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Suicide Ideations, Suicide Attempts, and Completed Suicide in Persons with Pathological Gambling and their First-Degree Relatives

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Abstract

We examined the relationship between suicidal ideations and attempts in 95 probands with pathological gambling (PG), 91 controls, and 1075 first-degree relatives. The results were analyzed using logistic regression with GEE. Thirty-four PG probands (35.8%) and 4 controls (4.4%) had attempted suicide (OR = 12.12, $P < .001$); in 13 the attempt occurred before PG onset. Lifetime suicidal ideations occurred in 60 PG probands (63.2%) and 12 controls (13.2%) (OR = 11.29, $P < .001$). Suicidality in PG probands is a marker of PG severity and is associated with greater psychiatric comorbidity. Offspring of PG probands had significantly higher rates of suicide attempts than control offspring.

Keywords

Family study; pathological gambling; suicidal ideations; suicide attempts

Pathological gambling (PG) is a major public health problem that is prevalent and is associated with poor quality of life (Cunningham-Williams et al., 2001; NORC, 1999; Shaw et al., 2008). The disorder has recently been renamed “gambling disorder” in DSM-5, and was moved to the chapter on substance-related and addictive disorders to recognize its commonalities with alcohol and drug disorders (Black & Grant, 2014).

Research shows that persons with PG have increased rates of suicidal ideations, suicide attempts, and completed suicides (Argo & Black, 2004; McCormick et al., 1984; Blaszczyński and Farrell, 1998; Kausch, 2003; Petry & Kiluk, 2002; Pfuhlmann & Schidtke, 2002; Thon et al., 2014). In an early study, McCormick et al (1984) showed that of 50 people seeking treatment for gambling problems, 80% had suicidal ideations, and 12% had made a suicide attempt. Blaszczyński & Farrell (1998) presented a case series of 44 completed suicides in persons with PG and found that most were middle aged men, and were unemployed or from a lower socioeconomic background. Nearly one-third reported

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having made one or more suicide attempt and nearly one-third had a history of depression. Nearly all had financial difficulties relating to their gambling. Using an epidemiologic approach, Newman & Thompson (2003) conducted a household survey in Alberta and reported an odds ratio of nearly four for suicide attempts occurring in the 30 individuals with PG.

Most evidence supporting a link to suicide comes from clinical samples and pertains to suicidal ideations and attempts. In a sample of 114 consecutive admissions to a Veterans Administration gambling treatment program, Kausch (2003) concluded that nearly 40% of subjects had past suicide attempts, two-thirds of which were prompted by gambling-related problems. Petry & Kiluk (2002) reported that 49% of 342 persons seeking treatment for disordered gambling had lifetime suicidal ideations and 17% reported making a suicide attempt. Those with suicidal ideations or a history of attempts also appeared to have more severe symptoms of PG than those without. Ledgerwood & Petry (2004) found that of 125 persons, 48% had a history of gambling-related suicidal ideation, while 12% reported a past gambling related suicide attempt. In another treatment seeking sample, Battersby et al. (2006) reported even higher rates of suicide ideations and attempts among 43 treatment seeking people with PG (81% and 30%, respectively).

This body of research suggests that suicidal ideations and attempts are common in persons with PG. What remains unclear is whether the association of PG with suicidality is an intrinsic part of PG, results from common factors such as co-occurring psychiatric or addictive disorders, or is a secondary complication of PG. To this end, Hodgins et al. (2006) reported that from a study of 101 problem gamblers that suicidal ideations or suicide attempts were related to prior mental health disorders. Their conclusion is consistent with that of Newman & Thompson (2003) who attributed an increase in suicide attempts in persons with PG to an a common “mental illness” factor, rather than factors intrinsic to problem gambling.

We examined these issues as part of the Iowa Family Study of PG, which has shown that PG and subclinical forms of disordered gambling are familial (Black et al., 2014). We expected that PG probands and their relatives would have higher rates of suicidal ideations and attempts than controls and their relatives. We also expected that suicidal ideations and attempts would be markers of greater gambling severity; greater psychiatric comorbidity; and greater impulsiveness. With this in mind, we first examined the prevalence of suicidality in PG probands, controls, and their respective first-degree relatives. We then estimated the relative odds of suicidal conditions in PG relatives versus control relatives controlling for within-family correlation and potentially confounding variables.

Methods

Study Sample

The study was undertaken as part of the Iowa Family Study of Pathological Gambling (Black et al., 2014). PG probands were recruited from the Iowa community. Controls were recruited via random digit dialing through the Center of Social and Behavioral Research at the University of Northern Iowa and were group matched to PG subjects for age, sex, and

educational level. PG probands had South Oaks Gambling Scores (SOGS; Lesieur & Blume, 1987) and National Opinion Research Center (NORC) DSM Screen for Gambling Problems (NODS; NORC, 1999) scores ≥ 5 ; they also had to meet DSM-IV PG criteria (American Psychiatric Association, 1994).

PG probands and controls had to be 18 years or older and to speak English. They could not have a psychotic, cognitive, or chronic neurological disorder. Controls were required to have a SOGS score of 2 or less and a NODS score of zero. Written informed consent was obtained from all subjects according to procedures approved by University of Iowa Institutional Review Board.

Subjects were interviewed between February 2005 and June 2010. PG probands and controls were interviewed in-person. Consenting relatives were interviewed blind to family status, usually by telephone. Informant interviews were conducted for those who were deceased, chose not to participate, could not be located, or if the proband refused to allow contact with the relative. This involved gathering data from the relatives of non-interviewed individuals, and in such cases there were usually multiple informants. This data was then used by senior diagnosticians to make best estimate diagnoses. This process is fully described in our earlier communication (Black et al., 2014). There were no diagnostic exclusions for PG or control relatives. As previously reported, 58 PG relatives and 7 control relatives were diagnosed with definite/probable PG.

Assessments

Diagnostic assessments included the Structured Clinical Interview for DSM-IV (SCID; Spitzer et al., 1994) and the Family History Research Diagnostic Criteria adapted to include criteria for PG (FHRDC; Andreasen et al., 1997; 1986). The Minnesota Impulsive Disorders interview (Christenson et al, 1994) was used to collect data on impulse control disorders. The Structured Interview for DSM-IV Personality (SIDP-IV; Pfohl et al, 1997) was used to assess Axis II disorders. The Barratt Impulsiveness Scale (BIS; Barratt, 1959) was used to measure motor, cognitive, and non-planning impulsiveness. Social and demographic data were collected from all subjects.

The presence of lifetime suicidal ideations and past suicidal attempts was assessed based on responses to questions on the SCID (A19–23) and SIDP-IV (item 5, section 1). For relatives who did not consent to an interview, suicide attempter status (or completed suicide status) was determined by responses to a question on the FHRDC by PG probands, controls, or other family members.

A blind consensus procedure employing all sources of data was used to make diagnostic assignments for each study subject for Axis I disorders and antisocial personality disorder (Leckman et al., 1982). (Of the personality disorders, antisocial personality disorder was specifically assessed because research shows that it can be reliably assessed using the best estimate method [Andreasen et al., 1986]). Subjects were rated for the presence of PG, subclinical PG, recreational gambling, and no gambling. Only probable and definite cases of PG and subclinical PG were included in the analyses.

Statistical Analysis

PG probands were placed into three groups: 1) those with no suicidality, 2) those with suicidal ideation only, and 3) those with prior suicide attempts. The three groups were compared on demographics, PG age at onset, PG severity, impulsivity, prevalence of psychiatric comorbidity, family history of psychiatric disorders, disordered gambling, and suicide attempts. For categorical variables, Pearson's Chi-Square test (or Fisher's Exact test, when appropriate) was used to test for group differences. For dimensional variables, the Mann-Whitney test was used to test for group differences.

Using Pearson's Chi-Square test, the lifetime prevalence of suicidal ideation (without suicide attempts), suicide attempts, and suicidal ideation or suicide attempts were compared among PG and control probands. The lifetime prevalence of suicidal ideations only, suicide attempts, completed suicide, suicidal ideation or suicide attempts, and suicide attempts or completed suicide were compared among first-degree relatives of PG and control probands. Pearson's Chi-Square test (or Fisher's Exact test, when appropriate) was used to test for group differences in the suicide outcomes. Using logistic regression with generalized estimating equations (GEE), this analysis was extended to examine the sensitivity of the results to within-family correlation and possible confounding variables including interview status, gender, and the proband's educational level. The GEE analyses used three models: Model 1 used gender and interview status as covariates without accounting for within-family correlation, Model 2 used the Model 1 covariates and accounted for within-family correlation, and Model 3 extended Model 2 by adding proband educational level as a covariate. This modeling strategy allows us to examine the sensitivity of group differences to including proband years of education as a covariate. The logistic regression GEE models provide odds ratios and 95% confidence intervals for predictors of suicide outcomes in relatives.

Of 537 first-degree relatives of PG probands, 103 were offspring, whereas of 538 first-degree relatives of controls, 130 were offspring. To examine whether suicidality is more directly transmitted to offspring, the analyses of the suicide outcomes for first-degree relatives were repeated using the offspring only. All statistical tests were 2-tailed with $\alpha = 0.05$.

Results

A total of 95 PG probands, 91 controls, and 1075 relatives were assessed as part of the Iowa PG Family study. We compared PG probands with a history of suicide ideations or suicide attempts, and those without either problem (Table 1). Thirty-five (37%) PG probands met had no history of suicide ideation or attempts, 26 (27%) had a history of only suicide ideations, while 34 (36%) had a history of past suicide attempts. Table 1 presents a comparison of social, demographic, and clinical features for the three mutually exclusive groups. The table shows that the groups are similar in terms of age, gender, racial/ethnic minority status, years of education, and age of PG onset (defined as when the person met criteria for PG).

Divorce rates were higher for PG probands with prior suicide attempts (73%) than those with suicidal ideation only (61%) and those with no suicidality (55%). PG severity measures (number of PG DSM-IV criteria met, SOGS and NODS scores) were all significantly lower for the PG probands with no suicidality relative to the groups with suicidality. Impulsivity was significantly greater in those with suicidal ideations only or suicide attempts. Rates of anxiety and mood disorders were highest for PG probands with suicide attempts, followed by those with suicidal ideations only. Rates for other types of psychiatric comorbidity (substance use, eating disorder, impulse control disorders, and antisocial personality disorder) were not significantly different across the groups. Rates of family history of psychiatric disorders (mood, substance use, anxiety, gambling, and suicide attempts) were highest among PG probands with suicide attempts, followed by those with suicidal ideation only, but the group differences were not statistically significant.

Thirty-four PG probands (35.8%) had a history of one or more suicide attempt. Half of those who attempted suicide made a single attempt, while the rest made greater than one attempt. In these subjects, the suicide attempt(s) preceded the onset of PG in 13 subjects (38.2%); in 14 subjects (41.2%), the suicide attempt(s) occurred during the course of PG. In 7 subjects (20.6%), the suicide attempts occurred both prior to PG onset and during its course.

Lifetime suicidal ideation and suicide attempts were frequent in PG probands (Table 2). There were significant differences in the prevalence of lifetime suicidal ideations only in PG probands and controls (27% vs. 9%, OR = 3.91, Chi-square = 10.7, $P = .001$), and lifetime suicide attempts (36% vs. 4%, OR = 12.12, Chi square = 28.2, $P < .001$). A majority of PG probands (63%) had suicidal ideations only or suicide attempts compared with 13% of control probands (OR = 11.29, Chi-square = 48.9, $P < .001$).

Lifetime suicidal ideations only and suicide attempts were less frequent among PG relatives compared to their proband family member (Table 3). Suicide attempts were more frequent among PG relatives compared to control relatives (4.7% versus 2.4%, OR = 1.97, Chi-Square = 4.0, $P = .047$). Five PG relatives and 4 control relatives completed suicide ($P = .753$). Suicide attempts or completed suicide were more frequent among PG relatives compared to control relatives (5.6% versus 3.2%, OR = 1.81), but the result did not reach statistical significance ($P = .052$). Rates of suicidal ideation only were not significantly different between the two groups.

Suicide attempts were more frequent among PG offspring compared to control offspring (8.7% versus 0.8%, OR = 12.35, Fisher's Exact Test, $P = .006$). Two control offspring but no PG offspring completed suicide ($P = .505$). Suicide attempts or completed suicide were more frequent among PG offspring compared to control offspring (8.7% versus 2.3%, OR = 4.05, $P = .027$). Rates of suicidal ideations only were not significantly different between the two groups. The analyses presented in Tables 3 and 4 do not account for within-family correlation or other potential confounding variables.

We determined the relative odds for suicide attempts and suicide attempts plus completed suicide based on logistic regression GEE models. After adjusting for gender and interview status (but without accounting for within-family correlation) (Table 5, Model 1), relatives of

PG probands were more likely to have attempted suicide without completed suicide (OR = 2.07, 95% confidence interval [1.04, 4.11]). Accounting for within-family correlation (Table 5, Model 2) did not decrease the PG group effect size (OR = 2.11), but did increase the width of the confidence interval so that the result was no longer significant. Adjusting for the proband's years of education (Model 3) decreased the PG group effect size from 2.11 to 1.93. The odds for suicide attempts were much higher among PG offspring, and the result was consistent across models (Model 3 OR = 14.81, 95% confidence interval [1.75, 125.5]). Female relatives and those who were interviewed were more likely to have at least one suicide attempt.

The GEE analysis for suicide attempts or completed suicide (Table 6) was similar to the analysis of suicide attempts in that the significance of the PG effect in all relatives varied by model. Among offspring, however, the odds were consistently higher for PG offspring. In Model 1, the odds of suicide attempts plus completed suicide were higher for PG relatives (OR = 1.86, 95% confidence interval [1.01, 3.43]). After accounting for within-family correlation and the covariates, the result was no longer significant (OR = 1.72, 95% confidence interval [0.84, 3.51]). After accounting for within-family correlation and the covariates, the odds of suicide attempts plus completed suicide was higher for PG offspring (OR = 5.67, 95% confidence interval [1.00, 32.25]).

Discussion

To our knowledge, this is the first study to combine data on PG probands and controls with systematically collected data on their first-degree relatives. The data show that suicidal ideations and suicide attempts are frequent in people with PG, and occur at rates substantially greater than among controls. The rates for these symptoms in controls occur at rates similar to those reported epidemiological studies (Moscicki et al., 1988; Weissman et al., 1999; Nock et al., 2008). The study also confirms that suicidality is a marker of PG severity, but that it is also associated with greater psychiatric comorbidity and more substance use disorders. Rates of both suicidal ideations and suicide attempts were more frequent in interviewed versus non-interviewed relatives, but this was likely due to our ability to directly assess these individuals rather than to rely on proxy interviews.

The high prevalence of lifetime suicidal ideations and suicide attempts in pathological gamblers in this study is in line with previous research. While the figures differ among the studies depending on assessment method and sample characteristics, it is reasonable to conclude that PG is a major risk factor for both suicidal ideations and attempts. Importantly, ours is one of the few studies to report prevalence of these conditions in persons with PG who were not selected because of treatment-seeking behavior. In fact, the rate for suicide ideations in our PG probands is *lower* than the rate reported in other studies, perhaps because the rate is for suicide ideations only; presumably, nearly all who report lifetime suicide attempts also have had suicide ideations. In that case, the true rate for suicide ideations is much greater (63.2%).

The data further suggest the presence of a complex relationship between suicidality and PG. In some individuals, the timing of the suicide attempt occurred prior to the onset of PG; in

these cases, suicidality is unlikely to represent a consequence of a co-occurring mental health or addictive disorder, but more likely represents an independent or pre-existing condition. For others, the timing of the suicide attempts suggests a more direct relationship between PG and suicidal behaviors. In these individuals, the suicidality may emerge as a direct psychological consequence of the PG. We have witnessed this first-hand among our study subjects who have told us how they have developed suicidal ideations as a direct consequence of their gambling losses. Because suicidality can arise as a complication of PG, clinicians must be alert to the possibility of suicidal ideations and attempts in people with PG and intervene accordingly.

The data partially support the hypothesis that risk for suicide is elevated in relatives of individuals with PG, particularly their offspring. While the rate for suicide attempts was not greater among case than control relatives as a group, the rate was significantly increased in PG offspring even after controlling for within family correlations. This finding has implications for treatment, because risk for suicidal behavior extends beyond the individual with PG and extends to other family members. As we have previously shown, the families of persons with PG are often chaotic and dysfunctional. While the reason behind this is complex (Shaw et al., 2007), it behooves the treatment provider to broaden the scope of treatment beyond the identified person with PG. For those who live within a family unit, family therapy can be a useful adjunct to individual therapy. Several evidence-based models have been described (Rychtarik & McGillicuddy, 2006; Makarchuk et al., 2002; Hodgins et al., 2007) and appear effective.

There are several methodologic limitations. First, PG probands recruited through an epidemiologic sample would have been more desirable, but was not feasible. Second, the low participation rate of minority subjects reduces the generalizability of our findings in these populations. Third, not all the interviews were direct and in person; PG probands and controls were all assessed in-person, but most relatives were assessed by telephone, and it is possible that some disorders were missed or that people were less comfortable talking about their suicidality by telephone. Fourth, some relatives could not be interviewed due to death or other reasons, and while we aimed to include these relatives by conducting informant interviews, it is possible that some disorders were missed because the relatives were not sufficiently familiar with the individual. We would have little information on their suicidal thoughts or acts. Last, the assessment of suicide ideations and past suicide attempts was based on questions from standardized interviews, but we did not employ specific suicide assessments such as the Columbia Suicide Severity Rating Scale (Posner et al., 2011).

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Table 1

A comparison of probands with pathological gambling without suicide ideation or attempts, those with suicide ideations only, and those with prior suicide attempts

Variables	No Suicidality (n = 35)	Suicidal ideation only (n = 26)	Suicide Attempts (n = 34)	Any Suicidality (n = 60)	Statistical Test	
					χ^2 , df	P-value
Age, years, mean (SD)	44.6 (15.8)	46.2 (12.9)	46.3 (8.8)	46.3 (10.7)	0.4, 2	0.805
Female, no. (%)	18 (51%)	16 (62%)	21 (62%)	37 (62%)	1.0, 2	0.662
Caucasian, no. (%)	28 (80%)	23 (88%)	30 (88%)	53 (88%)	1.2, 2	0.543
Ever Divorced (%) *	12 (55%)	11 (61%)	22 (73%)	33 (69%)	2.1, 2	0.357
Education, years, mean (SD)	13.9 (2.0)	14.1 (1.9)	14.4 (2.0)	14.3 (1.9)	0.8, 2	0.673
PG age at onset, years, mean (SD)	34.0 (14.7)	35.4 (11.7)	33.7 (12.6)	34.4 (12.1)	0.5, 2	0.786
# of PG DSM-IV criteria, mean (SD)	8.1 (1.4)	8.8 (1.3)	8.8 (1.5)	8.8 (1.4)	7.2, 2	0.028
SOGS score, mean (SD)	12.1 (3.3)	14.9 (3.6)	13.6 (3.6)	14.2 (3.6)	10.4, 2	0.005
NODS score, mean (SD)	12.3 (4.0)	14.7 (4.0)	15.0 (4.1)	14.9 (4.0)	8.0, 2	0.018
BIS total score, mean (SD)	65.3 (10.6)	70.6 (11.3)	74.9 (11.4)	73.1 (11.5)	10.0, 2	0.007
Psychiatric comorbidity						
Any substance use disorder, no. (%)	22 (63%)	18 (69%)	25 (74%)	43 (72%)	0.9, 2	0.631
Any anxiety disorder, no. (%)	11 (31%)	11 (42%)	24 (71%)	35 (58%)	11.1, 2	0.004
Any mood disorder, no. (%)	11 (31%)	25 (96%)	32 (94%)	57 (95%)	43.9, 2	<0.001
Any eating disorder, no. (%)	3 (9%)	3 (12%)	7 (21%)	10 (17%)	FET	0.360
Any impulse control disorder, no. (%)	7 (20%)	7 (27%)	10 (29%)	17 (28%)	0.9, 2	0.650
Antisocial personality disorder, no. (%)	6 (18%)	1 (4%)	7 (21%)	8 (14%)	FET	0.136
Family History						
Mood disorder, no. (%)	27 (77%)	21 (81%)	28 (82%)	49 (82%)	0.3, 2	0.858
Substance use disorder, no. (%)	26 (74%)	21 (81%)	30 (88%)	51 (85%)	2.2, 2	0.335
Anxiety disorder, no. (%)	17 (49%)	14 (54%)	25 (74%)	39 (65%)	4.8, 2	0.090
Gambling disorder, no. (%)	13 (37%)	10 (38%)	18 (53%)	28 (47%)	2.1, 2	0.354
Suicide attempt, no. (%)	5 (14%)	7 (27%)	10 (29%)	17 (28%)	2.5, 2	0.286

PG=pathological gambling; SOGS=South Oaks Gambling Screen; NODS= National Opinion Research Center (NORC) DSM Screen for Gambling Problems; BIS=Barratt Impulsiveness Scale; Divorce rates only applicable to subjects who were married at least once

Table 2

Prevalence of suicidal ideations and suicide attempts in PG probands and controls

Variable	PG Probands (n = 95)	Controls (n = 91)	OR (95% C.I.)	Statistical Test	
				χ^2 , df	P-value
Suicidal ideations only, no. (%)	26 (27.4%)	8 (8.8%)	3.91 (1.66, 9.19)	10.7, 1	0.001
Suicide attempts, no. (%)	34 (35.8%)	4 (4.4%)	12.12 (4.09, 35.93)	28.2, 1	<0.001
Suicide ideation or attempts, no. (%)	60 (63.2%)	12 (13.2%)	11.29 (5.40, 23.57)	48.9, 1	<0.001

OR = odds ratio, C.I. = confidence interval

Prevalence of suicidal ideations, suicide attempts, and completed suicides in first-degree relatives of PG probands and controls

Table 3

Variable	PG Relatives (n = 537)	Control Relatives (n = 538)	OR (95% C.I.)	Statistical Test	
				χ^2 , df	P-value
Suicidal ideations only, no. (%)	7 (1.3%)	12 (2.2%)	0.58 (0.23, 1.48)	1.3, 1	0.249
Suicide attempts, no. (%)	25 (4.7%)	13 (2.4%)	1.97 (1.00, 3.90)	4.0, 1	0.047
Completed suicide, no. (%)	5 (0.9%)	4 (0.7%)	1.25 (0.34, 4.70)	FET	0.753
Suicidal ideations or attempts, no. (%)	32 (6.0%)	25 (4.7%)	1.30 (0.76, 2.23)	0.9, 1	0.337
Suicide attempts or completed suicide no. (%)	30 (5.6%)	17 (3.2%)	1.81 (0.99, 3.33)	3.8, 1	0.052

FET=Fisher's exact test, OR = odds ratio, C.I. = confidence interval

Prevalence of suicidal ideations, suicide attempts, and completed suicides in offspring of PG probands and controls

Table 4

Variable	PG Offspring (n = 103)	Control Offspring (n = 130)	OR (95% C.I.)	Statistical Test	
				χ^2 , df	P-value
Suicidal ideations only, no. (%)	1 (1.0%)	6 (4.6%)	0.20 (0.02, 1.71)	FET	0.137
Suicide attempts, no. (%)	9 (8.7%)	1 (0.8%)	12.35 (1.54, 99.16)	FET	0.006
Completed suicide, no. (%)	0 (0.0%)	2 (1.5%)		FET	0.505
Suicidal ideations or attempts, no. (%)	10 (9.7%)	7 (5.4%)	1.89 (0.69, 5.15)	1.6, 1	0.208
Suicide attempt or completed suicide no. (%)	9 (8.7%)	3 (2.3%)	4.05 (1.07, 15.39)	4.9, 1	0.027

FET=Fisher's exact test

Table 5

GEE comparison of prevalence of suicide attempts in first-degree relatives of PG probands and controls

Predictor	Odds Ratio (95% confidence interval)		
	Model 1	Model 2*	Model 3*
All first-degree relatives			
Proband group	2.07 (1.04, 4.11)	2.11 (0.99, 4.49)	1.94 (0.91, 4.13)
Gender (male=1)	0.46 (0.22, 0.96)	0.46 (0.22, 0.97)	0.46 (0.22, 0.96)
Interviewed	2.41 (1.24, 4.71)	2.39 (1.18, 4.83)	2.49 (1.22, 5.08)
Proband years of education			0.86 (0.73, 1.00)
Offspring only			
Proband group	16.92 (2.05, 140.0)	15.17 (1.87, 123.3)	14.81 (1.75, 125.5)
Gender (male=1)	0.16 (0.03, 0.85)	0.16 (0.03, 0.76)	0.15 (0.03, 0.79)
Interviewed	2.78 (0.64, 12.03)	2.79 (0.70, 11.21)	2.74 (0.68, 11.07)
Proband years of education			0.77 (0.56, 1.05)

GEE = generalized estimating equations

Table 6

GEE comparison of prevalence of suicide attempts or completed suicide in first-degree relatives of PG probands and controls

Predictor	Odds Ratio (95% confidence interval)		
	Model 1	Model 2*	Model 3*
All first-degree relatives			
Proband group	1.86 (1.01, 3.43)	1.91 (0.93, 3.91)	1.72 (0.84, 3.51)
Gender (male=1)	0.72 (0.39, 1.34)	0.71 (0.38, 1.32)	0.71 (0.39, 1.31)
Interviewed	1.73 (0.94, 3.18)	1.71 (0.92, 3.19)	1.78 (0.96, 3.32)
Proband years of education			0.84 (0.71, 0.98)
Offspring only			
Proband group	4.82 (1.24, 18.69)	6.02 (1.10, 32.77)	5.67 (1.00, 32.25)
Gender (male = 1)	0.34 (0.09, 1.23)	0.19 (0.05, 0.68)	0.20 (0.05, 0.73)
Interviewed	1.72 (0.50, 5.97)	1.65 (0.38, 7.07)	1.62 (0.42, 6.25)
Proband years of education			0.71 (0.53, 0.94)

GEE = generalized estimating equations