Original Article

Psychosocial problems and suicidal ideation in Chinese adolescents: findings from a longitudinal study

Xiulu Yang[1#], Jingyi Wang[1#], Tingting Wang[2], Haijiang Lin[2], Yuting Yang[1], Xiaoxiao Chen[2], Chaowei Fu[1]

[1]School of Public Health, Key Laboratory of Public Health Safety, NHC Key Laboratory of Health Technology Assessment, Fudan University, Shanghai, China; [2]Taizhou City Center of Disease Prevention and Control, Taizhou, China

Contributions: (I) Conception and design: J Wang, X Chen, C Fu; (II) Administrative support: J Wang, H Lin, X Chen; (III) Provision of study materials or patients: T Wang, H Lin, X Chen; (IV) Collection and assembly of data: T Wang, X Yang, Y Yang; (V) Data analysis and interpretation: X Yang, J Wang; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

[#]These authors contributed equally to this work.

Correspondence to: Chaowei Fu, PhD. School of Public Health, Key Laboratory of Public Health Safety, NHC Key Laboratory of Health Technology Assessment, Fudan University, No. 130, Dongan Road, Xuhui District, Shanghai 200032, China. Email: fcw@fudan.edu.cn; Xiaoxiao Chen, MSc. Taizhou City Center of Disease Prevention and Control, No. 608, Donghai Avenue, Jiaojing District, Taizhou 318000, China. Email: tzcdccxx@126.com.

Background: Few studies have explored the important role of different dimensions of emotional and behavioral problems (EBPs), perceived social support and loneliness in predicting suicidal ideation among Chinese adolescents. Based on a 6-month longitudinal study conducted in Taizhou high schools, we aimed to explore the associations between psychosocial problems and suicidal ideation in Chinese adolescents, and to ascertain whether co-occurring psychosocial problems increase suicidal ideation.

Methods: A total of 3,267 students were eligible for this analysis. Perceived social support was assessed using the Multidimensional Scale of Perceived Social Support. Loneliness and suicidal ideation were assessed using the University of California, Los Angeles (UCLA) 3-Item Loneliness Scale and one item from the Children's Depression Inventory. The Strength and Difficulties Questionnaire assessed EBPs. Multivariable logistic regression models were used to estimate longitudinal associations between each psychosocial problem (lack of perceived social support from family, friends, and significant others, loneliness, emotional, conduct and peer problems, hyperactivity, and poor prosocial behavior) at baseline and suicidal ideation at follow-up. Multinomial logistic regression models were used to examine the association between the number of psychosocial problems at baseline and suicidal ideation at follow-up.

Results: The multivariable logistic regression results showed that after adjusting for baseline suicidal ideation, sociodemographic covariates and depressive symptoms, low level of perceived social support from family (OR =1.78; 95% CI: 1.10–2.87), emotional problems (OR =2.35; 95% CI: 1.41–3.79), and poor prosocial behavior (OR =1.74; 95% CI: 1.08–2.79) were significant predictors of suicidal ideation among the adolescents. The risk of suicidal thoughts increased as the number of psychosocial problems increased. The participants with five or more psychosocial problems had a higher risk of having serious suicidal thoughts than those with no problem (relative risk ratio =4.50; 95% CI: 2.13–9.49).

Conclusions: The study confirmed the predictive role of multiple psychosocial problems on suicidal ideation, and the accumulative effect of co-occurring psychosocial problems in magnifying the risk of suicidal ideation. More integrated and holistic approaches need to be taken to identify high-risk groups and provide interventions of suicidality in adolescents.

Keywords: Perceived social support; emotional and behavioral problems (EBPs); loneliness; suicidal ideation; adolescents

Introduction

Adolescence is a period of transition from childhood to adulthood marked by dramatic changes in body, mind and behavior. During this transitional period, adolescents are vulnerable to psychosocial problems (1). Suicide is a common cause of death among teenagers, especially in recent decades, the number of deaths caused by suicide increased dramatically (2). Suicidal ideation is the first stage of suicidal behavior (3). Previous studies reported that the prevalence of suicidal ideation among Chinese adolescents was 13–24% and suicide attempt was 3–5% (4-6). Even though several risk factors of suicidal ideation have been reported, including psychological, environmental, and psychosocial factors (7), the predictors of suicidal ideation in Chinese adolescents remain unclear.

Findings from existing research show that adolescents with high perceived social support are likely to have better psychological well-being (8). Social support refers to the material or psychological assistance received from all aspects of society, including family, friends, community or organizations, and reflects the closeness and quality of one's social ties (9). It can be further classified as received and perceived social support (10). Perceived social support

refers to an individual's beliefs about how much support is potentially available from their social relationships and about the quality of this support (11). Previous studies indicated that lower levels of perceived social support from family, friends, and significant others were associated with suicidal ideation, whereas the importance of support from different sources in predicting suicidal ideation remains controversial (12-14).

Apart from the lack of social support, emotional and behavioral problems (EBPs), such as emotional problems, conduct problems, hyperactivity, peer problems and poor prosocial behavior, are well-documented psychosocial problems in adolescents of having negative impact on their psychological well-being. The high prevalence of EBPs in adolescents is a common concern in both high-income (15,16) and low- and middle-income countries (17,18). There was an increasing trend of EBPs among Dutch adolescents from 1993 to 2003 (19). Previous research revealed that EBPs have a serious negative impact on mental health, social development, and quality of life among adolescents (20,21). A Spanish cross-sectional study demonstrated that higher levels of EBPs were associated with a higher risk of committing suicide (22). Existing evidence showed that emotional problems such as depression and anxiety were powerful risk factors for onset or recurrent suicidal ideation (23,24). A longitudinal study in college students found that the symptoms of attention deficit hyperactivity disorder seem to have no direct but indirect effect on suicidal ideation through both depressive symptoms and lowering of self-esteem (25). However, very few studies have investigated the longitudinal associations between multiple EBPs and suicidal ideation, and the evidence for the correlation of poor prosocial behavior and suicidal ideation was particularly scarce.

In addition, loneliness is a well-known psychosocial problem among teenagers. A study involving 25 countries documented that approximately 18.1% of secondary school students reported being friendless or lonely most of the time (26). A meta-analysis of prospective studies found that loneliness was a significant predictor of both suicidal ideation and behavior, and the associations were more likely to be identified in people aged 16–20 or over 58 years at baseline, thereby suggestive of a U-shaped trend with regard to age (26).

Although associations between various psychosocial problems and suicidal ideation have been reported, substantial studies on their relationships in adolescents are based on cross-sectional research, and longitudinal evidence

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Highlight box

Key findings
- Low level of perceived social support from family at baseline was associated with suicidal ideation at follow-up.
- Poor prosocial behavior and emotional problems were significant predictors of suicidal ideation.
- The risk of suicidal thoughts increased as number of psychosocial problems increased.

What is known and what is new?
- Low level of perceived social support from family at baseline and emotional problems were associated with suicidal ideation at follow-up.
- Poor prosocial behavior and emotional problems were significant predictors of suicidal ideation; the risk of suicidal thoughts increased as number of psychosocial problems increased.

What is the implication, and what should change now?
- The study confirmed the predictive role of multiple psychosocial problems on suicidal ideation, and the accumulative effect of co-occurring psychosocial problems in magnifying the risk of suicidal ideation.
- More integrated and holistic approaches need to be taken to identify high-risk groups and provide interventions of suicidality in adole.

1078

Yang et al. Psychosocial and suicidal problems in Chinese adolescents

is still scarce. Knowing which psychosocial problems are independently associated with suicidal ideation over time is important for a better understanding, prediction and treatment of suicide. Additionally, most of the existing evidence is from Western countries where individualism is the cultural norm, and a focus on more collectivist culture is required (26). Therefore, based on the 6-month longitudinal data among adolescents in Taizhou, China, this study aimed to explore the association between psychosocial problems and suicidal ideation, and to ascertain whether co-occurring psychosocial problems increase suicidal ideation. We present this article in accordance with the STROBE reporting checklist (available at https://tp.amegroups.com/article/view/10.21037/tp-22-676/rc).

Methods

Participants and design

The population-based longitudinal study was conducted among students of junior and senior high schools in Taizhou, Zhejiang province, China. The baseline survey was conducted between May 2021 and June 2021, and a 6-month follow-up was conducted between November 2021 and December 2021. This study used multistage cluster sampling and randomly sampled 15 junior and 16 senior high schools from six counties or districts in Taizhou City. Two classes were randomly chosen from each grade within the selected schools. All participants completed an online questionnaire through the Wenjuanxing platform (https://www.wjx.cn). The eligibility criteria for the study were: (I) students in junior or senior high school; (II) being able to read, understand, and complete the questionnaire independently; and (III) providing online informed consent. A total of 4,168 participants were recruited in the baseline survey. Those who were lost to follow-up (n=901) were excluded from the study. Finally, the remaining 3,267 participants were eligible for the analysis. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the Ethics Committee of Taizhou Central Hospital (No. 2022L-01-17). Informed consent was obtained from all participants.

Assessment of sociodemographic characteristics

Sociodemographic characteristics included gender (male or female), grade (junior high school or senior high school), household registration (rural or urban), only child (yes or no), economic status (poor, fair, or good), parental marriage (married or divorced/widowed), education of father and mother (primary school or lower, middle/high school, college or higher), death or serious illness of relatives or friends in the past 3 months (yes or no).

Assessment of psychosocial variables

Perceived social support

The present study used the 12-item Multidimensional Scale of Perceived Social Support (MSPSS) (27) to measure perceived social support. MSPSS included three dimensions: perceived social support from family (Fam), from friends (Fri), and from significant others (SO). Each subscale consisted of four items scored from 1 to 7 (very strongly disagree =1, strongly disagree =2, mildly disagree =3, neutral =4, mildly agree =5, strongly agree =6, very strongly agree =7). The subscale total scores were calculated by summing scores across items of that subscale ranging from 4–28, with lower scores indicating a lower level of perceived social support. The scores of each subscale were divided into three equal groups and the lowest group was designated as low level of perceived social support, the middle and the high group as high level of perceived social support. The Cronbach's α of the total scale, family support, friends' support, and significant others' support was 0.88, 0.88, 0.90, and 0.87, respectively.

EBPs

The Strength and Difficulties Questionnaire (SDQ) (28) was a 25-item scale used to access EBPs. The student version of SDQ was used in this study, which included five subscales: emotional problems, conduct problems, hyperactivity, peer problems, and prosocial behavior. Each subscale consisted of five items scored from 0 to 2 (not true =0, somewhat =1, certainly true =2 with five reverse-scored items). The total score of a subscale was calculated by summing scores of the five items ranging from 0–10. Higher scores of subscales of emotional problems, conduct problems, hyperactivity and peer problems indicated a higher level of EBPs, while lower scores of prosocial subscale indicated poorer prosocial behavior. The scores of each subscale were divided into four categories (close to average, slightly raised/slightly lowered, high/low, and very high/very low). "Close to average" and "slightly raised/slightly lowered" were designated as the reference group, and "high/low" and "very high/very low" as another group. The Cronbach's α of the SDQ in our sample was 0.85.

Loneliness

Loneliness was evaluated based on the 3-item UCLA Loneliness Scale (29). This scale comprised three questions that measure feelings of loneliness: relationship connectedness, social connectedness, and self-perceived isolation. Each question consisted of three items scored from 1 to 3 (hardly ever =1, some of the time =2, often =3). The total scores were calculated by summing scores of the three items ranging from 3–9, with higher scores indicating a higher level of loneliness. The total scores were divided into two categories (not lonely: 3–5; lonely: 6–9) (30). The Cronbach's α of the loneliness scale in the present study was 0.86.

The number of psychosocial problems was calculated by summing the frequencies of nine types of problems, including loneliness, three perceived social support problems (lack of perceived social support from family, friends, and significant others), and five EBPs (emotional, conduct and peer problems, hyperactivity, and poor prosocial behavior). Then the number of psychosocial problems, ranging from 0 to 9, was divided into four levels: no (0 psychosocial problem), low level (1–2 problems), moderate level (3–4 problems), and high level (5 or more problems).

Assessment of suicidal ideation and depressive symptoms

Suicidal ideation was evaluated based on one item from the Chinese version of the Children's Depression Inventory (CDI) (31,32). The item comprised three statements: (I) I do not think about killing myself; (II) I think about killing myself, but would not do it; (III) I want to kill myself. The participants were asked to choose the best statement that described their feelings and thoughts during the last two weeks. The responses were categorized into no or yes (but would not do it) *vs.* serious suicidal thoughts. The complete CDI is a 27-item scale used to assess children's depressive symptoms. Each item consisted of three statements scored from 0 to 2 and accordingly total scores range from 0 to 54. This study set 19 as a cut-off value for depressive symptoms as recommended in several studies (33,34). The Cronbach's α of the CDI in the present study was 0.83.

Statistical analysis

Participant characteristics at baseline were reported as frequencies and percentages within each category for categorical variables. Chi-square tests were used to compare the categorical variables between the two suicidal ideation groups at follow-up. With respect to psychosocial variables, descriptive statistics were reported as frequencies and percentages for the assessment at baseline and follow-up. The multivariable logistic regression models were used to determine the association between each psychosocial variable (three subscales of perceived social support, loneliness, and five subscales of EBPs) at baseline and suicidal ideation at follow-up, and to estimate the odds ratios (ORs) and 95% confidence intervals (CIs). Model 1 adjusted for baseline suicidal ideation; model 2 added sociodemographic factors (gender, grade, household registration, only child, economic status, parental marital status, mother's and father's education, death or serious illness of relatives or friends in the past three months); and model 3 additionally adjusted for baseline depressive symptoms except for the predictor of emotional problems as they considerably overlap with CDI. The multinomial logistic regression models were used to examine the association between the number of psychosocial problems at baseline and suicidal ideation at follow-up, and to estimate the relative risk ratios (RRRs) and 95% CIs. The model adjusted for baseline suicidal ideation, gender, grade, household registration, only child, economic status, parental marital status, mother's and father's education, and death or serious illness of relatives or friends. All statistical tests were two-sided and P<0.05 was considered statistically significant. All analyses were performed in R software (Version 4.1.0; R Foundation for Statistical Computing, Vienna, Austria).

Results

Baseline characteristics of participants

Descriptive information for the baseline characteristics is shown in *Table 1*. Totally, 3,267 eligible participants were included in this study. Of all the participants, more than half were boys and junior high school students. The prevalence of serious suicidal ideation was 3.8% at baseline and 3.1% at follow-up. Approximately 20.6% of the students reported depressive symptoms. When comparing baseline characteristics of the participants by suicidal ideation status at follow-up, the results showed that students in junior high school, whose parental marital status being divorced or widowed, whose father's education being college or higher, whose relatives or friends died or suffered serious illness in the past three months and those with depressive symptoms at baseline were more likely to have serious suicidal

Table 1 Baseline characteristics of the study participants by suicidal ideation status at follow-up

Variable	Overall	Suicidal ideation		P value
		No/yes (but would not do it)	Serious suicidal thoughts	
N	3,267	3,167 (96.9)	100 (3.1)	
Gender, n (%)				
Male	1,665 (51.0)	1,620 (51.2)	45 (45.0)	0.267
Female	1,602 (49.0)	1,547 (48.8)	55 (55.0)	
Grade, n (%)				
Junior high school	1,852 (56.7)	1,783 (56.3)	69 (69.0)	0.015
Senior high school	1,415 (43.3)	1,384 (43.7)	31 (31.0)	
Household registration, n (%)				
Rural	2,136 (65.4)	2,077 (65.6)	59 (59.0)	0.209
Urban	1,131 (34.6)	1,090 (34.4)	41 (41.0)	
Only child, n (%)				
No	2,260 (69.2)	2,195 (69.3)	65 (65.0)	0.419
Yes	1,007 (30.8)	972 (30.7)	35 (35.0)	
Economic status, n (%)				
Poor	184 (5.6)	174 (5.5)	10 (10.0)	0.111
Fair	2,472 (75.7)	2,403 (75.9)	69 (69.0)	
Good	611 (18.7)	590 (18.6)	21 (21.0)	
Parental marital status, n (%)				
Married	2,927 (89.6)	2,845 (89.8)	82 (82.0)	0.018
Divorced/widowed	340 (10.4)	322 (10.2)	18 (18.0)	
Mother's education, n (%)				
Primary school or lower	608 (18.6)	594 (18.8)	14 (14.0)	0.346
Middle/high school	2,246 (68.7)	2,176 (68.7)	70 (70.0)	
College or higher	413 (12.6)	397 (12.5)	16 (16.0)	
Father's education, n (%)				
Primary school or lower	453 (13.9)	443 (14.0)	10 (10.0)	0.015
Middle/high school	2,396 (73.3)	2,328 (73.5)	68 (68.0)	
College or higher	418 (12.8)	396 (12.5)	22 (22.0)	
Death or serious illness of relatives or friends, n (%)				0.003
No	2,746 (84.1)	2,673 (84.4)	73 (73.0)	
Yes	521 (15.9)	494 (15.6)	27 (27.0)	
Depressive symptoms, n (%)				<0.001
No	2,595 (79.4)	2,558 (80.8)	37 (37.0)	
Yes	672 (20.6)	609 (19.2)	63 (63.0)	

Table 2 Frequencies of psychosocial variables at baseline and follow-up

Psychosocial variables	Baseline	Follow-up
Fam, n (%)		
High	2,314 (70.8)	2,314 (70.8)
Low	953 (29.2)	953 (29.2)
Fri, n (%)		
High	2,337 (71.5)	2,337 (71.5)
Low	930 (28.5)	930 (28.5)
SO, n (%)		
High	2,198 (67.3)	2,198 (67.3)
Low	1,069 (32.7)	1,069 (32.7)
Loneliness, n (%)		
No	2,384 (73.0)	2,470 (75.6)
Yes	883 (27.0)	797 (24.4)
Emotional problems, n (%)		
Close to average/slightly raised	2,706 (82.8)	2,779 (85.1)
High/very high	561 (17.2)	488 (14.9)
Conduct problems, n (%)		
Close to average/slightly raised	2,981 (91.2)	2,934 (89.8)
High/very high	286 (8.8)	333 (10.2)
Hyperactivity, n (%)		
Close to average/slightly raised	2,949 (90.3)	2,967 (90.8)
High/very high	318 (9.7)	300 (9.2)
Peer problems, n (%)		
Close to average/slightly raised	2,128 (65.1)	2,160 (66.1)
High/very high	1,139 (34.9)	1,107 (33.9)
Prosocial behavior, n (%)		
Close to average/slightly lowered	2,620 (80.2)	2,552 (78.1)
Low/very low	647 (19.8)	715 (21.9)

Fam, perceived social support from family; Fri, perceived social support from friends; SO, perceived social support from significant others.

thoughts at follow-up (*Table 1*).

Table 2 presents the descriptive results of psychosocial variables at baseline and follow-up. Around 30% of the participants reported low social support and loneliness. The percentage of students who experienced emotional problems was 17.2%, 8.8% of conduct problems, 9.7% of hyperactivity, 34.9% of peer problems and 19.8% of poor prosocial behavior. The frequencies and percentages of psychosocial problems were similar between baseline and follow-up, although the prevalence of conduct problems and poor prosocial behavior appeared to increase at follow-up.

Association between psychosocial problems at baseline and suicidal ideation at follow-up

In the logistic regression models, the association between psychosocial problems at baseline and suicidal ideation at follow-up is presented in *Table 3*. When baseline suicidal ideation was adjusted in model 1, low level of perceived social support from family, friends and significant others, loneliness, emotional problems, hyperactivity, and poor prosocial behavior significantly predicted suicidal ideation at follow-up. After the adjustment for sociodemographic covariates and baseline suicidal ideation in model 2, the associations were still significant. After further adjustment for baseline depressive symptoms in model 3 (except for emotional problems), low level of perceived social support from family (OR =1.78; 95% CI: 1.10–2.87), emotional problems (OR =2.35; 95% CI: 1.41–3.79), and poor prosocial behavior (OR =1.74; 95% CI: 1.08–2.79) were significant predictors of suicidal ideation.

Table 4 presents the multinomial logistic regression results between the number of psychosocial problems and suicidal ideation. After the adjustment for sociodemographic covariates and baseline suicidal ideation, low level of psychosocial problems (1–2 problems) significantly predicted students' mild suicidal thoughts (RRR =1.59; 95% CI: 1.25–2.01) rather than serious suicidal thoughts (RRR =1.68; 95% CI: 0.77–3.64) compared with those who had no psychosocial problem. However, moderate level of psychosocial problems (3–4 problems) was a significant predictor of both mild (RRR =1.98; 95% CI: 1.53–2.57) and serious (RRR =2.31; 95% CI: 1.05–5.08) suicidal thoughts. Also, participants with high level of psychosocial problems (5 or more problems) were 2.5 and 4.5 times more likely to have mild (RRR =2.50; 95% CI: 1.88–3.31) and serious (RRR =4.50; 95% CI: 2.13–9.49) suicidal thoughts compared with no psychosocial problem.

Discussion

In the present study, the association between psychosocial problems and suicidal ideation was explored based on a 6-month longitudinal study in Taizhou, China. Around

Table 3 Psychosocial variables at baseline predicting suicidal ideation at follow-up

Psychosocial variables	Suicidal ideation					
	Model 1		Model 2		Model 3	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Fam (ref: high)	2.63 (1.70–4.09)	<0.001	2.45 (1.55–3.86)	<0.001	1.78 (1.10–2.87)	0.018
Fri (ref: high)	1.81 (1.17–2.80)	0.007	1.84 (1.18–2.86)	0.007	1.21 (0.74–1.96)	0.439
SO (ref: high)	2.33 (1.50–3.65)	<0.001	2.33 (1.48–3.68)	<0.001	1.49 (0.90–2.48)	0.121
Loneliness (ref: no)	1.88 (1.21–2.92)	0.005	1.89 (1.20–2.97)	0.006	1.09 (0.65–1.82)	0.750
Emotional problems (ref: close to average/ slightly raised)	2.41 (1.50–3.81)	<0.001	2.35 (1.43–3.79)	<0.001	2.35 (1.41–3.79)	<0.001
Conduct problems (ref: close to average/ slightly raised)	1.41 (0.77–2.47)	0.250	1.40 (0.76–2.49)	0.261	0.97 (0.51–1.74)	0.909
Hyperactivity (ref: close to average/slightly raised)	2.09 (1.22–3.47)	0.006	1.96 (1.12–3.34)	0.015	1.28 (0.72–2.22)	0.392
Peer problems (ref: close to average/slightly raised)	1.44 (0.93–2.21)	0.098	1.42 (0.91–2.20)	0.123	0.97 (0.60–1.55)	0.896
Prosocial behavior (ref: close to average/ slightly lowered)	2.29 (1.45–3.55)	<0.001	2.28 (1.44–3.58)	<0.001	1.74 (1.08–2.79)	0.021

Model 1: adjusted for baseline suicidal ideation; Model 2: adjusted for baseline suicidal ideation, gender, grade, household registration, only child, economic status, parental marital status, mother's and father's education, death or serious illness of relatives or friends in the past 3 months; Model 3: model 2 plus baseline depressive symptoms except for emotional problems. Fam, perceived social support from family; Fri, perceived social support from friends; SO, perceived social support from significant others; OR, odds ratio; 95% CI, 95% confidence interval.

Table 4 Multinomial logistic regression between the number of psychosocial problems and suicidal ideation

Number of psychosocial problems	Suicidal ideation				
	No	Yes (but would not do it)		Serious suicidal thoughts	
		RRR (95% CI)	P value	RRR (95% CI)	P value
No (0 psychosocial problem)	Ref				
Low level (1–2 psychosocial problems)		1.59 (1.25–2.01)	<0.001	1.68 (0.77–3.64)	0.192
Moderate level (3–4 psychosocial problems)		1.98 (1.53–2.57)	<0.001	2.31 (1.05–5.08)	0.038
High level (5 or more psychosocial problems)		2.50 (1.88–3.31)	<0.001	4.50 (2.13–9.49)	<0.001

Model adjusted for baseline suicidal ideation, gender, grade, household registration, only child, economic status, parental marital status, mother's and father's education, death or serious illness of relatives or friends in the past 3 months. RRR, relative risk ratio.

30% of the participants reported low social support and loneliness. The percentage of students who experienced emotional problems was 17.2%, conduct problems 8.8%, hyperactivity 9.7%, peer problems 34.9% and poor prosocial behavior 19.8%. The prevalence of serious suicidal ideation was 3.1%. Multiple baseline psychosocial problems were found to be associated with suicidal ideation at follow-up, including low level of perceived

social support from family, friends and significant others, loneliness, emotional problems, hyperactivity, and poor prosocial behavior. Although the adjustment of depressive symptoms reduced the effect size of some associations, the low level of perceived social support from family, emotional problems, and prosocial problems remained to be significant predictors of suicidal ideation. Additionally, the risk of suicidal thoughts increased when the adolescents

had a larger number of psychosocial problems. Thus, the accumulation of psychosocial problems was related to more severe suicidal thoughts.

Previous research indicated that perceived social support may protect against suicidal ideation (35). A population-based cohort study reported the association between higher perceived social support and lower risk of suicidal ideation during the transition into emerging adulthood (36). Although all the three dimensions of perceived social support were shown to be associated with suicidal ideation in this study, the low level of perceived social support from family rather than from friends or significant others predicted suicidal ideation independent of depressive symptoms. Our finding was consistent with another longitudinal study where family support acted as a crucial role in protecting against suicidal behaviors (13). Adolescents with good family connectedness are more likely to have confidence and power inside and their family can provide tangible and emotional support in a time when they are vulnerable to psychosocial problems (37,38). As a unit of social network, family members communicate and interact in many ways. Family cohesion and family member involvement have a positive impact on adolescents' emotional intelligence and psychological well-being (39). This is in line with several studies which documented that strong family ties and close connectedness reduce the risk of suicidal ideation (40-42).

The results of adjusted logistic regression models showed that SDQ subscales, including emotional problems, hyperactivity and prosocial behavior, significantly predicted suicidal ideation, although the association between hyperactivity and suicidal ideation was not independent of depressive symptoms. Emotional problems were positively associated with the risk of suicidal ideation, whereas prosocial behavior was reversely associated with the risk of suicidal ideation. Similar results were reported in southern China (43), India (44) and Israel (45), which found that emotional problems increased the risk of suicidal ideation, attempts and behavior in adolescents. Several researchers have suggested that emotional problems including nervousness, fear, and worry were risk factors of suicidal behaviors (46,47).

However, few studies have explored the association between prosocial behavior and suicide. Prosocial behaviors are characterized by a concern for the feelings, rights and welfare of others. The measure of prosocial behavior in the SDQ includes actions such as comforting, helping and sharing. In this study, the results showed that poor prosocial

behavior significantly predicted suicidal ideation. Xiao *et al.* (48) also reported similar results for the above two variables. Prosocial behavior was negatively associated with anxiety (49) and depressive symptoms (50-52) and was positively associated with self-esteem (53). A study conducted in Sweden and China found that psychological well-being was strongly related to an individual's tendency to perform prosocial behaviors during the COVID-19 pandemic (54). Self-esteem may mediate the effects of altruism on well-being (55). Research has also shown that people who engage in prosocial behaviors are more likely to experience better moods and have social support benefits, and suffer less from the impact of stress (56). In addition, being responsible for someone else is favorable to building resiliency in adolescents. Prosocial behavior may help adolescents feel valuable and important, and nurture positive self-view. The multiple positive effects of prosocial behavior on psychological health may ultimately result in the reduced risk of committing suicide.

Loneliness is a common risk factor of suicidal thoughts. After adjusting for sociodemographic covariates and baseline suicidal ideation, loneliness significantly predicted suicidal ideation in this current study. However, after further adjusting for depressive symptoms, the effect size was largely reduced and the confidence interval became wider. One reason may be that depressive symptoms mediated the relationship between loneliness and suicidal ideation. Findings of a cross-sectional study showed that depressive symptoms partially explained the association between loneliness and suicidal ideation (57). A systematic review which involved meta-analytic mediation model found that depression acted as a mediator of the association between loneliness and later suicidal ideation and/or behavior (26). Moreover, the systematic review reported that loneliness was more strongly associated with suicidal ideation and behavior in the studies with longer term of follow-up compared to short-term follow-up (26). If loneliness persists over long time, its impact on committing suicide may be more pernicious. Therefore, more long-term prospective studies are needed to ascertain the effect of loneliness on suicidal ideation and the role of depression in their relationship. Furthermore, it was found that the moderate and high levels of psychosocial problems were significant predictors of both mild and serious suicidal thoughts in the present study. As the number of psychosocial problems increased, the risk of having suicidal thoughts increased accordingly. When adolescents have several psychosocial problems at the same time, prompt

attention and intervention should be provided.

Based on the 6-month longitudinal study, we considered the predictive role of a variety of dimensions of perceived social support, loneliness and EBPs on changes in suicidal ideation. The key strengths of this study included a longitudinal design and the estimation of the accumulative effect of multiple psychosocial problems. The findings emphasized the importance of controlling and preventing adolescents' suicidal ideation from the perspective of perceived social support from family, emotional problems and prosocial behavior. However, there are several limitations to be noted. First, the period of follow-up was not very long to identify clear longitudinal associations. Second, suicidal ideation was measured by just one item from the CDI due to the concern for potential adverse effects to do it with a suicide scale, and more detailed information about suicidal thoughts, attempts and behavior cannot be captured by this. As suicide in adolescents is a very sensitive issue in China, using one item in CDI is a more feasible way to measure suicidal ideation in schools. Third, this study only included students from one city in China, and thus it remains unclear whether the findings from this sample can be generalized to adolescents of other geographical regions. Future studies which cover multiple areas and have a longer follow-up period are needed to clearly establish the relationships and potential pathways.

Conclusions

In summary, this longitudinal study of Chinese adolescents demonstrated that perceived social support from family, prosocial behavior, and emotional problems were strong predictors of suicidal ideation over a 6-month follow-up period. It also confirmed the effect of multiple psychosocial problems in magnifying the risk of suicidal ideation. A more integrated and holistic intervention which combines psychological, social and behavioral aspects may be beneficial to prevent suicide in adolescents. Additionally, strengthening the potential resilience resources and ability, especially social support from family and prosocial behavior, is constructive in buffering the effects of risk factors on suicidality.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://tp.amegroups.com/article/view/10.21037/tp-22-676/rc

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013), and was approved by the Ethics Committee of Taizhou Central Hospital (No. 2022L-01-17). Informed consent was obtained from all participants.

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