

PAPER

PSYCHIATRY AND BEHAVIORAL SCIENCES

Cun-Xian Jia,^{1,2} *Ph.D.* and *Jie Zhang*,^{1,3} *Ph.D.*

Global Functioning and Suicide Among Chinese Rural Population Aged 15–34 Years: A Psychological Autopsy Case-Control Study*

ABSTRACT: As the relationship between global functioning and young suicide remains unclear in rural China, this study was aimed to explore the relationship between them. Data of 391 rural suicides and 416 controls, all aged 15–34 years in three provinces in China were used for this study. The Global Assessment of Functioning (GAF) scale was adopted to assess global functioning of suicides and controls. The results showed that GAF score was stronger than mental illness in predicting suicide in China. Different correlates of GAF score were found between suicides and controls. Unsurprisingly, GAF score was significantly correlated with mental illness in both suicides and controls. Different characteristics were also found among three types of suicide which were classified using GAF score. Assessing global functioning is useful and GAF scale should be regularly used in suicide prevention practice.

KEYWORDS: forensic science, suicide, Global Assessment of Functioning, case-control study, rural, China

Suicide is a major cause of mortality worldwide and one of the public health concerns in rural areas (1). In China, suicide rates in rural areas are two- to three-fold greater than that in urban areas, the female suicide rates are slightly higher than the male suicide rates (2). Suicide is the leading cause of death in the population aged 15–34 years and the fifth highest for the general population (2). Rural suicides are also estimated to share 90% of total years of life lost (YLL) with rural women aged 25–39 years contributing the largest share of YLL (3).

In Western countries, psychiatric illness is a major contributing factor, and over 90% of suicides have mental illness (4). In China, although the percent of suicides with mental illness is lower than those of western countries, mental illness is still a major predictor of suicide (5,6). Among 895 suicides, 63% (563) have suffered from a mental illness diagnosed by using criteria of the DSM-IV (7). In a nationally representative psychological autopsy (PA) study ($n = 519$), 40% are diagnosed with depression, 7% with schizophrenia, and 7% with alcohol dependence (6). Zhang et al. (5) found that 76% of 66 rural suicides have a diagnosable mental illness. However, these studies just show that mental illness is associated with suicide, but did not show the relationship between severity of mental illness and suicide.

The Global Assessment of Functioning (GAF) scale is an instrument to measure a patient's current level of psychological, social, and occupational functioning dimensions (8), its score can show individual's severity of mental illness. Since GAF was introduced

as a rating scale for Axis V in DSM-III-R in 1987 (9), due to its good concurrent validity and inter-rater reliability (10–13), it has become a reliable, quick measure for assessing disturbance in functioning and can be used by multidisciplinary raters (10) with minimal instruction (13,14). However, few studies are found in studying severity of mental illness measured by GAF scale in Chinese culture (15). Furthermore, according to our knowledge, no study is found on relationship between GAF score and suicide among Chinese rural youths.

In this study, our major aims were to explore the relationship between the global functioning measured by GAF scale and suicide in Chinese rural population aged 15–34 years old, understand the correlates of global functioning in suicides and controls, and compare characteristics of demographic and suicidal variables among suicides with severe, mild to moderate, and none dysfunction classified by their GAF scores.

Methods

Study Design and Subjects

Our data came from a PA case-control study in three provinces in China funded by NIMH. PA method in Chinese social and cultural background is demonstrated as a feasible method in studying suicide (16). The Western developed instruments are reliable and valid with the Chinese samples (17). There were 16 rural counties randomly selected from three provinces (Liaoning, 6; Hunan, 5; Shandong, 5). Suicides victims aged 15–34 years old were consecutively sampled from October 2005 to June 2008. Community controls aged also 15–34 years were randomly sampled within the same county as suicide cases according to the 2005 census database. Local Centers for Disease Control and Prevention (CDCs) of 16 counties took charge of the roll of suicides and controls.

¹School of Public Health, Shandong University, 44 Wenhuxi Road, Jinan, Shandong, 250012, China.

²Postdoc. Program of School of Economics, Shandong University, 27 Shanda Nanlu Road, Jinan, Shandong, 250100, China.

³Department of Sociology, State University of New York College at Buffalo, 1300 Elmwood, Buffalo, NY 14222.

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Procedures of Interview

Local workers of CDCs of 16 counties led our trained interviewers to the villages of suicides and controls. Interview locations were office rooms of village doctors or home of suicides or controls. For each suicide or control, two informants were interviewed after getting their agreement by written informed consent. Interviews were carried out between 2 and 6 months after suicide events. Generally, the first informant of suicide or control was one next of kin, the second informant was a best friend, colleague, classmate, neighbor, etc. The average time of interview was 2.5 h.

Measurements

The GAF scale in DSM-IV was used in this study (8). GAF scales 1–100, with 1 representing lowest possible functioning and 100 representing highest general adaptive function. The GAF scale is regarded as a global severity measure in the assessment of outcome in routine mental health care (13,18,19). High inter-rater reliability is found in different studies (11,13,20,21). In this study, the time of global functioning referred to the previous month of suicide event or the interview time.

Chinese version of the Structured Clinical Interview for the DSM-IV (SCID) (22) was used in the study for diagnosing mental illness of patients. SCID has been demonstrated to be an adequate instrument for Chinese populations (17). Except Kappa value of anxiety disorder being 0.66, Kappa values of alcohol, eating, depression, and mood disorders are all 1.00 by comparing mental disorder diagnoses provided by control targets and informants.

Suicide intent was measured by the Chinese version of the first eight items of Suicide Intent Scale (23,24), whose each item is graded on a scale with 0, 1, and 2. The total scores can range 0–16. Social support was measured by seven-item social support scale with each item's answer being "yes" (1) or "no" (0). The total scores of social support can range 0–7.

Demographic factors included age, gender (male: 1; female: 0), education years, marriage status (never married (0): single and no dating; ever married (1): married, widowed, divorced, remarried, and single, but dating with others), personal annual income (RMB, 1US \$ \approx 6.70 RMB), religion (No (0): Atheist; Yes (1): Taoism, Islam, Protestantism, Catholicism, Buddhism, other). Previous suicide attempt (Yes: 1; No: 0) was also included in this study.

Integrating the Information from Different Sources

The majority of the responses by two informants of each suicide or control were same or similar. Data of different responses were integrated according to the variables which were based on previous experiences (25). For example, the demographic information basically relied on the responses by the informant with better knowledge of it. For a symptom recording with using the SCID, as we thought that the other informant might not have had an opportunity to observe the specific behavior of the target, the positive response in two informants was selected at last.

Statistical Analysis

T-tests or χ^2 tests were used to analyze differences of means of continuous variables or the percents of categorical variables between different groups. *F*-tests were used to analyze differences of means of continuous variables among suicides with severe, mild, and none dysfunction. Pearson correlation coefficients (*r*) were computed to analyze correlations between GAF score and other

continuous variables. Multiple logistic regression models were used to analyze factors associated with suicide. Odds ratio (OR) and 95% confidence interval (CI) of each variable was also calculated. All statistical analyses were carried out using SPSS, version 16.0 (SPSS Inc., Chicago, IL). The significant level in this study was $\alpha = 0.05$.

Results

Association Between GAF Score and Suicide

Altogether data of 392 suicides and 416 controls were collected at last. Only one suicide had missing value of GAF score, so, 391 suicides and 416 controls were used in this study. In 391 suicides, GAF scores ranged from 4 to 95, their mean (SD) was 63.27 (21.67) whereas in 416 controls, their mean (SD) was 89.19 (7.18) with the range from 38 to 99. There was significant difference in GAF score between suicides and controls ($t = -22.517$, $p < 0.001$).

There were also significant differences between suicides and controls in age ($t = 2.565$, $p = 0.011$), educations years ($t = -9.573$, $p < 0.001$), religion ($\chi^2 = 17.016$, d.f. = 1, $p < 0.001$), mental illness ($\chi^2 = 207.100$, d.f. = 1, $p < 0.001$), and social support ($t = -11.483$, $p < 0.001$). There were no significant differences between suicides and controls in gender ($\chi^2 = 3.076$, d.f. = 1, $p = 0.079$), marriage ($\chi^2 = 3.691$, d.f. = 1, $p = 0.055$), and personal annual income ($t = -1.858$, $p = 0.064$). See Table 1.

In 391 suicides, the mean and SD of suicide intent scores were 8.29 and 3.30, 19.6% (76/391) had at least one previous suicidal attempt.

In 782 informants of suicides and 832 informants of controls, there were significant difference in age ($t = 15.389$, $p < 0.001$), gender ($\chi^2 = 36.506$, d.f. = 1, $p < 0.001$), education years ($t = -7.089$, $p < 0.001$), marriage ($\chi^2 = 23.778$, d.f. = 1, $p < 0.001$), and relationship to targets ($\chi^2 = 138.900$, d.f. = 8, $p < 0.001$). See Table 2.

Multiple logistic regression models were carried out to analyze whether GAF score was associated with suicide after controlling for other factors. Table 3 showed that GAF score was negatively associated with suicide (OR = 0.845, $p < 0.001$) in the multiple logistic regression model. However, mental illness (OR = 1.233, $p = 0.621$) was not statistically significant in this multiple logistic regression model which showed that GAF might be stronger than mental illness in predicating suicide.

Correlates of Demographic Variables and Mental Illness to GAF Score in Suicides and Controls

In suicides, GAF score was significantly related to age ($r = -0.224$, $p < 0.001$), personal annual income ($r = 0.109$, $p < 0.05$), previous suicide attempt ($t = -3.634$, $p < 0.001$), suicide intent ($r = -0.216$, $p < 0.001$), and mental illness ($t = 14.512$, $p < 0.001$). In 391 suicides, five categories of DSM-IV axis I diagnoses were obtained, mood disorders (133, 34.01%), schizophrenia and other psychotic disorders (44, 11.25%), substance use disorders (23, 5.88%), anxiety disorders (9, 2.30%), other axis I disorder (pathological gambling) (1, 0.26%). The GAF score was lowest in suicides with schizophrenia and other psychotic disorders. See Table 4.

In control group, GAF was significantly related to education years ($r = 0.127$, $p < 0.05$), personal annual income ($r = 0.158$, $p < 0.01$), and mental illness ($t = -4.451$, $p < 0.001$). In 416 controls with mental disorders, four categories of DSM-IV axis I diagnoses were obtained, mood disorders (10, 2.40%), schizophrenia and other psychotic disorders (2, 0.48%), substance use disorders (3, 0.72%), anxiety disorders (2, 0.48%). GAF score was also

TABLE 1—Comparing suicides and controls for demographic characteristics, mental illness, suicide intent, previous attempt(s), and GAF.

Variable	Suicides N = 391	Controls N = 416	Statistics	p
Age (mean [SD])	26.83 (6.37)	25.69 (6.16)	t = 2.565	0.011
Gender (n of male [%])	214 (54.73)	202 (48.56)	χ ² = 3.076	0.079
Marriage (n of ever married [%])	230 (58.82)	272 (65.38)	χ ² = 3.691	0.055
Education years (mean [SD])	7.39 (2.77)	9.14 (2.40)	t = -9.573	0.000
Personal annual income (mean [SD])	5606 (13936)	7437 (13210)	t = -1.858	0.064
Religion (n of yes [%])	113 (29.27)	70 (16.99)	χ ² = 17.016	0.000
Mental illness (n of yes [%])	187 (47.83)	16 (3.85)	χ ² = 207.100	0.000
Social support (mean [SD])	2.78 (1.25)	3.76 (1.16)	t = -11.483	0.000
Suicide intent	8.29 (3.30)	—	—	—
Previous attempt(s) (n of yes [%])	76 (19.43)	0	χ ² = 89.266	0.000
GAF (mean [SD])	63.27 (21.67)	89.19 (7.18)	t = -22.517	0.000

GAF, Global Assessment of Functioning.
The numbers are variance due to variables with missing data.

TABLE 2—Comparing suicide informants and control informants for demographic characteristics.

Variable	Informants of Suicides N = 782	Informants of Controls N = 832	Statistics	p
Age (mean [SD])	45.14 (12.90)	35.21 (12.97)	t = 15.389	0.000
Gender (n of male, [%])	440 (56.26)	343 (41.22)	χ ² = 36.506	0.000
Education years (mean [SD])	7.14 (3.48)	8.30 (3.03)	t = -7.089	0.000
Marriage (n of ever married, [%])	709 (90.67)	685 (82.33%)	χ ² = 23.778	0.000
Relationship to targets (n [%])				
Spouse	56 (7.16)	142 (17.07)	χ ² = 138.900	0.000
Parents	164 (20.97)	150 (18.03)		
Siblings	52 (6.65)	48 (5.77)		
Parents in-law	37 (4.73)	24 (2.88)		
Grandparents	10 (1.28)	4 (0.50)		
Other relatives	116 (14.83)	48 (5.76)		
Friends	51 (6.52)	168 (20.19)		
Neighbors	237 (30.32)	210 (25.24)		
Medical personals or others	59 (7.54)	38 (4.56)		

TABLE 3—Association between GAF and suicide after controlling for other factors by multiple logistic regression model analysis.

Variable	β	SE (β)	Wald χ ²	p	OR	95% CI
Age	-0.008	0.031	0.061	0.805	0.992	0.934–1.054
Gender	-0.048	0.249	0.037	0.848	0.953	0.585–1.555
Education years	-0.280	0.056	25.297	0.000	0.756	0.677–0.843
Marriage	-1.117	0.406	7.562	0.006	0.327	0.148–0.726
Personal annual income	0.000	0.000	2.607	0.106	1.000	1.000
Religion	1.067	0.285	13.978	0.000	2.906	1.661–5.083
Social support	-0.801	0.111	51.874	0.000	0.449	0.361–0.558
Mental illness	0.209	0.422	0.245	0.621	1.233	0.539–2.821
GAF	-0.169	0.016	107.618	0.000	0.845	0.818–0.872
Constant	19.246	1.820	111.859	0.000	—	—

GAF, Global Assessment of Functioning; OR, odds ratio; CI, confidence interval.
Cox & Snell R² = 0.538, Nagelkerke R² = 0.717; χ² = 560.582, p < 0.001.

lowest in controls with schizophrenia and other psychotic disorders. See Table 4.

Comparison of Correlates of Demographic and Suicidal Variables Among Suicides with Severe, Mild, and None Dysfunction

As GAF ≤ 50 indicates that an individual has severe symptoms or severe difficulty in social, occupational, or school functioning, GAF > 50 and GAF ≤ 70 indicates that an individual has mild to moderate symptoms or difficulty in social, occupation, or school functioning, and GAF ≥ 71 indicates that an individual has good

psychological, social, occupational, or school functioning (8), we also adopted them as criteria for severe, mild to moderate, or none dysfunction in suicides or controls here. In 391 suicides, 114 (29.16%) had severe dysfunction, 101 (25.83%) had mild to moderate dysfunction, and 176 (45.01%) had none dysfunction, whereas in 416 controls, only 1 (0.24%) had severe dysfunction, 8 (19.23%) had mild dysfunction, and 407 (97.84%) had none dysfunction. There was significant difference in dysfunction between suicide and control groups (χ² = 281.400, d.f. = 2, p < 0.001).

Table 5 showed that there were statistically significant differences in age, personal annual income, previous suicide attempt(s), mental illness, social support, and suicide intent scores among

TABLE 4—Correlates of GAF among 391 suicides and 416 controls aged 15–34 years in rural China.

Variable	Suicides		Controls	
	<i>N</i>	Mean (SD) or <i>r</i>	<i>N</i>	Mean (SD) or <i>r</i>
Age	391	–0.224***	416	–0.037
Gender				
Male	214	61.69 (21.43)	202	89.11 (7.52)
Female	177	65.19 (21.86)	214	89.26 (6.89)
Marriage				
Never married	161	63.74 (22.32)	144	89.35 (6.91)
Ever married	230	62.94 (21.23)	272	88.88 (7.68)
Education years	388	0.041	414	0.127*
Personal annual income	379	0.109*	380	0.158**
Religion				
Yes	113	62.62 (23.81)	70	89.43 (7.00)
No	273	63.60 (20.91)	342	89.13 (7.26)
Suicide attempt(s)				
1–10	76	54.26 (24.61)***	–	–
0	311	65.35 (20.42)	–	–
Social support	377	0.090	407	–0.082
Suicide intent	385	–0.216***	–	–
Mental illness [†]				
Yes	187	49.75 (20.26)***	16	74.19 (13.96)***
No	204	75.67 (14.24)	400	89.78 (6.08)
Mood disorders				
Yes	133	52.19 (17.78)***	10	74.50 (10.37)***
No	258	68.98 (21.30)	406	89.55 (6.71)
Schizophrenia and other psychotic disorders				
Yes	44	30.93 (17.20)***	2	64.00 (36.77)
No	347	67.37 (18.51)	414	89.31 (6.74)
Substance use disorders				
Yes	23	60.91(15.56)	3	77.67 (12.50)**
No	368	63.42 (22.00)	413	89.27 (7.08)
Anxiety disorders				
Yes	9	56.33 (18.50)	2	78.00 (4.24)*
No	382	63.43 (21.73)	414	89.24 (7.15)
Other axis disorders				
Yes	1	85.00 (–)	0	–
No	390	63.22 (21.67)		

GAF, Global Assessment of Functioning.

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

[†]The total number of diagnoses exceeds the number of study subjects with any diagnosis due to multiple diagnoses.

suicides with severe, mild to moderate, and none dysfunction. From suicides with severe to none dysfunction, there were trends of younger age, more personal annual income, less percent of previous suicidal attempt, mental illness, higher social support score, and lower suicide intent score.

Table 6 further showed comparison of demographic and suicidal variables among suicides with severe, mild to moderate, and none dysfunction. Suicides with severe dysfunction had more percent of mental illness (OR = 4.670, $p < 0.001$) compared with suicides with mild to moderate dysfunction; had lower percent of ever married (OR = 0.253, $p = 0.026$), higher percent of mental illness (OR = 41.260, $p < 0.001$), lower social support score (OR = 0.630, $p = 0.008$), and higher suicide intent score (OR = 1.191, $p = 0.011$) compared with suicides with none dysfunction. Suicides with mild to moderate dysfunction had higher percent of mental illness (OR = 9.119, $p < 0.001$), and higher suicide intent score (OR = 1.183, $p = 0.003$) compared with suicides with none dysfunction.

Discussion

Mental illness has been known to be associated with suicide in the world. In China, mental illness as other factors, like culture, psychological variables, family history of suicide etc., is also an important predictor of suicide (5,6). In this study, the prevalence of

mental illness in suicide case was 47.83% which is lower than that of previous finding (76%) by Zhang et al. (5) and another finding (63%) by Phillips and Yang (7). Cause might be our cases are rural suicides with 15–34 years, not like those two studies of suicides with all age groups (5,7). In China, prevalent of mental illness (mood disorders and anxiety disorders) in individuals 40 years and older is more than in those younger than 40 years (26), which can give some support for our finding.

The GAF scale is regarded as a method for assessing global functioning of a patient with mental illness (8). Unsurprisingly, GAF was also significantly correlated with mental illness in suicides and controls in this study. Considering five types of mental illness diagnosed in this study, global functioning in suicides might be more influenced by mood disorder and schizophrenia. Comparing the parameters of mental illness and GAF score, we found that GAF score was stronger than mental illness in association with suicide in this study. GAF has been used in assessing severe dysfunction in suicide behavior (27). Reduced GAF score found in untreated mental illness in a 4-year follow-up study (28) indicates that early intervention will be helpful in improving global functioning. So, if we actively identify mood disorders and schizophrenia in the population, assess their global functioning, and carry out some intervention measures for them, it would be helpful in reducing suicide event in rural population.

TABLE 5—Comparison of demographic characteristics and suicidal variables among suicides with severe (GAF ≤ 50) (N = 114), mild to moderate (50 < GAF ≤ 70) (N = 101), and none dysfunction (GAF ≥ 71) (N = 176).

Variable	Suicides With Dysfunction			Statistics	p
	Severe	Mild to Moderate	None		
	Mean (SD)/n (%)	Mean (SD)/n (%)	Mean (SD)/n (%)		
Age (mean [SD])	28.39 (6.06)	27.55 (6.26)	25.39 (6.36)	F = 8.922	0.000
Gender (n of male [%])	70 (61.40)	56 (55.44)	88 (50.00)	χ ² = 3.659	0.160
Marriage (n of ever married [%])	64 (56.14)	64 (63.37)	102 (57.95)	χ ² = 1.254	0.534
Education years (mean [SD])	7.34 (3.12)	7.22 (2.92)	7.51 (2.43)	F = 0.377	0.686
Personal annual income (mean [SD])	3800 (7056)	4072 (4510)	7645 (19511)	F = 3.389	0.035
Religion (n of yes [%])	35 (30.97)	23 (23.47)	55 (31.43)	χ ² = 2.145	0.342
Suicide attempt (n of yes [%])	35 (30.70)	19 (19.00)	22 (12.72)	χ ² = 14.119	0.001
Mental illness (n of yes [%])	99 (86.84)	59 (58.42)	29 (16.48)	χ ² = 143.400	0.000
Social support (mean [SD])	2.55 (1.37)	2.75 (1.13)	2.94 (1.21)	F = 3.448	0.033
Suicide intent (mean [SD])	9.14 (3.08)	8.92 (3.13)	7.36 (3.31)	F = 13.182	0.000

GAF, Global Assessment of Functioning.
The numbers are variance due to variables with missing data.

TABLE 6—Comparison of correlates of demographic and suicidal variables among suicides with severe dysfunction (GAF ≤ 50, N = 114), mild to moderate dysfunction (50 < GAF ≤ 70, N = 101), and none dysfunction (GAF ≥ 71, N = 176) by multiple logistic regression models.

Variable	Suicides with Dysfunction					
	Severe vs. Mild to Moderate*		Severe vs. None [†]		Mild to Moderate vs. None [‡]	
	OR	p	OR	p	OR	p
Age	1.035	0.315	1.090	0.060	1.060	0.117
Gender	0.907	0.785	0.936	0.880	0.946	0.876
Marriage	0.435	0.070	0.253	0.026	0.565	0.243
Education years	1.030	0.592	0.970	0.686	1.003	0.960
Personal income	1.000	0.780	1.000	0.004	1.000	0.007
Religion	1.525	0.261	0.608	0.269	0.518	0.080
Suicide attempt	1.438	0.328	2.462	0.074	2.067	0.119
Mental illness	4.670	0.000	41.260	0.000	9.119	0.000
Social support	0.919	0.509	0.630	0.008	1.021	0.888
Suicide intent	0.976	0.662	1.191	0.011	1.183	0.003
Constant	0.260	0.191	0.036	0.010	0.032	0.003

GAF, Global Assessment of Functioning; OR, odds ratio.
*Cox & Snell R² = 0.127, Nagelkerke R² = 0.170, χ² = 26.182, p = 0.004.
[†]Cox & Snell R² = 0.505, Nagelkerke R² = 0.684, χ² = 184.486, p < 0.001.
[‡]Cox & Snell R² = 0.288, Nagelkerke R² = 0.395, χ² = 83.520, p < 0.001.

As the American Psychiatric Association (8) has given suggestions about GAF criteria for classifying severe, mild to moderate, and none dysfunction in psychological, social, occupational, or studying dimensions, in this study we used it and got three types of suicides or controls. There were significant difference in dysfunction types between suicides and controls. Most (97.84%) of controls were classified as none dysfunction group, only one (0.24%) was classified as severe dysfunction whereas there were 45.01% of suicides classified as none dysfunction and 29.16% classified as severe dysfunction. If we want to screen high risk population of suicide using GAF with its score ≤70, GAF's sensitivity would be 54.98% [(114 + 101)/391] whereas its specificity would be 97.84% (407/416). Although its sensitivity is not higher, its higher specificity will make up this shortcoming, combining other factors related to suicide, assessing individual's global functioning should be played an important role in suicide prevention and intervention.

According to our knowledge by reviewing literature, this is the first study to analyze different characteristics of suicides with different dysfunction in young rural Chinese. There were differences

among suicides with severe, mild to moderate, and none dysfunction in age, personal annual income, previous suicide attempt(s), mental illness, social support, and suicide intent scores. According to their clinical, psychological, and psychosocial factors, 142 suicides were fallen into three distinct clusters (29). These results indicate that there is heterogeneity in suicides. Obtaining the characteristics of different subtypes of suicide has important significance in clinical treatment or suicide prevention (29,30) for formulating suitable measures to prevent or control different subtypes of suicide occurrence.

In this study, suicide intent was negatively correlated with GAF score. GAF as a scale itself has an aspect of considering suicide ideation or suicide attempt. Our study has supported that low GAF score is associated with high suicide intent, which indicates that assessing global functioning can show someone's level of suicide intent. Due to stigma of suicide in rural areas, assessing global functioning is easily carried out compared with measuring suicide intent in the population. So, GAF should be regularly used in suicide prevention practice. However, in China, impulsivity personality and easy access to insecticides are strongly related to rural suicide risks (6), and most of them might have no real intent to

die. These results suggest, although suicide intent can be reflected by GAF score, the GAF score alone is not enough to explain why individuals without intent have committed suicide in rural China. GAF should be used with other scales together in screening high risk population of suicide.

Previous suicide attempt has been demonstrated to be an important predictor of completed suicide (31–33). In this study, previous suicide attempt was also associated with suicide. However, in this study, there were <20% of suicides with previous suicide attempt, which also shows that only previous suicide attempt will not be enough in predicting suicide (31). GAF is found to be an important predictor of reattempt (34,35) or survival time of attempters (36). In this study, GAF score in suicides with previous attempt was significantly lower than that in suicides without previous attempt, and more percent of previous attempt was in suicides with severe dysfunction, which indicate that GAF score is also a predictor of suicide with previous suicide attempt. From these results, we can know that measuring global functioning is very helpful in predicting suicide in suicide attempts.

Suicide has different demographic characteristics from controls (2,5,37,38). In this study, suicide was negatively associated with education years and social support, which was similar with the previous reports (5,39). A study focused on suicide and marital status conducted in Northern Ireland (37) has demonstrated that never marrying increased male suicide risk and its effect with age among 20–34 years old, and the effect of divorce was far more pronounced in men and women aged 20–34 years old, which support that marriage protects both gender against suicide. Although we have not carried out analyzing the relationship between marriage status and suicide by gender, status with married was also a protector factor of suicide in this study. Unlike most other societies in the world, it was found that religion might be a risk factor for suicide in rural China. In China, Chinese religions are often associated with superstition as the saying of *zongjiao mixin* (religious superstition) (5). Being religious is equivalent to being superstitious for some Chinese populations, and death is a solution to all the problems and the beginning of a new life (38).

In this study, we have found that global functioning is an important factor of suicide and should be assessed in the suicide prevention practice. However, some limitations of this study should be mentioned here. GAF scores should be obtained before suicide events, and it is best for specifying the association between global functioning and suicide, however, this study is a retrospective study in which GAF scores could be only obtained by information provided by informants. Information bias might exist due to our information source coming from incorporating responses from two informants. By analyzing demographic characteristics of informants, we found that there were significant difference in age, gender, education years, marriage, and relationship to the targets between informants of suicides and controls, these factors might influence informants' responses to the target and influence our results. Our sample has its specific characteristics, such as their age of 15–34 years, rural suicides, and controls in China, which lead to some limitations in extrapolation of our findings.

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References

- Hirsch JK. Risk and protective factors, incidence, and prevention. *Crisis* 2006;27:189–99.
- Phillips MR, Li XY, Zhang YP. Suicide rates in China 1995–99. *Lancet* 2002;359:835–40.
- Yip PSF, Liu KY, Law CK. Years of life lost from suicide in China, 1990–2000. *Crisis* 2008;29:131–6.
- Mann JJ, Apter A, Bertolote J, Beautrais A, Currier D, Haas A, et al. Suicide prevention strategies: a systematic review. *JAMA* 2005;294:2064–74.
- Zhang J, Conwell Y, Zhou L, Jiang C. Culture, risk factors and suicide in rural China: a psychological autopsy case control study. *Acta Psychiatr Scand* 2004;110:430–7.
- Phillips MR, Yang G, Zhang Y, Wang L, Ji H, Zhou M. Risk factors for suicide in China: a national case-control psychological autopsy study. *Lancet* 2002;360:1728–36.
- Phillips MR, Yang GH. Suicide and attempted suicide in China, 1990–2002. *MMWR Morb Mortal Wkly Rep* 2004;53:481–4.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 4th edn. Washington, DC: APA, 1994.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 3rd rev. edn. Washington, DC: APA, 1987.
- Jones SH, Thornicroft G, Coffey M, Dunn G. A brief mental health outcome scale—reliability and validity of the global assessment of functioning (GAF). *Br J Psychiatry* 1995;166:654–9.
- Hilsenroth MJ, Ackerman SJ, Blagys MD, Baumann BD, Baity MR, Smith SR, et al. Reliability and validity of DSM-IV axis V. *Am J Psychiatry* 2000;157:1858–63.
- Rey JM, Starling J, Wever C, Dossetor DR, Plapp JM. Inter-rater reliability of global assessment of functioning in a clinical setting. *J Child Psychol Psychiatry* 1995;36:787–92.
- Startup M, Jackson MC, Bendix S. The concurrent validity of the global assessment of functioning (GAF). *Br J Clin Psychol* 2002;41(Pt 4): 417–22.
- Hall RC. Global assessment of functioning. A modified scale. *Psychosomatics* 1995;36(3):267–75.
- Tang VW, Leung SK, Lam LC. Clinical correlates of the caregiving experience for Chinese caregivers of patients with schizophrenia. *Soc Psychiatry Psychiatr Epidemiol* 2008;43:720–6.
- Zhang J, Wiczorek WF, Jiang C, Zhou L, Jia S, Sun Y, et al. Studying suicide with psychological autopsy: social and cultural feasibilities of the methodology in China. *Suicide Life Threat Behav* 2002;32:370–9.
- Zhang J, Conwell Y, Wiczorek WF, Jiang C, Jia S, Zhou L. Studying Chinese suicide with proxy-based data: reliability and validity of the methodology and instruments in China. *J Nerv Ment Dis* 2003;191:450–7.
- Salvi G, Leese M, Slade M. Routine use of mental health outcome assessments: choosing the measure. *Br J Psychiatry* 2005;186:146–52.
- Ramirez A, Ekseius L, Ramklint M. Axis V—Global Assessment of Functioning Scale (GAF), further evaluation of the self-report version. *Eur Psychiatry* 2008;23:575–9.
- Jovanovic AA, Gasic MJ, Ivkovic M, Milovanovic S, Damjanovic A. Reliability and validity of DSM-IV Axis V scales in a clinical sample of veterans with posttraumatic stress disorder. *Psychiatr Danub* 2008;20:286–300.
- Vatnaland T, Vatnaland J, Friis S, Opjordsmoen S. Are GAF scores reliable in routine clinical use? *Acta Psychiatr Scand* 2007;115:326–30.
- First MB, Spitzer RL, Gibbon M, Williams JBW. Structured clinical interview for DSM-IV-TR Axis I disorders, research version, patient edition. (SCID-I/P). New York, NY: Biometrics Research, New York State Psychiatric Institute, 2002.
- Zhang J, Jia CX. Validating a short version of the Suicide Intent Scale in China. *Omega (Westport)* 2007;55:255–65.
- Beck AT, Schuyler D, Herman I. Development of suicidal intent scales. In: Beck AT, Resnik HLP, Lettieri DJ, editors. *The prediction of suicide*. Bowie, MD: Charles Press, 1974:45–56.
- Kraemer HC, Measelle JR, Ablow JC, Essex MJ, Boyce WT, Kupfer DJ. A new approach to integrating data from multiple informants in psychiatric assessment and research: mixing and matching contexts and perspectives. *Am J Psychiatry* 2003;160:1566–77.
- Phillips MR, Zhang J, Shi Q, Song Z, Ding Z, Pang S, et al. Prevalence, treatment, and associated disability of mental disorders in four provinces in China during 2001–05: an epidemiological survey. *Lancet* 2009;373:2041–53.
- Reynolds SK, Lindenboim N, Comtois KA, Murray A, Linehan MM. Risky assessments: participant suicidality and distress associated with research assessments in a treatment study of suicidal behavior. *Suicide Life Threat Behav* 2006;36:19–34.
- Clarke M, Whitty P, Browne S, McTigue O, Kamali M, Gervin M, et al. Untreated illness and outcome of psychosis. *Br J Psychiatry* 2006;189:235–40.

29. O'Connor RC, Sheehy NP, O'Conner DB. The classification of completed suicide into subtypes. *J Ment Health* 1999;8:629–37.
30. Ellis TE. Classification of suicidal-behavior—a review and step toward integration. *Suicide Life Threat Behav* 1988;18:358–71.
31. Zihlerl S, Zalar B. Risk of suicide after attempted suicide in the population of Slovenia from 1970 to 1996. *Eur Psychiatry* 2006;21:396–400.
32. Schmidtke A, Bille-Brahe U, DeLeo D, Kerkhof A, Bjerke T, Crepet P, et al. Attempted suicide in Europe: rates, trends and sociodemographic characteristics of suicide attempters during the period 1989–1992. Results of the WHO/EURO multicentre study on parasuicide. *Acta Psychiatr Scand* 1996;93:327–38.
33. Dahlgren KG. Attempted suicides—35 years afterward. *Suicide Life Threat Behav* 1977;7(2):75–9.
34. Cedereke M, Ojehagen A. Prediction of repeated parasuicide after 1–12 months. *Eur Psychiatry* 2005;20:101–9.
35. Johnsson Fridell E, Ojehagen A, Traskman-Bendz L. A 5-year follow-up study of suicide attempts. *Acta Psychiatr Scand* 1996;93:151–7.
36. Tejedor MC, Diaz A, Castillon JJ, Pericay JM. Attempted suicide: repetition and survival—findings of a follow-up study. *Acta Psychiatr Scand* 1999;100:205–11.
37. Corcoran P, Nagar A. Suicide and marital status in Northern Ireland. *Soc Psychiatry Psychiatr Epidemiol* 2010;45:795–800.
38. Zhang J, Wiczorek W, Conwell Y, Tu XM, Wu BY, Xiao S, et al. Characteristics of young rural Chinese suicides: a psychological autopsy study. *Psychol Med* 2010;40:581–9.
39. Zhang J, Xiao S, Zhou L. Mental disorders and suicide among young rural Chinese: a case-control psychological autopsy study. *Am J Psychiatry* 2010;167:773–81.

Additional information and reprint requests:

Jie Zhang, Ph.D.

Department of Sociology

State University of New York College at Buffalo

1300 Elmwood

Buffalo, NY 14222

E-mail: zhangj@buffalostate.edu