ORIGINAL ARTICLE

Prevalence of suicidal behaviour and associated factors in a large sample of Chinese adolescents

X. C. Liu[1,2,3]*, H. Chen[1], Z. Z. Liu[1], J. Y. Wang[4] and C. X. Jia[1]*

[1] *Shandong University School of Public Health, Jinan 250012, China*

[2] *School of Psychology, South China Normal University, Shipai, Guangzhou 510631, China*

[3] *The University of Tennessee Health Science Center, Memphis, TN 38163, USA*

[4] *Zhejiang Cancer Hospital, Hangzhou 310022, China*

Aims. Suicidal behaviour is prevalent among adolescents and is a significant predictor of future suicide attempts (SAs) and suicide death. Data on the prevalence and epidemiological characteristics of suicidal behaviour in Chinese adolescents are limited. This study was aimed to examine the prevalence, characteristics and risk factors of suicidal behaviour, including suicidal thought (ST), suicide plan (SP) and SA, in a large sample of Chinese adolescents.

Method. This report represents the first wave data of an ongoing longitudinal study, Shandong Adolescent Behavior and Health Cohort. Participants included 11 831 adolescent students from three counties of Shandong, China. The mean age of participants was 15.0 (s.d. = 1.5) and 51% were boys. In November–December 2015, participants completed a structured adolescent health questionnaire, including ST, SP and SA, characteristics of most recent SA, demographics, substance use, hopelessness, impulsivity and internalising and externalising behavioural problems.

Results. The lifetime and last-year prevalence rates were 17.6 and 10.7% for ST in males, 23.5 and 14.7% for ST in females, 8.9 and 2.9% for SP in males, 10.7 and 3.8% for SP in females, 3.4 and 1.3% for SA in males, and 4.6 and 1.8% for SA in females, respectively. The mean age of first SA was 12–13 years. Stabbing/cutting was the most common method to attempt suicide. Approximately 24% of male attempters and 16% of female attempters were medically treated. More than 70% of attempters had no preparatory action. Female gender, smoking, drinking, internalising and externalising problems, hopelessness, suicidal history of friends and acquaintances, poor family economic status and poor parental relationship were all significantly associated with increased risk of suicidal behaviour.

Conclusions. Suicidal behaviour in Chinese adolescents is prevalent but less than that previously reported in Western peers. While females are more likely to attempt suicide, males are more likely to use lethal methods. Multiple child and family factors are associated with suicidal behaviour. These findings highlight the importance of early screening and intervention of suicidal behaviour in Chinese adolescents.

Introduction

Suicide and non-fatal suicidal behaviour among youths are a worldwide major public health concern (McLoughlin *et al.* 2015). Suicide is the second or the third leading cause of death in youths in many countries (Kokkevi *et al.* 2012; Ougrin *et al.* 2015). Non-fatal suicidal behaviour is common among youths, with 6–26% of adolescents reporting serious ideation during the past year (Kann *et al.* 2016; McKinnon *et al.* 2016; Price & Khubchandani, 2017) and 5–15% of adolescents having attempted suicide/self-harmed (Gould *et al.* 2003; Hawton *et al.* 2012;

* Address for correspondence: Dr Xianchen Liu and Dr Cun-Xian Jia, School of Public Health, Shandong University, No.44, Wenhuaxi Rd, Lixia Dist. Jinan 250012, China.

(Email: xliu69@uthsc.edu or jiacunxian@sdu.edu.cn)

Kokkevi *et al.* 2012; Kann *et al.* 2016). Suicidal behaviour has been reported as a leading cause of psychiatric emergencies for adolescents (Safer, 1996) and the strongest predictor of future suicide attempts (SAs) and suicide death (Gould *et al.* 2003; Hawton *et al.* 2012; Ougrin *et al.* 2015). Suicidal behaviour among youths is associated with multiple biological, cognitive, psychological, family and social factors (Gould *et al.* 2003; Liu & Tein, 2005; Hawton *et al.* 2012; Kokkevi *et al.* 2012; McKinnon *et al.* 2016).

Suicide rate in China has been declining from 23.2 per 100 000 in late 1990s (Phillips *et al.* 2002*a*) to 8.1–9.8 per 100 000 in early 2010s (Wang *et al.* 2014; Zhang *et al.* 2014). However, suicide accounts for 19% of all deaths and remains the leading cause of death among youths aged 15–34 years (Wang *et al.* 2008; Zhao & Zhang, 2015). Although suicidal behaviour is a significant predictor of suicide death,

longitudinal epidemiological data in Chinese adolescents are scarce. Most epidemiological studies were cross-sectional and were mainly conducted in urban adolescents (Hu *et al.* 2015). A meta-analysis of 43 studies from 1989 to 2014 reported a pooled prevalence of SAs in Chinese adolescents was 2.94% (Hu *et al.* 2015). Epidemiologic studies of suicidal behaviour in Chinese adolescents share the limitations of small sample sizes and differences in the assessment of suicidal behaviour (Liu & Tein, 2005; Hu *et al.* 2015), so the prevalence rates are not directly comparable between studies. Little is known about age and gender-specific prevalence, the age of first SA, developmental changes, methods of attempting suicide, medical consequences of SA, prospective risk and protective factors, and prospective association between suicidal behaviour and suicide in rural youths of China. Shandong Adolescent Behavior and Health Cohort (SABHC) study was designed to address the limitations and data gaps of previous small and cross-sectional studies. Based on the first wave data of the SABHC study, the current paper was to (1) report the prevalence, (2) describe epidemiological characteristics and (3) explore risk factors of suicidal thought (ST), suicide plan (SP) and SA (Silverman *et al.* 2007) in a large sample of rural Chinese adolescents (*n* = 11 831).

Methods

Participants and procedure

SABHC is an ongoing longitudinal study of adolescent behaviour and health in Shandong, China. Shandong, located in the middle eastern coast of China, is a typical province in terms of population structure and social and cultural life. Shandong has a total population of 95.8 million and about half of its population lives in rural areas. A total of 11 836 adolescent students participated in the SABHC baseline survey. Detailed sampling and baseline data collection have been described elsewhere (Chen *et al.* 2017; Liu *et al.* 2017). In brief, participants were sampled from five middle and three high schools, which were selected from a total of 62 middle schools and nine high schools in three counties (Lijin, Yanggu and Zoucheng) of Shandong. The three counties and eight schools in Shandong were selected for the study, with consideration of the representativeness of adolescent students in the region, prior study collaboration, convenience and budget for at least three waves of data collection.

In November–December 2015, participants were invited to complete a self-administered, structured adolescent health questionnaire (AHQ). The AHQ was developed by our team and has been used in our previous studies to assess suicidal behaviour,

mental health and psychosocial factors (Liu *et al.* 2000; Liu & Tein, 2005; Tepper *et al.* 2008). After getting permission from the target schools, trained master-level public health workers administered AHQ to participants in their classrooms during regular school hours. Before filling out the questionnaire, participants were instructed to read the instructions carefully and informed that the survey was anonymous and their responses were blind to teachers and their participation was voluntary without any penalties for non-participation.

We obtained permission to conduct the study from the principals in the target schools and informed consent from participants in the target classes before the survey. The study was approved by the research ethics committee of Shandong University School of Public Health and target schools.

Measures in the AHQ

Suicidal behaviour

Following Silverman *et al.* (Silverman *et al.* 2007), suicidal behaviour includes ST, SP and SA. Lifetime ST and SP are defined as a 'yes' response to the questions: 'Have you ever seriously thought about suicide or killing yourself?' and 'Have you ever had a specific plan for how you would kill yourself?', respectively. A lifetime SA is defined as a 'yes' response to the question: 'Have you ever in your whole life tried to kill yourself?' Similar questions were used to ask suicidal behaviours that happened in the past year. These questions are commonly used in suicidality studies in the world (Kann *et al.* 2016; McKinnon *et al.* 2016). The age of first attempt was asked for those who had attempted suicide. For most recent attempt, individuals were asked the intent to suicide, the method used to attempt suicide, preparatory acts (such as writing a will or suicide note, saying goodbye to friends) and if they received medical treatment.

Internalising and externalising problems. The Youth Self-Report (YSR) of Child Behavior Checklist was used to measure behavioural problems (Achenbach, 1991; Liu *et al.* 1997). The YSR comprises 103 problem items, which are grouped into eight syndromes and two second-order factors (internalising and externalising). The externalising factor is made up of the aggressive behaviour and delinquent behaviour; the internalising factor is made up of the anxious/depressed, withdrawn and somatic complaints. Cronbach α was 0.93 for internalising problems and 0.91 for externalising problems with the current sample.

Psychological vulnerability

Psychological vulnerability assessed in the study included hopelessness and impulsiveness. The Beck

Table 1. *Sample characteristics (%)*

	Total (*n* = 11 831)	Male (*n* = 6018)	Female (*n* = 5813)	χ^2/t	*p*
Age				21.89	0.001
12	4.5	4.8	4.2		
13	16.9	18.3	15.4		
14	13.3	13.0	13.5		
15	22.3	21.9	22.7		
16	30.6	29.9	31.3		
17	10.5	10.1	10.9		
18	1.9	1.9	2.0		
Mean (S.D.)	14.97 (1.45)	14.92 (1.47)	15.01 (1.44)	3.80	0.000
Chronic disease/disability	4.0	4.8	3.2	20.56	0.000
Ever smoking	21.7	32.3	10.7	813.46	0.000
Ever drinking	37.2	48.6	25.4	680.34	0.000
Negative life events (No.)					
Mean (S.D.)	35.96 (31.37)	36.84 (32.62)	35.07 (29.98)	3.07	0.002
Internalising problems*					
Mean (S.D.)	11.40 (9.12)	11.26 (9.31)	11.55 (8.90)	1.71	0.087
Externalising problems					
Mean (S.D.)	8.92 (7.58)	9.95 (8.23)	7.85 (6.68)	15.24	0.000
Hopelessness					
Mean (S.D.)	4.67 (3.31)	4.97 (3.40)	4.37 (3.19)	9.81	0.000
Impulsiveness					
Mean (S.D.)	33.43 (8.12)	33.38 (8.30)	33.48 (7.95)	0.65	0.519
Friend/acquaintance SA	8.2	7.3	9.2	14.50	0.000
Friend/acquaintance suicide	5.2	5.0	5.3	0.37	0.545
Family suicide attempt history	3.3	3.6	3.0	3.63	0.057
Family suicide history	3.6	3.6	3.6	0.01	0.905
Family economic status				97.73	0.000
Excellent	2.4	3.2	1.6		
Good	17.3	18.8	15.9		
Fair	68.1	65.0	71.2		
Poor	10.7	10.9	10.5		
Very poor	1.5	2.2	0.8		
Parental relationship				18.89	0.000
Excellent	41.5	40.5	42.4		
Good	26.9	28.1	25.7		
Fair	24.9	25.4	24.4		
Poor	3.0	2.8	3.2		
Separated/divorced/died	3.7	3.3	4.2		
Father education				1.84	0.766
Primary school	13.5	13.2	13.8		
Middle school	53.7	53.6	53.7		
High school	18.4	18.5	18.2		
Professional school	7.9	7.9	7.9		
College or above	6.6	6.9	6.3		
Father occupation: farmer	37.0	33.5	40.6	60.00	0.000

*Excluding self-harm and suicidal thought.

Hopelessness Scale (BHS) (Beck *et al.* 1974) is a 20-item, true-or-false, self-report scale designed to assess negative expectancies about future. It is scored by summing the keyed responses of pessimism for each of the 20 items. Cronbach α was 0.74 with the current sample. The Eysenck I7 impulsiveness scale (Eysenck *et al.* 1984) was used to assess adolescent's impulsivity.

The scale is composed of 19 items. Cronbach α was 0.92 with the current sample.

Adolescent and family demographic factors

Adolescent factors included age, sex, grade, chronic physical diseases/disabilities, ever smoking a cigarette,

Lifetime Suicide Thought

Last-Year Suicide Thought

Lifetime Suicide Plan

Last-Year Suicide Plan

Lifetime Suicide Attempts

Last-Year Suicide Attempt

Fig. 1. Prevalence (%) of suicidal behaviour by age and gender.

ever drinking alcohol, history of suicide or attempt among friends or acquaintances and number of negative life events experienced in the last year. Family factors included paternal education and occupation, parental relationship, family history of suicide or attempt and family economic status.

Statistical analysis

The χ^2 tests for categorical variables or t tests for continuous variables were performed to examine the differences in terms of demographics and psychosocial characteristics between male and female adolescents. Age and sex differences in the three suicidal behaviours were examined by χ^2 testes. Univariate logistic regression analyses were performed to examine the associations between individual adolescent and family variables and last-year suicide thought, plan and

attempt, respectively. Separate multivariate regressions were performed to examine which adolescent and family variables were independently associated with suicide thought, plan or attempt. All variables were entered to adjust for potential confounding effects with each other (Table 1). The $p < 0.05$ was used as a threshold for significance tests. Statistical tests of the regression estimates or odds ratios were based on Wald statistics. All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp, Armonk, New York, USA).

Results

Sample characteristics

Of 12 301 students sampled for the baseline survey, 11 836 who attended school on the day of survey returned questionnaires; five students returned their

Table 2. *Suicidal characteristics of most recent suicide attempt by gender (%)*

	Total	Male	Female	χ^2	p
Suicide methods, $n*$	309	127	182	33.74	0.000
Stabbing/cutting	52.4	38.6	62.1		
Overdose of sleep pills, or other medications	11.3	9.4	12.6		
Jumping from high places	9.1	14.2	5.5		
Hanging, strangulation or suffocation	6.1	7.9	4.9		
Overdose of pesticides	6.1	6.3	6		
Drowning	2.9	6.3	0.5		
Carbon monoxide	1.0	0.8	1.1		
Running into traffic	0.6	0	1.1		
Other	10.4	16.5	6		
Medical treatment, $n*$	340	138	192	4.29	0.117
No medical treatment	80.6	76.1	83.9		
Outpatient	15.2	17.4	13.5		
Hospitalisation	4.2	6.5	2.6		
Suicide intent, $n*$	351	146	205	2.86	0.413
I made a serious attempt to kill myself but I did not success	21.7	24.0	20.0		
I tried to kill myself but I knew the method was not fool-proof	24.5	20.5	27.3		
My attempt was a cry for help. I did not intend to die	30.2	29.5	30.7		
Uncertain	23.6	26.0	22.0		
Preparatory acts toward making a suicide attempt (e.g., writing a note/will, saying bye to friends)	317	130	187	0.003	0.955
No	74.4	74.6	74.3		
Yes	25.6	25.4	25.7		

*Ns differ due to missing values.

questionnaires in blank, leaving 11 831 for statistical analysis (96.2%). Mean age of the participants was 15.0 (S.D. = 1.5) and 51% were boys. Participant and family characteristics by sex are presented in Table 1.

Prevalence of suicidal behaviour

Of the sample, 17.6% of boys and 23.5% girls had ever had ST, 10.7 and 14.7% had ST in the last year; 8.9 and 10.7% had ever had SP, 2.9 and 3.8% had SP in the last year; and 3.4 and 4.6% had ever had SA, 1.3 and 1.8% had SA in the last year, respectively. The lifetime and last-year prevalence rates of all the three suicidal behaviours were significantly higher in girls than in boys (all $p < 0.05$). As shown in Fig. 1, all the three suicidal behaviours tended to increase before age 17.

Characteristics of SA

The mean age of first SA was similar between boys (12.3, S.D. = 2.29) and girls (12.6, S.D. = 2.17). As shown in Table 2, stabbing/cutting was the most common method to attempt suicide, with 62% in girls and 39% in boys. Jumping from high places was the second common method (14.2%) for boys, overdose of sleep pills or other medications was the second common method (12.6%) for girls. There were significant differences in attempt methods between males and females ($\chi^2 = 33.74$, $p < 0.001$).

One in five suicide attempters made a serious attempt to kill self and 30% made attempt just for help. Three in four suicide attempters had no preparatory action (e.g., made a will and said goodbye to family or friends). About one in five male attempters were medically treated and 6.5% were hospitalised, 16.1% of female attempters were medically treated and 2.6% were hospitalised.

Demographic and psychosocial factors associated with last-year suicidal behaviour

The factors that were associated with increased odds of suicidal behaviour were very similar across ST, SP and SA. As shown in Figs 2–4, after adjusting for all other demographics and psychosocial variables, female gender, ever smoking, ever drinking, internalising and externalising problems, hopelessness, suicide/attempt history of friends or acquaintances, poor family economic status and poor parental relationship were significantly associated with elevated risk of the three suicidal behaviours.

Chronic disease/disability, impulsiveness, college or above of father's education and non-famer occupation of father were associated with increased risk of suicide
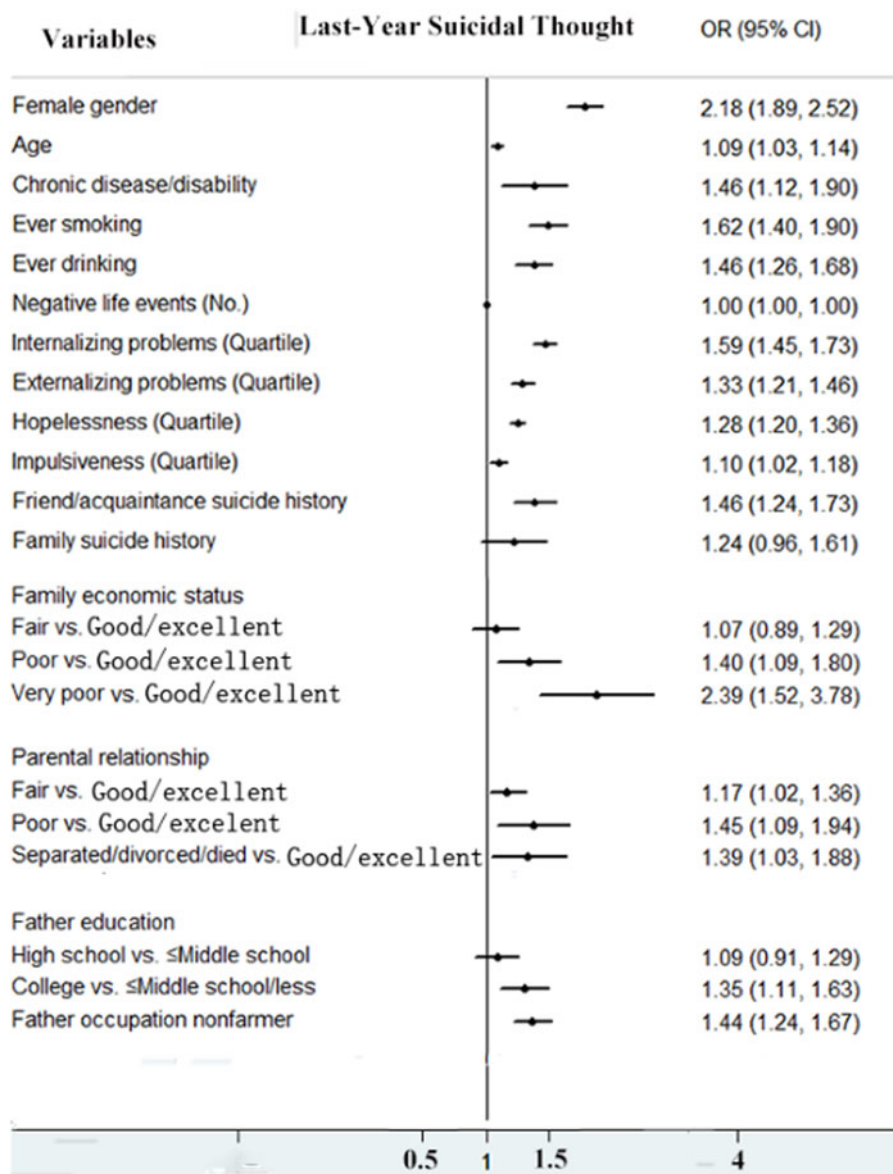
Variables	Last-Year Suicidal Thought	OR (95% CI)
Female gender		2.18 (1.89, 2.52)
Age		1.09 (1.03, 1.14)
Chronic disease/disability		1.46 (1.12, 1.90)
Ever smoking		1.62 (1.40, 1.90)
Ever drinking		1.46 (1.26, 1.68)
Negative life events (No.)		1.00 (1.00, 1.00)
Internalizing problems (Quartile)		1.59 (1.45, 1.73)
Externalizing problems (Quartile)		1.33 (1.21, 1.46)
Hopelessness (Quartile)		1.28 (1.20, 1.36)
Impulsiveness (Quartile)		1.10 (1.02, 1.18)
Friend/acquaintance suicide history		1.46 (1.24, 1.73)
Family suicide history		1.24 (0.96, 1.61)
Family economic status		
Fair vs. Good/excellent		1.07 (0.89, 1.29)
Poor vs. Good/excellent		1.40 (1.09, 1.80)
Very poor vs. Good/excellent		2.39 (1.52, 3.78)
Parental relationship		
Fair vs. Good/excellent		1.17 (1.02, 1.36)
Poor vs. Good/excelent		1.45 (1.09, 1.94)
Separated/divorced/died vs. Good/excellent		1.39 (1.03, 1.88)
Father education		
High school vs. ≤Middle school		1.09 (0.91, 1.29)
College vs. ≤Middle school/less		1.35 (1.11, 1.63)
Father occupation nonfarmer		1.44 (1.24, 1.67)

Scale: 0.5 1 1.5 4

Fig. 2. Adjusted odds ratios (95% CI) of risk factors associated with last-year suicidal thought.

thought and SA in the past year. Family suicide/attempt history was significantly associated with 70% increased risk of SP (OR = 1.70, 95% CI = 1.19–2.43) compared with those adolescents without family history of suicide/attempt.

Discussion

SAHBC represents one of the largest epidemiological studies of suicidal behaviour and risk factors in Chinese rural adolescents. Our major findings are (1) suicidal behaviour was prevalent and increased before age 17 in Chinese adolescents; (2) suicidal behaviour was more prevalent in girls than in boys but with a low female-to-male ratio of 1.2–1.3; (3) the mean age of first SA was 12–13 years; (4) male attempters were more likely than females to use lethal methods and to be medically treated and hospitalised; (5) suicide thought, plan and attempt shared similar multiple adolescent and family risk factors.

In the sample of Chinese adolescents, 18–25% had ever seriously thought about killing self, 11–15% had thought about it in the last year; 9–11% had ever made a SP, 3–4% had a plan in the last year; and 3–5% had ever attempted suicide, 1–2% had attempted in the last year. The rates of suicide thought and SAs are comparable to those reported in previous studies of Chinese adolescents (Liu & Tein, 2005; Hu *et al.* 2015). For example, in a meta-analysis of SA in Chinese adolescents, the authors found that the prevalence rates were
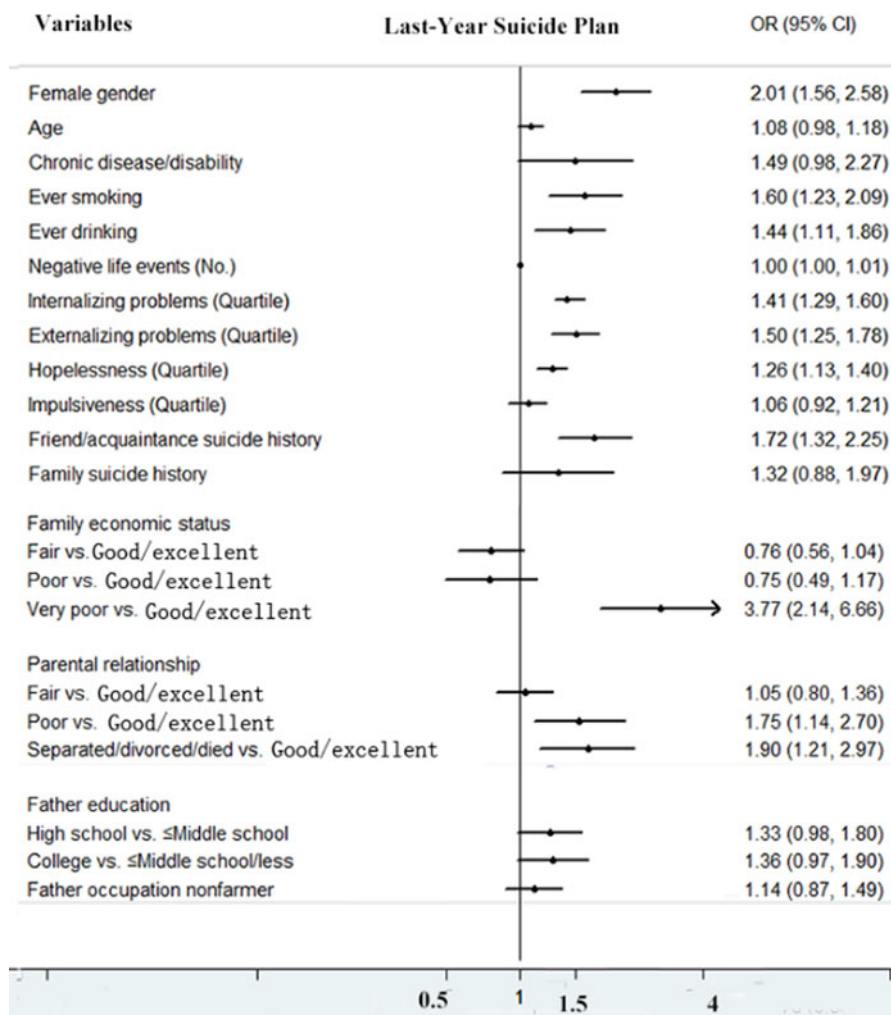
Fig. 3. Adjusted odds ratios (95% CI) of risk factors associated with last-year suicide plan.

3.10% in rural area and 3.56% in urban area (Hu *et al.* 2015). However, the rates are lower than those reported in Western adolescents. For example, in the US 2015 Youth Risk Behavior Survey (YRBS) (Kann *et al.* 2016), 17.7% of students seriously considered attempting suicide, 14.6% planned for SA and 8.6% attempted suicide during the past year. In the European School Survey Project on Alcohol and Other Drugs (ESPAD) 2007 school survey (Kokkevi *et al.* 2012), the median prevalence of any lifetime self-reported SA was 10.5% across 17 European participating countries (range 4.1–23.5%).

The variation of prevalence rates of suicidal behaviour may be influenced substantially by methodological differences between studies, including study populations, measures or question wording of suicidal behaviour, and the level of confidentiality (Hawton *et al.* 2012; Kokkevi *et al.* 2012; Kann *et al.* 2016). However, the study population (adolescent students), data collection (self-report) and questions to assess the three suicidal behaviours are similar between our study and the

US YRBS (Kann *et al.* 2016). The lower rates of suicidal behaviour in Chinese adolescents may be explained by cultural and psychosocial differences. For example, mental health problems, especially depression, are a major risk factor of suicidal behaviour. Studies have demonstrated that behavioural and emotional problems, including depression, are less prevalent in Chinese children and adolescents than in their Western peers (Liu *et al.* 1999; Tepper *et al.* 2008). Another potential explanation is that Chinese adolescents are likely to under-report their suicidal behaviour. Further study is warranted to understand why Chinese adolescents reported less suicidal behaviour than Western peers.

Consistent with previous studies, we found that female adolescents reported more suicidal behaviour than male peers (Hu *et al.* 2015; McKinnon *et al.* 2016). However, our study showed a lower female-to-male ratio (1.2–1.3) for each suicidal behaviour in Chinese adolescents than in Western adolescents (≥2) (Madge *et al.* 2008; Kokkevi *et al.* 2012; Kann *et al.* 2016). For
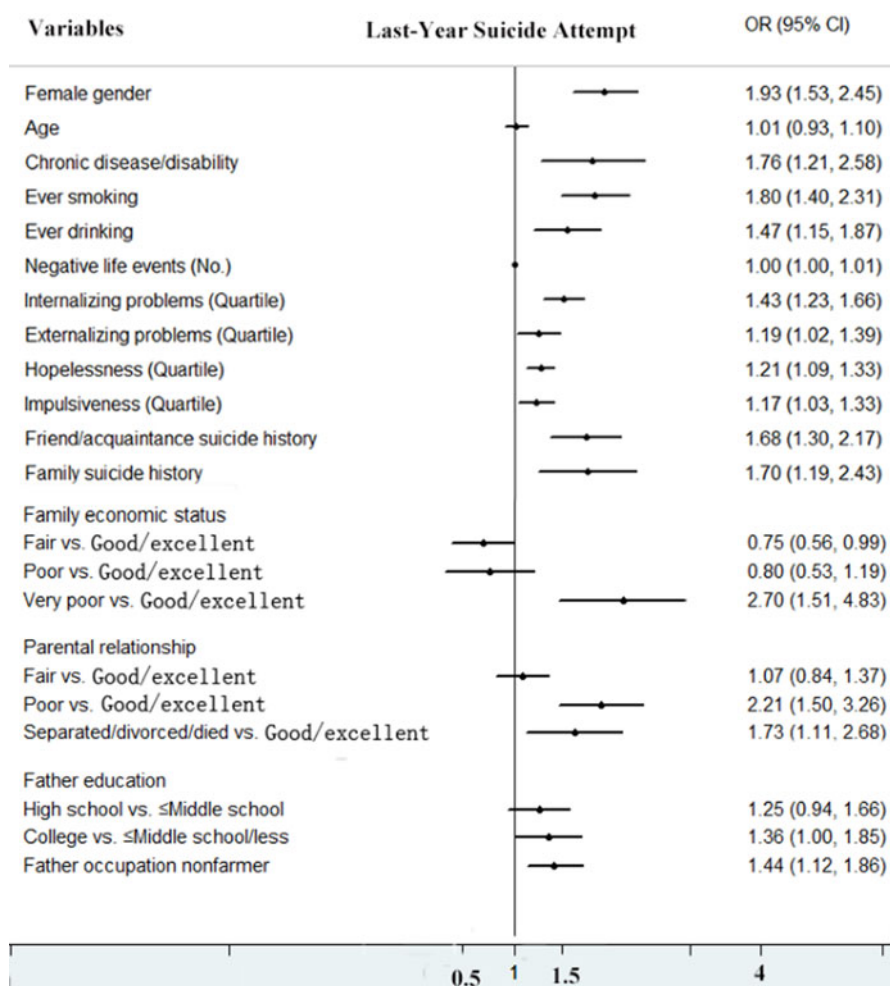
Fig. 4. Adjusted odds ratios (95% CI) of risk factors associated with last-year suicide attempt.

example, in the study of 17 European countries (Kokkevi *et al.* 2012), the lifetime prevalence rates in females are almost double those in males for SAs (13.7% *v.* 6.9%) and ST (41.2% *v.* 20.2%). Further studies are needed to investigate the environmental and/or genetic influences on the lower female–male ratio of suicidal behaviour in Chinese adolescents.

Little is known about methods of attempting suicide, intent of suicide and medical treatment due to SA in Chinese adolescents. In the current study, we found that more than half attempters tried to kill self by stabbing/cutting. Female adolescents were more likely than males to stab or cut self to attempt suicide (60 *v.* 38%). These findings are consistent with most Western studies that demonstrate that self-cutting/stabbing is the most common method (Hawton *et al.* 2003; Olfson *et al.* 2005; Madge *et al.* 2008).

We also found that lethal methods like jumping from high places and hanging were more commonly used by male attempters. Male attempters were more likely to be medically treated and hospitalised, possibly due to violent methods used (Madge *et al.* 2008). Overdose of pesticides is the most common suicide method in rural Chinese adults (Phillips *et al.* 2002*b*), but only 6% of attempters took pesticides to attempt suicide in the general population of rural adolescents. Majority of rural Chinese adolescent attempters (>80%) did not get medical treatment, consistent with most Western studies (Madge *et al.* 2008; Hawton *et al.* 2012).

It should be noted that more than 20% of attempters in Chinese rural adolescents made a serious non-fatal attempt and three in four attempters did not make any preparatory acts towards attempting suicide. This may mean that Chinese suicide attempters might have serious suicide intent or their attempts might happen impulsively, similar to completed suicide in China (Lin *et al.* 2016). Although the rate of SA is lower in rural Chinese adolescents than in Western peers, the consequence of the attempt may be more severe and this may explain relatively higher rates of completed suicide (Phillips *et al.* 2002*a*) but lower rates of ST and SA in China (Hu *et al.* 2015).

Consistent with previous studies (Liu & Tein, 2005; Hawton *et al.* 2012; Kokkevi *et al.* 2012), we found that multiple child and family factors are associated with suicidal behaviour in adolescents. In addition to female gender, smoking, alcohol drinking, internalising and externalising problems, hopelessness, suicide history of friends and acquaintances, poor family economic status and poor parental relationship were all significantly associated with increased risk of suicidal behaviour. Although longitudinal studies are needed to examine the causal relationships between these factors and suicidal behaviour, all of which should be taken into consideration to develop comprehensive preventative and interventional programmes for suicide prevention in rural Chinese youths.

This study has several limitations. First, the data were collected by self-report, which may have led to biased reporting of suicidal behaviour. However, given that many SAs may never come to medical attention or result in hospitalisation, self-report measures facilitated through anonymous questionnaires remain a valuable source of information (Madge *et al.* 2008; Kokkevi *et al.* 2012). Second, the sample was large and the selection of classes was random, but it is unknown the extent to which the findings could be generalised to those adolescents who are not attending schools. Third, although many adolescent and family factors were examined in the study, some other factors from school and community were not included. Furthermore, this is a baseline data analysis of a longitudinal study, so it is not possible to determine the direction of causality between adolescent and family factors and suicidal behaviour.

In conclusion, this study represents one of the largest to report the prevalence, to describe suicidal characteristics, and to examine multiple adolescent and family risk factors of suicidal behaviour in rural Chinese adolescents. Suicidal behaviour is prevalent in Chinese adolescents but less prevalent than that reported in Western peers. Suicidal behaviour in Chinese adolescents has a lower female-to-male ratio (1.2–1.3) that reported in Western peers ($\geqslant 2.0$). While females are more likely to attempt suicide, males are more likely to use lethal methods. Majority of attempters did not take any preparatory action. Multiple adolescent and family factors are associated with suicidal behaviour. These findings may be of great importance for early identifying adolescents at risk and for developing and implementing suicide prevention and intervention programmes for adolescents.

Acknowledgements

Financial Support

Conflict of Interest

None.

Ethical Standard

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Availability of Data and Materials

Please contact Dr Xianchen Liu at xliu69@uthsc.edu or Dr Cun-Xian Jia at jiacunxian@sdu.edu.cn for data supporting the findings of the study.

References

Achenbach TM (1991). *Manual for the Youth Self-Report and 1991 Profile*. Department of Psychiatry, University of Vermont: Burlington, VT.

Beck AT, Weissman A, Lester D, Trexler L (1974). The measurement of pessimism: the hopelessness scale. *Journal of Consulting and Clinical Psychology* **42**, 861–865.

Chen H, Wang XT, Bo QG, Zhang DM, Qi ZB, Liu XC, Jia CX (2017). Menarche, menstrual problems and suicidal behavior in Chinese adolescents. *Journal of Affective Disorders* **209**, 53–58.

Eysenck SBG, Easting G, Pearson PR (1984). Age norms for impulsiveness, venturesomeness and empathy in children. *Personality and Individual Differences* **5**, 315–321.

Gould MS, Greenberg T, Velting DM, Shaffer D (2003). Youth suicide risk and preventive interventions: a review of the past 10 years. *Journal of the American Academy of Child and Adolescent Psychiatry* **42**, 386–405.

Hawton K, Hall S, Simkin S, Bale L, Bond A, Codd S, Stewart A (2003). Deliberate self-harm in adolescents: a study of characteristics and trends in Oxford, 1990–2000. *Journal of Child Psychology and Psychiatry* **44**, 1191–1198.

Hawton K, Saunders KE, O'Connor RC (2012). Self-harm and suicide in adolescents. *Lancet* **379**, 2373–2382.

Hu J, Dong Y, Chen X, Liu Y, Ma D, Liu X, Zheng R, Mao X, Chen T, He W (2015). Prevalence of suicide attempts among Chinese adolescents: a meta-analysis of cross-sectional studies. *Comprehensive Psychiatry* **61**, 78–89.

Kann L, McManus T, Harris WA, Shanklin SL, Flint KH, Hawkins J, Queen B, Lowry R, Olsen EO, Chyen D, Whittle L, Thornton J, Lim C, Yamakawa Y, Brener N, Zaza S (2016). Youth risk behavior surveillance – United States, 2015. *MMWR Surveillance Summaries* **65**, 1–174.

Kokkevi A, Rotsika V, Arapaki A, Richardson C (2012). Adolescents' self-reported suicide attempts, self-harm thoughts and their correlates across 17 European countries. *Journal of Child Psychology and Psychiatry* **53**, 381–389.

Lin L, Zhang J, Zhou L, Jiang C (2016). The relationship between impulsivity and suicide among rural youths aged 15–35 years: a case-control psychological autopsy study. *Psychology Health and Medicine* **21**, 330–337.

Liu XC, Tein JY (2005). Life events, psychopathology, and suicidal behavior in Chinese adolescents. *Journal of Affective Disorders* **86**, 195–203.

Liu XC, Guo CQ, Liu LQ, Sun LM (1997). Reliability and validity of the youth self-report (YSR) of Achenbach's child behavior checklist (CBCL). *Chinese Mental Health Journal* **11**, 200–203.

Liu XC, Kurita H, Guo CQ, Miyake Y, Ze J, Cao H (1999). Prevalence and risk factors of behavioral and emotional problems among Chinese children aged 6 through 11 years. *Journal of the American Academy of Child and Adolescent Psychiatry* **38**, 708–715.

Liu XC, Kurita H, Uchiyama M, Okawa M, Liu LQ, Ma DD (2000). Life events, locus of control and behavioral problems among Chinese adolescents. *Journal of Clinical Psychology* **56**, 1565–1577.

Liu XC, Yang YY, Liu ZZ, Chen H, Fan F, Jia CX (2017). Psychometric assessment of the Chinese adolescent daytime sleepiness scale (CADSS). *Sleep and Biological Rhythms* **15**, 207–216.

Madge N, Hewitt A, Hawton K, de Wilde EJ, Corcoran P, Fekete S, van Heeringen K, De Leo D, Ystgaard M (2008). Deliberate self-harm within an international community sample of young people: comparative findings from the child & adolescent self-harm in Europe (CASE) study. *Journal of Child Psychology and Psychiatry* **49**, 667–677.

McKinnon B, Gariepy G, Sentenac M, Elgar FJ (2016). Adolescent suicidal behaviours in 32 low- and middle-income countries. *Bulletin of the World Health Organization* **94**, 340–350.

McLoughlin AB, Gould MS, Malone KM (2015). Global trends in teenage suicide: 2003–2014. *QJM* **108**, 765–780.

Olfson M, Gameroff MJ, Marcus SC, Greenberg T, Shaffer D (2005). Emergency treatment of young people following deliberate self-harm. *Archives of General Psychiatry* **62**, 1122–1128.

Ougrin D, Tranah T, Stahl D, Moran P, Asarnow JR (2015). Therapeutic interventions for suicide attempts and self-harm in adolescents: systematic review and meta-analysis. *Journal of the American Academy of Child and Adolescent Psychiatry* **54**, 97–107.

Phillips MR, Li X, Zhang Y (2002*a*). Suicide rates in China, 1995–99. *Lancet* **359**, 835–840.

Phillips MR, Yang G, Zhang Y, Wang L, Ji H, Zhou M (2002*b*). Risk factors for suicide in China: a national case-control psychological autopsy study. *Lancet* **360**, 1728–1736.

Price JH, Khubchandani J (2017). Latina adolescents health risk behaviors and suicidal ideation and suicide attempts: results from the national youth risk behavior survey 2001–2013. *Journal of Immigrant and Minority Health* **19**, 533–542.

Safer DJ (1996). A comparison of studies from the United States and Western Europe on psychiatric hospitalization referrals for youths exhibiting suicidal behavior. *Annals Clinical Psychiatry* **8**, 161–168.

Silverman MM, Berman AL, Sanddal ND, O'Carroll PW, Joiner TE (2007). Rebuilding the tower of Babel: a revised nomenclature for the study of suicide and suicidal behaviors. Part 2: suicide-related ideations, communications, and behaviors. *Suicide and Life-Threatening Behavior* **37**, 264–277.

Tepper P, Liu XC, Guo C, Zhai J, Liu T, Li C (2008). Depressive symptoms in Chinese children and adolescents: parent, teacher, and self reports. *Journal of Affective Disorders* **111**, 291–298.

Wang CW, Chan CL, Yip PS (2014). Suicide rates in China from 2002 to 2011: an update. *Social Psychiatry and Psychiatric Epidemiology* **49**, 929–941.

Wang SY, Li YH, Chi GB, Xiao SY, Ozanne-Smith J, Stevenson M, Phillips MR (2008). Injury-related fatalities in China: an under-recognised public-health problem. *Lancet* **372**, 1765–1773.

Zhang J, Sun L, Liu Y, Zhang J (2014). The change in suicide rates between 2002 and 2011 in China. *Suicide and Life-Threatening Behavior* **44**, 560–568.

Zhao S, Zhang J (2015). Suicide risks among adolescents and young adults in rural China. *International Journal of Environmental Research and Public Health* **12**, 131–145.