Case-Control Study in China of Risk Factors for Suicide in Men With Alcohol Use Disorders

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ABSTRACT. Objective: This secondary analysis of China's National Psychological Autopsy Study assesses the risk factors for suicide among men with alcohol use disorders (AUDs)—the second most common psychiatric diagnosis among suicide decedents in China. **Method:** Based on data collected from family members and close associates, the characteristics of 68 men with AUDs who died by suicide and 51 men with AUDs who died of other injuries at 23 geographically representative locations in China were compared using univariate and multivariate logistic regression models. Interactions between AUDs and other risk factors for suicide were explored using data from 448 male suicide decedents and 521 men who died from accidental injuries. **Results:** After adjusting for covariates, risk factors for suicide among men with AUDs were history

of previous suicide attempts (odds ratio [OR] = 46.72, 95% CI [4.70, 464.89]), acute negative life events in the 2 days before death (OR = 18.92, 95% CI [3.32, 107.88]), and comorbid major depressive disorder (OR = 14.65, 95% CI [2.93, 73.31]). These three factors accounted for 54.3% of the variance in outcome. There was a statistically significant interaction between AUDs and major depression; the association between major depression and suicide risk was weaker in men with AUDs than in men without AUDs. **Conclusions:** Among men with AUDs in China, prior suicidal behavior, acute life events, and major depression confer risk for suicide. However, the risk associated with depression in men with AUDs is somewhat less than the risk of suicide associated with depression in men without AUDs. (*J. Stud. Alcohol Drugs*, 73, 15–20, 2012)

POSTMORTEM STUDIES WORLDWIDE SHOW that alcohol use disorders (AUDs)—which includes alcohol abuse or dependence—are present in 16%–61% of those who kill themselves (Conwell et al., 1996; Henriksson et al., 1993; Kölves et al., 2006; Manoranjitham et al., 2010) and are the second most common Axis I psychiatric disorders among suicide decedents (Cavanagh et al., 2003). Wilcox et al. (2004) report a 9.79-fold (95% CI [8.98, 10.65]) higher risk of suicide among persons with AUDs compared with the general population. Among people with AUDs, additional risk factors for suicide include comorbid major depression, stressful life events, poor social support, living alone, unemployment, and serious medical illness (Conner et al., 2003b; Murphy et al., 1992).

Most data about risk factors for suicide among individuals

with AUDs are based on Western samples; therefore, their relevance to China—where drinking patterns are different—is unclear. A large, nationally representative case-control psychological autopsy study of suicide deaths and deaths from other injuries conducted in China in 1995–2000 (Phillips et al., 2002; Yang et al., 2005) found that AUDs were the second most common Axis I psychiatric disorders among suicide decedents and the most common psychiatric diagnosis among people who died from other injuries. A previous analysis of data from this study found that suicide decedents with AUDs were more likely to have a history of suicide attempts than other suicide decedents (Zhang et al., 2010). In the current secondary analysis, we also considered data from nonsuicide decedent controls to determine the risk factors for suicide among 119 Chinese decedents with AUDs. This strategy to analyze the subsample of subjects with AUDs and other substance use disorders has been used in prior reports in non-Asian samples (Conner et al., 2003b; Murphy et al., 1992; Schneider et al., 2009) but never before in China.

Method

Subjects

The institutional review boards of the Beijing Huilongguan Hospital and the Chinese Center for Disease Control and Prevention approved the National Psychological Au-

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topsy Study (Centers for Disease Control and Prevention, 2004; Phillips et al., 2002; Yang et al., 2005). In this study, 895 suicides and 701 deaths from other injuries were identified from 20 rural and 3 urban geographically representative regions of China from August 1, 1995 to August 31, 2000. Two independent interviews with family members and other individuals who knew the subject well were conducted, and the data from these interviews were aggregated for analysis. Informed consent was obtained from all proxy informants.

Most psychological autopsy studies use living controls, but this study used deceased controls because this method greatly increases the comparability of the sources of information used to assess risk factors—proxy informants who have recently experienced the sudden and unexpected death of a family member or close associate (Clark and Horton-Deutsch, 1992). In this study, the equivalence of informants for suicide decedents and controls was especially important because additional information sources—such as coroners' reports and clinical records—are not available in China.

The current analysis assesses the risk factors for dying from suicide among 119 Chinese male decedents (68 suicide deaths and 51 deaths from other injuries) who met the diagnostic criteria for AUDs at the time of death. Women were excluded because there were only four female decedents in the main study (four suicide deaths and no deaths from other injuries) with AUDs; this low prevalence is consistent with the very low prevalence of AUDs reported among women in

the general Chinese population (Hao et al., 2004; Phillips et al., 2009).

As shown in Table 1, most of the 119 male decedents were young or middle-aged adults who were currently married and who lived in rural villages. About half of them were agricultural laborers who had received less than 6 years of formal education and who had a monthly per capita family income of \$18 (\$U.S.) or less.

Measures

Diagnosis of alcohol use disorder. An AUD, including alcohol abuse and alcohol dependence, was diagnosed if decedents met the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV; American Psychiatric Association, 1994) criteria at any time during the 12 months before death. This was determined by administering an adapted version of the Structured Clinical Interview for DSM-IV Axis I Disorders (First et al., 1996) that was revised for use with proxy informants to both the family members and close associates of the decedents. If the diagnoses from the two independent interviews were different, the research team reviewed all of the data to make a final determination. The interrater reliability for AUDs among different coders assessing tape-recorded interviews was high (intraclass correlation coefficient [ICC] = 0.94) (Phillips et al., 2002).

Among 454 male suicide decedents, 68 (15.0%) met diagnostic criteria for AUDs during the 12 months before death.

TABLE 1. Comparison of the characteristics of male decedents in China who met DSM-IV criteria for an alcohol use disorder (AUD) and who died by suicide with those who died from other injuries

Correlates	Suicide decedents with AUDs (<i>n</i> = 68) <i>n</i> (%)	Those with AUDs who died from other injuries (<i>n</i> = 51) <i>n</i> (%)	OR [95% CI]
Sociodemographic characteristics			
Age group, in years			
≤34	24 (35.3%)	9 (17.6%)	1.00
35–54	22 (32.4%)	31 (60.8%)	0.27 [0.10, 0.68]**
≥55	22 (32.4%)	11 (21.6%)	0.75 [0.26, 2.15]
Lives in rural village	53 (77.9%)	30 (58.8%)	2.47 [1.11, 5.50]*
Less than 6 years of formal education	36 (52.9%)	19 (37.3%)	1.89 [0.90, 3.97]
Monthly per capita income in family ≤\$18 (\$U.S.)	43 (63.2%)	22 (43.1%)	2.27 [1.08, 4.76]*
Not currently married	21 (30.9%)	18 (35.3%)	0.82 [0.38, 1.77]
Agriculture laborer	35 (51.5%)	20 (39.2%)	1.64 [0.79, 3.43]
Psychological factors, social environment, and life events			
Met criteria of major depression at time of death	18 (26.5%)	3 (5.9%)	5.76 [1.59, 20.82]**
Low level of overall function in month before death	54 (79.4%)	29 (56.9%)	2.93 [1.30, 6.56]**
Acute life events in 2 days before death	20 (29.4%)	2 (3.9%)	10.21 [2.26, 46.07]**
High chronic stress score in year before death	55 (80.9%)	24 (47.1%)	4.76 [2.10, 10.78]***
Had made previous suicide attempt	22 (32.4%)	1 (2.0%)	23.91 [3.10, 184.57]**
Any blood relative had suicidal behavior ^a	14 (20.9%)	5 (10.0%)	2.38 [0.79, 7.11]
Friends or associates had suicidal behavior ^b	27 (40.9%)	11 (22.0%)	2.45 [1.07, 5.63]*

Notes: DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*; OR = odds ratio; CI = confidence interval. ^aOne missing value in the suicide group and one in the control group; ^btwo missing values in the suicide group and one in the control group.

p* < 0.05; *p* < 0.01; ****p* < 0.001.

Of these subjects, 18 had comorbid major depressive disorder, 1 had dysthymia, 1 had schizophrenia, 1 had dementia, and 1 had mental retardation. None had a comorbid (nonalcohol) substance use disorder, which is partly explained by the very low prevalence of other substance use disorders in China (Phillips et al., 2009).

Among 532 men who died from other types of injury, 51 (9.6%) met diagnostic criteria for AUDs during the 12 months before death. Of these individuals, three had comorbid major depressive disorder, one had dementia, and four had mental retardation. None had a comorbid (nonalcohol) substance use disorder.

We used the summary category AUD rather than the more specific alcohol abuse and alcohol dependence diagnoses because it is uncertain whether postmortem proxy data can reliably discriminate the two conditions and because almost all prior psychological autopsy studies have used this summary category in their analyses of the role of alcohol use in suicide (Isometsä, 2001).

Other measures. The diagnosis of major depression was based on a structured interview using DSM-IV criteria (American Psychiatric Association, 1994) that was translated and adapted for use with proxy informants in China. To increase the sensitivity of the interview to detect depression in China, clinical interviewers also used additional, culture-sensitive methods of probing for symptoms of depression (Phillips et al., 2007). The diagnosis of major depression included depressive episodes caused by alcohol or other substances as well as those that occurred independent of substance use (Conner et al., 2003b; Phillips et al., 2002). The ICC for mood disorders among different coders assessing tape-recorded interviews was 0.87 (Phillips et al., 2002).

A measure of the level of overall functioning was assessed using a six-item scale that evaluated decedents' physical health, psychological health, economic circumstances, work, family relationships, and relationships with nonfamily associates in the month before death on a 5-point Likert scale (1 = *very poor* to 5 = *excellent*). The average of the sum of the six original scores from the two independent interviews was converted to a range of 0–100. The correlation between the two independent informants for this score was excellent (ICC = 0.79). In the current study, we dichotomized the measure (by a median split) to make it easier to interpret the results of the logistic regression analyses.

A 60-item life-event scale constructed and pretested specifically for the National Psychological Autopsy Study obtained the following information for each type of life event: the time of occurrence, the perceived quality of the life event (positive or negative), the magnitude of the psychological effect of the life event on the deceased in the prior year (from none to very severe, coded as 0–4), and the number of months in which the life event had a psychological effect on the deceased in the 12 months before death. Acute life events were defined as negative life events that occurred within 2

days of the death and resulted in a severe or very severe psychological effect (coded as 3 or 4). The chronic stress score was the product of the duration and magnitude of the psychological effect over the year before death, summed for all negative life events that had a psychological effect on the deceased in the year before death; the correlation of this score between family members and other associates of the deceased was good (ICC = 0.69). For ease of interpretation of the logistic regression analyses, the mean score for the two independent informants was dichotomized into high versus low chronic stress (by a median split), consistent with the approach used in prior studies of the National Psychological Autopsy Study (Phillips et al., 2002).

History of prior suicide attempt was assessed by asking family members and close associates structured, easily comprehended questions about whether the decedent had attempted suicide at any point in his lifetime. If any of the informants reported such an attempt by the decedent, the case was classified as having had a prior attempt. Information about previous suicidal behaviors in blood relatives and friends or associates of the decedents was also collected from proxy informants using similar questions.

Sociodemographic characteristics that were considered included age group (≤ 34 years, 35–59 years, ≥ 60 years), location of residence (rural village vs. other), educational level (< 6 years of formal education vs. ≥ 6 years), monthly per capita income in the family ($\leq \$18$ [U.S.] vs. $> \$18$), marital status (not currently married vs. currently married), and employment status (agricultural laborer vs. other).

Statistical analysis

Analyses were performed using SPSS Version 15.0 (SPSS Inc., Chicago, IL). A series of univariate binary logistic regression models was used to compare the measures between suicide decedents with AUDs and those with AUDs who died from other injuries. The multivariate logistic regression model was constructed by starting with factors that had a p value of 0.10 or less in the univariate analysis and then by excluding factors using a backward stepwise method.

To test whether the risk factors for suicide in men with AUDs were different than those in men without AUDs, the multiplicative interaction terms between the diagnosis of AUD and other risk factors for suicide were added into a multiple logistic regression model that included data from the 448 male suicides and 521 male injury death controls in the main study (Centers for Disease Control and Prevention, 2004; Phillips et al., 2002; Yang et al., 2005). A backward stepwise method was used to select the significant multiplicative interaction terms.

The probability level for removal from the multivariate logistic regression models was set as 0.05. A Hosmer and Lemeshow test provided a measure of goodness of fit (Hosmer and Lemeshow, 2000), and statistical significance in the

logistic regression models was assessed using the Wald statistic. The odds ratios (ORs) and 95% CIs for each retained variable were based on maximum likelihood estimation methods (Hosmer and Lemeshow, 2000).

Results

Among the 68 suicide decedents with AUDs, 42 (61.8%) died by ingestion of agricultural chemicals or rat poison, 16 (23.5%) by hanging, 4 (5.9%) by poisoning with other substances, 2 (2.9%) by jumping, 1 (1.5%) by drowning, and 3 (4.4%) by other methods. The cause of death among the 51 other injury decedents with AUDs included 17 (33.3%) accidental poisonings, 15 (29.4%) traffic accidents, 6 (11.8%) accidental falls, 6 (11.8%) deaths by drowning, 4 (7.8%) murders, 2 (3.9%) electrocutions, and 1 (2.0%) other unintentional injury.

Univariate logistic regression analysis

As shown in Table 1, compared with controls, suicide decedents with AUDs were less likely to be 35–54 years old and more likely to live in rural areas and to have a lower level of per capita family income. There were no significant differences between the two groups in the level of education, marital status, or employment status.

Comorbid major depression and previous suicide attempts were more frequent in suicide decedents with AUDs. Compared with accidental-death decedents, suicide decedents were more likely to have a lower level of overall functioning in the month before death and to have friends or associates with previous suicidal behaviors.

Suicide decedents with AUDs were also more likely to have experienced acute life events in the 2 days before death and to have a higher chronic stress score because of negative life events in the year before death. The two most common chronic negative life events that had a psychological effect on suicide decedents in the year before death were marital conflict 63% (43/68) and economic difficulties 57% (39/68). Most of the acute negative life events experienced by suicide

TABLE 2. Multivariate model of risk factors for suicide among male decedents in China who met DSM-IV criteria for an alcohol use disorder and who died by suicide or other types of injuries

Correlates	Adjusted OR [95% CI] ^a
Had made previous suicide attempt	46.72 [4.70, 464.89]***
Acute life events in 2 days before death	18.92 [3.32, 107.88]***
Met criteria of major depression at time of death	14.65 [2.93, 73.31]***

Notes: DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*; OR = odds ratio; CI = confidence interval. ^aAdjusted for sociodemographic characteristics (age group, location of residence, educational level, and monthly per capita income in the family) and other variables in the model.

*** $p < 0.001$.

decedents were intense interpersonal conflicts. Among the 20 suicide decedents with acute life events, 8 had had a severe marital dispute, 4 had had conflicts with their children, 3 had had disputes with other relatives, and 3 had had disagreements with friends or neighbors.

Multivariate logistic regression analysis

After adjustment for age group, location of residence, educational level, and monthly per capita income in the family, the multivariate logistic regression model identified three factors that were significant independent risk factors for suicide among men with AUDs: previous suicide attempts, acute life events, and a diagnosis of major depression (Table 2). These variables accounted for 54.3% of the total variance among the two groups of decedents. The overall fit of the multivariate logistic regression model was acceptable, $\chi^2(8, n = 116) = 5.18, p = 0.74$.

The multivariate logistic regression models of risk factors for suicide among 116 male decedents with the diagnosis of AUD and 853 without AUD are shown in Table 3. One significant interaction term was found between AUDs and other risk factors for suicide. AUDs modified the effect of major depression on suicide risk ($\beta = -1.994, p = 0.017$). After adjustment for sociodemographic risk factors and other risk factors for suicide, the ORs [95% CIs] of suicide among individuals with both AUDs and major depression,

TABLE 3. Risk factors for suicide among Chinese male decedents with or without an alcohol use disorder (AUD)

Correlates	Adjusted OR [95% CI] ^a		
	Total ($n = 969; R^2 = 0.687$)	With AUD ($n = 116; R^2 = 0.590$)	Without AUD ($n = 853; R^2 = 0.712$)
Had made previous suicide attempt	26.56 [7.83, 90.12]***	27.38 [2.37, 315.60]**	25.29 [5.71, 112.08]***
Acute life events in 2 days before death	18.91 [9.66, 37.01]***	17.07 [2.70, 107.98]**	20.91 [9.98, 43.81]***
Met criteria of major depression at time of death	17.54 [8.60, 35.81]***	7.26 [1.30, 40.69]*	23.74 [10.29, 54.76]***
Low level of overall function in month before death	5.07 [3.27, 7.86]***	3.42 [0.84, 13.97]	6.03 [3.72, 9.78]***
High chronic stress score in year before death	3.57 [2.34, 5.44]***	1.97 [0.60, 6.47]	3.86 [2.42, 6.14]***
Any blood relative had suicidal behavior	2.25 [1.15, 4.37]*	2.37 [0.42, 13.30]	2.28 [1.07, 4.87]*
Friends or associates had suicidal behavior	1.86 [1.20, 2.90]**	1.47 [0.46, 4.72]	2.07 [1.26, 3.39]**

Notes: OR = odds ratio; CI = confidence interval. ^aAdjusted for sociodemographic characteristics (age group, location of residence, educational level, monthly per capita income in the family, marital status, and employment status) and other variables in the model.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

those with major depression without AUDs, and those with AUDs without major depression were 3.14 [0.82, 12.07], 24.22 [10.64, 55.12], and 0.95 [0.52, 1.75], respectively.

Discussion

This secondary analysis of a large, community-based sample of suicide decedents from geographically representative regions of China found three risk factors for suicide among men with AUDs: a history of suicide attempts, experience of acute life events in the 2 days before death, and comorbid major depression. Collectively, they accounted for more than 50% of the variance in the outcome, underscoring the importance of these factors in suicide risk among men with AUDs in China.

Few studies have assessed the relationship between previous suicide attempts and suicide among individuals with AUDs, but one large prospective study of subjects with alcohol dependence (Preuss et al., 2003) did find that a history of suicide attempts was a robust predictor of future suicidal behavior, consistent with our findings.

The acute stressful life events that preceded suicide in Chinese men with AUDs were almost all interpersonal conflicts. These findings are similar to Western studies that consistently report a key role of interpersonal difficulties in suicidal behavior among individuals with alcohol and drug use disorders (Conner and Ilgen, 2011; Conner et al., 2003b; Heikkinen et al., 1994; Pirkola et al., 2000). Previous studies consider interpersonal events occurring from 6 weeks to 1 year before the suicidal behavior. The current study found that both chronic (1-year) and acute (within 2 days before the suicide) life events were associated with suicide risk among men with alcohol use problems, but after adjusting for all potential risk factors in a multivariate analysis, only acute life events (almost all of which were interpersonal conflicts) remained as significant predictors of suicide.

In line with several Western studies (Conner et al., 2003b; Murphy et al., 1992), this analysis found elevated risk for suicide among persons with AUDs who have comorbid depression.

Few prior psychological autopsy studies have tested interactions between AUDs and depression, and those that have tested these interactions did not report statistically significant interactions between these disorders (Cheng et al., 2000; Conner et al., 2003a). However, the nonsignificant results from these studies may have been attributable to low statistical power because of relatively small sample sizes (considerably smaller than in the present study). We identified a statistically significant interaction between AUDs and depression that indicated that depression was a more potent risk factor for suicide among Chinese men without AUDs than in those with AUDs. In discussing these findings, the results of an analysis of a large Danish cohort followed for 26 years are informative (Flensburg-Madsen et al., 2009).

That study showed a statistically significant interaction between AUDs and other psychiatric disorders ($p < 0.001$); in a follow-up analysis stratified by the presence or absence of another psychiatric disorder, AUDs conferred higher risk for suicide in individuals without psychiatric disorder (OR = 5.86, 95% CI [2.83, 12.15]) than in those with a psychiatric disorder (OR = 1.94, 95% CI [1.08, 3.49]). These Danish results suggest that the impact of AUDs on suicide is lower in the presence of another psychiatric disorder, a mirror image to the present results showing that the impact of major depression is lower in the presence of AUDs.

Similarly, a multinational study of attempted suicide concluded that the independent contribution to risk for an attempt by a person with a psychiatric disorder is lowered in the presence of a second psychiatric disorder, referred to as “sub-additive risk” (Nock et al., 2009). A potential explanation for sub-additive risk is that the etiologic and phenotypic overlap between mental disorders (Kendler et al., 2011; Rzhetsky et al., 2007) creates some redundancy in risk for suicide with an additional diagnosis.

There were some limitations to the current study. First, although China’s National Psychological Autopsy Study was the largest case-control psychological autopsy study ever conducted in a single country, the suicide and control group with AUDs was of less than optimal size for the purpose of multivariate comparisons, and the power to detect statistically significant interactions between AUD and other risk factors using the entire data set was not optimal. Second, although these data were gathered only 10–15 years ago, the epidemiology of AUDs among men in China is changing rapidly (Hao et al., 2004; Phillips et al., 2009; Zhou et al., 2009), and the extent to which similar results would be obtained with a more contemporary sample is unclear. Third, psychological autopsy research is limited by the reliance on proxy respondents to provide information and depends on retrospective recall.

The rapidly increasing rate of AUDs among men in China (Hao et al., 2004; Phillips et al., 2009; Zhou et al., 2009) suggests that the importance of AUDs as a factor in the causal pathway for suicidal behavior—particularly among men—will likely increase over time. Targeted suicide-prevention activities that focus on identification of previous suicidal behaviors, treatment of depressive symptoms, and improved resilience for dealing with acute interpersonal conflicts could be beneficial, but currently there are few health providers capable of providing such services, particularly in the rural areas. Moreover, less than 1% of persons with alcohol use problems in China ever receive any type of substance use disorder treatment (Phillips et al., 2009), making this a particularly difficult population to identify. There are no shortcuts on the long and difficult road of changing public attitudes about suicide, about problem drinking, and about seeking professional help for intractable psychosocial problems.

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