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Low-planned suicides in China

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ABSTRACT

Background. Acts of suicide differ widely in the amount of planning preceding the act. Correlates of completed suicide in China identified in a previous investigation were re-examined to identify those that may be especially relevant to low-planned (impulsive) and high-planned suicidal behavior. The association of planning and method in completed suicide was also assessed.

Method. A psychological autopsy study of 505 suicide decedents aged $\geqslant$18 years sampled to be representative of suicides in China was conducted. Multinomial regression analyses compared three levels of suicide planning (low, intermediate, high).

Results. Women and younger individuals were more likely to carry out low-planned and intermediate-planned than high-planned acts of suicide. Greater acute stress distinguished low-planned from high-planned suicides. Ingestion of pesticides stored in the home was a more commonly employed method in low-planned than high-planned suicides.

Conclusions. Low-planned suicides are more common in women, in younger individuals, and among those who are experiencing acute stress. Prevention strategies targeted at restricting access to pesticides may preferentially lower the rate of low-planned suicides.

INTRODUCTION

Acts of suicide are heterogeneous; some are carried out impulsively with little premeditation or preparation whereas others are carefully planned. A focus on planning is important because low-planned (impulsive) suicides may require different prevention strategies than high-planned suicides (Brent, 1987; Conner, 2004). Individuals who make detailed suicide plans are in a suicidal state for a period of time, creating an opportunity for detection so strategies emphasizing improved risk recognition, such as the use of school-based screening programs (Shaffer *et al.* 2004) and primary-care physicians to detect depression (Bruce, 1999; Rutz *et al.* 1989) may be effective.

The precipitous nature of low-planned suicides may make risk recognition an ineffective strategy (Kessler *et al.* 1999). However, some data suggest restrictions on methods of suicide may be effective. Preventing access to firearms has been shown to reduce the proportion of suicides due to firearms by 32% among minors, and by 6·5% among adults (Shenassa *et al.* 2003). Access to firearms is associated with the greatest risk for suicide among youth under age 15 years (Miller *et al.* 2002). Among individuals with no apparent psychopathology, a loaded firearm is associated with the greatest attributable risk for completed suicide (Kellerman *et al.* 1992; Brent *et al.* 1993). Assuming that youth and individuals without psychopathology are more likely to carry out impulsive suicides,

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presumably in reaction to acute stressful life events, these data suggest method restrictions may be most effective in preventing unplanned suicides. Data on method restrictions in suicide prevention are not limited to firearms. A report from the UK showed 2- and 3-year follow-up data on the impact of legislation to restrict package size for paracetamol and salicylate tablets (Hawton *et al*. 2004). The investigators showed that the reduction in suicidal deaths from analgesics seen in the year after the change in legislation persisted in the next 2 years, as did a reduction in paracetamol overdoses.

In order to guide suicide prevention initiatives that may explicitly examine impact of the intervention according to level of planning of suicides, better data on the profiles of individuals that make high-planned and low-planned suicides are needed. There are consistent reports that higher planned acts are associated with greater depression (Brown *et al*. 1991; Simon *et al*. 2001; Li *et al*. 2003) and hopelessness (Brent, 1987; Brown *et al*. 1991; Groholt *et al*. 2000). Data on other presumed correlates of planning (e.g. age, gender, acute life stress, aggression/impulsivity) are equivocal (Conner, 2004). Previous studies of suicide investigating planning have had modest sample sizes that contained very small subgroups of women (Brent *et al*. 1988; Conwell *et al*. 1998). Small samples of female suicide decedents (e.g. $n=45$, Cheng, 1995) have characterized post-mortem suicide studies in general. The present study used a large sample and included a high number of female suicide decedents, overcoming these limitations.

We had four *a priori* hypotheses about the relationship of planning and suicide based on previous reports. (1) A study in China of attempted suicide showed that those reporting that they first 'thought about suicide' less than 2 hours before acting – conceptualized as low-planned attempts – were more likely to experience a severe negative life event in the preceding month compared to attempts associated with greater planning (Li *et al*. 2003). These results are consistent with the notion that low-planned acts occur in response to acute life stressors (Conner, 2004) so we hypothesized that low-planned suicides are more strongly associated with acute stressors than high-planned suicides. (2) Preliminary data from studies of suicide in Western countries suggest that younger age is associated with less planning (Conwell *et al*. 1998; Brent *et al*. 1999), but a large multinational study in Europe of attempted suicide did not show age-related patterns in planning (Hjelmeland *et al*. 2000). For the purposes of the current study we hypothesized that individuals carrying out low-planned suicides are younger than those who make high-planned suicides. (3) Gender was not significantly related to planning in Western studies (Brent *et al*. 1999; Conwell *et al*. 1998; Hjelmeland *et al*. 2000) but Chinese women are more likely than Chinese men to ingest highly lethal pesticides in the context of acute life events (Eddelston & Phillips, 2004), so we hypothesized that women are more likely to carry out low-planned suicides. (4) Finally, we hypothesized that high-planned suicides are more strongly associated with depression, consistent with prior reports (Brown *et al*. 1991; Groholt *et al*. 2000; Simon *et al*. 2001; Li *et al*. 2003).

METHOD

Procedure

The methods have been described in detail in a prior analysis of risk factors for completed suicide in China (Phillips *et al*. 2002*b*). Between 1 March 1998 and 31 August 2000, all deaths recorded on the death certificate as due to suicide or other injury in persons older than 10 years of age that occurred at 20 rural sites and three urban sites in China were eligible for inclusion. The sites were selected to be representative of different regions of the country, and consequently the identified suicide decedents did not differ in age, gender, or residency (rural *versus* urban) from suicides reported nationally. The investigators were able to obtain data in 1065 of the 1220 cases (87·3%) they selected for inclusion. Final cause of death (suicide, accidental death, or death due to illness) was determined by a consensus process of the research team; in 7·6% of cases they changed the cause of death reported on the death certificate.

In the original study, there were 519 suicides and 536 injury death controls (Phillips *et al*. 2002*b*). For this study, we restricted the sample to subjects age $\geqslant$18 years, and we excluded controls because they do not contribute data on planning, yielding a sample of 505 adult suicide

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cases. Of this sample, 52% were women, 84% lived in a rural area, and 34% were aged 18–34 years, 25% aged 35–54 years and 41% aged ⩾55 years. Sixty-nine per cent of suicides were by ingestion (91% of which were carried out with pesticides used in agriculture or to control rodents), 26% were by violent methods (83% of which were by hanging), and 5% were by other method (93% of which were by drowning).

Data are based on two independent 2-hour interviews with family members and non-related associates of subjects (in 5% of the suicides only one of the interviews was completed). The interview schedule was field-tested and revised over a 2-year period before formal data collection began. It consisted of three sections: (1) an open-ended tape-recorded interview about the cause of death; (2) a structured questionnaire regarding the decedent's social and family environment that included a 60-item life event scale developed for the study; and (3) a semi-structured psychiatric interview administered by an attending-level psychiatrist. For continuous measures, a mean score was generated to combine data from the two proxy-respondent interviews; for diagnostic symptoms of depression the higher score was used.

The study was approved by the institutional review boards of the Beijing Hui Long Guan Hospital and the Chinese Academy of Preventive Medicine and the analyses herein met federal and University of Rochester criteria for exemption associated with secondary use of pre-existing data. After complete description of the study to the subjects, informed consent was obtained.

Measures

Outcome

We operationalized suicide planning as the degree of objective (overt) signs of planning based on interview questions surrounding the circumstances of the suicide that were judged to tap the content of items contained in the planning (objective) factor of the Beck Suicide Intent Scale (SIS; Beck *et al.* 1974). Research supports the inter-rater reliability and internal consistency of the SIS planning factor (Mieczkowski *et al.* 1993). We eliminated one item, suicidal communication, because it has been shown to load poorly on the full scale (Mieczkowski *et al.* 1993) (and also loaded poorly in the present sample), yielding a continuous 7-item measure of suicidal planning (Mieczkowski *et al.* 1993; Mann & Malone, 1997). The seven remaining items tap the following content: (1) isolation, (2) timing, (3) precautions against discovery, (4) acting to get help during or after the attempt, (5) final acts, (6) preparation, and (7) leaving a note. The items are coded 0 ('definitely did not occur'), 1 ('probably occurred'), or 2 ('definitely occurred') to yield scores with a range of 0–14. Internal consistency (α) of the 7-item SIS was 0·60 and level of agreement [intra-class correlation coefficient (ICC), 95% CI] between the two proxy respondent interviews was 0·78 (0·75–0·80). We categorized suicides into tertiles: low-planned (modified SIS ⩽5·5, $n=162$, 32%), intermediate-planned (modified SIS 6·0–7·5, $n=127$, 25%), and high-planned (modified SIS ⩾8·0, $n=216$, 43%). The cut-points were chosen *post hoc* to obtain groups of similar size. Our hypotheses regarding planning are based on the comparison of low-planned and high-planned (not intermediate) subgroups.

Predictors

In the original study of risk factors for suicide (Phillips *et al.* 2002*b*), an empirical approach was used to derive a trimmed multivariate model that distinguished cases and controls. Predictors retained in the final model were: blood relative with a history of suicidal behavior (present/absent), friend or associate with a history of suicidal behavior (present/absent), severe negative life event in the 2 days prior to death (present/absent), prior suicide attempt (present/absent), and scores derived on measures of chronic stress, acute stress, quality of life, and severity of depressive symptoms. Age, gender, residence (rural *versus* urban), and research site were also included in the model. Several other candidate variables (e.g. income, residing alone, presence or absence of a psychiatric illness) were excluded from the final multivariate model because they did not distinguish cases and controls after accounting for other variables in the model.

We carried these predictors over to the present investigation. Measures have been described previously (Phillips *et al.* 2002*b*). Briefly, chronic and acute stress scores were derived from a 60-item life event scale (referring to the year

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prior to death) administered to proxy respondents. The scale was pilot-tested and revised in studies of suicidal behavior in China over a 2-year period, and was developed to assess the time of occurrence, duration, and psychological effect of stressful life events that commonly occur in China. The chronic stress score was the product of the duration (in months) and perceived severity of the psychological effect of the negative life event, summed for all negative life events. The acute stress score was the product of the perceived severity of the psychological effect of the negative life event and the inverse of the time from the life event to death, summed for all negative life events. The concordance, using Spearman's *r*, of the chronic and acute stress scores derived from independently evaluated life-event scales of 1549 pairs of proxy respondents were 0·67 and 0·69 respectively, supporting the reliability of the procedure. The life-event scale was also used to identify severe negative life events in the 2 days prior to death; most of these were acute interpersonal crises that were perceived to be intensely stressful for the deceased. A quality of life score (past month) was derived by rating six characteristics of subjects (physical health, psychological health, economic circumstances, work, family relationships, relationships with non-family) on a scale of 1 (very poor) to 5 (excellent) and converting the sum to a scale of 0–100.

In the original study (Phillips *et al.* 2002*b*), continuous depression scores based on symptom intensity and duration were derived. In this analysis the presence or absence of each of the nine symptoms of a major depressive episode in the 2 weeks prior to death were assessed and a symptom count was computed for eight of the symptoms (range 0–8); the 'thoughts of death and suicide' symptom was excluded given the nature of the sample. The diagnostic interview used to identify depressive symptoms was an adaptation of the *Structured Clinical Interview for DSM-IV Axis I Disorders* (SCID; Spitzer *et al.* 1994) for use with proxy informants in China. Research supports the reliability (Henriksson *et al.* 1993; Beautrais *et al.* 1996) and validity (Kelly & Mann, 1997; Conner *et al.* 2001) of proxy-based diagnoses of mood disorders based on the SCID. The scale adapted for China asked about the symptoms of depression using both the standard probes and additional probes that were designed to improve the sensitivity of the assessment of depressive symptoms among Chinese respondents. The concordance (ICC) of the 8-item depressive symptom count between independent proxy-respondent interviews was 0·80 and the internal consistency (α) was 0·92.

Analyses

We conducted two multivariate analyses with SAS Proc Logistic (SAS Institute, 1999) using unordered multinomial logistic regression models that simultaneously compare one or more case groups to a reference group (Hosmer & Lemeshow, 2000). The aforementioned predictors (quality of life score, etc.) and covariates (age, etc.) were entered simultaneously. All variables were retained in the model in which suicides in the low-planning and intermediate-planning groups were compared simultaneously to suicides with high-planning which served as the reference group. We derived odds ratios and asymmetric confidence intervals computed using the method of profile likelihood (Hosmer & Lemeshow, 2000) that compares each level of the case group to the reference group. Statistical significance is based on $\alpha = 0{\cdot}05$. Goodness of fit was assessed using the Hosmer–Lemeshow Goodness of Fit test (Hosmer & Lemeshow, 2000) that is based on secondary multivariate binary logistic regression analyses stratified by level of planning (not shown).

RESULTS

Descriptive data on the predictors in suicides stratified by the three levels of planning are provided in Table 1. Scores on acute stress, chronic stress, and quality of life are presented in tertiles for descriptive purposes, but in the multivariate analyses continuous scores are used. Logarithmically transformed scores on acute stress and chronic stress were used to improve their distribution. A 3×3 analysis of method by planning (shown in Table 2) found that ingestion is significantly more common in low-planned than high-planned suicides while violent methods are more common in high-planned than low-planned suicides ($\chi^2 = 49{\cdot}5$, $df = 4$, $p < 0{\cdot}001$). A 2×3 analysis of suicides by

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Table 1. *Suicides stratified by level of planning*

Independent variable	Suicide: Low-planned ($N=162$) *n* (%)	Intermediate-planned ($N=127$) *n* (%)	High-planned ($N=216$) *n* (%)
Female	96 (59)	71 (56)	94 (44)
Age (years)			
18–34	72 (44)	44 (35)	57 (26)
35–54	50 (31)	22 (17)	52 (24)
⩾55	40 (25)	61 (48)	107 (50)
Rural resident	138 (85)	108 (85)	179 (83)
Relative with history of suicidal behavior	41 (25)	24 (19)	40 (19)
Associate with history of suicidal behavior	77 (48)	65 (51)	87 (40)
Stressful life event within 48 h	61 (38)	37 (29)	51 (24)
Chronic stress score*			
Low tertile	26 (16)	15 (12)	14 (6)
Middle tertile	59 (36)	51 (40)	69 (32)
High tertile	77 (48)	61 (48)	133 (62)
Acute stress score*			
Low tertile	13 (8)	11 (9)	26 (12)
Middle tertile	48 (30)	45 (35)	93 (43)
High tertile	101 (62)	71 (56)	97 (45)
Depressive symptoms*			
0	68 (42)	48 (38)	83 (38)
1–4	39 (24)	32 (25)	47 (22)
5–8	55 (34)	47 (37)	86 (40)
Quality of life score*			
Low tertile	74 (46)	71 (56)	124 (57)
Middle tertile	64 (40)	46 (36)	72 (33)
High tertile	24 (15)	10 (8)	20 (9)

* Categories are presented for descriptive purposes. In multivariate analyses, continuous measures are used.

Table 2. *Suicides stratified by method and level of planning*

	Low-planned ($N=162$) *n* (%)	Intermediate-planned ($N=127$) *n* (%)	High-planned ($N=216$) *n* (%)
Violent method	17 (10)	31 (24)	83 (38)
Ingestion	140 (86)	92 (72)	115 (53)
Other	5 (3)	4 (3)	18 (8)

Table 3. *Level of planning stratified by type of storage among ingestion suicides*

Storage of substance ingested	Low-planned ($N=140$) *n* (%)	Intermediate-planned ($N=92$) *n* (%)	High-planned ($N=115$) *n* (%)
Stored in home	115 (82)	61 (66)	42 (36)
Not stored in home	25 (18)	31 (34)	73 (64)

Table 4. *Multivariate results comparing characteristics of low-planned suicides and intermediate-planned suicides to high-planned suicides*

Characteristic	Subgroups compared	OR	95% CI
Age 18–34	Low *v.* High	2·49*	1·43–4·33
(*v.* ⩾55 years)	Intermediate *v.* High	1·26	0·73–2·19
Age 35–54	Low *v.* High	2·26	1·30–3·94
(*v.* ⩾55 years)	Intermediate *v.* High	0·66	0·36–1·21
Female	Low *v.* High	1·55	0·99–2·43
	Intermediate *v.* High	1·71	1·07–2·74
Rural	Low *v.* High	1·01	0·61–1·98
	Intermediate *v.* High	1·10	0·59–2·04
Depressive symptom count	Low *v.* High	1·01	0·93–1·09
	Intermediate *v.* High	1·00	0·92–1·09
Acute stressful life event	Low *v.* High	0·72	0·33–1·56
	Intermediate *v.* High	0·85	0·37–1·97
Chronic stress score	Low *v.* High	0·93	0·83–1·05
	Intermediate *v.* High	0·97	0·85–1·11
Acute stress score	Low *v.* High	1·20	1·04–1·38
	Intermediate *v.* High	1·08	0·94–1·25
Quality of life score	Low *v.* High	1·02	1·00–1·04
	Intermediate *v.* High	1·00	0·98–1·02
History of prior suicide attempt	Low *v.* High	1·37	0·82–2·27
	Intermediate *v.* High	1·24	0·73–2·10
Relative with history of suicidal behavior	Low *v.* High	1·55	0·92–2·63
	Intermediate *v.* High	1·01	0·56–1·79
Associate with history of suicidal behavior	Low *v.* High	1·28	0·82–2·00
	Intermediate *v.* High	1·63	1·03–2·58

* This odds ratio (95% CI) indicates that suicides aged 18–34 years, compared to aged ⩾55 years, had a 2·49 (1·43–4·33) times greater likelihood of carrying out a low-planned act of suicide than a high-planned act.

ingestion (shown in Table 3) indicated that substances used in low-planned suicides were predominantly those stored in the home for purposes other than suicide whereas the majority of those used in high-planned suicides were not stored in the home (the subject purchased or otherwise obtained the substance for use in suicide) ($\chi^2=56{\cdot}9$, df = 2, $p<0{\cdot}001$).

Results of the multivariate model are presented in Table 4. Model fits based on the Hosmer–Lemeshow statistic were satisfactory. Consistent with hypotheses, the table indicates that after accounting for other predictors in the model women compared to men, and younger (ages 18–34 years) compared to older individuals (ages ⩾55 years), were more likely to carry out a low-planned than a high-planned act

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of suicide. These patterns also held in comparisons of intermediate-planned suicides and high-planned suicides, suggesting that the clinically meaningful cut-point, at least in terms of age and gender, is the distinction between high-planned suicides (SIS $\geqslant 8{\cdot}0$) and suicides showing lower planning. In other words, individuals who carried out high-planned suicides differed from both low-planned and intermediate-planned suicides. Finally, also consistent with the hypothesis, individuals experiencing acute stress were more likely to carry out low-planned rather than high-planned acts of suicide. Contrary to hypotheses, major depression and recent stressful life event(s) were not associated with planning.

DISCUSSION

Results support three of four hypotheses pertaining to planning and suicide in China. First, younger age is associated with less planning consistent with prior post-mortem studies of suicide conducted in the West (Conwell *et al.* 1998; Brent *et al.* 1999). Second, women carried out acts of suicide with lower planning. Previous studies of completed suicide based on Western samples have reported non-significant associations of gender and planning (Brent *et al.* 1988; Conwell *et al.* 1998) but these studies contained small samples of females and were statistically underpowered. Third, there was mixed support pertaining to the hypothesis about the relationship of planning and acute stress: this construct defined as a continuous measure (acute stress score) showed an association with low-planned suicide but acute stress defined as a categorical measure (exposure to a stressful life event in the 2 days prior to death) did not show an association with planning. Given a strong correlation of acute life event and acute stress score ($r = 0{\cdot}68$, $p < 0{\cdot}001$), secondary multivariate analyses were conducted with acute stress score deleted from the models. The association of planning and acute life events remained statistically non-significant, indicating the non-significant findings concerning this variable are not attributable to multicollinearity. Categorical variables tend to have lower statistical power compared to continuous measures of a construct, and the optimal time period that defines an 'acute' life event is unclear, which may explain the non-significant findings for stressful life event. Contrary to our fourth hypothesis, we did not find that depressive symptoms are associated with suicide planning; most prior studies showing an association of depression and planning were based on Western, clinic-based samples of suicide attempters (Brown *et al.* 1991; Groholt *et al.* 2000; Simon *et al.* 2001), so the relevance of their results to the current study are unclear.

Ninety per cent of ingestion suicides were carried out with pesticide(s) that are readily available in China, particularly in rural areas. Such deaths are not evenly distributed across levels of planning; low-planned suicides were overwhelmingly committed by ingestion (86·4%) and were infrequently violent (10·4%) whereas in high-planned suicides ingestion (53·2%) and violent methods (38·4%) were each commonly used (Table 2). Finally, among suicides using ingestion, the substance(s) were stored in the home of 82·1% of low-planned *versus* 36·5% of high-planned suicides (Table 3). Taken together, these data indicate that low-planned suicides in China typically involve the ingestion of substances readily available in the home whereas high-planned suicides are more likely to involve the active purchase of poisons for the purpose of ingestion or the use of violent methods that require preparation (most commonly hanging).

In light of these data, there has been a call to restrict the accessibility of pesticides as a suicide prevention strategy (Phillips *et al.* 2002*b*; Eddelston & Phillips, 2004). Given the high proportion of low-planned suicides that involve pesticides stored in the home, successful implementation of such a strategy would be expected to differentially decrease the rate of low-planned suicides. The presumed mechanisms of action of this means restriction strategy include (1) attenuation of the acute suicidal state before a suicidal act requiring more planning is implemented, and (2) failure to choose an alternative method if the preferred method is unavailable. Moreover, in addition to safer storage and limited access, strategies to reduce the toxicity of agricultural chemicals and rat poisons and to improve the equipment and training in rural primary-care centers, although unlikely to affect the incidence of suicidal behav-

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ior, should improve survivability (Eddelston & Phillips, 2004). Evaluations of the impact of these strategies must account for potential substitution of other methods of suicide, for example adopting the use of hanging and other methods (Cantor & Baume, 1998), and must consider that the phenomenon of method substitution may vary in degree in different segments of the population (Kreitman, 1976) potentially including persons who make low *versus* high-planned suicides.

Phillips and colleagues' (2002*b*) case-control study of suicide showed that in China, as in the West, depression is a robust risk factor for suicide. Together with evidence that pesticide availability is a critical issue in suicide prevention, China may be a suitable environment in which to implement and evaluate the effectiveness of integrated prevention strategies, for example, those that pair population-based restrictions on methods – presumed to be the most cost-effective – with interventions targeted to high-risk individuals such as programs for the screening and treatment of persons with depression. Successful integration of population-based and high-risk approaches has not been demonstrated in suicide prevention, although such approaches have been extended successfully to combat other conditions such as heart disease, stroke, cancer and HIV/AIDS (Knox *et al*. 2004).

There were limitations of the study. The SIS planning subscale (Beck *et al*. 1974) was not administered formally and our derived measure showed suboptimal internal consistency ($\alpha = 0{\cdot}60$). A measure of impulsivity was not available as a predictor which is unfortunate in light of some provocative findings concerning impulsivity and level of planning (Mann *et al*. 1996; Mann & Malone, 1997). Generalization of suicide studies in China to Western societies is unclear. Indeed, use of pesticides to complete suicide is rare in the West (Thompson *et al*. 1995) and the epidemiological pattern of suicide is unique in China as rural rates are threefold urban rates and female rates are 25% higher than male rates (Phillips *et al*. 2002*a*). Nonetheless, our results on the relationship of planning to age and gender – which has been of interest to suicide researchers (Conwell *et al*. 1998; Brent *et al*. 1999; Hjelmeland *et al*. 2000) – may be relevant beyond China.

There were also many strengths of the study. The sample is representative of suicides aged $\geqslant 18$ years in China. Analyses were hypothesis-driven and built directly upon a prior report that identified risk factors for suicide in China (Phillips *et al*. 2002*b*). The SIS planning items tap observable phenomena, making the content of the items appropriate for use with proxy-respondents, and the high concordance on modified SIS scores between different proxy-respondents (ICC = 0·78) demonstrates the reliability of the measure as employed in this study. The large sample size allowed for stratification by planning and the investigation of patterns according to gender and method of suicide, making the study unique. Finally, the estimated 287 000 suicides in China each year (Phillips *et al*. 2002*a*) may be more representative of suicides in developing countries, which account for 85% of all suicides worldwide (WHO, 2002), than suicides in developed counties, so these results may inform suicide prevention efforts for a substantial proportion of world suicides.

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DECLARATION OF INTEREST

None.

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