Understanding the Unique Characteristics of Suicide in China: National Psychological Autopsy Study[1]

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Objective To compare the characteristics of suicides in the four main demographic groups: urban males, urban females, rural males and rural females in order to help clarify the demographic pattern of suicides in China. **Methods** A detailed psychological autopsy survey instrument was independently administered to 895 suicide victims in family members and close associates from 23 geographically representative locations from around the country. **Results** Pesticide ingestion accounted for 58% (519) of all suicides and 61% (318/519) of deaths were due to unsuccessful medical resuscitation. A substantial proportion (37%) of suicide victims did not have a mental illness. Among the 563 victims with mental illness, only 13% (76/563) received psychiatric treatment. Compared to other demographic groups, young rural females who died from suicide had the highest rate of pesticide ingestion (79%), the lowest prevalence of mental illness (39%), and the highest acute stress from precipitating life events just prior to the suicide. **Conclusion** Many suicides in China are impulsive acts of deliberate self-harm following acute interpersonal crises. Prevention of suicides in China must focus on improving awareness of psychological problems, improving mental health services, providing alternative social support networks for managing acute interpersonal conflicts, limiting access to pesticides, and improving the resuscitation skills of primary care providers.

Key words: Suicide; Mainland China; Psychological autopsy; Case-control studies; Community surveys; Risk factors; Mental disorders; Depression; Suicide tool; Pesticide; Negative life event

INTRODUCTION

Data from the 145-National Disease Surveillance Point (NDSP) system indicate that suicide is the most common injury death in China[1] and the WHO 1999 World Health Report[2] indicated that suicide is the fourth most important public health problem in China in terms of disability-adjusted life year (DALY) lost. According to the NDSP data, the average death rate for suicide after adjustment for underreporting was 23 per 100 000 during 1990-2000.

The pattern of suicide in China is different from that reported in other countries[3]. The suicide rate among women is about 30% higher than that among men (26.3 v. 20.1 per 100 000), but this is primarily due to high rates in rural females. In urban areas the male suicide rate is slightly higher than the female suicide rate. Rural rates are three to four times higher than urban rates. Since the population in rural communities accounts for 65%-70% of the total population, the age by gender distribution of suicides in rural areas is the major determinant of the pattern of suicides in the nation as a whole. There is a peak in the suicide rate among rural women aged 20-34 years and another peak among both men and women over 60 years of age in both urban and rural areas.

About one-third of the rural NDSP sites have a markedly elevated suicide rate, most of these sites are in the intensely cultivated areas of China's central plains[4].

Developing effective, cohort-specific suicide prevention programs for China depends on detailed understanding of the factors that produce this unique pattern of suicides. To do this, the Chinese Academy of Preventive Medicine (renamed the Chinese Center for Disease Control and Prevention in January 2002) and the Beijing Suicide Research and Prevention Center collaboratively conducted a detailed psychological autopsy study of suicides in 23 of the NDSPs from 1996 to 2000 by convenient sampling. The 23 points located in 17 provinces (Fig. 1). The randomized case-control part of the project which focused on risk factors has been described in an earlier paper[5]. To help clarify the demographic pattern of suicides in the country, this paper compares the characteristics of suicides in the four main demographic groups: urban males, urban females, rural males and rural females.

FIG. 1. Research points for suicide in China.

METHODS

Each site in the NDSP system covers a population of 50 000 to 100 000 persons and the entire system which is representative of the entire population includes 10 million persons from urban and rural areas in all provinces in the country[6]. Twenty rural sites and three urban sites that are representative of the different regions in the country and have relatively high suicide rates were selected for participation in this project. Deaths due to suicide or other injuries (based on death certificates) in persons over 10 years of age that occurred in 3 of the sites from 1 August, 1995 to 31 August, 2000 and in the other 20 sites from 1 January, 1997 to 31 August, 2000 were reported to the research group at 3-month intervals. Deaths occurred prior to 1 March, 1998 (in the pre-randomization phase of the project) were selected for detailed investigation based on the availability of informants. Starting in March 1998, if more than 5 suicides or 5 other injury deaths were reported in any 3-month period, 5 cases of each type of death were randomly selected for detailed investigation; if less than 5 cases of either type were reported, all reported deaths were selected and additional cases were identified (based on availability) from the death registries in adjacent counties or townships.

Research teams including public health physicians and psychiatrists who were extensively

trained in the administration of the interview schedule visited each site at regular intervals (every 3 to 6 months) and administered the schedule to family members and separately to close associates of identified subjects. The fifth revision of the survey instrument was used in this study. It took approximately two hours to complete the detailed information on the circumstances of the death, the characteristics and life history of the deceased, and the psychological status of the deceased at the time of the death. Among the 1767 injury deaths selected for detailed investigation, appropriate respondents could not be located in 67 cases, identified respondents refused to participate in 65 cases, the data was lost in the mail in 22 cases, and the psychiatric interview was incomplete in 4 cases. In 99 of the 1609 remaining cases included in this analysis only one group of respondents (family members or close associates) could provide information. All respondents gave their informed consent for the interview.

The final determination of the status of each death (suicide, other injury, or death due to illness) was the consensus opinion of the interviewers and independent researchers (who did not participate in the interview) after reviewing all available information about the specific events surrounding the death. The final determination was different from the original death certificate in 5.6% (90/1609) of the cases. Among the 895 cases classified as suicides, 225 were selected during the pre-randomization phase of the project, 519 were randomly selected from the 23 sites, and 151 were selected from adjacent counties or townships. Seven hundred and eight cases (79.1%) were from rural villages, 454 (50.7%) were male, and their mean (sd) age was 45.6 (19.6) years. The detailed demographic characteristics of these suicide cases are presented in Table 1.

Measures

The presence or absence of a mental illness was determined by administering a slightly revised version of the Structured Clinical Interview for DSM-IV Axis I Disorders[7] to both the family members and close associates of the deceased. If the information provided in these two structured interviews was different, which occurred in 23.6% (199/842) of the cases for which both types of respondents were available, the case was reviewed in detail by the research team to make a final determination. If more than one diagnosis were present, the primary diagnosis was determined by the research team.

A 60-item life event scale was constructed and pre-tested specifically for this project. Two measures of psychological stress related to life events were derived from the scale. The 'chronic stress score in the year prior to death' was the product of the duration (in months) and severity of the psychological effect (from none to very severe, coded 0-4) summed for all negative life events that either occurred in the year prior to death or occurred earlier but continued to have a negative psychological effect on the deceased in the year prior to death. To quantify the psychological triggering effect of negative life events, the 'acute stress score at time of death' was computed as the product of the severity of the psychological effect and the inverse-time from the life event to death, summed for all negative life events that continued to have a psychological effect on the deceased at the time of death. The scores computed from the independent interviews with family members and other associates were highly correlated. The ranked correlation coefficient for the two chronic stress scores was 0.671 and that for the two acute stress scores was 0.595.

The 'depression symptom score for the two weeks prior to death' which reflected the number, severity and persistence of depressive symptoms was derived from the structured psychiatric examination: It was computed as the product of the severity score (0=absent, 1=sub-threshold, or 2=definitely present) and time when the symptom was present (in days) summed for eight of the nine symptoms in the DSM-IV diagnosis of depression (the 'recurrent thoughts of death or suicide' symptom was excluded) and converted to a scale of 0 to 100. The details of the measures used and the method of combining data from the two interviews for each case have been described in a previous paper[6].

Statistical Analysis

Proportions in the four demographic groups of interest (urban males, urban females, rural males, and rural females) were compared using chi-square tests and ranked variables were compared using Kruskal-Wallis tests. If the overall test was statistically significant, multiple comparison tests were conducted to test the statistical significance of differences between demographic groups. We used a Tukey-type method based on an arcsin transformation of the original proportions for dichotomous variables and a non-parametric method for ranked variables in groups with unequal sample sizes that compares mean ranks between groups and adjusts for tied ranks[8].

The study was approved by the institutional review boards of Chinese Academy of Preventive Medicine and Beijing Huilongguan Hospital.

Role of Funding Source

None of the funding sources for the project had any role in the study design, data collection, data analysis, data interpretation or writing of the paper.

RESULTS

Table 2 shows the method of suicide by gender and location of residence. The majority of suicides in China are by poisoning. The number of suicides by pesticide digestion accounts for 58% of all suicides. The 519 suicides by pesticide ingestion included 424 (82%) by insecticides, 89 (17%) by rat poison, and 6 (1%) by herbicides. Three hundred and eighteen (61%) of these victims received medical treatment following the ingestion but the resuscitation efforts failed. Pesticides are used to commit suicide in rural areas more than in urban areas while hanging and jumping are more commonly used in urban areas. In both rural and urban areas women are more likely to commit suicide by ingesting poisons (pesticides or medications) than men, but the difference is not statistically significant. Males, particularly urban males, are significantly more likely to commit suicide by hanging than females. Use of medications to commit suicide is relatively uncommon, accounting for only 4% of all suicides. Only two of the 895 suicide cases died from discharging a firearm.

Based on DSM-IV criteria[7], 563 of the 895 cases (62.9%) had a mental illness at the time of suicide. Table 3 shows that the distribution and type of mental illness varied across the four demographic groups. The proportion of suicides in persons with a mental illness was higher in urban area than in rural area and substantially lower in rural women than in the other three groups. The proportion of suicides in persons with a mental illness also varied by age group: 50% (132/263) victims aged 10-29 years, 71% (234/328) victims aged 30-54 years and 65% (197/309) victims aged 55 years and more. Only 39% of young rural women victims aged 10-29 years who died from suicide had a mental illness at the time.

Depression and other disorders were present in 35% of all suicides, accounting for more than half of all mental disorders identified, but the prevalence of depression in the four groups of suicide victims was quite similar. Schizophrenia and associated psychoses were more common in women while substance abuse problems were more common in men. Since many individuals who do not meet the diagnostic criteria for major depressive disorder may nevertheless have depressive symptoms related to suicide risk, we also compared the level of depressive symptoms across the four groups in all suicide victims. Table 4 shows that the level of depressive symptoms was somewhat higher in males both in urban and rural areas, but this difference was not statistically significant.

Rates of prior treatment among the 563 suicides with a mental illness were relatively low. Only 147 (26.1%) saw a medical professional for a psychological problem, only 76 (13.5%) visited a mental health professional, and only 87 (15.5%) were taking psychiatric medication in the month before death. Use of services varied both by diagnostic group and by demographic group. Compared to the 478 suicide victims with other diagnoses, 85 who had schizophrenia or other psychotic disorders might have sought medical treatment (76.5% v. 17.2%, $\chi^2 =131.61$, df=1) or have seen a mental health professional (56.6% v. 5.9%, $\chi^2 =158.32$) or to have used psychiatric medication in the month prior to death (54.1% v. 8.6%, $\chi^2 =114.56$) ($P<0.0001$). Compared to the 306 male suicide victims with a mental illness, the 257 females victims might have sought treatment for psychological problems from a medical doctor at some time in the past (34.6% v. 19.0%, $\chi^2 =17.79$, df=1) or have seen a mental health professional (20.2% v. 7.8%, $\chi^2 =18.37$) or have taken psychiatric medication in the month prior to the suicide (21.4% v. 10.5%, $\chi^2 =12.80$) ($P <0.0001$). The utilization rates for the three methods of treatment in the 423 suicide victims with a mental illness who lived in villages were somewhat lower than those in the 140 who lived in cities or towns (24.8% v. 30.0% for medical treatment; 12.3% v. 17.1% for psychiatric treatment; and 14.9% v. 17.1% for use of psychiatric drugs in last month), but none of these differences was statistically significant.

The median (25%-75% range) number of negative life events that affected the victims in the year prior to death was 3.0 (2.0-4.5). Table 4 shows that chronic stress from long-standing negative life events was much lower in rural females than in the other demographic groups and acute stress from precipitating life events (largely from intense interpersonal conflict just prior to the suicide) was significantly higher in rural females. Among young rural female suicide victims aged 10-29 years, 43% occurred in those without a mental illness who were experiencing high acute stress (above the median level) at the time they committed suicide. The most common negative life events were financial problems (40%), serious physical problems (38%), and marital discord (35%). As shown in Table 5, financial problems were significantly more common in male suicide victims, serious physical problems were more common in rural male suicide victims, and the prevalence of marital discord was not significantly different in the four groups.

TABLE 1

Distribution of 895 Suicides In China By Gender, Age, and Location of Residence

Age Group	All Cases		Urban Males		Urban Females		Rural Males		Rural Females	
	n	%	n	%	n	%	n	%	n	%
10-19	39	4.36	1	1.02	3	3.37	20	5.62	15	4.26
20-29	224	25.03	14	14.29	21	23.60	78	21.91	111	31.53
30-39	163	18.21	19	19.39	24	26.97	55	15.45	65	18.47
40-49	119	13.30	18	18.37	12	13.48	45	12.64	44	12.50
50-59	105	11.73	17	17.35	10	11.24	47	13.20	31	8.81
60-69	111	12.40	8	8.16	9	10.11	52	14.61	42	11.93
70-79	89	9.94	16	16.33	5	5.62	42	11.80	26	7.39
80+	45	5.03	5	5.10	5	5.62	17	4.78	18	5.11
All ages	895	100.00	98	100.00	89	100.00	356	100.00	352	100.00

TABLE 2

Methods Used in 895 Suicides in China by Location of Residence and Gender

	All Cases (n=895)		Urban Males (n=98)		Urban Females (n=89)		Rural Males (n=356)		Rural Females (n=352)		χ^2 (df=3)	P-value	Multiple Comparisons[a]
	n	%	n	%	n	%	n	%	n	%			
Pesticides[b]	519	57.99	27	27.55	33	37.08	215	60.39	244	69.32	72.63	<0.001	RM>UM[**], RF>UF[**]
Medications	37	4.13	5	5.10	9	10.11	10	2.81	13	3.69	10.01	0.0185	all NS
Hanging	197	22.01	39	39.80	19	21.35	86	24.16	53	15.06	28.79	<0.001	UM>UF[*]; RM>RF[*]; UM>RM[*]
Drowning	35	3.91	4	4.08	3	3.37	10	2.81	18	5.11	2.58	0.4606	all NS
Jumping	33	3.69	12	12.24	16	17.98	3	0.84	2	0.57	89.14	<0.001	UM>RM[**]; UF>RF[**]
Other Methods[c]	74	8.27	11	11.22	9	10.11	32	8.99	22	6.25	3.66	0.3003	all NS

Note. UM=urban male; UF=urban female; RM=rural male; RF=rural female; [*]P<0.05; [**]P<0.001. NS=not significant. [a]Four pair-wise comparisons are considered: UM v UF; RM v RF; UM v RM; and UF v RF. Tukey-type multiple comparison method based on an arcsin transformation of the original proportions[8]. [b]Includes insecticides (n=424), rat poison (n=89), and herbicides (n=6). [c]Other methods include 39 poisonings with other toxins, 9 cutting, 3 motor vehicles, 2 firearms, 2 self-immolations, 1 electrocution, 14 other violent means and 4 miscellaneous.

TABLE 3

Mental Illnesses[a] in 895 Suicides in China by Location of Residence and Gender

| | All Case | | Urban Males | | Urban Females | | Rural Males | | Rural Females | | χ^2 | | |
| | (n=895) | | (n=98) | | (n=89) | | (n=356) | | (n=352) | | | | |
	n	%	n	%	n	%	n	%	n	%	(df=3)	P-value	Multiple Comparisons[b]
Any Disorder	563	62.91	73	74.49	67	75.28	233	65.45	190	53.98	24.47	<0.001	RM>RF[*]; UF>RF[**]
Affective Disorders	315	35.20	34	34.69	33	37.08	131	36.80	117	33.24	1.14	0.7672	all NS
Schizophrenia and Associated Disorders	85	9.50	7	7.14	17	19.10	21	5.90	40	11.36	16.97	0.0007	RF>RM[*]
Substance Abuse Disorders	79	8.83	17	17.35	4	4.49	52	14.61	6	1.70	47.88	<0.0001	UM>UF[*]; RM>RF[***]
Organic Mental Disorders	39	4.36	7	7.14	5	5.62	19	5.34	8	2.27	6.65	0.0838	all NS
Other Mental Disorders	45	5.03	8	8.16	8	8.99	10	2.81	19	5.40	8.71	0.0334	all NS

Note. UM=urban male. UF=urban female; RM=rural male; RF=rural female; [*]P<0.05; [**] P<0.01; [***] P<0.001. NS=not significan. [a]Using DSM-IV diagnoses[7]. Only the primary diagnosis is considered. Affective disorders include major depression in 307 cases and other affective disorders in 8 cases; schizophrenia and related disorders include schizophrenia in 70 cases and other types of psychoses in 5 cases; substance abuse disorders include alcohol dependence or abuse in 69 cases and drug dependence or abuse in 10 cases; organic mental disorders included dementia in 21 cases and mental retardation in 18 cases; and other mental disorders included anxiety-related disorders in 11 cases, adjustment disorder in 11 cases, borderline personality disorder in 10 cases and miscellaneous diagnoses in 13 cases. [b]Four pair-wise comparisons are considered: UM v UF; RM v RF; UM v RM; and UF v RF. Tukey-type multiple comparison method based on an arcsin transformation of the original proportions[8].

TABLE 4

Severity of Depressive Symptoms, Chronic and Acute Stress in Suicides in China by Location of Residence and Gender

	All Case	Urban Males	Urban Females	Rural Males	Rural Females	χ^2		
	(n=895)[a]	(n =98)	(n =89)	(n =356)	(n =352)[a]			
	median	median	median	median	median			
	(IQR)	(IQR)	(IQR)	(IQR)	(IQR)	(df=3)	P-value	Multiple Comparisons[c]
Depressive Symptom Score	18.8 (0.0-50.0)	31.3 (0.0-57.8)	15.2 (0.0-57.0)	25.0 (0.0-56.3)	12.5 (0.0-46.9)	7.20	0.0659	all NS
No. of Negative Life Events	3.0 (2.0-4.5)	3.0 (2.0-5.0)	3.5 (2.0-5.0)	3.5 (2.0-5.0)	3.0 (1.5-4.5)	12.10	0.0071	RM>RF[*]
Chronic Stress Score	52.5 (22.4-93.0)	62.0 (34.5-116.4)	69.0 (29.5-106.5)	57.0 (26.6-98.6)	42.0 (15.0-79.0)	26.61	<0.0001	RM>RF[**]; UF>RF[**]
Acute Stress Score	1.97 (0.46-38.19)	1.46 (0.47-7.99)	1.00 (0.19-7.93)	2.08 (0.56-44.29)	2.72 (0.45-46.59)	10.86	0.0125	RF>UF[*]

Note. UM=urban male; UF=urban female; RM=rural male; RF=rural female; IQR=interquartile range (25%-75%). [*]P<0.05. [**] P<0.01. NS=not significant. [a]In the analyses of the number of negative life events, chronic and acute stress, N's for all cases and rural females are 894 and 351, respectively. [b]Based on Kruskal-Wallis ranked test. [c]Four pair-wise comparisons are considered: UM v UF; RM v RF; UM v RM; and UF v RF. Uses a non-parametric multiple comparison method for subgroups with unequal sample sizes that compares mean ranks between groups and adjusts for tied ranks[8].

TABLE 5

Three Most Common Negative Life Events in 894 Suicides in China by Location of Residence and Gender

	All Cases		Urban Males		Urban Females		Rural Males		Rural Females		χ^2		
	(n=894)		(n =98)		(n =89)		(n =356)		(n =351)				
	n	%	n	%	n	%	n	%	n	%	(df=3)	P-value	Multiple Comparisons[a]
Financial Problems	358	40.04	42	42.86	22	24.72	179	50.28	115	32.76	33.38	<0.0001	UM>UF[*]; RM>RF[**]
Serious Physical Illness	341	38.14	36	36.73	32	35.96	157	44.10	116	33.05	9.48	0.0235	RM>RF[*]
Marital Discord	310	34.68	42	42.86	27	30.34	109	30.64	132	37.61	7.55	0.0562	all NS

Note. UM=urban male; UF=urban female; RM=rural male; RF=rural female. [*]P<0.05. [**]P<0.001. NS=not significant. [a]Four pair-wise comparisons are considered: UM v UF; RM v RF; UM v RM; and UF v RF. Tukey-type multiple comparison method based on an arcsin transformation of the original proportions[8].

Comparison of the life events of suicide victims with and without mental illness found that persons with mental illness experienced more negative life events (Mann-Whitney test Z=2.61, P=0.0089) and had higher chronic stress due to life events (Z=5.91, P<0.0001) but had lower acute stress related to life events (Z=6.26, P<0.0001). This relationship between mental illness and life events held true for all four demographic groups, but in some of the groups there were not enough subjects for the differences to reach statistical significance.

In many cases the victim's behavior suggested that the intent of the suicidal behavior was not to and his or her life. In 89 (9.9%) cases someone else was present observing the victim at the time of the behavior and in a further 84 (9.4%) cases the victim immediately sought help from others after the suicidal behavior.

DISCUSSION

Limitations

This study conducted detailed psychological autopsies on a large sample of suicides from 23 geographically representative regions of China. The 895 suicides in the sample included 519 randomly selected suicides from these sites and 376 suicides selected on the availability of informants (225 from the sites and 151 from adjacent communities). The proportion of females and the rates of mental illness were similar in these two groups of suicide cases, but the mean (sd) age of the randomly selected group was greater than that of the non-random group (47.5 (20.3) v. 42.9 (18.2) years; t=3.49. P=0.001). The mean age of the overall sample (45.6) may be slightly lower than that of the true suicides nationally, but the sample is otherwise broadly representative of all suicides in China.

In some cases the much larger number of suicides in rural versus urban areas in the sample resulted in statistically significantly differences in the rural groups while larger absolute differences in the urban groups were not statistically significant. Readers should be cautious when interpreting such cross-group differences. Like all psychological autopsy studies, this study met the problems of recall bias when proxy informants were used to provide information about the psychological status of the deceased before death, and the lack of blinding of the interviewer regarding the cause of death. The substantial literature about the psychological autopsy method[9-11] concludes that data obtained by this method are nevertheless valid.

Understanding the Unique Pattern of Suicides in China

The results from this study help explain the three main differences in the social epidemiology of suicide in China compared to that in other countries: the three-fold higher rate in rural versus urban communities, the low male-to-female ratio in suicide rates and the very high rate in young rural females. The high proportion of suicides by pesticide ingestion in rural areas, the high rate of unsuccessful resuscitation following pesticide ingestion, and the lower prevalence of mental illnesses among rural suicides suggest that the much higher rates of suicide in rural communities may be due to a lower threshold for precipitating suicidal behavior, the ready availability of pesticides in rural homes, the high lethality of pesticides and limited availability of effective resuscitation services in many rural communities. The lack of mental health services in rural areas does not appear to be an important factor in determining the large rural versus urban difference in suicide rates. Utilization of services by persons with mental illness are somewhat lower in rural areas, but gender is a more important determinant of utilization than location of residence (women with psychological problems are much more likely to seek help in both urban and rural settings). Similarly, despite the huge economic gap between urban and rural China, this does not appear to be an important determinant of the three-fold difference in rural and urban suicide rates. Stress from financial problems is significantly more prevalent in male than in female suicides but it is only slightly more prevalent in rural than in urban suicides.

The relatively high rate of female suicides in China and the corresponding lower male-to-female ratio in suicide rates are an extension of the lower male-to-female suicide ratios seen in other Asian countries. Analysis of data from the Global Burden of Disease study[12] showed that the gender ratios for China, India and 'other Asia and Islands' (i.e., other parts of Asia) in 1990 are 0.81, 1.20, and 1.48, respectively, much lower than the 2.67 ratio for established market economies (i.e. developed countries). In China (and, perhaps, for other Asian countries) the lower gender ratio may be due to differences in the prevalence of mental illnesses among suicide victims, differences in the methods used to commit suicide and a higher fatality rate among suicide 'attempts'.

Cross-national differences in diagnostic patterns among suicide victims could either reflect different prevalences of the conditions in general population or different risks of suicide associated with disorders. In

either case they can affect the gender ratio for suicide. Our study found that both the prevalence of depression, the psychological disorder most closely associated with suicide, and the severity of depressive symptoms were quite similar in the four demographic groups of suicide victims, but it is unlikely that differences in depression can explain the excess of female suicides seen in China. We also found that the prevalence of substance abuse was much lower in Chinese suicides (8.8%) than that reported in Western suicides[13] (a weighted mean of 37.1%). Since substance abuse is much more common among males it can result in a relative decrease in male suicide rates in China compared to the West. On the other hand, we found that the rates of schizophrenia and associated psychotic disorders among female suicides in China were substantially higher than those in males (12.9% v. 6.1%)[14], a situation being reverse of that reported in the west[15-16], suggesting that they can result in a relative increase in female suicide rates in China.

In Western countries, males tend to use more lethal methods[17], but our study showed little difference in the lethality of the methods employed by gender, which could result in a relative increase in female rates. Moreover, given the high rate of pesticide use in suicide attempts (20%-30% of all medically treated attempts), the high failure rate for resuscitation following pesticide ingestion and the substantial proportion of completed suicides who did not apparently intend to end their life (based on their method of making the attempt), we estimated that one-third completed suicides might be suicide 'attempts' that would have survived in other countries where less lethal methods are employed and the resuscitation services are better. Since female suicide attempters outnumber males by a 3:1 ratio[18], the more the suicide 'attempts' that result in death, the greater the relative increase in female suicide rates.

It was reported that suicides account for 31% of all deaths in young rural women ages 15-35 years in China and that suicides in this cohort account for 22% of all suicides in the country. Understanding this unique characteristic of suicides in China is thus a priority problem for suicide prevention in the country. Our study found that compared to suicide victims in other demographic groups, young rural females who died from suicide had the lowest rate of mental illness (39%), the highest suicide rate associated with high acute stress in the absence of mental disorder (43%), and the highest suicide rate by pesticide ingestion (79%). These characteristics suggest that many of these suicides are impulsive acts of deliberate self-harm following acute interpersonal crises in which victims who do not have pre-existing mental illness employ the most readily available

means. This hypothesis is supported by the finding of high rates of impulsivity among young rural females who make serious suicide attempts using pesticides[20]. Traditionally, suicide is a powerful way for persons in lower social status in China (particularly women) to proclaim their innocence or to protest unfair treatment, suggesting that cultural factors may also play a role in the high rates of suicide among young rural women[21].

Developing Suicide Prevention Programs for China

Several factors identified in this study will become the focus for cohort-specific suicide prevention strategies in China: the low rate of treatment for mental disorders, the substantial proportion of suicides in persons without mental disorder, the importance of acute interpersonal crises, the high failure rate of medical resuscitation and the high proportion of suicides by pesticide ingestion.

Low rates of care-seeking among persons with mental disorders that are serious enough to result in suicide (26%) and the very low rates of professional mental health treatment in this group (13%) are related to three factors: failure to recognize the condition by both the victims and the medical professionals, unwillingness to seek mental health treatment because of fear of stigma and lack of appropriate treatment facilities. Interventions focused on these problems such as training community health care workers to identify and treat common mental disorders, increasing the availability of psychiatric medications (particularly anti-depressants) in rural areas, changing public attitudes to health care seeking for psychological problems particularly among males and providing specialized psychiatric services in new settings beyond the confines of large psychiatric hospitals in urban centers, will involve public education about mental illnesses, particular depression.

In most other countries over 90% of suicides are related to mental illnesses[22]. Appropriate identification and management of mental illness are the core goal of most preventive programs. But in China preventing 37% of suicides that occur in the absence of mental illness and 61% of suicides in young rural females that occur in the absence of a mental illness, require the development and testing of innovative strategies that focus on social support networks rather that on mental health networks. Local cadres in the Women's Federation, village doctors and other local officials need to be trained to identify persons in crises and to learn how to provide them with alternative ways of dealing with domestic disputes and other types of interpersonal conflict. Specific programs are needed to provide focused

social support to persons who have recently attempted suicide, persons experiencing domestic abuse, isolated elders and others at high risk for suicidal behavior. Techniques for assessing and if necessary changing local beliefs about suicide should be developed and tested.

Based on our findings, 166 000 suicides by pesticide ingestion occur each year in China (58% of 287 000 annual suicides), 100 000 of them can receive medical attention but 61% of 166 000 suicides by pesticide Ingestion can not be successfully resuscitated. Any attempt to significantly reduce suicide rates in the country must address these two problems. A number of studies in other countries have found a strong relationship between method availability and the method chosen to commit suicide[23]. This could explain the high rate of pesticide ingestion in rural China. Method availability may also change the threshold at which negative life events precipitate suicidal behavior. If true, it could partially explain the higher suicide rates in rural that in urban China. Other studies showed that method restriction can reduce the rate of specific types of suicides[24] and the overall suicide rate[25], suggesting that this will be an important part of the suicide prevention effort in China.

Pesticides are an essential part of the rural agricultural economy in China, restricting use and access to these agents are difficult. Potential steps that need to be tested are public education about appropriate use and storage, selectively restricting production of the most potent poisons, limiting package size, only allowing sale of diluted forms of the pesticides, and licensing a limited number of individuals in each community to apply the agents (so they are not stored in every home). Moreover, since the management of pesticide poisoning is quite complex and may involve the use of respirators or other equipment not typically available in rural hospitals, suicide prevention efforts must also involve better training of primary care health workers and provision of the necessary drugs and equipment at the local level.

If most suicide victims are determined to die, restriction of one method is unlikely to substantially reduce suicide rates because there will be a rapid substitution of method. But if a substantial proportion of suicide victims do not really intend to die, then restriction of access to a readily available means has a significant, long-term effect on overall suicide rates. We have suggested that in China many completed suicides are actually suicide 'attempts' (with a low intent to die) resulting in death due to the lethality of the method and the lack of effective emergency treatment. If our hypothesis is correct, restriction of access to such lethal means and improving primary

care provider's ability to manage suicide attempts are the most cost-efficient method of rapidly reducing the high suicide rates in the country. As part of a national suicide prevention plan funding is currently being sought to test these hypotheses by comparing changes in suicide rates over time in rural counties randomly selected as intervention or control counties.

ACKNOWLEDGEMENTS

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