



Research report

## Predictors of suicide relative to other deaths in patients with suicide attempts and suicide ideation: A 30-year prospective study

Amy Wenzel\*, Edward R. Berchick, Thomas Tenhave, Steffanie Halberstadt, Gregory K. Brown, Aaron T. Beck

University of Pennsylvania, United States

### ARTICLE INFO

*Article history:*

Received 25 July 2010

Received in revised form 8 January 2011

Accepted 2 March 2011

Available online 8 April 2011

*Keywords:*

Suicide

Predictor

Prospective study

### ABSTRACT

**Background:** Although there is a large literature that prospectively examines predictors of suicide, low base rates of suicide and imprecision of measurement hinder definitive conclusions from being drawn.

**Method:** This study examined predictors of suicide relative to other types of death in a sample of 297 patients who had been hospitalized for suicide ideation or a suicide attempt between 1970 and 1975 and who were confirmed dead in 2005. Many predictors were measured using well-validated assessment instruments.

**Results:** Fifty-five patients had died by suicide. Univariate predictors of an increased risk for eventual suicide included younger age, completion of at least a high school degree, a diagnosis of a psychotic disorder, taking active precautions against discovery during the attempt, and a non-zero score on the suicide item of the *Beck Depression Inventory*, whereas African American ethnicity was associated with a decreased risk of eventual suicide. Variables that remained significant in a multivariate analysis included younger age, African American ethnicity, and taking active precautions against discovery during the attempt. Risk factors did not vary as a function of whether eventual suicide occurred less than or more than five years after the initial evaluation or by attempter v. ideator status.

**Limitations:** Despite the attempt to maximize statistical power by following a high-risk sample for 30 years, the number of deaths by suicide was still relatively low.

**Conclusions:** Taking active precautions against discovery of a suicide attempt has the potential to be an important predictor of eventual suicide and should be assessed by clinicians. Future prospective studies should assess predictors at multiple time points to gain a richer clinical picture of the circumstances surrounding deaths by suicide.

© 2011 Elsevier B.V. All rights reserved.

### 1. Introduction

Perhaps the most frequently examined topic in the field of suicidology is the degree to which death by suicide can be predicted. Investigators embark on these studies with the notion that they can identify a set of variables that predict suicide and with the intention of designating high-risk groups that should

receive intensive monitoring in clinical settings. This body of literature has uncovered a large array of predictors of suicide, including (but not limited to) demographic characteristics (e.g., older age, male gender, and unemployment), psychiatric diagnoses (e.g., depressive disorders, bipolar disorder, psychotic disorders, and alcohol and drug use disorders), psychiatric history (e.g., previous psychiatric treatment), psychological symptoms (e.g., depression and hopelessness), and characteristics broadly related to suicidality (e.g., suicide ideation, and history of suicide attempts). Despite the fact that many of these variables are accepted by the scientific (Wenzel et al., 2009) and

\* Corresponding author at: 217 Walnut Place, Havertown, PA 19083, United States. Tel.: +1 267 746 0566; fax: +1 484 454 3110.

E-mail address: [awenzel@dramywenzel.com](mailto:awenzel@dramywenzel.com) (A. Wenzel).

clinical (Canapary et al., 2002) communities as robust predictors of eventual suicide, research shows that models incorporating these variables fail to correctly classify even one patient who has died by suicide (e.g., Goldstein et al., 1991). Pokorny (1993) indicated that two factors contribute to this conundrum—(a) the low base rate of suicide, which severely reduces the power to detect stable predictors, and (b) imprecision of predictor scales and instruments.

One way to increase the number of suicides under consideration is to examine predictors of suicide in high-risk samples (e.g., those who have been hospitalized for suicide ideation or suicide attempts) across a very long period of time. Although a great deal of research suggests that the highest rate of suicide in high risk-samples is in the first year or two after the index episode (e.g., Tejedor et al., 1999), a few studies indicate that an elevated risk of eventual suicide remains present after 20 or more years (Angst et al., 2005; Brådvik, 2003; Dahlgren, 1977; Mützell, 1997; Suominen et al., 2004). Rates of suicide in these studies range from 8% (Brådvik, 2003) to 18% (Mützell, 1997). Thus, examining rates of suicide in a large sample of high-risk patients evaluated at least 20 years prior to study analysis has the potential to yield a greater number of suicides than what is typically observed in this literature.

The present study was designed to identify predictors of eventual suicide among all deaths in a large sample of high-risk patients who were hospitalized for suicide ideation or a suicide attempt from 1970 through 1975 and who were deceased by the end of 2005. Between 1970 and 1975, these patients were evaluated thoroughly by a clinical psychologist or psychiatrist and a research assistant who administered standardized self-report and interview measures to assess a range of clinical, psychosocial, and demographic predictors of suicide. Many of these measures (e.g., *Beck Depression Inventory* [BDI], *Beck Hopelessness Scale* [BHS]) are those in which a large number of studies provide support for their sound psychometric characteristics and their central role in contemporary psychological assessments (e.g., Beck et al., 1988). Thus, this study has the potential to remedy the problem of suicide's low base rate because high-risk patients were followed for over 30 years after their initial evaluation, and it also has the potential to remedy the problem with imprecision in the measurement of predictor variables through its use of well-established scales.

Five categories of predictor variables were considered in this study. *Demographic* variables included age, gender, level of education, race, social isolation (operationalized as living alone), and employment status, as previous research has found that death by suicide is associated with older age (e.g., Hawton et al., 2003), male gender (e.g., Suokas et al., 2001), Caucasian ethnicity (e.g., Kaplan et al., 2006), social isolation (e.g., Trout, 1980), and unemployment (e.g., Beck and Steer, 1989a). *Diagnostic* variables included diagnoses of depressive disorder, bipolar disorder, psychotic disorder, alcohol use disorder, drug use disorder, and anxiety disorder, as research shows that nearly every type of psychiatric diagnosis elevates the risk of death by suicide (Harris and Barraclough, 1997). *Psychiatric history* variables included a previous mood disorder episode and a visit to a psychiatric or psychologist in the year prior to hospitalization, selected on the basis of research showing that people with a psychiatric history are more likely to die by suicide than people without a psychiatric history (e.g., Brown et al., 2000). *Psychological* variables included scores on the BDI and BHS, as both of these self-report measures

have been used successfully to predict eventual suicide in previous studies (e.g., Brown et al., 2000). Finally, *suicide-relevant* variables included a history of previous attempts, a family history of suicide, the *Suicide Intent Scale* (SIS) total score, responses to two specific items on the SIS regarding whether patients took precautions against discovery during their attempt and their reaction toward their attempt, the *Lethality Scales* total score, and the response to the suicidal thoughts and wishes item of the BDI. There is an abundance of research suggesting that a history of suicide attempts (Harris and Barraclough, 1997), a family history of suicide (Cheng et al., 2000), suicide intent at the index episode (Pierce, 1981), taking precautions against discovery when making an attempt (Beck and Steer, 1989a), regretting that one survived an attempt (Beuatrias, 2004; Henriques et al., 2005), greater medical lethality of previous attempts (Oquendo et al., 2007), and suicide ideation at the time of the index episode (e.g., Goldstein et al., 1991) predict eventual suicide.

Variables associated with eventual suicide have been evaluated previously in the sample under consideration in the present study. Beck et al. (1985) examined the degree to which many of the demographic, diagnostic, psychological, and suicide-relevant variables listed above differentiated between patients hospitalized for suicide ideation who did and did not commit suicide five to ten years after admission. Relative to those who did not commit suicide, a greater proportion of ideators who committed suicide were Caucasian. Moreover, ideators who committed suicide scored higher on the BHS than those who did not commit suicide. Beck et al. (1985) determined a BHS score of 9 or above characterized 13 of the 14 patients who committed suicide, suggesting that this cut-off score has the potential to be an especially useful indicator of suicide risk. Subsequently, Beck and Steer (1989a) examined the degree to which some of these variables predicted eventual suicide five to ten years after admission in patients who were hospitalized after making a suicide attempt. They found that unemployment, a diagnosis of an alcohol use disorder, and taking precautions against discovery during the attempt predicted eventual suicide. Unexpectedly, BHS scores did not predict eventual suicide, although they noted that the scales were administered after patients had been in the hospital for 24–48 h, and many patients who attempted suicide were relieved that they were alive and therefore were less hopeless about their life circumstances.

The present study expands upon the previous work by Beck and his colleagues in four ways. As stated previously, it examined predictors of eventual suicide over a much longer follow-up period, which was expected to increase the number of deaths by suicide in the sample. Moreover, the samples of suicide ideators (Beck et al., 1985) and suicide attempters (Beck and Steer, 1989a) were combined to further increase the number of deaths by suicide. Second, it evaluated the predictors considered by Beck and his colleagues 20 years ago as well as predictors that have been found in recent research to predict eventual suicide (e.g., reaction to the attempt; Henriques et al., 2005). Third, it constrained the sample only to those patients who were confirmed dead by the end of 2005 in order to account for the recent finding that predictors of eventual suicide in high-risk patients overlap with predictors of death for other reasons in these patients (Neeleman et al., 1998; Reith et al., 2004; but see Brown et al., 2000, for an exception). This strategy ensures that the significant predictors identified in this

study are unique to death by suicide and not to death by other causes and has been used in other contexts to assess the risk of death due to a rare event over a long-term follow-up period (e.g., Lee et al., 2003; Miettinen and Wang, 1981). Fourth, it examined whether the predictors of eventual suicide interacted with two important variables—whether patients were classified as ideators or attempters when they were hospitalized, and whether patients died in the first five years of the follow-up (i.e., sooner deaths) or after more than five years of follow-up (i.e., later deaths).

## 2. Method

### 2.1. Data collection

#### 2.1.1. Original sample and follow-up procedure

The sample was drawn from a group of 706 patients who were hospitalized for either suicide ideation ( $n = 207$ ; Beck et al., 1985) or for a recent suicide attempt ( $n = 499$ ; Beck and Steer, 1989a)<sup>1</sup> at Philadelphia General Hospital (PGH) between 1970 and 1975. Within 24–48 h of admission, patients were asked to participate in a longitudinal study of suicidal behavior. After giving their informed consent, patients were interviewed by a clinical psychologist or a psychiatrist who obtained an extensive psychiatric, medical, and psychosocial history. In addition, a research assistant independently administered standardized instruments, including the *Beck Depression Inventory* (BDI; Beck and Steer, 1987), *Beck Hopelessness Scale* (BHS; Beck and Steer, 1989b), *Suicide Intent Scale* (SIS; Beck et al., 1974), and *Lethality Scales* (Beck et al., 1975).

Attempts were made to follow the 706 patients through 1982, and 95% were successfully followed. If the follow-up indicated that the patient was deceased, appropriate agencies were contacted to verify cause, mode of death, and circumstances. In addition, the death records of the Philadelphia Medical Examiner's Office were scanned daily to determine whether any of the patients were on the list. When a patient died, the relevant medical examiner's or coroner's records were requested so that the cause of death could be verified. Deaths that occurred in other states or countries were also investigated. At this time, 14 patients with suicide ideation (Beck et al., 1985) and 30 patients who had made suicide attempts (Beck and Steer, 1989a) had died by suicide.<sup>2</sup> Sixty-one patients had died of other causes.

#### 2.1.2. 30-year follow-up procedure

To identify additional participants in the sample who had died by suicide, information for patients who were identified as alive in 1982 was sent to the National Center for Health Statistics' National Death Index (NDI), a central database containing death certificate information for all deaths reported to state vital statistics offices between 1979 and 2005. The NDI uses a matching algorithm containing 12 criteria to identify possible death records that match with records submitted by the user. Variables considered in searches include first and last

names and middle initial; Social Security number; date of birth; father's surname; and sex. Age at death, race, marital status, state of residence, and state of birth are not included in the algorithm but are considered to further verify the match. Phonetic codes for first and last names are used to enhance the effectiveness of the matching criteria. The NDI search yielded a retrieval report that contained rank-ordered lists of possible NDI record matches for each study participant, including state of death, date of death, death certificate number, and an indication of which items from the NDI record agreed or disagreed with items from the study record (Bilgrad, 2000). The NDI Plus option was selected for the present study, which yielded cause of death codes according to the *International Classification of Diseases* (ICD). The University of Pennsylvania Institutional Review Board reviewed and approved of this use of NDI records to obtain follow-up on the original sample.

Four raters examined the NDI Retrieval Report in order to determine whether one of the results matched the study participant, with an agreement of 89%. A consensus meeting was held to discuss the remaining cases and make the final determination of whether the NDI search results matched the study data. For records that remained in question after the consensus meeting, a death certificate was ordered from the relevant state vital statistics office to compare additional information from the certificate to the participant's study records. Items were classified as a suicide *only* if it was explicitly coded as such in the ICD-9 cause of death codes for deaths that occurred before 1999 (i.e., codes E950–E959) and in the ICD-10 for deaths that occurred in 1999 or after (i.e., codes X60–X84). Previous research shows that there is virtually perfect correspondence between ICD-9 and ICD-10 codes for intentional self-harm (Anderson et al., 2001). Questionable or undetermined suicides were regarded as those with “injury undetermined whether accidentally or purposely inflicted” or “event of undetermined intent” (i.e., ICD-9 codes E980–E989; ICD-10 codes Y10–Y34). Death certificates were ordered for questionable and undetermined suicides to provide further information in determining the cause of death, including motor vehicle accidents involving a pedestrian (ICD-9 codes E810–E819; ICD-10 codes V01–V89) and drug abuse (ICD-9 codes 304–305).

### 2.2. Sample characteristics

Of the total sample of 706 patients, 297 were confirmed dead, 55 of whom had died by suicide (7.8% of the original sample; 18.5% of the confirmed deaths) and 15 of whom were regarded as questionable or undetermined suicides. The average age of the 297 confirmed dead was 36.0 (min = 17; max = 78) at admission, 53% were male, 57% were Caucasian, and 60% had not completed high school. Approximately 70% of the sample were admitted to the hospital for a suicide attempt ( $n = 206$ ), whereas 30% were admitted for suicide ideation ( $n = 91$ ). Nearly half (49%) of those who died by suicide did so within 5 years after they were admitted to the hospital.

### 2.3. Data analysis

The outcome of interest in this study was death by suicide, measured as a binary variable. Questionable or undetermined suicides and suicides of participants whose study records only partially matched the NDI search results were excluded from

<sup>1</sup> Beck and Steer (1989a)'s sample size was limited to 413 of the original 499 patients who had complete data for their analyses of interest.

<sup>2</sup> Beck and Steer's (1989a) sample contained 20 deaths by suicide; the additional 10 deaths by suicide through 1982 comprise patients who were not included in their analyses.

data analysis because (a) they could not be verified, and (b) analyses including these deaths a similar pattern of results as analyses focused on confirmed suicides only. Demographic predictors included age (younger than age 30; age 30 or older), gender (male; female), education level (did not complete high school; high school degree; some college; college degree), race (Caucasian; African American; Asian; Other), social isolation (does not live alone; lives alone), and employment status (unemployed; employed or student). Diagnostic predictors included the presence or absence of a depressive disorder, bipolar disorder, psychotic disorder, alcohol use disorder, drug use disorder, and anxiety disorder. Psychiatric history predictors included the presence or absence of a previous mood disorder episode and the presence or absence of a visit to a psychiatrist or a psychologist in the past year. Psychological predictors included the BDI total score and the BHS total score, dichotomized as being less than 9 or greater than or equal to 9 (Beck et al., 1985; Brown et al., 2000). Suicide-relevant predictors included the presence or absence of a history of previous attempts, the presence or absence of a family history of suicide, the SIS total score, the score on the SIS item assessing whether precautions against discovery were taken during the attempt (no precautions; passive precautions; active precautions), the score on the SIS item assessing patients' reaction toward their attempt (regret making the attempt/glad to be alive or ambivalent; regret failure of attempt; cf. Henriques et al., 2005), the *Lethality Scales* total score, and the score on the suicidal thoughts and wishes item of the BDI (no thoughts of killing myself; have thoughts of killing myself, but would not carry them out; would like to kill myself; would kill myself if I had the chance).

Univariate analyses were conducted first to identify significant predictors of death by suicide. Significant univariate predictors were then included in a multivariate model that adjusted estimated associations with death by suicide for potential confounding by these observed covariates. Additional analyses focused on whether the significant univariate associations of predictors of suicide differed between suicide ideators and suicide attempters and between those who died in the first five years of the follow-up period (i.e., sooner death) as compared to those who died after the first five years of the follow-up period (i.e., later death). Although many studies examining differences in predictors as a function of sooner v. later deaths use a one-year cut point (e.g., Kaplan et al., 2006), the five-year cut point was chosen because only 20% of the deaths by suicide occurred within the first year of the follow-up period, and use of that cut-point would have significantly reduced the power to detect significant predictors.

All analyses of unadjusted (univariate) or adjusted (multivariate) associations involving suicide were performed with logistic regression that yielded mortality odds ratios (MOR), which are based on the odds of suicide relative to other causes of death (Miettinen and Wang, 1981). The mortality odds ratio, then, is the ratio of such odds of suicide for one level of a risk factor (e.g., Caucasian ethnicity) over the odds of suicide for another level of the risk factor (e.g., African American ethnicity). To investigate differences in associations with death by suicide between ideators and attempters and between sooner and later suicide completion, we used logistic regression with interaction terms. Because suicide was rare in this sample, the odds ratios can

be interpreted as ratios of probabilities (e.g., “xx times more likely”).

Multiple imputation (Schafer, 1997) was performed on two variables that were significant in univariate analyses but that had some missing data—the precautions item of the SIS (30% missing by definition, as these patients were hospitalized for suicide ideation and did not make a suicide attempt, which meant that they did not complete this measure) and the suicidal thoughts and wishes item of the BDI (4% missing). This procedure replaced missing values on these variables with predicted values obtained from a logistic model with baseline variables as covariates and each of the SIS and BDI variables as separate outcomes. It was conducted to retain the sample size in order to increase power for the other variables that were not imputed, as well as to provide appropriate adjustments for variability of the SIS and BDI items due to uncertainty of imputation. All analyses were performed in STATA Version 9.2. Table 1 displays descriptive and univariate statistics for the predictor variables evaluated in this study.

### 3. Results

There were 11 new deaths by suicide that occurred between 1982 and 2005, 6 of whom had been hospitalized for suicide ideation, and 5 of whom had been hospitalized following a suicide attempt. The mean age at admission for these 11 patients was 39.3 (3 patients were under age 30 at the time of admission), 4 (36%) were male, 10 (91%) were Caucasian, 4 (36%) did not have a high school degree, 5 (45%) were unemployed, and 8 (73%) lived alone. Previous attempts were reported by 7 (64%) of these patients. Six patients were diagnosed with a depressive disorder (55%), 1 with bipolar disorder (9%), 4 with a psychotic disorder (36%), 1 with an alcohol use disorder (9%), and 1 with a drug use disorder (9%). The mean score on the BDI was 22.09 (SD = 15.77), and 6 of these patients (55%) scored a 9 or above on the BHS. Of the 5 patients who attempted suicide and completed the SIS, none indicated that they took active precautions against discovery during their index attempt, and 1 indicated a regret that the attempt had failed.

Table 2 presents odds ratio estimates, 95% confidence intervals, and *p* values under the unadjusted (i.e., univariate) and adjusted (i.e., multivariate) models without interactions. In the *univariate* logistic regression analyses, patients older than 30 years when they were admitted to the hospital were approximately 50% less likely than younger patients to die by suicide (Odds Ratio = 0.51, CI [0.28–0.93], *p* = 0.027). There was a trend for African American patients to be approximately 50% less likely than Caucasian patients to die by suicide (Odds Ratio = 0.54, CI [0.29–1.00], *p* = 0.056).<sup>3</sup> In comparison to those patients who did not complete high school, patients who had a high school degree were 2.2 times more likely to die by suicide (CI [1.16–4.16], *p* = 0.016). Patients who were diagnosed with a psychotic disorder were 1.8 times more likely to die by suicide than patients who were not diagnosed with a psychotic disorder (CI [1.00–3.33], *p* = 0.049). Moreover, patients who took active precautions against discovery during their index attempt were over 3 times more likely to die by suicide than those who did not

<sup>3</sup> Odds ratios for the Asian and Other categories of ethnicity were not computed because no patients who died by suicide were of ethnicities other than Caucasian or African American.



**Table 1**  
Descriptive and univariate statistics.

Predictor	Suicide (n = 55)	Other death (n = 242)	$\chi^2 (1)^a$	p
Age (<30)	50.91	34.71	5.01	0.025
Gender (% male)	43.64	54.96	2.31	0.129
Education (% did not complete high school)	45.28	62.61	5.36	0.021
Race (% Caucasian)	69.09	54.13	4.09	0.043
Social isolation (% living alone)	80.39	72.69	1.30	0.255
Employment (% unemployed)	73.08	75.63	0.15	0.699
Depressive disorder diagnosis (%)	32.73	39.26	0.81	0.368
Bipolar disorder diagnosis (%)	3.64	3.72	0.01	0.977
Psychotic disorder diagnosis (%)	43.64	29.75	3.95	0.047
Alcohol use disorder diagnosis (%)	7.27	12.40	1.16	0.281
Drug use disorder diagnosis (%)	7.27	3.31	1.82	0.177
Anxiety disorder diagnosis (%)	0.00	1.24	0.69	0.407
Previous mood disorder (%)	76.09	74.09	0.78	0.780
Visited psychiatrist or psychologist in past year (%)	45.45	45.71	0.01	0.975
BDI total score (mean [SD]; t [286])	24.69 (13.29)	24.55 (11.97)	0.08	0.940
BHS total score (%≥9)	59.09	47.09	2.09	0.148
History of attempts (%)	71.15	65.82	0.55	0.460
Family history of suicide (%)	9.52	12.69	0.33	0.568
SIS total score (mean [SD]; t [199])	13.57 (5.88)	12.56 (6.08)	0.90	0.370
SIS precautions item (% = 2; active precautions against discovery)	28.57	14.81	3.81	0.051
SIS reaction to attempt item (% = 2; regret failure of attempt)	33.33	22.29	1.83	0.176
Lethality scales total score (mean [SD]; t [195])	3.16 (2.44)	2.99 (2.38)	0.37	0.715
BDI suicidal thoughts and wishes item (%≥1)	73.58	56.84	5.05	0.025

Note. BDI = Beck Depression Inventory, SIS = Suicide Intent Scale.

<sup>a</sup> All statistics are  $\chi^2 (1)$  unless otherwise noted.

take active precautions against discovery (Odds Ratio = 3.12, CI [1.13–8.65],  $p = 0.028$ ), and those who scored 1 or higher on BDI item assessing suicidal thoughts and wishes were over 2 times more likely to die by suicide than those who scored 0 (Odds Ratio = 2.41, CI [1.11–5.22],  $p = 0.025$ ).

Adjusting for other covariates in the *multivariate* model, the odds of suicide for older patients was about one-third that of younger patients (Odds Ratio = 0.34, CI [0.15–0.76],  $p = 0.008$ ). African-American patients were much less likely than Caucasian patients to die by suicide (Odds Ratio = 0.26; CI [0.11–0.61],  $p = 0.002$ ). The odds for those who indicated that they took active precautions against discovery during their attempt were 4.6 times the odds for those who did not indicate that they took active precautions against discovery (CI [1.21–17.33],  $p = 0.025$ ). In contrast, education level, psychotic disorder diagnosis, and endorsement of suicidal thoughts and wishes on the BDI were not significant predictors when considered in conjunction with these other variables. Moreover, none of the analyses examining interactions between significant univariate predictors and the two moderating variables of interest (i.e., ideators v. attempters and sooner v. later deaths) were significant.

#### 4. Discussion

The present study is a long-term prospective follow-up study of 706 patients who were hospitalized for suicide ideation or a suicide attempt between 1970 and 1975. By 1982, 44 patients had committed suicide (Beck et al., 1985; Beck and Steer, 1989a), and by 2006, an additional 11 patients had committed suicide. Thus, the rate of death by suicide in this sample was 7.8%. Our results confirm observations made by other suicidologists that the rate of suicide in high-risk samples is elevated but declines markedly after the first ten years following hospitalization (Cullberg et al., 1988).

All of the variables tested in analyses were those that have been shown previously in the literature to predict eventual suicide. As expected, African American ethnicity was associated with a decreased risk of suicide, and a diagnosis of a psychotic disorder, report of taking active precautions to prevent discovery during the attempt, and suicidal thoughts and wishes were associated with an increased risk of suicide. Although we expected older age to predict eventual suicide, our results suggest that the opposite pattern was at work in this sample—those who were younger at admission were more likely to commit suicide during the follow-up period. Many studies have found that older age predicts eventual suicide (e.g., Hawton et al., 2003; Rognestad, 1997); however, Zahl and Hawton (2004) reported that younger age was associated with suicide among women who engaged in repeat deliberate self-harm behavior. Furthermore, being less than 40 years old was a univariate predictor, but not a multivariate predictor of suicide in Wang and Mortensen's (2006) 10-year follow-up of patients hospitalized after a suicide attempt. Thus, there is precedence for younger age to predict suicide in similar types of samples. Another surprising finding in our study was that participants who completed high school had a greater risk of committing suicide than people who did not complete high school, a finding that runs contrary to some studies in the literature (e.g., Beautrais, 2001).

It is equally as important to consider the variables that did *not* predict eventual suicide in our sample as it is to consider the variables that did predict suicide. For example, we expected male gender to be associated with suicide, as rates of suicide are higher in men than in women in nearly every country in the world (see Wenzel et al., 2009, for a review). However, it is important to acknowledge that those rates are based on the general population, rather than high risk clinical samples such as that under consideration in the present study. Although male gender is a significant predictor of suicide in some prospective

**Table 2**  
Predictors of death by suicide.

	Unadjusted model			Adjusted model		
	Odds ratio and 95% CI	Standard error	p	Odds ratio and 95% CI	Standard error	p
Age ≥ 30 (v. age < 30)	0.51 (0.28–0.93)	0.15	0.027	0.34 (0.15–0.76)	0.14	0.008
African American ethnicity (v. Caucasian ethnicity)	0.54 (0.29–1.00)	0.17	0.056	0.26 (0.11–0.61)	0.11	0.002
Completed at least a high school degree (v. did not complete high school degree)	2.20 (1.16–4.16)	0.72	0.016	1.80 (0.79–3.96)	0.73	0.165
Psychotic disorder diagnosis (v. no psychotic disorder diagnosis)	1.82 (1.00–3.33)	0.56	0.049	2.34 (1.09–5.04)	0.92	0.029
SIS precautions item score = 2 (i.e., active precautions to avoid discovery) (v. score ≤ 1)	3.12 (1.13–8.65)	1.60	0.028	4.58 (1.21–17.33)	3.10	0.025
BDI suicidal thoughts and wishes item score ≥ 1 (v. score = 0)	2.41 (1.11–5.22)	0.95	0.025	2.00 (0.76–5.26)	0.99	0.160

Note. BDI = Beck Depression Inventory, SIS = Suicide Intent Scale.

studies using high-risk samples (e.g., Hawton et al., 2003; Suokas et al., 2001), this finding has not been replicated in many other studies using similar samples (e.g., Angst et al., 2005; de Moore and Robertson, 1998; Tejedor et al., 1999). In fact, Angst et al. (2005)'s findings suggest that the rate of suicide is especially elevated in high-risk female patients, relative to the rate of suicide in women representative of the general population. In addition, it was surprising that diagnoses of a depressive, bipolar, alcohol use, or substance use disorder were not significant predictors of eventual suicide in this sample. Again, although many studies find that these diagnoses elevate the risk of eventual suicide in high-risk samples (see Harris and Barraclough, 1997, for a meta-analysis), others using similar samples have failed to find that these diagnoses predict suicide (Beautrias, 2004; Allgulander and Fisher, 1990; Angst et al., 2005; Rynestad, 1997). Allgulander and Fisher (1990) noted that diagnoses are not particularly helpful in predicting suicide because they are “generally unspecific and insensitive (p. 275).”

These results partially replicate the findings reported by Beck and his colleagues on this same sample after it had been followed for five to ten years. As Beck et al. (1985) reported, the odds of death by suicide in African American suicide ideators were lower than the odds in Caucasian suicide ideators. As Beck and Steer (1989a) reported, the odds of death by suicide were higher in those who took precautions against discovery during their attempt than in those who did not take precautions against discovery. In contrast with Beck and Steer's (1989a) findings, unemployment and a diagnosis of an alcohol use disorder did not predict eventual suicide. One explanation for this pattern of results is that our statistical analyses provided a more stringent test of its predictive power, as the comparison group was composed of patients who had died of other causes, and unemployment and alcohol use disorders elevate the risk for many adverse health outcomes (Costello, 2006; Jin et al., 1995; Kessler et al., 1989; Norström and Ramstedt, 2005; Taylor et al., 2007; Wilson and Walker, 1993).

The predictive value of hopelessness, as measured by the BHS, is of particular interest because hopelessness is a characteristic of high-risk patients that is able to be modified in psychotherapy. Beck et al. (1985) found that hopelessness was the variable that had the most robust association with eventual suicide in their sample of suicide ideators. Although BHS scores failed to predict eventual suicide in Beck and Steer's (1989a) sample of suicide attempters, this finding could be

explained in part because the assessment took place after the attempt, when many patients were glad to be alive. BHS scores did not predict eventual suicide in our sample, which was composed primarily of the suicide attempters considered in Beck and Steer's (1989a). However, BHS scores also did not predict eventual suicide in analyses that were restricted to ideators only. We offer three potential explanations for this finding: (a) that hopelessness is a predictor of a broad array of adverse health outcomes not limited to suicide, (b) that stable levels of hopelessness over time is a most potent predictor of eventual suicide, and hopelessness over time was not measured in this study because the BHS was completed only at the time patients were hospitalized (see Young et al., 1996, for results that support this explanation), and (c) that hopelessness is a stronger predictor in samples characterized by a range of degrees of hopelessness, such as outpatient samples (Brown et al., 2000) or samples representative of the general population (cf. Cox et al., 2004), rather than inpatients who are hospitalized for suicidality, who might be more uniform in their reports of hopelessness.

There are several strengths of this study, including its use of the NDI to identify deaths of study participants, which has high sensitivity and specificity, the high quality assessment of participants, the length of the follow-up, and the high percentage of African American participants. Nevertheless, several limitations must be acknowledged. First, the number of deaths by suicide was still relatively low, which likely limited the power to detect other significant predictors (cf. Pokorny, 1993). Second, there were only a small number of patients who were characterized by some of the variables under consideration, such as a bipolar disorder diagnosis or an anxiety disorder diagnosis. Third, a few of the variables were relevant only to the participants who were hospitalized after their suicide attempt, rather than hospitalized for suicide ideation. Specifically, the SIS was administered only to attempters because it assesses the degree of intent associated with a recent attempt. Thus, one of the main findings of the study—that people who take active precautions against discovery are at high risk for eventual suicide—applied only to patients who were hospitalized for attempts. Fourth, a limitation of all studies of this nature is the possibility of underreporting of deaths by suicide and the misclassification of suicides as other types of death (Carr et al., 2004), which often varies among states or even among individual coroners (O'Carroll, 1989). Some researchers attempt to overcome this limitation by classifying accidental

deaths, undetermined deaths, and/or possible suicides as deaths by suicide in their studies. We chose to focus only on the deaths by suicide that were confirmed unequivocally, and results did not vary substantially by including possible suicides. However, these classification concerns raise the possibility that studies of this nature inevitably will incorrectly classify some deaths. Finally, variables of recent interest to the community of suicidologists were not considered, such as impulsivity and aggression (cf. Angst and Clayton, 1998; McGirr et al., 2007). Moreover, the only follow-up variable collected pertained to whether or not the participant had died, so the impact of long-term psychiatric care upon eventual suicide could not be examined.

This study makes a unique addition to the literature on predictors of eventual suicide because it is one of only a few studies that examined suicide risk over a very long period of time, and it adopted a unique analytic approach by comparing participants who committed suicide with participants who died by other causes. Its results raise the possibility that taking active precautions against discovery during a suicidal crisis is an especially potent risk factor for eventual suicide and should be assessed by clinicians. On the other hand, the degree to which it clarifies the literature on the prediction of suicide is limited because, like most other studies in this literature, it confirmed some previous findings but did not support others. In fact, there is no one variable that uniformly predicts eventual suicides across studies. As Beautrais (2004) aptly noted, it is difficult to predict suicide by variables gathered at one initial assessment because subsequent suicidal behavior may relate to events that occur in the interim, such as treatment, life events, changes in physical and mental health status, and changes in one's social environment.

Thus, we suggest that researchers adopt new strategies in examining variables that predict eventual suicide. First, it would be helpful to conduct assessments at several points over the course of a follow-up period, so that the degree to which chronicity of various characteristics (e.g., hopelessness) and/or abrupt changes in various characteristics (e.g., a change from being employed to being unemployed) are associated with suicidal behavior can be examined. Second, it is important to identify the most proximal characteristics associated with suicidal behavior to provide some insight into the mechanisms that facilitate suicidal behavior in the context of more distal risk factors (cf. Mościcki, 1999). We speculate that many of the predictors considered in this and other studies of this nature elevate risk of eventual suicide in a non-specific manner, and that it is the cognitions (e.g., acute hopelessness), emotions (e.g., severe depression), behaviors (e.g., heavy alcohol or drug use), and situations (e.g., loss of a job) at work immediately prior to a crisis that can best explain why a suicidal act occurred.

#### Role of the funding source

Funding for this study was provided by a Standard Research Grant from the American Foundation for Suicide Prevention and by the National Institute of Mental Health (P20 MH071905). These agencies had no further role in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication.

#### Conflict of interest

The authors declare that they have no conflicts of interest.

## Acknowledgements

The authors would like to thank Robert Bilgrad, Allison Fox, Ellen Jørstad-Stein, Jennifer Mayer, and Blair Wisco for their assistance with this research.

## References

- Allgulander, C., Fisher, L.D., 1990. Clinical predictors of completed suicide and repeated self-poisoning in 8895 self-poisoning patients. *European Archives of Psychiatric and Neurological Science* 239, 270–276.
- Anderson, R.N., Minino, A.M., Hoyert, D.L., Rosenberg, H.M., 2001. Comparability of Cause of Death between ICD-9 and ICD-10: Preliminary Estimates. *National Vital Statistics Reports*, vol. 49 no 2. National Center for Health Statistics, Hyattsville, MD.
- Angst, J., Angst, F., Gerber-Werder, R., Gamma, A., 2005. Suicide in 406 mood-disorder patients with and without long-term medication: a 40 to 44 years' follow-up. *Archives of Suicide Research* 9, 279–300.
- Angst, J., Clayton, P.J., 1998. Personality, smoking, and suicide: a prospective study. *Journal of Affective Disorders* 51, 55–62.
- Beautrais, A.L., 2001. Subsequent mortality in medically serious suicide attempts: a 5 year follow-up. *Australian and New Zealand Journal of Psychiatry* 147, 595–599.
- Beautrais, A.L., 2004. Further suicidal behavior among medically serious suicide attempters. *Suicide and Life-Threatening Behavior* 34, 1–11.
- Beck, A.T., Beck, R.W., Kovacs, M., 1975. Classification of suicidal behaviors: I. Quantifying intent and medical lethality. *American Journal of Psychiatry* 132, 285–287.
- Beck, A.T., Schuyler, D., Herman, I., 1974. Development of suicidal intent scales. In: Beck, A.T., Resnik, H.L., Lettieri, D.J. (Eds.), *The Prediction of Suicide*. Charles Press, Bowie, MD.
- Beck, A.T., Steer, R.A., 1987. *Manual for the Beck Depression Inventory*. The Psychological Corporation, San Antonio, TX.
- Beck, A.T., Steer, R.A., 1989a. Clinical predictors of eventual suicide: a 5- to 10-year prospective study of suicide attempters. *Journal of Affective Disorders* 17, 203–209.
- Beck, A.T., Steer, R.A., 1989b. *Manual for the Beck Hopelessness Scale*. The Psychological Corporation, San Antonio, TX.
- Beck, A.T., Steer, R.A., Garbin, M.G., 1988. Psychometric properties of the Beck Depression Inventory: twenty-five years of evaluation. *Clinical Psychology Review* 8, 77–100.
- Beck, A.T., Steer, R.A., Kovacs, M., Garrison, B., 1985. Hopelessness and eventual suicide: a 10-year prospective study of patients hospitalized with suicidal ideation. *American Journal of Psychiatry* 142, 559–563.
- Bilgrad, R., 2000. *National Death Index User's Manual*. National Center for Health Statistics, Hyattsville, MD.
- Brådvik, 2003. Suicide after suicide attempt in severe depression: a long-term follow-up. *Suicide and Life-Threatening Behavior* 33, 381–388.
- Brown, G.K., Beck, A.T., Steer, R.A., Grisham, J.R., 2000. Risk factors for suicide in psychiatric outpatients: a 20-year prospective study. *Journal of Consulting and Clinical Psychology* 68, 371–377.
- Canary, D., Bongar, B., Cleary, K.M., 2002. Assessing risk for completed suicide in patients with alcohol dependence: clinicians' views of critical factors. *Professional Psychology: Research and Practice* 33, 464–469.
- Carr, J.R., Hofe, C.W., Gardner, J., Potter, R., 2004. Suicide surveillance in the U.S. military—reporting and classification biases in rate of calculation. *Suicide and Life-Threatening Behavior* 34, 233–241.
- Cheng, A.T., Chen, T.H., Chen, C.C., Jenkins, R., 2000. Psychological and psychiatric risk factors for suicide: case control psychological autopsy study. *British Journal of Psychiatry* 177, 360–365.
- Costello, R.M., 2006. Long-term mortality from alcoholism: a descriptive analysis. *Journal of Studies on Alcohol* 67, 694–699.
- Cox, B.J., Enns, M.W., Clara, I.P., 2004. Psychological dimensions associated with suicide ideation and attempts in the National Comorbidity Survey. *Suicide and Life-Threatening Behavior* 34, 209–219.
- Cullberg, J., Wasserman, D., Stefansson, C.-G., 1988. Who commits suicide after a suicide attempt? An 8 to 10 year follow-up in a suburban catchment area. *Acta Psychiatrica Scandinavica* 77, 598–603.
- Dahlgren, K.G., 1977. Attempted suicides—35 years afterward. *Suicide and Life-Threatening Behavior* 7, 75–79.
- De Moore, G., Robertson, A., 1998. Suicide in the 18 years after deliberate self-harm: a prospective study. In: Kosky, R.J., Eshkevari, H.S., Goldney, R.D., Hassan, R. (Eds.), *Suicide Prevention: The Global Context*. Plenum Press, New York, NY, pp. 79–85.
- Goldstein, R.B., Black, D.W., Nasrallah, A., Winokur, G., 1991. The prediction of suicide: sensitivity, specificity, and predictive value of a multivariate

- model applied to suicide among 1906 patients with affective disorders. *Archives of General Psychiatry* 48, 418–422.
- Harris, E.C., Barraclough, B., 1997. Suicide as an outcome for mental disorders: a meta-analysis. *British Journal of Psychiatry* 170, 205–228.
- Hawton, K., Zahl, D., Weatherall, R., 2003. Suicide following deliberate self-harm: long-term follow-up of patients who presented to a general hospital. *British Journal of Psychiatry* 182, 537–542.
- Henriques, G., Wenzel, A., Brown, G.K., Beck, A.T., 2005. Suicide attempters' reaction to survival as a risk factor for eventual suicide. *American Journal of Psychiatry* 162, 2180–2182.
- Jin, R.L., Shah, C.P., Svoboda, T.J., 1995. The impact of unemployment on health: a review of the evidence. *Canadian Medical Association Journal* 153, 529–540.
- Kaplan, M.S., McFarland, B.H., Hugest, N., Newsom, J.T., 2006. Sooner versus later: factors associated with temporal sequencing of suicide. *Suicide and Life-Threatening Behavior* 36, 377–385.
- Kessler, R.C., House, J.S., Turner, J.B., 1989. Unemployment and health in a community sample. *Journal of Health Social Behavior* 28, 51–59.
- Lee, L.J.H., Chung, C.W., Ma, Y.C., Wang, G.S., Chen, G.S., Hwang, Y.H., et al., 2003. Increased mortality odds ratio of male liver cancer in a community contaminated by chlorinated hydrocarbons in groundwater. *Occupational and Environmental Medicine* 60, 364–369.
- McGirr, A., Renaud, J., Bureau, A., Seguin, M., Lesage, A., Turecki, G., 2007. Impulsive-aggressive behaviours and completed suicide across the life cycle: a predisposition for younger age of suicide. *Psychological Medicine* 38, 407–417.
- Miettinen, O.S., Wang, J.-D., 1981. An alternative to the proportionate mortality ratio. *American Journal of Epidemiology* 114, 144–148.
- Mościcki, E.K., 1999. Epidemiology of suicide. In: Jacobs, D.G. (Ed.), *The Harvard Medical School Guide to Suicide Assessment Intervention*. Jossey-Bass, San Francisco, CA, pp. 40–51.
- Mützell, S., 1997. Survival after attempted suicide in Sweden: a follow-up study after 20 years. *International Journal of Adolescence and Youth* 6, 315–328.
- Neeleman, J., Wessely, S., Wadsworth, M., 1998. Predictors of suicide, accidental death, and premature natural death in a general-population birth cohort. *The Lancet* 351, 93–97.
- Norström, T., Ramstedt, M., 2005. Mortality and population drinking: a review of the literature. *Drug and Alcohol Review* 24, 537–547.
- O'Carroll, P.W., 1989. A consideration of the validity and reliability of suicide mortality data. *Suicide and Life-Threatening Behavior* 19, 1–16.
- Oquendo, M.A., Bongiovi-Garcia, M.E., Galfalvy, H., Goldberg, P.H., Grunebaum, M.F., Burke, A.K., et al., 2007. Sex differences in clinical predictors of suicidal acts after major depression: a prospective study. *American Journal of Psychiatry* 164, 134–141.
- Pierce, D.W., 1981. The predictive validation of a Suicide Intent Scale: a five-year follow-up. *British Journal of Psychiatry* 139, 391–396.
- Pokorny, A.D., 1993. Suicide prediction revisited. *Suicide and Life-Threatening Behavior* 23, 1–10.
- Reith, D.M., Whyte, I., Carter, G., McPherson, M., Carter, N., 2004. Risk factors for suicide and others deaths following hospital treated self-poisoning in Australia. *Australian and New Zealand Journal of Psychiatry* 38, 520–525.
- Rygnestad, T., 1997. Mortality after deliberate self-poisoning: a prospective follow-up study of 587 persons observed for 5279 person years: risk factors and causes of death. *Social Psychiatry and Psychiatric Epidemiology* 32, 443–450.
- Schafer, J.L., 1997. *Analyses of Incomplete Multivariate Data*. Chapman and Hall, New York.
- Suokas, J., Suominen, K., Isometsä, E., Ostamo, A., Lönnqvist, J., 2001. Long-term risk factors for suicide mortality after attempted suicide—findings of a 14-year follow-up study. *Acta Psychiatrica Scandinavica* 104, 117–121.
- Suominen, K., Isometsä, E., Suokas, J., Haukka, J., Achte, K., Lönnqvist, J., 2004. Completed suicide after a suicide attempt: a 37-year follow-up study. *American Journal of Psychiatry* 161, 562–563.
- Taylor, B., Rehm, J., Patra, J., Popova, S., Baliunas, D., 2007. Alcohol-attributable morbidity and resulting health care costs in Canada in 2002: recommendations for policy and prevention. *Journal of Studies on Alcohol and Drugs* 68, 36–47.
- Tejedor, M.C., Díaz, A., Castillón, J.J., Pericay, J.M., 1999. Attempted suicide: repetition and survival—findings of a follow-up study. *Acta Psychiatrica Scandinavica* 100, 205–211.
- Trout, D.L., 1980. The role of social isolation in suicide. *Suicide and Life-Threatening Behavior* 10, 10–23.
- Wang, A.G., Mortensen, G., 2006. Core features of repeated suicidal behaviour: a long-term follow-up after suicide attempts in a low-suicide-incidence population. *Social Psychiatry and Psychiatric Epidemiology* 41, 103–107.
- Wenzel, A., Brown, G.K., Beck, A.T., 2009. *Cognitive Therapy for Suicidal Patients: Scientific and Clinical Applications*. APA Books, Washington, DC.
- Wilson, S.H., Walker, G.M., 1993. Unemployment and health: a review. *Public Health* 107, 153–162.
- Young, M.A., Fogg, L.F., Scheftner, W., Fawcett, J., Akiskal, H., Maser, J., 1996. Stable trait components of hopelessness: baseline and sensitivity to depression. *Journal of Abnormal Psychology* 105, 155–165.
- Zahl, D., Hawton, K., 2004. Repetition of deliberate self-harm and subsequent suicide risk: a long-term follow-up study in 11,583 patients. *British Journal of Psychiatry* 185, 70–75.