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Suicidal behavior in relatives or associates moderates the strength of common risk factors for suicide

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Abstract

The prevalence and odds ratios of different suicide risk factors were compared in three pairs of decedents: 80 suicides and 25 injury decedents with blood-relatives with suicidal behavior history (biologically-exposed); 259 suicides and 126 injury decedents with unrelated acquaintances with suicidal behavior history (socially-exposed); and 471 suicides and 523 injury decedents with neither relatives nor acquaintances with suicidal behavior history (unexposed). Negative life events and high psychological stress were more common in socially-exposed suicides than in other suicides. The adjusted odds ratios of most established suicide risk factors were higher in unexposed decedents than in biologically- or socially-exposed decedents, suggesting that the predictive value of established risk factors wanes in individuals who have been exposed to suicidal behavior in family or friends.

INTRODUCTION

Increased suicide risk among individuals who have blood relatives with a history of suicidal behavior (Brent & Melhem, 2008; Cheng, Yen, Chang, Wu, Ko, & Li, 2013; Rajialin, hirvikoski, & Jokinen, 2013; Tidemalm et al., 2011) has been attributed to the familial transmission of genes associated with psychiatric disorders, especially mood disorders

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DECLARATION OF CONFLICT OF INTEREST

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(Brent et al., 2002; McGirr, Alda, Seguin, Cabot, Lesage, & Turecki, 2009; Pedersen & Fiske, 2010; Petersen, Sørensen, Andersen, Mortensen, & Hawton, 2013; Sequeira et al., 2006), or impulsive-aggressive personality traits (Baud, 2005; Savitz, Cupido, & Ramesar, 2006; Turecki, 2005). In contrast, elevated suicide risk among non-related acquaintances of individuals with a history of suicidal behavior (Crepeau-Hobson & Leech, 2014) has been attributed to shared social stressors (Cheng, Hawton, Lee, & Chen, 2007; McKenzie et al., 2005; McKenzie, & Keane, 2007; Mesoudi, 2009; Roy, 2011; Wilcox, Kuramoto, Brent, & Runeson, 2012). It is reasonable to hypothesize that exposure to suicidal behavior in relatives or associates would influence the type and relative strength of other risk factors for suicide but, to the best of our knowledge, no prior study has tested such a hypothesis. A large national case-control psychological autopsy study in China (Phillips, Yang, Zhang, Wang, Ji, & Zhou, 2002; Tong & Phillips, 2010) provides an opportunity to consider these hypotheses by comparing the risk factors for suicide in three cohorts of suicide and injury decedents – those with 1) only blood relatives (but no other acquaintances) with a history of suicidal behavior; 2) only non-blood relatives or acquaintances (but no blood relatives) with a history of suicidal behavior; and 3) neither relatives nor acquaintances with a history of suicidal behavior.

We test two hypotheses. First, based on the theory that the transmission of suicidal behavior among blood relatives can largely be associated with the transmission of mood disorders (Brent et al., 2002; McGirr, Alda, Seguin, Cabot, Lesage, & Turecki, 2009), we hypothesize that the odds ratios associated with mood disorders and mood symptoms should be higher in suicide decedents who had blood relatives with suicidal behavior than in other suicide decedents. Although there is some emphasis on impulsivity in the genetic transmission literature, our focus here is on theories that view the genetic transmission of suicide as a product of the genetic transmission of risk for depression. Second, based on the theory that the increased risk of suicide among individuals with unrelated acquaintances who have a history of suicidal behavior is attributed to shared environmental risk factors (Cheng, Hawton, Lee, & Chen, 2007; McKenzie & Keane, 2007; Roy, 2011; Wilcox, Kuramoto, Brent, & Runeson, 2012), we hypothesize that the odds ratios for negative life events and for the psychological stress related to negative life events should be higher in suicide decedents with acquaintances with suicidal behavior than in other suicide decedents.

METHODS

Sample

The sampling methods have been described in detail in prior reports of the national psychological autopsy study (Phillips, Yang, Zhang, Wang, Ji, & Zhou, 2002; Tong & Phillips, 2010). In brief, at 3 urban and 20 rural geographically representative disease surveillance points of the national mortality surveillance system, all deaths attributed to suicide and other injuries were identified based on death certificate. Each contacted death was examined by two different interviewers. Final determination of cause of death (suicide or other injury) was based on the consensus opinion of interviewers and researchers, after reviewing all available information about the specific events surrounding the death. A total of 895 suicide decedents and 701 non-suicidal injury deaths were included (Tong & Phillips,

2010). Of the 895 suicide decedents, 80 had at least one blood-relative with a history of suicide attempts or death by suicide; for convenience, we refer to this group as “biologically exposed”. Among the remaining 815 decedents, 259 had at least one non-blood relative or acquaintance with a history of suicide (we refer to this group as “socially exposed”); and 471 had neither relatives nor acquaintances with a history of suicidal behavior (“unexposed”). In addition, 75 suicide decedents had both blood-relatives and non-blood relatives with a history of suicidal behavior and in 10 suicide decedents there was no information available on the suicidal history of relatives or acquaintances: these 85 suicide decedents were excluded from the present analyses.

The methods of suicide among the 810 decedents included in the analysis were as follows: 464 (57%) pesticide ingestion, 186 (23%) hanging, 36 (4%) medication ingestion, 31 (4%) drowning, 32 (4%) jumping, and 61 (8%) by other or unspecified methods.

Of the 701 injury death controls, 25 had blood-relatives with a history of suicidal behavior, 126 had unrelated acquaintances with a history of suicidal behavior, and 523 had neither relatives nor acquaintances with a history of suicidal behavior. The remaining 27 injury deaths were excluded, either because they had both blood relatives and acquaintances with a history of suicidal behavior ($n=12$) or because there was no information about the suicidal history of their relatives or acquaintances ($n=15$).

Psychological Autopsy Procedures

For each suicide case and control, two separate interviews were administered by trained psychiatrists and other health professionals to a co-resident family member and another close acquaintance of the decedent. We began with an audio-taped open-ended interview about the causes and circumstances of the death. We then administered a structured questionnaire that included information about the circumstances of the death, detailed demographic and socioeconomic status of the decedent, a life-event scale, a quality of life scale, and a medical and psychiatric history. We concluded with a semi-structured diagnostic interview. The median time between death and interview was 11 months.

Measures

Prior suicidal behavior in friends and family members of the decedent was assessed by asking informants whether the decedents’ parents, siblings, or children had a history of suicidal behavior, whether the decedents had any other blood-relatives with such a history, and whether the decedents had any non-blood relatives, friends, neighbors, or other acquaintances with a history of suicidal behavior.

The presence or absence of a mental disorder was determined by administering a slightly revised Chinese version of SCID-P (First, Spitzer, Gibbon, & Williams, 1996) that includes most DSM-IV Axis I disorders, mental retardation and borderline personality disorder. The interview was administered to both the co-resident family member and the close acquaintance of each decedent. If the information provided in these two interviews was different, the case was reviewed in detail by the research team to make a final determination.

A depressive symptom score reflecting the number, severity, and persistence of depressive symptoms in the 2 weeks prior to death was derived from the structured psychiatric examination (Phillips et al., 2007). In the present study, this continuous variable (scored 0–100) was dichotomized as having depressive symptoms (a score ≥ 1) versus having no depressive symptoms (scored 0) in the 2 weeks prior to suicide.

A 60-item life event scale was used to assess the frequency and timing of life events in the 12 months prior to death. The numbers of all negative life events in the 12 months prior to death were counted. To quantify the psychological triggering effect of negative life events, an acute stress score at the time of death was computed as the product of the severity (mild, moderate, severe, and very severe, coded as 1–4) of the psychological effect and the inverse of the time from the life event to death, summed for all negative life events.

Quality of life in the month prior to death was assessed by asking informants to rate six characteristics (physical health, psychological health, economic circumstances, work, family relationships, and relationships with non-family associates) on a scale of 1 (very poor) to 5 (excellent). The sum of the six items was then converted to a scale of 0–100.

Suicidal intentionality was assessed by asking proxy-informants to make a judgment about the cause of death: accidental, probably suicide or definitely suicide. If both the family member and close associate reported that the death was definitely suicide, suicidal intentionality was classified as ‘high’.

Data were also collected on physical illnesses, on the occurrence of decreased social activities over the month prior to death, and, for suicides, whether or not the decedent discussed suicide with others and whether or not others were present at the time of the suicidal act.

When different informants offered discrepant ratings (e.g., number and severity of negative life events, depressive symptoms), mean values derived from the two interviews (family members and close associates) were used for analysis.

The study was approved by the institutional review boards of the Beijing Hui Long Guan Hospital and the Chinese Center for Disease Control and Prevention, and has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. We obtained informed consent from all proxy informants.

Statistical analysis

Characteristics of the three groups of suicide decedents were compared using chi-square tests for the nominal variables, Kruskal-Wallis tests for ranked or skewed continuous variables, and analysis of variance (ANOVA) for normally distributed continuous variables. If the overall test was statistically significant, multiple comparison tests were conducted to test the statistical significance of differences between the three pairs of groups: for nominal variables we used a Tukey-type method based on an arcsine transformation of the original proportions, and for ranked variables we used a non-parametric method for ranked variables that compares mean ranks between groups and adjusts for tied ranks (Zar, 1999). Given the

documented influence of age, gender, and rural versus urban residence on suicide rates in China (Phillips, Li, & Zhang, 2002), all multivariate analyses were adjusted for age, gender, and rural versus urban residence. The adjusted odds ratios for each factor in the three groups (generated by comparing each suicide decedent group to the parallel group in the injury decedents) were compared to each other by computing the ratio of the three sets of two adjusted odds ratios. The statistical significance of the ratios was assessed by adding the corresponding interaction term (e.g. mental disorder * group) to the logistic model (Altman & Bland, 2003).

RESULTS

Table 1 shows that there were no significant differences among the three groups of suicide decedents by gender, age, educational level, family economic status, quality of life prior to death, or presence of religious beliefs. There were, however, statistically significant differences in location of residence and the proportion of who had experienced changes in social activities prior to death. The socially exposed suicide decedents were more likely than the unexposed to live in rural areas ($q=4.55$, $p<0.01$) and less likely to experience a decrement in social activities in the month prior to death ($q=5.03$, $p<0.01$).

There were no significant differences between the three groups of suicide decedents in the proportions with prior suicide attempts, in whether or not others were present at the time of the suicidal behavior, and in whether or not the decedent discussed death with others prior to suicide. However, the unexposed suicide decedents had higher suicidal intent ($q=3.99$, $p<0.05$) and were less likely to die by pesticide ingestion ($q=4.60$, $p<0.01$) than the socially exposed suicide decedents.

We had hypothesized that mood disorders and symptoms would be more prevalent and severe among the biologically exposed suicide decedents, but this hypothesis was not supported. Moreover, there were no significant differences between the three groups of suicide decedents in the prevalence of mental disorders at the time of death, in the occurrence of physical illnesses in the year prior to death, or in the number of negative life events in the year prior to death. And there was no difference in the prevalence of borderline personality disorder between the three groups (only 1% of suicide decedents were retrospectively diagnosed with borderline personality disorder).

In accordance with our second hypothesis, the socially exposed suicide decedents were more likely to experience high stress and severe negative life events 2 days prior to suicide than the biologically exposed suicide decedents ($q=3.34$, 3.41 , respectively, both p values <0.05) and than the unexposed suicide decedents ($q=4.44$, 4.70 , respectively, both p values <0.01).

Table 2 shows the odds ratios (OR) of different suicide risk factors among the three groups of suicide and injury decedents, and compares the OR for these factors across the three types of decedents. In the biologically exposed decedents, suicide was significantly associated with poor quality of life, the presence of one or more mental disorders, the presence of depressive symptoms in the two weeks prior to death, and the presence of more negative life events in the last year. Contrary to our hypotheses, the OR for suicide of the presence of

mood disorders and of the presence of depressive symptoms were not significantly higher in biologically exposed decedents than in unexposed decedents. In fact, the OR for having experienced any depressive symptoms in the prior two weeks in biologically exposed decedents was lower than the corresponding OR in unexposed decedents. Unexpectedly, biologically exposed injury decedents had a higher prevalence of depressive symptoms than unexposed injury decedents ($X^2=21.99$, $p<0.001$; multiple comparison tests: $q=3.52$, $p<0.05$). Although we had no a priori hypothesis about the role of life events in the biologically exposed, it is notable that acute psychological stress due to negative life events was not associated with suicide risk in the biologically exposed, and the OR for acute psychological stress was lower in the biologically exposed than in the unexposed.

In socially exposed decedents, suicide risk was associated with poor quality of life, being unmarried, a decrease in social activities in the month prior to death, the presence of at least one mental disorder, the presence of depressive symptoms in the two weeks prior to death, the presence of more life events in the last year, and the presence of severe negative life events 2 days before death. Contrary to our hypotheses, the ORs associated with negative life events and severe psychological stress were not significantly higher in socially exposed decedents than in the other two groups of decedents. In fact, the adjusted OR for suicide in socially exposed decedents were *lower* than those for unexposed decedents both for 1–3 negative life events (4.27 vs. 9.98) and for more than 3 negative life events (12.15 vs. 29.49). Socially exposed injury decedents were more likely than the unexposed to experience more than 1 negative life events ($X^2=17.20$, $p=0.002$, multiple comparison tests: $q=4.12$, $p=0.01$).

DISCUSSION

This is the first study to compare the prevalence and strength of common risk factors for suicide among suicide and injury decedents with and without prior exposure to suicidal behavior among blood relatives and other non-biologically related associates. By dividing the large sample of 810 suicide decedents and 674 injury decedents into three independent groups – decedents with blood relatives with suicidal behavior, with non-related acquaintances with suicidal behavior, and with neither relatives nor associates with suicidal behavior -- this analyses allowed us to determine whether or not prior exposure to suicidal behavior modulates the effect of known risk factors for suicide.

We found that suicide decedents who had non-biologically related associates with suicidal behavior had more negative life events and higher levels of psychological stress due to negative life events than other types of suicide decedents, but we did not find higher rates of mood disorders or depressive symptoms in biologically exposed suicide decedents. Contrary to our main hypotheses, we did not find that biological or social exposure to suicidal behavior increased the strength of the association of other risk factors for suicide: the OR for suicide associated with mood disorders and depressive symptoms were not higher in biologically exposed decedents and the OR associated with negative life events and psychological stress were not higher in socially exposed decedents. Failure to confirm these hypotheses may be related to the unexpectedly high rates of negative life events in socially exposed injury decedents and the unexpectedly high rates of depressive symptoms in

biologically exposed injury decedents. One other unexpected finding was that the risk of suicide associated with acute psychological stress was *lower* in biologically exposed decedents than in other types of decedents.

Our findings do not support the theory – based on Western studies -- that familial transmission of suicide behavior is mediated by the transmission of mood disorders (Brent et al., 2002; McGirr, Alda, Seguin, Cabot, Lesage, & Turecki, 2009; Pedersen & Fiske, 2010; Petersen, Sørensen, Andersen, Mortensen, & Hawton, 2013; Sequeira et al., 2006). Failure to confirm our hypothesis of higher OR for depression and depressive symptoms in biologically exposed suicide decedents may have been due to similar prevalence of depressive symptom between biologically exposed and the other two suicide groups as well as a higher level of depressive symptoms in biologically exposed injury decedents. It is also possible that the hypothesis and the underlying theory were not confirmed because we studied readily observable, multi-determined “phenotypes” (mood disorders and symptoms) rather than the endophenotypes (Courtet, Gottesman, Jollant, & Gould, *al.* 2011), which can only be studied in laboratory settings (Courtet, Guillaume, Malafosse, & Jollant, 2010).

Our second hypothesis, that acute psychological stress and life events would be relatively more important among suicide decedents with unrelated acquaintances who had engaged in suicidal behavior, received partial support. Contrary to our hypothesis, the OR associated with number of negative life events in the prior year was lower among the socially exposed than among the unexposed; this was largely due to the very low prevalence of negative life events in the unexposed injury controls. On the other hand, in support of our hypothesis, socially exposed were more likely to experience acute psychological stress due to negative life events and to experience a severe negative life event in the two days prior to death. This suggests that a more stressful environment might be particularly important among individuals whose non-blood relatives or acquaintances have a history of suicidal behavior, and, thus, that strategies aimed at improving coping skills and conflict resolution skills while facing stressful life events would be especially important for this subgroup of high-risk individuals.

Interestingly, in all instances where we found a statistically significant difference in the magnitudes of OR between the exposed and unexposed groups, the OR was always larger in the unexposed. This suggests that the importance of many risk factors as predictors of suicide is attenuated in the presence of suicidal behavior in family or friends. This hypothesis could be explored in future research.

There are some limitations to these findings. 1) Information about suicide and injury decedents was obtained from proxy informants an average of 11 months after death. It is possible that the data may not accurately reflect the real status of decedents at the time of death because of recall bias. However, the original study (Phillips, Yang, Zhang, Wang, Ji, & Zhou, 2002) reported no relationship between the reported prevalence of psychiatric conditions and symptoms and the duration of time between the death and the interview, so it does not appear that family members’ and close associates’ of suicide and injury decedents change their reports over time. 2) The lone indicator of impulsive-aggressive traits in the study was the presence of borderline personality disorder, rates of which were much lower

than has been reported in post-mortem samples in the West (Duberstein & Witte, 2009). Thus we could not adequately assess whether biologically exposed suicides had higher rates of impulsive-aggressive traits. 3) No data are available on the accuracy of proxy reports of suicide histories in family or friends, and we were unable to independently determine whether the relatives and acquaintances of the decedents had engaged in lethal or nonlethal suicidal behavior. 4) Nor do we know when suicide decedents had been exposed to their relatives or acquaintances' suicidal behavior. For example, it is possible that in a few cases the elevated rates of life events in the socially exposed group could reflect exposure to suicidal behavior in friends and relatives in the year prior to their own death, which could spuriously inflate the rate of negative life events. On the other hand, rates of life events were not particularly elevated among the biologically exposed, suggesting that the elevated rate of life events in the socially exposed is unlikely to be accounted for by suicidal behavior in acquaintances and non-blood relatives. 5) We used deceased controls to ensure that all proxy informants were bereaved, but having a deceased control group may decrease the apparent importance of risk factors for suicide if the factor is also a risk factor for injury death (e.g., mental disorders) (Crump, Sundquist, Winkleby, & Sundquist, 2013). Moreover, like risk factors for suicide mortality, risk factors for injury mortality might be related to the presence of suicidal behavior in the relatives or associates. 6) Misclassification bias might have made it more difficult to find support for the *a priori* hypotheses, particularly if some suicides were misclassified as injuries; 7) Given the relatively low rate of care-seeking for mental disorders in China (Phillips et al., 2009), mental health records are not available for most suicide cases. This may result in an underestimate of the importance of mental disorders in suicide decedents. 8) Finally, despite using data from the largest case-control psychological autopsy yet reported, only 80 suicide cases and 25 injury death cases had a history of suicidal behavior in blood relatives, so findings should be interpreted with caution.

In conclusion, this is the first study to explore whether the importance of risk factors for suicide is related to the presence of prior suicidal behavior in the social network of the suicide decedent. Two novel conclusions can be drawn. First, social stressors and death by pesticide ingestion are more prevalent among suicide decedents who had acquaintances with suicidal behavior than among other types of suicide decedents. Interventions aimed at decreasing access to pesticides and improving coping skills and conflict resolution skills are particularly important for this group. Second, although our *a priori* hypotheses were only partially supported, the overall pattern of findings of significant differences across the three groups of suicide decedents suggests that there may be value in discriminating these sub-groups both in research and when developing group-specific preventive interventions. Individuals exposed to suicide behavior in relatives or acquaintances accounted for nearly half of all suicide decedents in the present study, underscoring the significance of this type of research.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Comparison of suicide decedents who were biologically exposed, unexposed, or socially exposed^a

Variables	Biologically Exposed BE(n=80)			Unexposed UE(n=471)			Socially Exposed SE(n=259)			χ^2	P	multiple comparisons ^b
	n	%		n	%		n	%				
Female	43	53.8%		228	48.4%		128	49.4%		0.79	0.675	
Rural resident	66	82.5%		353	74.9%		220	84.9%		10.72	0.005	SE>UE
Unmarried	24	30.0%		182	38.6%		80	31.0%		5.36	0.068	
Years of formal education												
0	21	26.3%		126	26.8%		80	31.0%				
1–6	38	47.5%		184	39.1%		105	40.7%		5.01	0.287	
7 years 21	21	26.3%		161	34.2%		73	28.3%				
Decrease in social activities in month prior to death	40	50.0%		262	55.7%		109	42.1%		12.49	0.002	SE<UE
Employed	60	75.0%		322	68.5%		194	74.9%		3.95	0.139	
Low quality of life in month prior to death(52 on a 0–100 scale)	37	46.3%		266	56.6%		130	50.2%		6.18	0.186	
Religious believer	6	7.5%		21	4.5%		14	5.4%		1.41	0.494	
Family monthly per capita income (RMB Yuan)												
0–99	27	33.8%		143	30.7%		80	31.1%				
100–200	23	28.8%		148	31.8%		98	38.1%		5.10	0.277	
>200	30	37.5%		175	37.6%		79	30.7%				
Prior suicide attempt	23	28.8%		132	28.0%		63	24.3%		1.32	0.518	
High suicide intentionality	56	70.9%		361	79.2%		176	69.6%		8.96	0.011	SE<UE
Other(s) present during suicide	5	6.3%		52	11.0%		21	8.1%		2.82	0.245	
Discuss death with others before suicide	41	51.9%		217	46.3%		129	50.0%		1.46	0.482	
Died by pesticide ingestion	46	57.5%		249	52.9%		169	65.3%		10.48	0.005	SE>UE

Variables	Biologically Exposed BE(n=80)			Unexposed UE(n=471)			Socially Exposed SE(n=259)			χ^2	P	multiple comparisons ^b
	n	%		n	%		n	%				
Any mental disorder, past month	49	61.3%		304	64.5%		156	60.2%		1.43	0.490	
Mood disorder, past month	33	41.3%		183	38.9%		102	39.4%		0.17	0.920	
Borderline Personality disorder	1	1.3%		5	1.1%		2	0.8%		0.21	0.902	
Depressive symptoms, 2 weeks prior to suicide	51	63.8%		297	63.1%		178	68.7%		2.41	0.299	
Physical illness, past year	27	33.8%		214	45.4%		119	45.9%		4.13	0.127	
Negative life events, past year												
1	11	13.8%		51	10.9%		31	12.0%		4.98	0.29	
1~3	35	43.8%		209	44.5%		95	36.7%				
<3	34	42.5%		210	44.7%		133	51.4%				
Acute psychological stress due to negative life events												
Low	12	15.0%		52	11.1%		27	10.4%		11.71	0.02	SE>BE, U
Moderate	38	47.5%		190	40.4%		83	32.0%				
High	30	37.5%		228	48.5%		149	57.5%				
Severe negative life event, past two days	11	13.8%		110	23.4%		82	31.7%		12.13	0.002	SE>BE, U

Biologically Exposed: Suicide decedents who had blood relatives with suicidal behavior.

Unexposed: Suicide decedents who had neither relatives nor acquaintances with suicidal behavior.

Socially Exposed: Suicide decedents who had non-blood relatives or acquaintances with suicidal behavior.

^aThe mean (sd) age at death of the BE, UE and SE groups were 41.7 (19.6), 45.1 (19.6) and 46.4 (19.6), respectively; $F=1.82, p=0.163$.

^bTukey-type multiple comparison method based on an arcsin transformation of the original proportions

Table 2

Suicide risk among biologically exposed, unexposed, or socially exposed: Comparisons of Odds Ratios (ORs)

Variables	Biologically Exposed (BE)				Unexposed (UE)				Ratio of BE/UE OR				Socially Exposed (SE)				Ratio of SE/UE OR			
	suicide (n=80) %	injury (n=25) %	OR ^a	95%CI	suicide (n=471) %	injury (n=523) %	OR ^a	95%CI	OR	P			suicide (n=259) %	injury (n=126) %	OR ^a	95%CI	OR	P		
Quality of life																				
High(68)	12.5	32.0	1.00		9.6	59.1	1.00						13.9	58.7	1.00					
Moderate(53-67)	41.3	44.0	3.34	0.93-12.01	33.8	28.7	7.48	5.01-11.16	0.45	0.106			35.9	32.5	5.88	3.14-11.00	0.79	0.192	0.57	0.388
Low(52)	46.3	24.0	7.82	1.94-31.44	56.6	12.2	32.43	20.73-50.74	0.24	0.015			50.2	8.7	43.54	18.97-99.94	1.34	0.934	0.18	0.029
Unmarried	30.0	52.0	0.43	0.16-1.12	38.6	32.5	1.48	1.12-1.95	0.29	0.026			31.0	24.6	1.71	1.02-2.85	1.15	0.701	0.25	0.024
Decrease in social activities	50.0	36.0	2.59	0.91-7.35	55.7	29.6	2.69	2.05-3.54	0.96	0.438			42.1	24.6	2.09	1.27-3.44	0.78	0.285	1.24	0.873
Mental disorder, past month	61.3	32.0	3.78	1.37-10.41	64.5	16.6	10.13	7.36-3.94	0.37	0.043			60.2	16.7	8.12	4.66-14.13	0.80	0.440	0.47	0.154
Mood disorder, past month	41.3	4.0	22.99	2.72-194.50	38.9	1.5	45.56	21.89-94.84	0.50	0.389			39.4	3.2	20.10	7.12-56.75	0.44	0.198	1.14	0.912
Depressive symptoms, past 2 weeks	63.8	24.0	7.79	2.39-25.37	63.1	7.1	23.05	15.49-4.32	0.34	0.010			68.7	19.0	11.17	6.39-19.53	0.48	0.012	0.70	0.297
Negative life events, past year																				
1	13.8	40.0	1.00		10.9	59.6	1.00						12.0	45.2	1.00					
1-3	43.8	28.0	4.22	1.22-14.59	44.5	29.1	9.98	6.73-14.79	0.42	0.263			36.7	36.5	4.27	2.34-7.81	0.43	0.019	0.99	0.879
>3	42.5	32.0	4.99	1.39-17.98	44.7	11.3	29.49	18.73-46.41	0.17	0.022			51.4	18.3	12.15	6.23-23.70	0.41	0.033	0.41	0.356
Acute psychological stress due to negative life events																				
Low	15.0	36.0	1.00		11.1	63.8	1.00						10.4	54.8	1.00					
Moderate	47.5	48.0	2.77	0.87-8.87	40.4	24.7	11.42	7.67-17.01	0.24	0.027			32.0	33.3	5.84	3.13-10.90	0.51	0.069	0.47	0.293

Variables	Biologically Exposed (BE)					Unexposed (UE)					Ratio of BE/UE OR					Socially Exposed (SE)					Ratio of SE/UE OR					Ratio of BE/SE OR				
	suicide (n=80) %	injury (n=25) %	OR ^a	95%CI		suicide (n=471) %	injury (n=523) %	OR ^a	95%CI		OR	P				suicide (n=259) %	injury (n=126) %	OR ^a	95%CI		OR	P				OR	P			
High	37.5	16.0	6.47	1.54-27.10		48.5	11.5	30.47	19.47-47.67		0.21	0.089				57.5	11.9	29.33	13.85-62.13		0.96	0.987				0.22	0.112			
Severe negative life events, past 2 days	13.8	4.0	3.57	0.41-31.12		23.4	3.4	8.87	5.21-15.09		0.40	0.624				31.7	2.4	17.63	5.38-57.84		1.99	0.267				0.20	0.302			

Biologically Exposed: Suicide decedents who had blood relatives with suicidal behavior. Unexposed: Suicide decedents who had neither relatives nor acquaintances with suicidal behavior.
Socially Exposed: Suicide decedents who had non-blood relatives or acquaintances with suicidal behavior.

^a odds ratios adjusted for sex, age, and community of residence (rural vs urban)Because of rounding, not all percentages total 100