

Social and individual risk factors for suicide ideation among Chinese children and adolescents: A multilevel analysis

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The objective of this study was to investigate the prevalence and predictors of suicide ideation among primary, middle and high school students. We used multilevel modelling to investigate suicide ideation among 12,733 Chinese children and adolescents aged 9–18 years from wide range of areas across China. Approximately, 32.09% of children and adolescents reported suicide ideation, with females were more likely to report suicide ideation than males (38.09% vs. 29.95%). Our results showed that the risk factors in primary school students were different from middle and high school student groups, whereas significant risk factors for middle and high school students were similar. The city's standard of living as indicated by the Engel coefficient and the city's divorce rate were positively associated with the prevalence of suicide ideation; in contrast, the school's pupil-to-teacher ratio was negatively correlated with elevated suicide ideation. Significant risk factors for suicide ideation included study anxiety, self-accusation tendency, impulsive tendency, terror tendency and physical symptoms. These results have important implications for the prevention of suicide, suggesting that both contextual (city-level) and compositional (individual-level) factors could be important targets for prevention and intervention for children and adolescents at risk of suicide ideation.

Keywords: Suicide ideation; Mental health; Children and adolescents; Multilevel analysis.

Suicide is one of the most serious public health problems in China and around the world, particularly in children and adolescents (Nock et al., 2008). According to the World Health Organisation's (WHO) mortality database for 90 countries, suicide is the third leading cause of death among female adolescents aged 15–19 and the fourth for male adolescents (Wasserman, Cheng, & Jiang, 2005). Suicide ideation, a critical part of the suicide process, is defined as thoughts of harming or killing oneself (Institute of Medicine, 2002). It is not only an important marker for other mental health problems but also a significant predictor of suicide attempts and completed suicide among youth (Harris & Barraclough, 1997). Identifying prevalence and predictors of suicide ideation is important because this would facilitate effective suicide

prevention strategies (Arria et al., 2009; Harris & Barraclough, 1997). Previous studies reported that adolescents endorse a lower level of mental health than young and older adults (Amanda, Garcia, Lauren, & Nadine, 2014; Sobowale, Zhou, Fan, Liu, & Sherer, 2014; Hintikka et al., 2009). Moreover, suicide rates among children and adolescents aged 10–19 years have increased in recent years in both developed and developing countries, whereas suicide rates have tended to plateau for young adults 20–34 years of age (Hesketh, Ding, & Jenkins, 2002; Scott et al., 2012; World Health Organization, 2009). However, very few studies have examined the prevalence and predictors of suicide ideation among children and adolescents, especially in developing countries, including China.

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Suicide risk is multifactorial, spanning from psychological, social, cultural, behavioural and biological factors (Mazza, 2006; Moskos, Olson, Halbern, Keller, & Gray, 2005; Zhang et al., 2010). Mental health problems, commonly consisting of neuroses and psychoses, constitute one of these risk factors. The importance of mental health problems as predictors of suicide ideation is compatible with the frameworks of several theories of suicide and developmental psychopathology research. For example, in favour of the psychache theory of suicide, a previous study found that most youth who commit suicide have multiple psychological problems (Miller & Taylor, 2005). Moreover, research has consistently found the substantial presence of comorbid forms of psychopathology, strongly demonstrating that suicide does not occur in isolation but rather is the by-product of other mental health problems (Mazza, 2006; Moskos et al., 2005). Mental health factors, commonly consisting of study anxiety, social anxiety, tendencies towards loneliness, self-accusation tendency, hypersensitivity, physical symptoms, terror tendency and impulsive tendency, are critical individual variables to consider in this regard. In addition, this study also assessed the demographic variables as individual variables to explore the pattern of youth suicide among Chinese children and adolescents. Because the pattern of suicide in China is very different from that in the West: a 60% higher female to male ratio rates and a threefold discrepancy between rural and urban suicide rates (Zhang et al., 2010; Phillips, Li, & Zhang, 2002).

Despite evidence of the multifactorial risk factors for suicide ideation, most suicide prevention strategies are based on identified individual-level risk factors. The importance of contextual factors for suicide has been highlighted by a small but promising body of literature. Phillips et al. have suggested that social factors may contribute to suicide behaviour in important ways. For example, factors such as divorce and migration from rural to urban areas for temporary and seasonal work could result in a higher level of dissatisfaction with one's social and economic situation (Phillips et al., 2002). Moreover, prior research has identified people's living standards (reflected by the Engel coefficient) as an important social factor in understanding the prevalence of suicide ideation, with improvement in people's living standards serving as a protective factor for at risk populations (Zhang et al., 2010; Phillips et al., 2002). These results are consistent with the strain theory of suicide: as living standards increase, strains caused by too much economic deprivation will be minimised. The importance of social factors in predicting suicide ideation is consistent with Durkheim's theory of suicidal behaviour. According to Durkheim's theory, economic growth as epitomised by industrialization, urbanisation and modernization usually leads to higher levels of social anomie and lower levels of social integration resulting from popularised individualism and egoism. This subsequently increases

the suicide rate (Durkheim, 1951). Some research has supported Durkheim's hypothesis that suicide rate is positively associated with urbanisation, modernization and economic growth; however, the majority of these findings are from Western countries (Stack, 2000; Durkheim, 1951). In contrast, other studies conducted mainly in Asia or developing countries found a negative association between suicide rates and economic growth or urbanisation (Zhang et al., 2010). It is possible that improved employment and educational opportunities serve as protective factors in predicting suicide.

Rarely investigated yet potential predictors of suicide ideation for children and adolescents are the characteristics of the school they attend. One such factor is the schools' promotion rate, which reflects the proportion of high school graduates entering colleges. In China and many other Asian countries, students can only access higher education if they pass the requisite entrance exams. Successful completion of higher education is perceived to provide the greatest opportunity for positive future outcomes. Failure to pass these exams has been associated with suicidality (Zhang et al., 2010; Phillips et al., 2002). As such, a school's promotion rate may predict suicide ideation. A second potentially important school factor is the pupil-to-teacher ratio. This indicates the number of students per teacher and is important for teacher workload and the availability of teachers' services to their students. Low pupil-to-teacher ratios, which facilitate more individual attention from teachers, have resulted in increased school performance (Konstantopoulos & Chung, 2009). To this end, the city's divorce rate, the city's standard of living as indicated by the Engel coefficient, the city's GDP reflecting economic growth, the high school's promotion rate and the school's pupil/teacher ratio were important social factors considered in this study.

The main purpose of this study was to assess the prevalence and predictors of suicide ideation in a large sample of Chinese children and adolescents. Possible predictors included both individual and social factors. We also examined which mental health factors were associated with suicide ideation in separate groups of primary, middle and high school students.

METHODS

Participants

This study was carried out in 13 cities across China in 2011–2012: Guangzhou, Yunfu, Dongguan, Heyuan and Shengzheng of Guangdong province; Nanning of Guangxi province; Changsha, Xiangtan and Shaoyang of Hunan province; Zhengzhou of Henan province; Wuhan of Hubei province; Xuzhou of Jiangsu province; Qingdao of Shandong province. The study was approved by South China Normal University Research Ethics Committee

and the local education authority. The study was conducted in accordance with the tenets of the Declaration of Helsinki. We approached 13,822 participants in total. Teachers and two trained research assistants explained the study and distributed the questionnaires to the students. Students took the questionnaires home and, together with their parents/guardians, made a decision on whether or not to participate. It took about 30 minutes to complete the entire administrative process. Participating students completed and returned the questionnaires within 1 week. Anonymity and confidentiality were assured. Students could freely withdraw at any time.

Among the returned questionnaires, 12,733 questionnaires were considered as valid. A total of 1089 questionnaires were excluded because they appeared not to have been seriously completed or the student refused to participate ($n = 256$) or there was considerable missing data ($n = 833$), yielding an overall response rate of 92.12%. A minority of participants ($n = 519$) did not report their gender. Of those who did, half were male ($n = 6104$). Participant's age ranged from 9 to 18 years ($M = 12.74$, $SD = 4.28$) and were attending grade 5 ($n = 1052$, 8%), grade 6 ($n = 964$, 7.30%), grade 7 ($n = 1560$, 11.90%), grade 8 ($n = 4268$, 32.50%), grade 9 ($n = 788$, 6%), grade 10 ($n = 2541$, 19.96%) and grade 11 ($n = 1500$, 14.60%). Two thirds of participants had siblings 7830 (66.80%), most of whom were either first born ($n = 3318$) or last born ($n = 3092$), with a relative minority of middle born children ($n = 1420$). Approximately, half of the participants were living in urban areas ($n = 6548$; 49.80%) and half were living in rural areas ($n = 6123$; 46.60%).

Measures

Suicide ideation

Participants' suicide ideation was assessed by a single item ("During the last 6 months, have you ever thought about committing suicide?"). The response options were "rarely or never", "about every month", "about every week", "more than once a week" and "about every day". Adolescents who indicated thinking about suicide "about every month" or more were considered to have suicide ideation. This item was adapted from the US youth risk behaviour survey (Zullig, Pun, Patton, & Ubbes, 2006). It has been widely used in studies of US and European young students (Swahn et al., 2012), and in Chinese adolescents as well (Wang, Lai, Hsu, & Hsu, 2011).

Mental health

Participants' mental health was measured by the Mental Health Test (MHT), a 100-item true-false self-report questionnaire, which was previously developed and validated for assessing Chinese children and adolescents'

general mental health. The measure has been described elsewhere in detail (Zhou, 1991). The MHT has demonstrated good reliability and validity and has been widely used in studies with Chinese adolescents and children (Chen, 2002). The MHT measures students' study anxiety, social anxiety, hypersensitivity, physical symptoms, tendencies towards loneliness, self-accusation, terror and impulsivity. Higher scores indicate a lower level of mental health. The MHT has exhibited good internal consistency in extant literature ($\alpha = .91$ to $.94$) and in the present study ($\alpha = .87$ to $.92$).

Data analysis

Suicide ideation was recoded as 0 ("rarely or never") and 1 ("about every month", "about every week", "more than once a week" and "about every day"). The MHT score, age and grade were treated as continuous variables. The other variables were coded as follows: gender (0: male, 1: female), area of residence (0: urban, 1: rural), if only child status (0: only child, 1: have at least one sibling) and birth order among siblings (0: first-born, 1: middle-born, 2: last-born). In order to analyse frequency distributions, chi-square tests and Student's *t*-tests were conducted to compare independent sample means. A binary logistic regression analysis was performed to differentiate the psychological risk factors separately for primary, middle and high school student groups. These statistical analyses were performed with SPSS version 16.0 (SPSS, Chicago, IL).

A multilevel logistic regression model was applied to represent the odds that a given student living in a given city would report having suicide ideation. We used multilevel models to account for the hierarchical structure of the two-level data with 12,733 individuals (level 1) nested within 13 cities (level 2) so that the contextual effects could be differentiated from compositional effects (Macintyre & Ellaway, 2000; Subramanian, Jones, & Duncan, 2003). A full model with city-level characteristics and individual-level variables is as follows:

$$\log[p_{ij}/(1 - p_{ij})] = \gamma_{00} + \gamma_{01} (\text{promotion rate}_{ij}) + \gamma_{02} (\text{Engel coefficient}_{ij}) + \gamma_{03} (\text{divorce rate}_{ij}) + \gamma_{04} (\text{pupil/teacher ratio}_{ij}) + \gamma_{05} (\text{GDP}_{ij}) + \gamma_{06} (\text{residence}_{ij}) + \gamma_{10} (\text{gender}_{ij}) + \gamma_{20} (\text{grade}_{ij}) + \gamma_{30} (\text{age}_{ij}) + \gamma_{40} (\text{if only child}_{ij}) + \gamma_{50} (\text{birth order_middle born}_{ij}) + \gamma_{60} (\text{birth order_last born}_{ij}) + \gamma_{70} (\text{study anxiety}_{ij}) + \gamma_{80} (\text{social anxiety}_{ij}) + \gamma_{90} (\text{lonely tendency}_{ij}) + \gamma_{100} (\text{self-accusation tendency}_{ij}) + \gamma_{110} (\text{hypersensitivity}_{ij}) + \gamma_{120} (\text{physical symptoms}_{ij}) + \gamma_{130} (\text{terror tendency}_{ij}) + \gamma_{140} (\text{impulsive tendency}_{ij}) + \gamma_{150} (\text{general mental health}_{ij}) + [u_{0j} + u_{7j} (\text{study anxiety})].$$

MLwin software, version 2.35 was used for the multilevel analysis. The statistical significance of covariates was calculated using Wald's test. All significance tests were two-sided, and statistical significance was defined

at the 5% level. All models were estimated by using quasi-likelihood methods. We started with the crudest approximation, first order MQL and used these estimates as starting values for second order PQL estimation in the model (Center of Multilevel Modelling, 2008).

RESULTS

Prevalence of suicide ideation and its distribution by demographic characteristics

As seen in Table 1, 32.09% of participants reported suicide ideation. The prevalence among primary school students, middle school students and high school students was 30.36, 34.70 and 35.09%, respectively. A higher risk of suicide ideation was significantly associated with female gender ($\chi^2 = 90.08, p < .001$), rural household registration ($\chi^2 = 25.30, p < .001$), being 13–15 years old ($\chi^2 = 67.74, p < .001$) and being a middle or high school student ($\chi^2 = 15.39, p < .001$). There was no significant association between sibling status (being an only child or having a sibling) and suicidal ideation. However, among those participants who had siblings, middle-born status was significantly correlated with greater suicide ideation.

Univariate analysis of risk factors

As can be seen in Table 2, significant associations were found between the risk of suicide ideation and all the mental health factors.

Multivariate analysis

We performed a binary logistic regression analysis to identify the psychological risk factors in predicting suicide ideation among students in different grades. Specifically, we tested the risk factors of primary, middle and high school students separately. The reason is that some differences might have existed at different grade levels due to different developmental contexts (Zhang et al., 2010). As shown in Table 3, suicide ideation among primary school students was associated with higher levels of study anxiety, self-accusation, impulsive and loneliness. Similarly, suicide ideation among middle and high school students were also associated with higher levels of study anxiety, and tendencies towards self-accusation, impulsivity and loneliness. In addition, middle and high school suicide ideation was also predicted by hypersensitivity, physical symptoms and terror tendency.

Multilevel model analysis

The results of the multilevel logistic regression analyses are reported in Tables 4. An examination of the

unconditional model (results not presented) showed that suicide ideation varied significantly across cities ($\beta = 5.05, p = .015$). Model 1 presents the effects of city-level and individual-level variables. For the city-level variables, divorce rate, Engel coefficient and pupil-to-teacher ratio exhibited significant effects on suicide ideation. For the individual-level variables, high levels of study anxiety, self-accusation tendency, impulsive tendency and terror tendency, and low levels of mental health were significantly associated with an elevated risk of suicide ideation.

DISCUSSION

Our large, multi-school study assessed the prevalence and predictors of suicide ideation among children and adolescents in China. The results demonstrate a high prevalence of suicide ideation in this sample, with approximately 32.09% of students reporting suicide ideation. This falls well within the broad range of previously reported prevalence rates (6–39.2%) in adolescents in China and other countries (Lei et al., 2012; Wang, Shen, Liang, Luo, & Zhang, 2012; You, Ma, Li, Zhao, & Zhang, 2012; Garlow et al., 2008; Arria et al., 2009). Importantly, prevalence rates and risk factors for suicide ideation varied depending on age, gender and other individual and social aspects of the students' lives. The results suggest that both social and individual risk factors should be considered when developing suicide interventions for children and adolescents.

We observed a higher prevalence of suicide ideation among high school versus younger students. This finding is consistent with results of research on adolescents in Europe, North America and China (Lei et al., 2012; You et al., 2012; Garlow et al., 2008; Arria et al., 2009). Possible reasons for the higher prevalence among this age group include the high levels of societal pressure and competition regarding academic success at school. This may be particularly relevant for high school students preparing for the national entrance examination required for admission into higher education (Shang et al., 2014).

Our findings are consistent with extant literature reporting that females are at a relatively higher risk of suicide ideation than males (Bossarte, Swahn, & Breiding, 2009; Joe, Baser, Neighbors, Caldwell, & Jackson, 2009). Previous research suggests that females experience more severe psychosocial conditions at school (such as perceived heavier school work, larger pressure to study) than males (Swahn et al., 2012). Further, females may be more vulnerable to adverse responses to these stressors, possibly due to differing sensitivities and problem solving abilities (Cheung et al., 2013; Evans, Hawton, Rodham, & Deeks, 2005; Juan, Xiao, Jia, & Liang, 2010).

We also report a higher prevalence of suicide ideation among middle-born children than first-born and last-born

TABLE 1
Distribution of the student sample according to suicide ideation (n = 12733)

Variables	Categorical variables	Number responding	Suicide ideation		χ^2	p
			Yes (%)	No (%)		
Gender	Male	6104	1828 (29.95)	4276 (70.05)	90.08	<.001
	Female	6110	2327 (38.09)	3783 (61.91)		
Grade	Primary	2016	612 (30.36)	1404 (69.64)	15.39	<.001
	Middle	6616	2296 (34.70)	4320 (65.30)		
	High	4041	1418 (35.09)	2623 (64.91)		
Residence	Urban	6548	2108 (32.19)	4440 (67.81)	25.30	<.001
	Rural	6123	2231 (36.44)	3892 (63.56)		
If only child	Yes	4360	1472 (33.76)	2888 (66.24)	.03	.870
	No	7830	2655 (33.91)	5175 (66.09)		
Birth order	First-born	3318	1099 (33.12)	2219 (66.88)	29.70	<.001
	Middle-born	1420	568 (40.00)	852 (60.00)		
	Last-born	3092	988 (31.95)	2104 (68.05)		
Age	9–12	2544	704 (27.67)	1840 (72.33)	67.74	<.001
	13–15	5871	2168 (36.93)	3703 (63.07)		
	16–18	3231	1095 (33.89)	2136 (66.11)		

TABLE 2
Comparison of the mental health factors associated with suicide ideation (mean \pm standard error)

Variables	Suicide ideation		t	p
	No	Yes		
Study anxiety	7.68 \pm 2.98	8.65 \pm 2.97	–17.44	<.001
Social anxiety	3.93 \pm 2.25	5.04 \pm 2.35	–25.62	<.001
Lonely tendency	2.42 \pm 2.11	3.41 \pm 2.37	–23.05	<.001
Self-accusation tendency	5.16 \pm 2.38	5.68 \pm 2.32	–11.91	<.001
Hypersensitivity	5.15 \pm 2.29	6.09 \pm 2.20	–22.57	<.001
Physical symptoms	4.47 \pm 2.79	6.13 \pm 2.97	–30.53	<.001
Terror tendency	2.84 \pm 2.45	3.29 \pm 2.57	–9.69	<.001
Impulsive tendency	2.81 \pm 2.16	3.69 \pm 2.36	–20.52	<.001
General mental health	34.13 \pm 12.98	42.60 \pm 12.83	–35.09	<.001

children. Previous research suggests that middle-born children receive less attention from their parents than their other siblings (Zajonc & Markus, 1975), which may be a contributing factor. Further research is necessary to elucidate this finding.

Participant's place of residence was also important, with rural areas associated with increased risk of suicide ideation. This finding is consistent with some previous research (Mazza, 2006; Cheung et al., 2013). Social disconnection, a variable associated with suicide, might be greater in many rural areas due to the sparser population and greater physical isolation (Joiner, 2005). Further, a higher proportion of rural children are cared for by extended family members rather than their parents, who seek work in urban areas (Zhang et al., 2010). Previous research has demonstrated that the separation of parents and children has a significant negative effect on both of them (Miller & Taylor, 2005).

Our study found that significant risk factors for primary school students comprised a subset of those associated with suicide ideation among middle and high school

students. Differences between these grades is consistent with Cheung et al. (2013), who suggested that this may be due to higher academic pressure and parental expectations, and associated lower levels of mental health among this group. Moreover, no matter which grade the students were in, high levels of study anxiety, tendencies towards self-accusation and impulsivity were associated with suicide ideation, independent of students' demographic characteristics. The results suggest that suicide intervention programs should not only include common components across grades but also should focus on different aspects when dealing with each grade group.

Our findings indicated that both contextual (city-level) and compositional factors (individual-level) are associated with students' suicide ideation. With regards to contextual factors, divorce rate and the Engel coefficient were positively correlated with suicide ideation. This is consistent with previous studies (Zhang et al., 2010; Phillips et al., 2002), suggesting that the improvement of people's living standards as a result of economic growth can be therapeutic for populations at risk of suicide.

TABLE 3

Multivariate logistic regression analyses of contributing factors to suicide ideation among primary school, middle school and high school students

<i>Variables</i>	β	<i>Wald</i> χ^2	<i>p</i>	<i>OR</i>	<i>95% CI</i>
Primary school (grades 5th–6th)					
Study anxiety	.156	53.656	<.001	1.169	1.121–1.219
Impulsive tendency	.076	12.125	<.001	1.079	1.034–1.127
Self-accusation tendency	.113	19.208	<.001	1.120	1.064–1.179
Lonely tendency	.092	13.718	<.001	1.096	1.044–1.151
Model $\chi^2 =$	10.62	$p < .001$			
Middle school (grades 7th–9th)					
Study anxiety	.134	91.064	<.000	1.143	1.112–1.175
Social anxiety	.044	6.595	.010	1.045	1.011–1.080
Self-accusation tendency	.103	46.342	<.000	1.108	1.076–1.141
Hypersensitivity	.068	16.964	<.000	1.070	1.036–1.105
Physical symptoms	.038	5.668	.017	1.039	1.007–1.073
Terror tendency	.045	15.279	<.000	1.046	1.022–1.071
Impulsive tendency	.058	21.082	<.000	1.060	1.034–1.087
Mental health	.077	102.580	<.001	1.080	1.064–1.096
Model $\chi^2 =$	688	$p < .001$			
High school (grades 10th–11th)					
Study anxiety	.097	22.437	<.001	1.102	1.060–1.146
Social anxiety	.052	4.231	.040	1.053	1.002–1.107
Self-accusation tendency	.204	85.578	<.001	1.226	1.174–1.280
Hypersensitivity	.148	36.974	<.001	1.159	1.106–1.215
Physical symptoms	.057	6.132	.013	1.058	1.011–1.107
Terror tendency	.069	15.588	<.001	1.071	1.034–1.109
Impulsive tendency	.149	61.995	<.001	1.161	1.119–1.205
Mental health	.115	102.325	<.001	1.122	1.097–1.148
Model $\chi^2 =$	480	$p < .001$			

OR, odds ratio; 95% CI, 95% confidence interval.

TABLE 4

Results of multilevel logistic regression of suicide ideation reported by Chinese children and adolescents

Model 1 Fixed effects β					
<i>Variables</i>	β	<i>Wald</i> χ^2	<i>p</i>	<i>OR</i>	<i>95% CI</i>
Intercept	2.403	.310	.578	11.056	.002–51969
Promotion rate	–.066	.483	.489	.936	.777–1.128
Engel coefficient	.494	12.270	<.001	1.639	1.243–2.161
Divorce rate	.568	12.920	<.001	1.765	1.295–2.406
Pupil/teacher ratio	–.390	6.805	.009	.677	.506–.907
GDP	.298	1.284	.257	1.347	.804–2.255
Residence	.002	.001	.984	1.002	.862–1.165
Gender	–.086	3.348	.065	.918	.837–1.007
Grade	–.123	.517	.471	.884	.632–1.236
Age	.152	10.459	.001	1.164	1.062–1.276
If only child	–.116	3.285	.071	.890	.785–1.009
Birth order: middle born	.151	3.563	.060	1.163	.994–1.360
Birth order: last born	–.152	5.821	.016	.859	.760–.972
Study anxiety	.053	16.618	<.001	1.054	1.027–1.081
Social anxiety	.001	.005	.931	.999	.972–1.027
Lonely tendency	.021	2.250	.117	1.021	.993–1.050
Self-accusation tendency	.086	37.734	.027	1.089	1.060–1.119
Hypersensitivity	.018	1.653	.217	1.653	.990–1.046
Physical symptoms	.027	3.719	.057	1.027	.999–1.056
Terror tendency	.030	9	.003	1.030	1.010–1.050
Impulsive tendency	.083	47.839	<.001	1.087	1.062–1.113
General mental health	.050	39.060	<.001	1.051	1.035–1.068
Random effects					
Variance components					
Intercept	5.547	6.052	.014		
Study anxiety	.011	5.061	.039		

For more details about the city-level variables, please refer to Appendix A.

Moreover, negative life events such as parents' divorce may adversely affect children's mental health, generating feelings of anxiety, anger, shock and disbelief (Phillips et al., 2002; Mazza, 2006). Surprisingly, the pupil-to-teacher ratio was negatively associated with suicide ideation. This finding requires further investigation, as the lower the pupil-to-teacher ratio, the higher the availability of teacher services to students (Zhang et al., 2010). It is possible that other teacher or school factors, such as perceived increased pressure to perform academically, result from lower pupil-to-teacher ratios. These results suggest that interventions targeting individual factors without also considering contextual factors may lack efficacy.

Finally, higher levels of study anxiety and physical symptoms, and tendencies towards self-accusation, impulsivity and terror were significantly associated with an increased risk of suicide ideation. These findings have important clinical implications for suicide prevention and intervention. They suggest that mental health services should be offered when working with children and adolescents who may be at risk of engaging in suicide behaviours. Further, schools should offer mental health support and treatment, such as proactive student counselling, to children and adolescents.

There are certain limitations to this study. First, it is important to note that some parental variables, such as the socioeconomic and parenting styles, were not measured in this study, which could also be important predictors. Further, we only recruited children and adolescents attending school and out-of-school adolescents should be considered in the future studies.

Despite these limitations, this is one of the first studies to systematically examine both contextual (city-level) and compositional (individual-level) risk factors for suicide ideation among children and adolescents in China. Because this study adopted a large sample of 12,733 students from thirteen urban and rural areas in China, the results may be more generalizable to the wider child and adolescent population in China. Further, results suggest that while there were common risk factors across grades, there were also unique risk factors for students in higher grades. Finally, our findings suggest that individual and social factors are associated with suicide ideation among children and adolescents, and that both of these need to be considered for youth suicide interventions.

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APPENDIX

Table A1: Descriptive statistics of city level variables

<i>City</i>	<i>GDP (billion)</i>	<i>Engel coefficient, %^a</i>	<i>Divorce rate, %</i>	<i>Pupil/teacher ratio, %^b</i>	<i>Promotion rate %^c</i>
1. Dongguan ^d	464.225	33.9	16.26	4.29	87.5
2. Heyuan ^d	47.719	48.1	12.29	16.28	71.5
3. Xuzhou ^d	286.693	35.5	15.23	15.88	82.1
4. Wuhan ^d	556.593	37.04	18.83	15.1	76.24
5. Guangzhou ^d	1060.448	33.3	25.23	18.88	89.74
6. Nanjing ^d	180.043	38.82	20.4	16.98	67.12
7. Yunfu ^d	39.427	48.5	13.7	16.81	69.5
8. Qingdao ^e	566.619	37.4	23.49	16.05	80
9. Shaoyang ^e	73.033	51.8	19.7	23.16	80.1
10. Shengzheng ^e	951.091	35.3	28.6	29.75	81.3
11. Xiangtan ^e	89.401	33.5	20.35	16.79	71.3
12. Zhengzhou ^e	400	36.33	12.52	17.84	71.96
13. Changsha ^e	454.706	35.7	24.24	19.68	82.47

GDP = Gross Domestic Product.

^aEngel's law is a reflection of the living standard of a country/area. As this proportion or "Engel coefficient" increases, the country/area is by nature poorer, and conversely a low Engel coefficient indicates a higher standard of living.

^bThe pupil/teacher ratio measures the number of students per teacher. The lower the pupil/teacher ratio, the higher the availability of teacher services to students.

^cPromotion rate is the proportion of high school students entering colleges.

^dNBSC (2011).

^eNBSC (2012).