levels of the high-risk criteria. In other words, these factors do not differentiate between suicide ideators who attempt suicide and those who do not. Furthermore, these guidelines provide lists of risk factors, but not constellations or profiles among these factors in relation to suicide attempts; consequently, they are not easily translated into clinical practice.

In summary, given the difficulties in identifying the risk of suicide attempt and the lack of a guideline that is easily translated into practice, clinicians working with psychiatric patients do not have a practical and easily implemented decision tree that is grounded in empirical evidence. This study takes a first step toward identifying information that eventually may be translated into practice by developing a decision tree and profiles of patients who attempt suicide, using a cross-sectional, nationwide sample focusing on suicide attempts in the 30 days before assessment. Relying on diagnoses identified by clinicians to reflect the reality of clinical practice and data that are easily translated into clinical practice, the study attempts to identify factors that are related to concurrent suicide attempts and provide profiles of patients who attempted suicide and an initial basis to guide future prospective research. To reflect the reality of clinical practice, this study focused only on patients who endorsed suicidal ideation.

MATERIALS AND METHODS

Participants

To evaluate the process and outcome of care for patients with substance use disorders (SUD), the Department of Veterans Affairs (VA) mandated that clinicians, as part of ongoing clinical practice, use the Addiction Severity Index (ASI, McLellan et al., 1992) to assess all patients at entry into any SUD treatment program nationwide. We report here on findings for a cohort of SUD patients ($N = 34,251$) seeking treatment in one of 150 facilities across the United States.

Procedure

The VA organized a nationwide program to train staff members to conduct ASI interviews to insure consistency and reliability (Moos et al., 1998). The VA Employee Education System coordinated a series of eight 2-day training sessions that were conducted by expert ASI interviewers. Training sessions were held in different cities around the United States and included information about the rationale and purpose of the ASI, a review of ASI interview procedures, and videotaped presentations of ASI interviews (Fureman et al., 1990). Patients were interviewed with the ASI after entering SUD treatment.

Measures

Addictions Severity Index. The ASI is one of the most commonly used instruments for SUD treatment and research; therefore, it provides practical utility for the current findings. The ASI has

established reliability and validity (McLellan et al., 1985; Argeriou et al., 1994; Zanis et al., 1994) and provides indices (referred to as composite scores) of psychiatric, alcohol, drug, medical, interpersonal, employment, and legal problems/functioning in the patient's lifetime and within the 30 days before assessment. However, composite scores (ranging 0–1) are not intuitively meaningful to clinicians and require complicated computation; therefore, their practical utility is limited. To increase the utility of the findings of this study, individual items that are part of the ASI composite scores ("core" items), rather than the composite scores, were used for the analyses. Furthermore, all of the multiple versions of the ASI contain the "core" items, thus increasing the likelihood of future replications.

Suicidal Ideation and Suicide Attempts. Based on the ASI interview (McLellan et al., 1992), clinical staff assessed suicidal ideation and suicide attempts in the past 30 days and in the patients' lifetime before the past 30 days. Only patients who endorsed suicidal ideation (Yes/No) in the past 30 days were included in the analyses. Suicide attempt in the past 30 days (Yes/No) was used as the outcome measure.

Psychiatric Diagnoses. We obtained information from nationwide VA databases about patients' psychiatric and substance use diagnoses in the specified episode of care. We focused on whether the following current diagnoses were present (coded "1") or absent ("0"): psychotic disorders, depressive disorders, posttraumatic stress disorder (PTSD), other anxiety disorders, alcohol abuse/dependence, drug abuse/dependence, and personality disorders (antisocial and borderline). Diagnostic and ASI interviews were conducted by experienced clinicians during regular clinical intake interviews in the usual process of care.

Demographic Factors. Demographic information was available from the ASI. Age and education were analyzed as continuous variables in number of years. Race was categorized as Caucasian versus other (1 vs 0), and marital status was coded as married versus not married (1 vs 0).

Data Analyses. Receiver operating characteristic (ROC) analysis was used to identify demographic and diagnostic factors and ASI items that maximally discriminated between patients with and without a suicide attempt in the past 30 days among patients with suicidal ideation. Receiver operating characteristic analyses identify higher order relationships between predictors and allow for the identification of homogenous subgroups of patients with similar risk (Kiernan et al., 2001). Most important for the current purpose, ROC analysis yields an empirically derived decision tree for identifying high-risk patients. Receiver operating characteristic also allows the level of sensitivity and specificity to be tailored to a particular research question. Because of the importance of detecting suicidal attempts, the present study set the weight at 0.70 (instead of 0.5), favoring sensitivity over specificity. The specific software used and its documentations are available at <http://mirecc.stanford.edu/>.

Based on the results of the decision tree, sensitivity and specificity were calculated on 3 hypothetical models using varying cut points of the percentages (10, 20, and 30%) of patients who attempted suicide in the past 30 days. A model that uses a cut point at 30% means that the model requires the true-positive rate to be at least a 30% and that 30% (or higher) of a group of patients are predicted to attempt suicide. In other words, the 30% model tolerates up to 70% of patients being incorrectly identified as high risk because they will not attempt suicide (false-positive).

RESULTS

Patients reporting no suicidal ideation were excluded in the ROC analyses. Over 16% ($n = 5,671/34,251$) of patients in this sample reported suicidal ideation in the

Table 1. Demographic and Diagnostic Characteristics and Suicide History of Patients With and Without Suicidal Ideation

Variable	Patients with suicidal ideation ($n = 5,671$)	Patients without suicidal ideation ($n = 28,580$)	Test statistic
Demographics			
Age (SD)	44.6 (7.7)	46.9 (9.8)	$F = 286.1^*$
Education (SD)	12.6 (2.0)	12.5 (2)	$F = 8.8^*$
Female	221 (4%)	788 (3%)	$\chi^2 = 22.5^*$
Caucasian	3,299 (59%)	15,386 (55%)	$\chi^2 = 37.5^*$
Unmarried	4,577 (82%)	21,851 (77%)	$\chi^2 = 52.0^*$
Employed full time	1,843 (33%)	10,514 (37%)	$\chi^2 = 38.0^*$
Diagnoses			
Depressive disorders	3,412 (61%)	9,715 (34)	$\chi^2 = 1,392.8^*$
Psychoses	1,257 (22%)	3,742 (13%)	$\chi^2 = 316.0^*$
PTSD	1,852 (3%)	5,346 (19%)	$\chi^2 = 561.6^*$
Other anxiety disorders	1,628 (29%)	4,428 (16%)	$\chi^2 = 573.7^*$
Alcohol abuse/dependence	4,931 (88%)	24,090 (85%)	$\chi^2 = 32.1^*$
Drug abuse/dependence	4,284 (77%)	19,421 (69%)	$\chi^2 = 137.2^*$
Personality disorders	1,368 (24%)	2,991 (11%)	$\chi^2 = 800.9^*$
Suicide history			
Lifetime attempt	3,182 (57%)	5,820 (21%)	$\chi^2 = 3,175.5^*$
Attempt in 30 days	1,021 (18%)	142 (1%)	$\chi^2 = 4,463.6^*$

PTSD, posttraumatic stress disorder.

past 30 days (Table 1). Compared with those who did not, patients who reported suicidal ideation were significantly younger (44.6 vs 46.9 years of age) and more likely to be female (4 vs 3%), Caucasian (58.9 vs 54.5%), unmarried (83 vs 79%), and unemployed (66.9 vs 62.6%). These patients also were more likely to have psychiatric diagnoses, including depressive disorders, psychoses, PTSD, other anxiety disorders, alcohol abuse/dependence, drug abuse/dependence, and personality disorders.

The ROC analyses were based only on patients who reported suicidal ideation within the 30 days before assessment. Out of the 5,671 individuals who reported suicidal ideation in the past 30 days, 1,031 (18%) reported a suicide attempt within the same 30-day period. Demographic factors, diagnoses (yes/no), and the core ASI items were analyzed using ROC based on their ability to identify patients who reported a suicide attempt in the past 30 days.

The ROC analysis resulted in the formation of a decision tree with 8 distinct groups, which are presented in Fig. 1. The pathways determining group membership are described in detail below.

Among patients who reported suicidal ideation, a history of a prior suicide attempt was the strongest variable discriminating between patients with and without a suicide attempt in the past 30 days [$\chi^2(1, N = 5,671) = 317.3, p < 0.01; k = 0.23$]. For patients who reported a suicide attempt before the past 30 days, 26% reported a suicide attempt in the past 30 days, compared with 8% for those without a history of a prior suicide attempt.

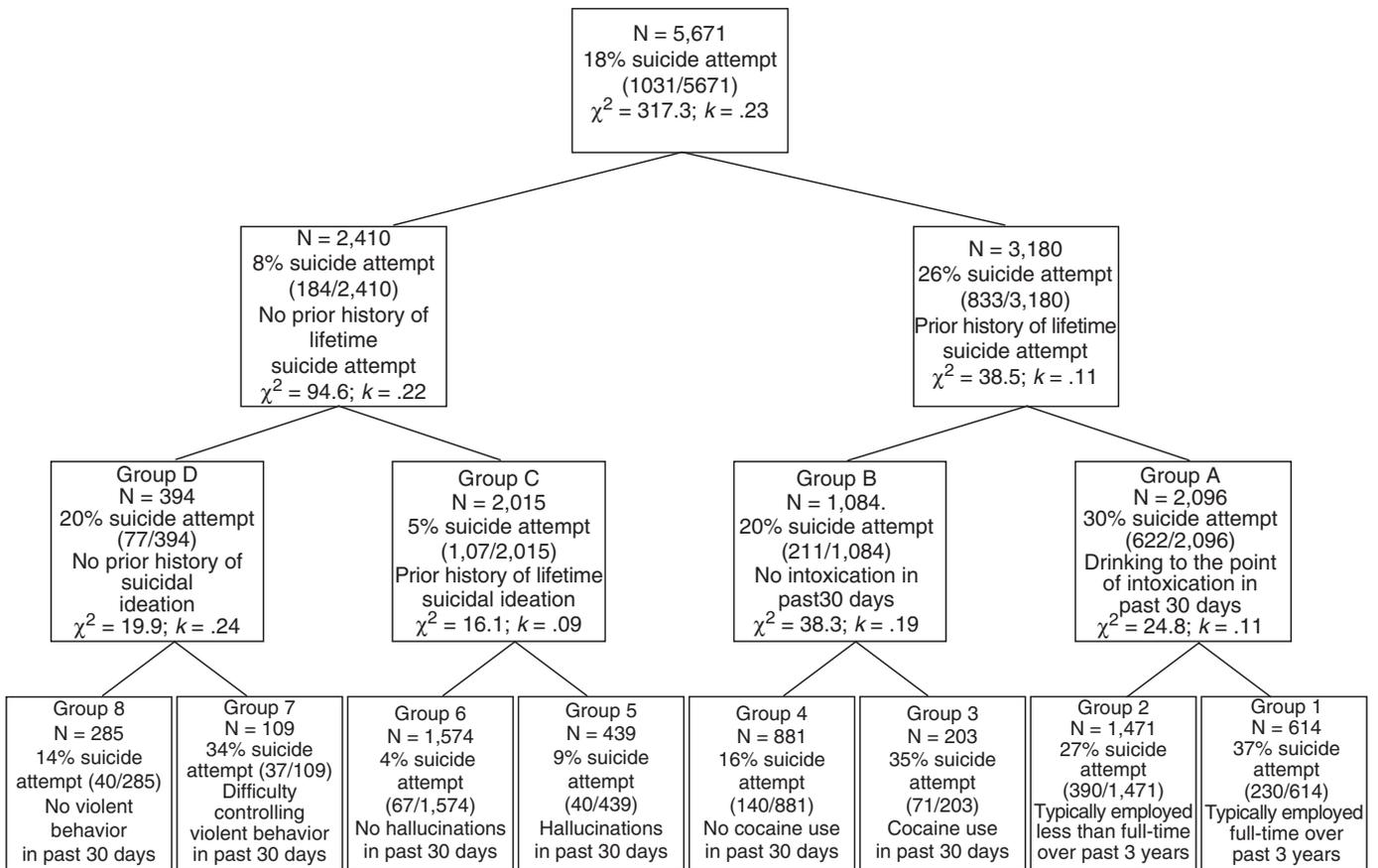


Fig. 1. Decision tree predicting likelihood of a suicide attempt among patients who report suicide ideation. Note. Owing to missing data on individual measures, the *n*'s for all subgroups do not equal the overall *n* for the sample.

Patients With a Prior Suicide Attempt

Within the group of 3,180 patients who reported a prior suicide attempt, the ROC analysis further divided these patients based on whether or they drank alcohol to the point of intoxication in the past 30 days [$\chi^2(1, n = 3,180) = 38.5, p < 0.01; k = 0.11$]. Thirty percent of patients who drank alcohol to intoxication (group A) reported a suicide attempt in the past 30 days, compared with 20% of those who reported no alcohol intoxication in the past 30 days (group B).

For the 2,096 patients who reported alcohol intoxication in the past 30 days, whether they were typically employed full-time in the past 3 years further discriminated between those with and without a suicide attempt in the past 30 days [$\chi^2(1, n = 2,096) = 24.8, p < 0.01; k = 0.11$]. A total of 27% of those who were not typically employed full time over the past 3 years reported a suicide attempt in the past 30 days (group 2). By comparison, 37% of patients who drank to intoxication in the past 30 days and were typically employed full time in the past 3 years reported a suicide attempt in the past 30 days (group 1). Receiver operating characteristic analyses ended in both branches of the tree because no other variable provided significant discrimination.

For the 1,084 patients who reported no recent alcohol intoxication, the use of cocaine (no/yes) further

discriminated between those with and without a suicide attempt in the past 30 days [$\chi^2(1, n = 1,084) = 38.3, p < 0.01; k = 0.19$]. Cocaine use in the past 30 days was associated with over a 2-fold increase in rates of suicide: 35% of patients who used cocaine (group 3) reported a suicide attempt in the past 30 days compared with 16% of those who reported no cocaine use (group 4). No other variable provided significant discrimination in this branch of the analysis.

Patients Without a Prior History of a Suicide Attempt

The ROC analysis further divided the subgroup of 2,410 patients who reported no prior suicide attempt based on the presence or absence of suicidal ideation in their lifetime before the past 30 days [$\chi^2(1, n = 2,410) = 94.6, p < 0.01; k = 0.22$]. About 5% of patients with a prior history of suicidal ideation (group C) reported a suicide attempt in the past 30 days compared with 20% of those who reported no prior history of suicidal ideation (group D).

Within group C, the presence or absence of hallucinations in the past 30 days further divided patients who had no prior history of suicide attempt but had experienced previous suicidal ideation [$\chi^2(1, n = 2,015) = 16.1, p < 0.01; k = 0.09$]. Among patients who experienced recent

Table 2. Sensitivity and Specificity of Models Predicting That Varying Proportions of Patients Will Attempt Suicide

Models	Predicted Attempt	Actual Yes	Attempt No	Sensitivity	Specificity	% Missed	% False -	% False +	+ Predictive Value	- Predictive Value	% correct	Efficiency	Sensitivity+ Specificity
Ideal model	Yes	1,015	0	1	1	0	0	0	1	1	100	100%	2
	No	0	4,561										
Least conservative ^a	Yes	0	0	0	1	100	18	—	—	0.82	81	81%	1
	No	1,015	4,561										
30% Model	Yes	338	588	0.33	0.87	67	15	63	0.37	0.85	95	77%	1.20
	No	677	3,973										
20% Model	Yes	728	1,669	0.72	0.63	28	9	70	0.30	0.90	79	65%	1.35
	No	287	2,892										
10% Model	Yes	908	2,655	0.89	0.42	10	5	75	0.25	0.95	62	50%	1.31
	No	107	1,906										
Most conservative ^b	Yes	1,015	4,561	1	0	0	—	82	0.18	—	18	18%	1
	No	0	0										
Total N = 5,612		1,015	4,561										

^aPredicting that no patients will attempt suicide.

^bPredicting that all patients will attempt suicide.

hallucinations, 9% reported a suicide attempt in the past 30 days (group 5), whereas among patients who experienced no hallucinations in the past 30 days (group 6) only 4% reported a suicide attempt in the past 30 days.

In the group of 394 individuals without a prior lifetime suicide attempt or lifetime suicidal ideation (group D), experiencing difficulty controlling violent behavior in the past 30 days was associated with the risk of a suicide attempt [$\chi^2(1, n = 394) = 19.9, p < 0.01; k = 0.24$]. Thirty-four percent of the patients who experienced difficulty controlling violent behavior in the past 30 days reported a suicide attempt in the past 30 days (group 7). By comparison, less than half (14%) of those with no recent experience of difficulty controlling violent behavior reported a suicide attempt in the past 30 days (group 8). No other variable provided further significant discrimination.

Model Sensitivity and Specificity

A hypothetical model that requires at least 30% true positives would only include groups 1, 3, and 7. This model has a sensitivity of 0.33 and a specificity of 0.87, misses 67% of the positive cases, and has 63% false positives (see Table 2). A model that requires at least 20% of true positives would include groups 1, 2, 3, and 7. This model has a sensitivity of 0.72 and a specificity of 0.63, misses 28% of the positive cases, and has 70% false positives. A model that requires at least 10% true positives would include 6 of the 8 groups of patients (all except groups 5 and 6). This model has a sensitivity of 0.89 and a specificity of 0.42, misses only 10% of the positive cases, but has 82% false positives.

DISCUSSION

The results of this study need to be interpreted in light of the following limitations. First, because of the cross-sectional nature of the data, the findings identify only associations, are not predictive, and do not provide

information on whether suicide attempts preceded or followed some of the key discriminating variables. For example, assuming that the patients reported accurately, lifetime history of suicide attempts before the past 30 days preceded suicide attempts in the past 30 days. However, the temporal sequence of other events, such as drinking alcohol to the point of intoxication or cocaine use, is less clear, even though it seems much more likely that suicide attempts would follow than lead to severe substance use. Second, suicide attempts were based on uncorroborated patients' reports, and therefore may have been under- or overestimated. Third, this study utilized diagnostic and ASI data provided by clinicians during regular clinical care and thus may lack the reliability of more structured assessments under research conditions. However, this method of data collection mirrors the actual clinical situation in which decisions about the clinical management of suicide are made. Finally, this study is based on primarily a male VA SUD patient sample; the generalizability of the findings to other samples is unknown.

Notwithstanding these limitations, this study provides a first attempt to identify profiles of SUD patients who are associated with a higher rate of suicide attempts. The profiles are based on history of prior suicide attempts, first occasion of suicidal ideation, current drinking to intoxication, current cocaine use, and difficulty controlling violent behavior. This is also a first attempt toward formulation of an empirically derived decision tree to supplement existing guidelines (e.g., American Psychiatric Association, 2003) that primarily provide lists of factors associated with increased risk for suicide. An empirically guided model and profiles of high-risk patients provide useful information that eventually may be translated into practice guidelines. However, such models and profiles can only be considered an adjunct to clinical judgment. Furthermore, this study also considered the short-term (30 days) factors associated with suicide attempts, rather than longer-term factors, such as suicide attempts over the past year

or during the lifetime. Short-term associations are particularly relevant to the clinical management of suicidal patients.

One way to interpret the ROC findings is to focus on each of the factors in the decision tree. The present findings are consistent with prior research (e.g., Joiner et al., 2005), showing that recent suicide attempts are more common in patients who have made a previous suicide attempt. Among suicidal SUD patients who had a previous suicide attempt, over a quarter attempted suicide in the 30-day period before assessment, which was more than a 3-fold increase (26 vs 8%) compared with suicidal SUD patients who had no prior history of suicide attempts. However, the association between past and current suicide attempts varied for different groups of patients. Among patients with a lifetime history of suicide attempt, recent alcohol or cocaine use further increased the risk of a recent attempt. Additionally, among SUD patients who had no lifetime history of suicide attempt, patients who thought about suicide for the first time were at particularly high risk for suicide attempts. One-fifth of these patients attempted suicide, a 4-fold increase (20 vs 5%) compared with suicidal patients with past suicidal ideation.

Alternatively, the findings can be interpreted by ranking the groups from highest to lowest risk and examining the profiles of the groups of high-risk patients. The highest-risk groups of patients had a 20% or higher chance of attempting suicide (groups 1, 2, 3, and 7). One of these groups had a lifetime history of suicide attempts and drank to intoxication in the past 30 days (group A). Prior suicide attempts may reflect a unique pattern of coping to escape difficult or painful situations or emotional distress. Joiner (2004) suggests previous attempts provide practice and, therefore, lead to being more able and less fearful to attempt suicide again. Drinking to intoxication among these patients further increases the risk of suicide attempts, perhaps because heavy drinking is a response to distress but does not effectively alleviate it. Moreover, alcohol abuse impairs judgment, reduces inhibition, and increases impulsivity, thereby further increasing the risk of a suicide attempt.

These 2 risk factors are associated with a high likelihood of a suicide attempt both among patients who have and among those who have not been employed full time in the past 3 years. However, it may take a higher threshold of stress to trigger heavy drinking among higher functioning individuals who have typically been employed full time in the past 3 years than among those who have not; therefore, drinking to intoxication among these individuals may be an indicator of more severe stress and related to a higher suicide attempt risk.

Besides alcohol use, cocaine use is another factor that is related to a higher rate of suicide attempts. Suicidal patients who had a history of suicide attempts and used cocaine in the past 30 days had a 35% chance of attempting suicide in that 30-day period. This finding is consistent with previous research showing that cocaine use is related

to suicide attempts (e.g., Borges et al., 2000). Similar to alcohol use, cocaine use may reflect a response to stress and may not effectively reduce it. In addition, cocaine use results in cognitive impairment and affective dysregulation, which may heighten the risk of a suicide attempt. These considerations may not be specific to cocaine use; any drug use may raise the risk of suicide attempts for SUD patients who have a history of suicide attempt. Future studies should examine the relative strength of the relationships between the use of cocaine and other specific drugs and suicide attempts.

Another group of high-risk SUD patients did not have prior suicidal ideation but did have difficulty controlling violent behavior. Individuals who think about suicide but do not attempt it may achieve a certain degree of protection in that their prior experience serves as a guide to caution them and help them cope. Therefore, patients who think about suicide for the first time have a higher risk of a suicide attempt, especially if they have difficulty controlling violent behavior. These individuals are more likely to act impulsively on their suicidal ideation, and their tendency to act out violent behavior toward others might make it more readily to act out violently on themselves. This finding has crucial clinical implications that some patients who have no history of suicide attempt can still have elevated risk.

The “20% model,” which includes patients who had a higher than 20% chance of suicide attempt in the past 30 days (subgroups 1, 2, 3, and 7), has a sensitivity of 0.72 and a specificity of 0.63. Although clinical judgment is still the gold standard of practice and future development of a model with higher sensitivity and specificity is needed, this preliminary decision tree could be adapted for a trial in clinical practice. For example, a decision tree following the “20% model” would advise a clinician to first assess a suicidal patient’s history of suicide attempt. For patients with a history of attempt, drinking to the point of intoxication or using cocaine in the past 30 days would signal a higher risk of a suicide attempt. For patients without a history of an attempt and no history of suicide ideation (first time ideator), those who had difficulty controlling their violent behavior in the past 30 days would be considered at high risk. As a speculative step beyond the individual risk factors, a decision tree may help translate research findings into practical guidelines to supplement clinicians’ judgment in making triage decisions. Owing to the seriousness of attempted suicide, it might be considered safer to use the “10% model” to detect more true positives despite the higher health care costs connected with identifying more false positives.

One important implication of the current findings is that patients with a history of suicidal ideation but no history of suicide attempt may be at a relatively low risk of suicide attempt. Most clinicians have problems managing patients who have suicidal thoughts, even though their clinical intuition indicates that the patient is unlikely to attempt

suicide. Although caution is always indicated, this finding could be comforting, provided that it is replicated by future longitudinal studies. Compared with all patients with suicidal ideation in the past 30 days, this group of patients had a much lower rate of suicide attempts in the past 30 days (5 vs 18%, respectively) and was comparable to the overall sample of all SUD patients (4%).

This study did not identify high-risk patients based on the presence (or absence) of many psychiatric diagnoses, even though some of these diagnoses are highly related to suicide attempts. The diagnostic information might not have entered the ROC analyses because history of lifetime suicide attempt was by far the most robust factor differentiating patients with and without suicide attempts in the past 30 days. Nonetheless, factors that were not significant in the ROC analyses may still be important.

In summary, this study is the first to use empirical data to attempt to develop a decision tree and identify profiles of patients who attempt suicide and to go beyond providing a list of risk factors. This study identified a number of profiles of suicidal patients who are at higher risk of suicide attempts in the past 30 days, including those who had a history of suicide attempt and heavy current alcohol use or drug use, as well as those who had suicidal ideation for the first time and had trouble controlling violent behavior. If replicated by future longitudinal studies, such high-risk profiles could be informative for establishing clinical guidelines for managing suicidal patients.

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