Risk Factors for Suicide Completion in Borderline Personality Disorder: A Case-Control Study of Cluster B Comorbidity and Impulsive Aggression

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Background: Borderline personality disorder is a major risk factor for suicidal behavior, yet prediction of suicide completion remains unclear. It has been proposed that impulsivity and aggression interact to increase suicide risk. Death by suicide in borderline personality disorder, then, may be the result of impulsivity, a core feature of the disorder, interacting with violent-aggressive tendencies. Using a case-control design, this study investigated clinical and behavioral risk factors for suicide completion in borderline personality disorder.

Method: One hundred twenty subjects meeting DSM-IV criteria for borderline personality disorder, 50 controls and 70 who died by suicide between 2001 and 2005, were investigated by means of proxy-based interviews using structured diagnostic instruments and personality trait assessments.

Results: Borderline personality disorder suicides had fewer psychiatric hospitalizations and suicide attempts than borderline personality disorder controls. Borderline personality disorder suicides were also more likely to meet criteria for current and lifetime substance dependence disorders. They had higher levels of current and lifetime Axis I comorbidity, novelty seeking, impulsivity, hostility, and comorbid personality disorders, while exhibiting lower levels of harm avoidance. Most importantly, borderline personality disorder suicides were more likely to have cluster B comorbidity. Impulsivity and aggression interacted to predict suicide, though not after controlling for cluster B comorbidity.

Conclusions: Borderline personality disorder individuals who die by suicide differ from those borderlines typically encountered in acute psychiatric settings. Our results suggest that the lethality of borderline personality disorder suicide attempts results from an interaction between impulsivity and the violent-aggressive features associated with cluster B comorbidity. Further, the anxious trait of harm avoidance appears to be protective against suicidal behavior resulting in death.

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Borderline personality disorder is a condition with high morbidity as well as significant mortality.[1] It is the only psychiatric diagnosis for which recurrent suicidal behavior figures into the definition. As many as 70% attempt suicide,[2] and the lifetime rate of suicide is 5% to 10%.[1,3,4] As such, all too frequently, clinicians working in acute psychiatric services have to face the difficult and legally-bound decision of judging whether a patient with borderline personality disorder presents a serious risk of committing suicide. It is, therefore, surprising that risk factors for suicide completion in borderline personality disorder have received limited attention from researchers.

Though the predictors of suicide attempts in borderline personality disorder have been extensively investigated,[5–17] few studies have examined individuals who meet criteria for borderline personality disorder and die by suicide. Yet, risk factors associated with suicide attempts are dubious predictors of suicide completion, for, especially among this population, most attempters do not die by suicide. Some studies have compared suicides with and without personality disorders[18,19] or employed chart reviews or follow-up studies among clinical samples of borderline personality disorder patients,[4,20–23] identifying too few suicides to make prediction practical and lacking generalizability to real-world populations. An in-depth examination of risk factors for suicide in borderline personality disorder is absent from the literature. More specifically, no study has examined the risk for suicide associated with Axis I and II disorders, or behavioral predispositions to

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suicide, in a large enough sample while directly controlling for borderline personality disorder.

Most of the available literature on suicide risk among borderline personality disorder patients focuses on general clinical features. A positive history of previous suicide attempts in patients with borderline personality disorder seems to be an important predictor.[20,23] However, this factor lacks specificity, as a large proportion of borderline personality disorder patients have a positive history of suicide attempts. Investigators have also reported that comorbidity for substance abuse and depression,[24] as well as several psychosocial factors,[19,20] increases the risk for completion. Additionally, several issues related to medical support and treatment have been found to be strongly associated with suicide. Among these are hospitalization, history of discharge against medical advice, and lack of regular follow up.[20,24]

Growing evidence suggests that impulsive aggressive behaviors play an important role in suicide risk among psychiatric patients.[25–28] Similarly, the increased risk for suicide associated with the presence of cluster B personality disorders is well documented. Some evidence suggests that impulsivity and aggression interact to result in an increased risk for suicide completion.[18,26,29] Thus, we hypothesized that borderline personality disorder patients would be particularly at risk for suicide completion when impulsivity, a core feature of borderline personality disorder,[30] was present together with the violent-aggressive features associated with other cluster B personality disorders, particularly antisocial personality disorder. In other words, we hypothesized that high levels of impulsivity may facilitate suicidal behavior but that successful completion requires the additional contribution of aggression.

Therefore, the purpose of this study was to investigate the relationship between suicide risk and Axis I and II disorders, behavioral predispositions, and temperament and character, while directly controlling for borderline personality disorder. More specifically, we compared individuals who met criteria for borderline personality disorder who had completed suicides to living borderline personality disorder subjects. We used informants for both the suicide group, where it was necessary, and for the living controls to prevent reporting artifacts due to the method of data collection.

METHOD

Subjects

Our sample consisted of 120 (93 male and 27 female) white subjects. Inclusion was contingent on proxy confirmation of at least 4 borderline personality disorder symptoms. The sample included 70 suicide completers, as determined by the Quebec Coroner's Office and the Montreal Central Morgue, and 50 matched controls. To ensure the comparability between samples, both suicide and control groups were equally assessed by means of proxy-based interviews. The mean age of the suicide group was 37.68 ± 10.72 years versus 37.50 ± 10.94 years for the control group ($t = .093$, $df = 119$, nonsignificant [NS]), and the 2 groups did not differ with respect to sex distribution ($\chi^2 = 3.359$, $df = 1$, NS).

A symptom count of 4 was chosen, as individuals with subthreshold borderline personality disorder (controls, N = 8; suicides, N = 18) most likely met full criteria for borderline personality disorder, yet were not identified as such in a proxy-based interview as a result of the reduced sensitivity of the psychological autopsy procedure.[31] In support of this proposition, informants in this sample significantly underrated cluster B personality disorder symptoms (see Interrater Reliability and Validity of Proxy-Based Diagnoses). Analyses were conducted to ensure that subthreshold borderlines did not differ from those meeting criteria for borderline personality disorder: no significant differences emerged with respect to Axis I and II psychopathology ($p > .414$) or behavioral, temperament, and character measures ($p > .549$). Further, borderline personality disorder symptom counts for cases and controls did not differ as a result of this inclusion ($p > .187$).

Suicide cases were recruited primarily during the 2001 through 2005 period. The participation acceptance rate by suicide families was 75%. Suicide cases from participating and nonparticipating families did not differ in age, race, or suicide method. Suicide methods for the sample were as follows: hanging (N = 39, 55.7%), firearm (N = 12, 17.1%), overdose (N = 6, 8.6%), jumping or traffic (N = 5, 7.1%), cutting (N = 3, 4.3%), carbon monoxide (N = 2, 2.9%), or other (N = 3, 4.3%). Nonviolent suicide methods were coded as carbon monoxide and overdose, while all other methods employed were considered violent.

The control group was recruited from among psychiatric outpatients of psychiatric community clinics affiliated with McGill University.

This study was approved by our local institutional review board, and suicide families, controls, and informants signed written informed consents.

Diagnoses

A psychological autopsy method was used to diagnose Axis I and II DSM-IV psychiatric disorders using the SCID-I[32] and SCID-II[33] interviews. This validated technique[28,34–36] involves selecting the family member or friend best acquainted with the subject to serve as an informant. Informants included mother, father, sibling, child, and significant other. We have previously reported that the rate of specific disorders identified does not differ between informants for a given subject,[28] nor does it vary as a function of the informant's relationship with the subject.[37]

Interrater Reliability and Validity of Proxy-Based Diagnoses

For a subset (N = 7), 2 or more interviewers were asked to separately rate the same subject; interrater agreement was calculated: 0.81, major depressive disorder; 1.00, alcohol dependence; 1.0, cluster A personality disorders; 0.71, cluster C personality disorders; 1.0, borderline personality disorder; and 1.0, other cluster B personality disorders.

For a different subset (N = 8), agreement between subject and informant was calculated. Kappas were as follows: 0.75, depressive disorders; 1.0, substance abuse/dependence; 1.0, anxiety disorders; 1.0, cluster A personality disorders; 0.77, cluster C personality disorders; 1.0, borderline personality disorder; and 0.69, comorbid antisocial personality disorder. Among this subset, we also compared the number of informant- and subject-reported Axis II symptoms. We found no differences in the number of cluster A or C personality disorder symptoms reported ($p \geq .652$); however, informants significantly underreported cluster B symptoms (mean ± SD = 8.35 ± 2.46 vs. 10.85 ± 3.05; $t = -2.379$, $df = 26$, $p < .05$). This effect was strictly confined to borderline personality disorder symptoms (5.21 ± 1.18 vs. 7.00 ± 1.17, $p < .001$) and did not apply to other cluster B disorders ($p = .515$)

Personality Trait Assessments

Behavioral measures assessed in this study focused on those commonly regarded as risk factors for suicide, notably, personality traits and measures of impulsive-aggressive behaviors. The Brown-Goodwin History of Aggression (BGHA)[38] is an 11-item assessment of aggressive behaviors; the adulthood subscale was used to ensure comparable levels of information in this population, which is characterized by tumultuous interpersonal relationships that might result in decreased reliability with respect to reports of child or adolescent aggression. The Barratt Impulsiveness Scale (BIS-11)[39] consists of 30 items and has been commonly used in the investigation of impulsive behaviors. The Buss-Durkee Hostility Inventory (BDHI)[40] is a 75-item assessment of impulsive aggression. Last, the Temperament and Character Inventory (TCI)[41] was used to complete information by assessing 4 basic temperament and 3 character dimensions. Consistent with our previous studies in different clinical samples[25] and with studies by other groups,[22–24] the internal consistency estimates in this study were overall very good with the informant version for the BGHA ($\alpha = .83$), the BIS ($\alpha = .90$), the BDHI ($\alpha = .82$), and the TCI ($.84 \geq \alpha \geq .55$ for each of the subscales).

Validity of Proxy-Based Personality Trait Assessments

The literature and our previous studies on the validity of proxy-based personality trait assessments support the use of the proxy-based assessments.[28,35,36,42] To ensure the validity of this procedure among individuals who meet criteria for borderline personality disorder, we compared personality trait information on borderline personality disorder controls by means of the instruments listed above scored by the informant and by the subject. No significant differences were found on any temperament and character comparisons ($N = 28$, $p > .370$ for all comparisons, $\gamma > .448$) or for impulsive aggressive behaviors ($N = 28$, $p > .562$ for all comparisons, $\gamma > .356$).

Statistical Analyses

Statistical analyses were performed using the SPSS statistical package, version 11.5 (SPSS Inc., Chicago, Ill.). Multiple logistic regressions (with exact limit test to evaluate the 95% confidence interval) were used to examine risk factors for borderline personality disorder suicide. Significant univariate predictors were then entered into a multivariate logistic regression to determine the independence of prediction. As some univariate predictors assess overlapping dimensions, categorical variables were chosen based on Cox & Snell R^2, while continuous variables were chosen based first on the respect of normality and subsequently on R^2. If any one variable was significantly correlated with every other significant univariate predictor, this variable was excluded from the test of independent prediction. The effect of this variable on the other predictors was then examined by way of partial correlation. Secondary analyses were conducted using multinomial logistic regression and analysis of variance (with Bonferroni post hoc) among borderline personality disorder suicides with and without cluster B comorbidity and borderline personality disorder controls. To test impulsivity-aggression interactions, the interaction was included in a logistic regression in which suicide status served as the predictor. Statistical significance was set at $p \leq .05$ for this study.

RESULTS

Demographics

The demographic characteristics of borderline personality disorder subjects are presented in Table 1. Matching resulted in borderline personality disorder suicide and control groups that could not be differentiated with respect to age or sex. Suicides who met criteria for borderline personality disorder were more likely to be married at the time of death (OR = 2.364; 95% CI = 1.015 to 5.506, $p < .05$) and were marginally less likely to live alone (OR = 0.474; 95% CI = 0.220 to 1.022, $p = .055$). In addition, borderline personality disorder cases were significantly less likely than borderline personality disorder controls to have previously attempted suicide (0.97 ± 1.10 vs. 2.31 ± 1.76, $p < .05$) and had fewer lifetime psychiatric hospitalizations (1.07 ± 3.13 vs. 2.73 ± 4.87, $p < .001$).

Table 1. Demographic Characteristics and Hospitalizations of Borderline Personality Disorder Suicides and Controls

Variable	Suicides	Controls	Analysis
Age, N (mean ± SD y)	70 (37.68 ± 10.72)	50 (37.90 ± 10.88)	Mean difference = –0.21 (95% CI = –4.17 to 3.74)
Male, N/total N (%)	58/70 (82.9)	35/50 (70.0)	OR = 0.483 (95% CI = 0.203 to 1.149)
Married, N/total N (%)	26/70 (37.1)	10/50 (20.0)	OR = 2.364 (95% CI = 1.015 to 5.506)**
Living alone, N/total N (%)	19/70 (27.1)	22/50 (44.0)	OR = 0.474 (95% CI = 0.220 to 1.022)***
Employed, N/total N (%)	40/70 (57.1)	34/50 (68.0)	OR = 0.627 (95% CI = 0.294 to 1.341)
Psychiatric hospitalizations, N (mean ± SD)	67 (1.07 ± 3.13)	41 (2.73 ± 4.87)	Mean difference = –1.66 (95% CI = –3.183 to –0.131)**
Suicide attempts, N (mean ± SD)[a]	48 (0.97 ± 1.10)	44 (2.31 ± 1.76)	Mean difference = –1.33 (95% CI = –0.721 to –0.195)*

[a]Suicide attempts were defined as self-injury with intent to die of sufficient severity to require medical treatment.
*p ≤ .001.
**p ≤ .05.
***p = .055.

Table 2. Comparisons of Borderline Personality Disorder Suicide Cases and Controls as Relates to Psychiatric and Personality Risk Factors for Suicide

			Analysis	
Variable	Suicides	Controls	OR (95% CI)	Adjusted OR (95% CI)
Current Axis I (last 6 months)				
Major depressive disorder, N/total N (%)	37/70 (52.9)	21/50 (42.0)	1.548 (0.745 to 3.219)	
Alcohol dependence, N/total N (%)	31/70 (44.3)	6/50 (12.0)	5.829 (2.199 to 15.449)*	10.200 (1.272 to 81.814)***
Drug dependence, N/total N (%)	28/70 (40.0)	11/50 (22.0)	2.303 (1.010 to 5.250)***	0.647 (0.136 to 3.070)
Anxiety disorder, N/total N (%)	12/70 (17.1)	11/50 (22.0)	0.734 (0.294 to 1.828)	
Comorbid disorders, N (mean ± SD)	70 (2.35 ± 1.31)	50 (1.14 ± 1.01)	2.493 (1.664 to 3.733)*	N/A
Lifetime Axis I				
Major depressive disorder, N/total N (%)	40/70 (57.1)	33/50 (66.0)	0.687 (0.324 to 1.458)	
Alcohol dependence, N/total N (%)	42/70 (60.0)	14/50 (28.0)	3.857 (1.767 to 8.422)*	1.965 (0.407 to 9.488)
Drug dependence, N/total N (%)	30/70 (42.8)	11/50 (22.0)	2.591 (1.140 to 5.890)***	4.288 (0.877 to 20.972)
Anxiety disorder, N/total N (%)	15/70 (21.4)	11/50 (22.0)	0.967 (0.401 to 2.330)	
Comorbid disorders, N (mean ± SD)	70 (2.38 ± 1.32)	50 (1.58 ± 1.34)	1.588 (1.180 to 2.136)**	N/A
Axis II				
Cluster A diagnosis, N/total N (%)	7/70 (10.0)	4/50 (8.0)	1.278 (0.353 to 4.623)	
Cluster B diagnosis, N/total N (%)[a]	40/70 (57.1)	14/50 (28.0)	3.429 (1.575 to 7.464)**	N/A
Cluster C diagnosis, N/total N (%)	13/70 (18.6)	6/50 (12.0)	1.673 (0.589 to 4.752)	
Comorbid personality disorders, N (mean ± SD)	70 (1.88 ± 0.80)	50 (1.56 ± 0.81)	1.690 (1.036 to 2.756)***	1.100 (0.526 to 2.300)
Personality traits				
BIS score, N (mean ± SD)	49 (81.66 ± 11.26)	45 (73.65 ± 13.75)	1.051 (1.015 to 1.089)**	1.006 (0.951 to 1.064)
BDHI score, N (mean ± SD)	48 (48.37 ± 10.47)	49 (42.73 ± 12.58)	1.040 (1.002 to 1.079)***	1.033 (0.978 to 1.091)
BGHA-Adult score, N (mean ± SD)	47 (10.64 ± 6.03)	50 (8.69 ± 7.08)	1.018 (0.993 to 1.043)	
TCI score, N (mean ± SD)				
Self-directedness	47 (19.85 ± 6.20)	49 (21.63 ± 7.27)	0.963 (0.905 to 1.025)	
Self-transcendence	47 (13.85 ± 7.02)	49 (13.02 ± 6.22)	1.020 (0.959 to 1.084)	
Cooperativeness	47 (24.55 ± 8.40)	49 (25.63 ± 7.38)	0.981 (0.930 to 1.034)	
Novelty seeking	47 (27.70 ± 5.93)	49 (23.04 ± 6.74)	1.120 (1.043 to 1.203)**	N/A
Harm avoidance	47 (18.04 ± 8.55)	49 (22.67 ± 6.62)	0.918 (0.865 to 0.973)**	0.897 (0.822 to 0.980)**
Reward dependence	47 (13.10 ± 4.12)	49 (12.83 ± 4.95)	1.017 (0.929 to 1.114)	
Persistence	47 (4.12 ± 2.70)	49 (4.12 ± 2.20)	1.007 (0.854 to 1.188)	

[a]In addition to borderline personality disorder.
*p ≤ .001.
**p ≤ .01.
***p ≤ .05.
Abbreviations: BDHI = Buss-Durkee Hostility Inventory, BGHA = Brown-Goodwin History of Aggression, BIS = Barratt Impulsiveness Scale, N/A = not applicable, TCI = Treatment and Character Inventory.

Psychiatric Characteristics and Personality Variants

Analyses related to psychiatric diagnoses and personality traits are presented in Table 2. Those who died by suicide were more likely to have currently (last 6 months) met criteria for alcohol dependence (OR = 5.829; 95% CI = 2.199 to 15.449, $p < .001$), as well as during their lifetime (OR = 3.857; 95% CI = 1.767 to 8.422, $p < .001$). Similarly, borderline personality disorder suicides were more likely to have met criteria for current (OR = 2.303; 95% CI = 1.010 to 5.250, $p < .05$), as well as lifetime drug dependence (OR = 2.591; 95% CI = 1.140 to 5.890, $p < .05$). In addition, they had higher levels of current (2.35 ± 1.31 vs. 1.14 ± 1.01, $p < .001$) and lifetime (2.38 ± 1.32 vs. 1.58 ± 1.34, $p < .01$) comorbid Axis I disorders. Borderline personality disorder suicides were more likely to concurrently meet criteria for cluster B comorbidity

(OR = 3.43; 95% CI = 1.57 to 7.46, $p < .01$), primarily driven by antisocial personality disorder (92.5%) and had higher levels of Axis II pathological trait comorbidity (1.88 ± 0.80 vs. 1.56 ± 0.81, $p < .05$). With respect to personality trait variants, borderline personality disorder suicides had higher levels of impulsivity (81.66 ± 11.26 vs. 73.65 ± 13.75, $p < .01$), hostility (48.37 ± 10.47 vs. 42.73 ± 12.58, $p < .05$), and novelty seeking (27.70 ± 5.93 vs. 23.04 ± 6.74, $p < .01$), while exhibiting lower levels of harm avoidance (18.04 ± 8.55 vs. 22.67 ± 6.62, $p < .01$). Although no difference emerged with respect to depression, borderline personality disorder suicides were significantly more likely to contemporaneously meet criteria for a major depressive episode and substance dependence (N = 24, 34.3% vs. N = 6, 12.2%; OR = 3.74; 95% CI = 1.39 to 10.03, $p < .01$).

Independent Prediction

The independence of prediction was examined using a logistic regression model into which significant univariate predictors were loaded. Following criteria selection for overlapping measures (see Method), BIS-11 was chosen over the novelty seeking subscale of the TCI (impulsivity), while substance dependence disorders were chosen over Axis I comorbidity. Cluster B comorbidity was not included in the model, for this predictor was significantly ($.648 > |r| > .215$; $p < .05$) correlated with every predictor of suicide in this population and is likely to underlie many identified differences. Total Axis II comorbidity did not significantly correlate with other predictors and was included in the model. The resulting adjusted odds ratios (AOR) are presented in the farthest column of Table 2. The model indicated that only 2 factors independently predicted suicide outcome: harm avoidance appears to play a protective role against suicide among individuals who meet criteria for borderline personality disorder (AOR = 0.897; 95% CI = 0.822 to 0.980, $p \leq .01$), while current alcohol dependence increased such individuals' risk for suicide (AOR = 10.200; 95% CI = 1.272 to 81.814, $p \leq .05$).

Borderline Personality Disorder Suicide and Cluster B Comorbidity

It is interesting to note that despite the commonly low prevalence of nonviolent suicide methods among suicide completers, with this sample being no exception (11.5%), nonviolent suicide methods were significantly associated with the absence of cluster B comorbidity (N = 6, 20.0% vs. N = 2, 5.0%; OR = 4.750; 95% CI = 0.885 to 25.484, $p = .05$).

As previously indicated, comorbid cluster B personality disorders were significantly correlated with every univariate predictor of suicide and it is possible that cluster B comorbidity is indicative of a fracture with respect to suicide risk among those who meet criteria for borderline personality disorder. We therefore conducted partial correlations between univariate predictors and suicide status while controlling for cluster B comorbidity. Controlling for cluster B comorbidity resulted in significant correlations for univariate predictors, with the exception of current and lifetime alcohol dependence disorders (and Axis I comorbidity) and the harm avoidance subscale of the TCI. Controlling did, however, result in a drop in both correlation and significance for each of these variables. Thus, we wished to examine the role of cluster B comorbidity in borderline personality disorder suicide by dichotomizing our suicides based on cluster B comorbidity and comparing these groups to borderline personality disorder controls.

Psychiatric Characteristics and Personality Traits by Cluster B Comorbidity

Results pertaining to psychiatric diagnoses and personality variants for borderline personality disorder suicides with cluster B comorbidity, those without cluster B comorbidity, and controls are presented in Table 3. It is important to note the general pattern with which a gradient of suicide risk emerges, with the greatest risk associated with the borderline personality disorder suicide with comorbid cluster B group, followed by the borderline personality disorder suicide without cluster B comorbidity group relative to the borderline personality disorder control group. This is most notably the case with respect to psychopathology related to substance dependence disorders, impulsive aggression, and harm avoidance.

At the same time, as we initially hypothesized that suicide was the result of an interaction between impulsivity, a core feature of borderline personality disorder, and violent-aggressive traits, we examined the interaction of these features in relation to suicide completion. The BIS × BDHI interaction significantly predicted suicide ($p < .05$), although only a trend emerged after controlling for cluster B comorbidity ($p = .091$).

DISCUSSION

In this study, we investigated correlates of suicide completion among subjects with borderline personality disorder using a case-control design with proxy-based interviews. To our knowledge, this is the first psychological autopsy study that allowed direct control for the effect of borderline personality disorder when investigating risk factors for suicide.

According to Widiger and Frances,[43] approximately 11% of all psychiatric outpatients and 19% of psychiatric inpatients meet criteria for borderline personality disorder. The burden of this group on mental health resources is probably, more than any other borderline personality disorder symptom, related to their recurrent suicidal threats and gestures. In line with the literature on suicide more generally,[44] examinations of suicides with

Table 3. Psychiatric Diagnoses and Personality Variants Comparing Borderline Personality Disorder Controls, Borderline Personality Disorder Suicides With Cluster B Comorbidity, and Borderline Personality Disorder Suicides Without Cluster B Comorbidity

	Suicides				Bonferroni Post Hoc		
Variable	A: With Cluster B Comorbidity (N = 40)	B: Without Cluster B Comorbidity (N = 30)	C: Controls (N = 50)	Analysis F or χ^2	A vs C	B vs C	A vs B
Current Axis I (last 6 months)							
Major depressive disorder, N (%)	23 (57.5)	14 (46.7)	21 (42.0)	$\chi^2 = 1.965$			
Alcohol dependence, N (%)	20 (50.0)	11 (36.7)	6 (12.0)	$\chi^2 = 16.206$*	7.167 (2.495 to 20.589)[a]**	4.149 (1.338 to 12.867)[a]***	
Drug dependence, N (%)	18 (45.0)	10 (33.3)	11 (22.0)	$\chi^2 = 5.119$†	2.826 (1.131 to 7.061)[a]***	1.727 (0.627 to 4.758)[a]	
Anxiety disorder, N (%)	6 (15.0)	6 (20.0)	11 (22.0)	$\chi^2 = 0.502$			
Comorbid disorders, mean ± SD	2.35 ± 1.42	2.37 ± 1.18	1.14 ± 1.01	F = 14.121*	1.19 ± 0.25[b]*	1.20 ± 0.28[b]*	–0.02 ± 0.29[b]
Lifetime Axis I							
Major depressive disorder, N (%)	25 (62.5)	15 (50.0)	33 (66.0)	$\chi^2 = 1.902$			
Alcohol dependence, N (%)	28 (70.0)	14 (46.7)	14 (28.0)	$\chi^2 = 15.602$*	5.833 (2.331 to 14.598)[a]**	2.188 (0.848 to 5.645)[a]	
Drug dependence, N (%)	19 (47.5)	11 (36.7)	11 (22.0)	$\chi^2 = 6.303$***	3.126 (1.253 to 7.796)[a]***	2.000 (0.735 to 5.441)[a]	
Anxiety disorder, N (%)	8 (20.0)	7 (23.3)	11 (22.0)	$\chi^2 = 0.131$			
Comorbid disorders, mean ± SD	2.50 ± 1.35	2.23 ± 1.27	1.59 ± 1.38	F = 5.426**	0.91 ± 0.28[b]**	0.64 ± 0.31[b]	0.27 ± 0.32[b]
Personality traits							
BIS score, mean ± SD	87.10 ± 9.18	75.55 ± 10.56	73.65 ± 13.75	F = 10.345*	12.94 ± 2.94[b]*	1.39 ± 3.02[b]	11.55 ± 3.39[b]**
BDHI score, mean ± SD	48.42 ± 12.30	48.32 ± 8.07	42.73 ± 12.58	F = 2.036			
BGHA-Adult score, mean ± SD	12.70 ± 5.56	7.85 ± 5.63	8.86 ± 7.04	F = 4.253***	3.84 ± 1.52[b]***	–1.01 ± 1.69[b]	4.85 ± 1.88[b]***
TCI score, mean ± SD							
Self-directedness	18.76 ± 6.39	21.09 ± 5.87	21.63 ± 7.27	F = 1.220			
Self-transcendence	12.84 ± 6.18	15.00 ± 7.86	13.02 ± 6.22	F = 0.335			
Cooperativeness	23.92 ± 8.43	25.27 ± 8.52	25.63 ± 7.38	F = 0.816			
Novelty seeking	30.24 ± 4.63	24.82 ± 6.01	23.04 ± 6.74	F = 10.642*	6.83 ± 1.49[b]*	1.41 ± 1.56[b]	5.42 ± 1.76[b]**
Harm avoidance	16.52 ± 8.48	19.77 ± 8.49	22.67 ± 6.62	F = 6.129**	–6.50 ± 1.87[b]**	–3.25 ± 1.95[b]	–3.25 ± 2.20[b]
Reward dependence	13.36 ± 3.95	12.82 ± 4.39	12.83 ± 4.95	F = 0.189			
Persistence	3.08 ± 2.43	5.32 ± 2.55	4.12 ± 2.20	F = 5.386**	–0.94 ± 0.58[b]	1.30 ± 0.60[b]	–2.24 ± 0.68[b]**

[a]OR (95% CI).
[b]Mean difference ± SE.
*p ≤ .001.
**p ≤ .01.
***p ≤ .05.
†p = .077.
Abbreviations: BDHI = Buss-Durkee Hostility Inventory, BGHA = Brown-Goodwin History of Aggression, BIS = Barratt Impulsiveness Scale, TCI = Treatment and Character Inventory.

personality disorders and those without have suggested that antisocial personality disorder is an important risk factor for suicide,[19,45] and higher lethality borderline personality disorder attempters are more likely than lower lethality borderline personality disorder attempters to possess cluster B comorbidity.[10,12] In addition, indirect evidence suggests that borderlines who possess antisocial traits are not typically encountered in mental health settings, as these individuals are less likely to be referred or less likely to self-select into these settings.[15] Our study is the first, to our knowledge, to show that suicides who meet criteria for borderline personality disorder differ from borderlines typically encountered in acute psychiatric services, for they are less likely to have previously attempted suicide or undergone psychiatric hospitalization. This is interesting in light of our initial hypothesis, as it suggests that borderline personality disorder suicides and attempters constitute, although partially overlapping, clearly different populations. This observation is of significant clinical relevance.

Violent suicide methods are considerably more lethal than nonviolent methods. They are associated with higher levels of lifetime aggression,[46] an effect that is not constrained by the prevalence of personality disorders, anxiety disorders, mood disorders, or substance abuse disorders in the 6 months preceding death. Of interest, the suicide methods employed by borderline personality disorder attempters and completers differ. Approximately 70% of borderline personality disorder suicide attempters' most severe attempts are nonviolent,[10] whereas only 11.5% of borderline personality disorder suicide completers in our sample used nonviolent methods. Violent methods were slightly more prevalent among borderline personality disorder suicides than among a partially overlapping sample of unselected suicides, similar with respect to culture and ethnicity (88.5% vs. 78.1%).[46] Our borderline personality disorder suicides were more likely to contemporaneously meet criteria for additional cluster B personality disorders, primarily antisocial personality disorder (92.5%), which is associated with higher levels of aggression and an increased risk for suicide. Analyses revealed that borderline personality disorder suicides without cluster B comorbidity were more likely to use nonviolent suicide methods. In addition, comorbid cluster B personality disorders differentiated borderline personality disorder suicides and controls, and this difference underlay all group differences.

It has been proposed that impulsivity and aggression predispose individuals to suicide by increasing the likelihood of acting on suicidal ideation.[47] This view of suicide would suggest that, as impulsivity is a core feature of borderline personality disorder, individuals who meet criteria for borderline personality disorder are more likely to impulsively carry out suicidal thoughts, yet that in the absence of a violent-aggressive complement, the lethality of these behaviors is limited and they seldom result in death. We found that borderline personality disorder suicides were more aggressive than borderline personality disorder controls, with a risk gradient emerging based on cluster B comorbidity. Moreover, a similar difference was found as relates to impulsivity, as measured by 2 different measures, and secondary analyses confirm the confinement of this increased risk to borderline personality disorder suicides with comorbid cluster B personality disorders. Most importantly, our results with respect to the interaction of these characteristics suggest that suicide in borderline personality disorder is, at least in part, due to the interaction of impulsivity and violent-aggressive features.

In the current study, substance dependence disorders consistently differentiated suicides and controls, with even greater risk associated with cluster B comorbidity. The relationship between substance disinhibition and suicide is both intuitive and well documented, yet the association in borderline personality disorder comes with additional implications. In recent years, several studies have countered the notion of borderline personality disorder diagnostic stability over the life cycle, with a remission rate as high as 74%,[1] with temperamental symptoms such as chronic feelings of intense anger associated with sustained diagnosis.[1] At the same time, several studies report greater borderline personality disorder diagnostic stability associated with comorbid substance abuse.[8,48] Substance dependence, therefore, may serve as an early indicator of a more persistent form of borderline personality disorder. More persistent forms of borderline personality disorder have been associated with a decreased preponderance of acute symptoms,[1,49] such as suicidal behavior of limited lethality, and therefore may be indicative of an increased risk for completed suicide. As clinical populations of borderline personality disorder at risk for suicide completion may not be readily identified by previous suicidal behavior, substance dependence in borderline personality disorder is of tremendous clinical relevance when assessing suicide risk.

In our sample, borderline personality disorder suicides, both with and without cluster B comorbidity, could not be differentiated from living borderlines with respect to major depression. This is expected in light of the affective lability observed in borderline personality disorder, for individuals who meet criteria for borderline personality disorder experience important mood shifts frequently and substantially enough to meet criteria for recurrent mood disorders.[48] Thus, depression may be symptomatic of borderline personality disorder rather than a contemporaneous factor influencing suicide outcome.

We found a decreased risk for suicide associated with anxious traits, and the absence of this protective factor was most evident among borderline personality disorder suicides with cluster B comorbidity. In the literature on borderline personality disorder suicide completion, one chart review study examining intake records reported an

increased prevalence of medium to severe anxiety neurosis among matched living borderlines.[20] Increasing evidence among suicide attempters,[50,51] and suicide completers,[52,53] suggests that anxiety reduces the risk for suicidal behavior. We thus find additional support for the protective role of anxious traits as relates to completed suicide.

Limitations

The limitations associated with the methodology employed in this study are inherent to postmortem studies involving proxy-based interviews. However, we demonstrated high levels of concordance between information provided by the informant and the individual himself or herself, as we have previously done in other populations.[28] In addition, we used proxy-based information for both suicides and controls to increase direct comparability between groups. Nevertheless, an asymmetry of information may exist between the proxies of living and deceased individuals, or family members in grief may exaggerate certain symptoms.

Another limitation concerns the low prevalence of comorbid narcissistic and histrionic personality disorder, thereby precluding tests of the specificity of the increased risk associated with cluster B personality disorders to antisocial personality disorder.

Though one might consider the recruitment of borderline personality disorder controls from outpatient clinics to have introduced a bias, it is within this population that clinicians are faced with the difficult task of risk assessment. Comparing this population to suicides who meet criteria for the same disorder is, therefore, an important contribution to our knowledge of risk for completed suicide in borderline personality disorder.

Last, though borderline personality disorder predominantly affects females,[1] our unselected sample of borderline personality disorder suicides was predominantly male, and therefore additional studies are needed to confirm the extension of our identified risk factors for suicide completion in borderline personality disorder to females.

CONCLUSION

We investigated by means of proxy-based interviews 120 individuals who met criteria for borderline personality disorder, 70 of whom died by suicide. We found support for the hypothesis that borderlines who die by suicide differ from those typically encountered in psychiatric settings, for they are less likely to have used psychiatric services and less likely to have previously attempted suicide. This appears to be attributable to concomitant cluster B personality disorders, particularly antisocial personality disorder. Further, our results indicate that suicide completion among this population may be the result of an interaction between impulsivity, a core feature of the disorder, and violent-aggressive traits, such as those associated with antisocial personality disorder. Thus, though borderlines may impulsively engage in suicidal behavior, in the absence of aggressive traits, these behaviors are less likely to prove fatal. At the same time, anxious traits appear to serve a protective role against suicide completion among this diagnostic category.

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