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Mental health symptoms among rural adolescents with different parental migration experiences: A cross-sectional study in China

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PHQ, Patient Health Questionnaire
GAD, generalized anxiety disorder
IQR, interquartile range
OR, odds ratio
CI, confidence interval
SCL-90: symptom checklist-90

ABSTRACT

In rural regions of China, the rural-to-urban migrant worker population and their left-behind children—60 million children who remain in home villages—have diversified the rural adolescence experience in terms of family life, compounding known mental health disparities. This study examined the impact of a comprehensive panel of home- and school-related variables on the prevalence of three common mental health complaints among rural adolescents. Data were collected using a self-formulated questionnaire administered to 1347 seventh grade students in a rural county of Hunan Province in Fall 2017. The prevalence of mental health symptoms was 10–18%. Bullying, loneliness, and stress from home and school environments were risk factors; good life satisfaction and willingness to reach out to adult and peer social networks were protective. Being a left-behind child was only significantly associated with depression symptoms, and notably, none of the other variables specific to left-behind children were found to be influential on mental health outcomes. These results suggest that the school-related factors included in our analysis accounted for a share of the risk typically explained by home-related factors alone. Schools may therefore be reliable settings for mental health programs in rural areas with ever more unpredictable home environments.

1. Introduction

Mental health disorders are among the top burdens of disease and disability around the world. They are believed to account for nearly one-third of all global years lived with disability (Vigo et al., 2016) and their lifetime prevalence is estimated to range from 18.1% to 36.1% (Kessler et al., 2009). With a substantial number of mental health disorders appearing at critical periods in child development, the availability of effective prevention and treatment options is critical for managing the mental health of populations. Oftentimes however, such demands are not met.

In China, mental health has drawn increasing attention as an important public health issue in recent years. While mental health centers and psychiatric hospitals can be found in cities, there are far fewer such resource centers in the rural regions where over 40% of the population resides (National Bureau of Statistics of China, 2017). Consequently, promotion of positive mental health relies heavily on preventive measures. Studies have shown that rural adolescents are more commonly associated with mood, anxiety, and psychotic disorders than their urban peers (Chen et al., 2018; Liu et al., 2015; Meng et al., 2013; Wang et al., 2017). To maintain a healthy and productive adult workforce, such mental health problems arising in adolescence must be addressed.

Compounding the challenge of rural adolescents' mental health in China is the existence of a unique subpopulation known as left-behind children (LBC). Comprising 60 million people under the age of eighteen years, LBC grow up in rural townships while one or both parents are away in urban areas for extended periods of time as migrant workers (Chang et al., 2011; Ye and Pan, 2011; Duan and Yang, 2008; Duan and Zhou, 2005). Because of tight controls on internal migration, rural migrants often encounter obstacles to public services accessibility in cities, which discourages workers from bringing their children along (Ye and Pan, 2011; Duan and Zhou, 2005; Duan and Yang, 2008; Xiang,

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2007). LBC are therefore particularly vulnerable, missing out on normal family relationships, emotional support, and educational capital, as their guardians tend to be older relatives with minimal schooling. Consequently, in terms of primary responsibility for child health and wellbeing, LBC families resemble single-parent families, though true single-parent families are exceedingly rare in China based on the 2.79% divorce rate (3.84 million filing couples) in 2015 (Zhao et al., 2018; China Ministry of Civil Affairs, 2016).

The literature has extensively documented the negative mental health impact of this social context (Wu et al., 2015; Xing et al., 2017). Depression and loneliness are common complaints among adolescent LBC, while suicidal ideation and various anxiety disorders have also been frequent subjects of study (Fan et al., 2011; Guo and Huang 2011; Cheng and Sun 2015; Lu et al., 2014; Zhao et al., 2012). Simultaneously, the lack of a close adult emotional outlet contributes to stress and aggression (Chen et al., 2014; Yan and Chen, 2013). In LBC families with one migrant parent, there has been variable evidence regarding the mental health impact of an absent mother versus father (Lu et al., 2014; Wang et al., 2014a; Yang et al., 2013). Some studies have indicated that an absent mother produced worse outcomes than an absent father (Wang, 2011), perhaps due to women's traditional caregiver roles; indeed, most respondents in our cohort reported that their primary caretaker was their mother. Nonetheless, absent migrant fathers comprise the major LBC family structure and have been associated with feelings of inferiority, self-doubt, and increased aggression among their children (Wang, 2005).

While China has issued general mental health education guidelines, there is not yet a national policy addressing the disproportionate mental health burden in rural areas (People's Republic of China Ministry of Health, 2012). Persistent shortages of qualified teachers, appropriate teaching materials, and community funding and support also contribute to this disparity (Liu, 2008). On a smaller scale, the effectiveness of various interventions aimed at fostering supportive family communication and peer acceptance shows that feasible paths toward improving LBC mental health exist (Li and Cai, 2012; Wang et al., 2014a; Wei et al., 2013).

However, cognizant that LBC share many of the same social determinants of health as their non-LBC peers in resource-limited environments, the scope of this mental health investigation was not solely limited to LBC but instead encompassed all rural adolescents. Given the diversity of home situations, the authors sought to identify a more reliable setting for preventive mental health programs. We hypothesized that schools would be potentially suitable environments, as there are nine years of compulsory education in China and the number of rural boarding students increases substantially past elementary school, making them key congregation sites (Shi et al., 2015). Therefore, for our pilot mental health program, we targeted the seventh grade, the first year of Chinese middle school and a critical period of academic and personal change for students. Moreover, both school mental health teachers and class head teachers (a head teacher is assigned to each class within a grade and is responsible for progress monitoring and general guidance for those students) serve as consistent adult presences in rural adolescents' lives, regardless of LBC status.

This study reports the baseline information gathered in preparation for a future mental health intervention. Its purpose was to characterize the symptom prevalence of three common mental health disorders—depression, generalized anxiety disorder, and suicidal ideation—among high-risk rural adolescents in China. Emphasis was placed on a comprehensive exploration of both home-related and school-related factors associated with student mental health.

2. Methods

2.1. Study design and population

This cross-sectional investigation was part of a larger intervention design that sought to evaluate an original mental health school curriculum from October 2017 to June 2018. The cross-sectional analysis presented here used only the baseline data collected for the intervention study. Results of the intervention will be presented separately.

This study was based on a cohort of seventh-grade students enrolled at four middle schools in a rural county in northeastern Hunan Province, China. The authors chose to focus on this age group as it was a critical time in their adolescent mental health development. Additionally, this region is known to have a sizeable proportion of LBC, making it a highly suitable location for examining mental health among this specific demographic. The four schools participating in the pilot intervention were selected from the 54 middle schools distributed across 12 school districts in the county. Two schools were randomly selected from each of the two districts with the highest concentration of LBC, to ensure sufficient numbers of LBC in the study population.

All seventh-grade students enrolled at the four schools were invited to participate in an anonymous, web-based, self-reported questionnaire between 10 October 2017 and 23 November 2017 during school hours. If a student was absent on the day his or her class was scheduled to complete the questionnaire, that student separately completed it during this period. No exclusion criteria were applied. A total of 1347 student responses across 30 seventh grade classes (ranging from 4 classes to 14 classes per school) were recorded.

2.2. Data collection

Private URLs to the web-based questionnaires were distributed to seventh-grade teachers in the participating schools. Students self-completed the anonymous questionnaires in their school computer lab during dedicated class time. The secure questionnaire could only be accessed through the correct URL address made available by the authors.

The self-designed questionnaire consisted of five components: (1) demographic information (including socioeconomic indicators); (2) family information; (3) questions about interpersonal relationships; (4) questions about health and communication behaviors; and (5) screening tools for depression, generalized anxiety disorder, and suicidal ideation symptoms.

The final socioeconomic status variable used in analysis was created by combining information collected through the questionnaire on house type and drinking water source, which were the only two socioeconomic indicators that were significantly associated with mental health disorders. The three house types (building complex, brick house, thatched hut) and six drinking water sources (tap, bottled, well, rain collection, spring water, surface water) were ranked from best to worst socioeconomic condition and assigned corresponding scores with "1" indicating lowest quality and "3" or "6" indicating highest, respectively. Participants were then categorized into three socioeconomic status levels (approximately equal thirds) based on the sum of these two scores—sums of 6 or below were classified as "low," 7 or 8 as "middle," and 9 as "high."

Family information included parental and primary caretaker profiles (i.e., age, education level, occupation) and variables associated with left-behind child status (i.e., LBC parental status, length of parental absence, frequency of parental visits, frequency of contact). The questions on interpersonal relationships collected information on the strength of relationships with parents, head teachers, and classmates; bullying; sources of social support; loneliness; and life satisfaction. Interpersonal relationship and life satisfaction variables were recorded on a ten-point scale from worst to best, and in final analysis they were each transformed into binary outcomes (good, bad) by dividing the numeric score at the median. Bullying was recorded as a binary yes/no and analyzed accordingly. Social support and loneliness variables were recorded on a five-tier scale (strongly disagree, disagree, neutral, agree, strongly agree) that was transformed into a binary outcome in analysis by grouping "strongly disagree" and "disagree" versus "neutral,"

"agree," and "strongly agree."

Health and communication behavior questions included self-assessments of stress, willingness to communicate about personal emotions, willingness to seek help from adult and peer sources, and willingness to help friends in need. Stress was likewise recorded on a five-tier scale and eventually transformed into a binary outcome (strongly disagree/disagree versus neutral/agree/strongly agree). Communication and help-seeking variables were recorded on a four-tier scale without a "neutral" choice and transformed into a binary outcome for analysis.

The Patient Health Questionnaire (PHQ-9) was used to screen for depression. It consists of nine items, each scored 0–3, for a total score range of 0–27. Based on the recommendation of the original scale developers (Kroenke et al., 2001), scores of 10 or higher indicated at least moderate depression and were considered positive depression screens for this study. The Mandarin-adapted version of the PHQ-9 has been validated for use among Chinese adolescents and was incorporated into our questionnaire. It has high internal consistency (Cronbach's alpha = 0.85), with a sensitivity of 93.33% and a specificity of 96.83% (AUC = 0.984) (Hu et al., 2014).

The Generalized Anxiety Disorder 7-item (GAD-7) scale was used to screen for generalized anxiety disorder. It consists of seven items, each scored 0–3, for a total score range of 0–21. Based on the recommendation of the original scale developers (Spitzer et al., 2006), scores of 10 or higher indicated at least moderate levels of GAD and were considered positive anxiety screens for this study. The Mandarin-adapted version of the GAD-7 has been validated for use among older Chinese adolescents and was included in our questionnaire. For our chosen score threshold of 10, it has high internal consistency (Cronbach's alpha = 0.85), with a sensitivity of 43% and a specificity of 91% (AUC = 0.72) (Lu, 2013).

To screen for suicidal ideation, the questionnaire posed a series of four binary questions about whether, over the previous month, the student had (1) seriously considered committing suicide, (2) made a plan to commit suicide, (3) prepared to commit suicide, or (4) attempted suicide. A response of "yes" to any of these questions was considered a positive screen for the presence of any suicidal ideation.

2.3. Statistical analysis

Subject characteristics are presented as number and percent for categorical variables or median and interquartile range (IQR) for continuous variables. Chi-squared tests were used to evaluate differences in the prevalence of mental health symptoms for several demographic and family factors. Univariate logistic regression to measure the association between mental health symptoms and explanatory variables was performed for all variables included on the questionnaire. Dummy variables were used to code for categorical questionnaire responses that were not transformed into binary outcomes for analysis. The multivariate model was built using stepwise regression with forward selection from the pool of variables that were univariately significant. Odds ratios (OR) are reported with their corresponding 95% confidence intervals (CI). *P*-values less than 0.05 were considered statistically significant. All analyses were performed with R statistical package (version 3.5.0, The R Foundation, USA).

2.4. Ethics

The Institutional Review Board of Xiangya School of Public Health, Central South University, approved this protocol (No. XYGW-2017-43). Parents or guardians of seventh-grade students enrolled in the four schools gave permission for minors to participate in this study, and students provided informed consent prior to beginning the anonymous, web-based questionnaire. Students could choose whether to answer the questions related to suicidal ideation symptoms on the questionnaire itself; they were required to answer all other questions if they consented to beginning the questionnaire. Parents and students were informed of their right to withdraw from participation at any time by informing a teacher. A debrief with school administrators and teachers was held, and schoolwide survey results were provided on demand.

Table 1
Study population characteristics.

Variable	N (%) or median (IQR)
Age (years)	12.5 (12.2–12.9)
Sex	
F	641 (47.6)
M	706 (52.4)
Socioeconomic status	
High	462 (34.3)
Middle	423 (31.4)
Low	462 (34.3)
Left-behind child?	
Y	492 (36.5)
Father away	244 (49.6)
Mother away	75 (15.2)
Both parents away	173 (35.2)
N	855 (63.5)
School year residence	
Dormitory	121 (9.0)
Own home	1082 (80.3)
Relative's house	40 (3.0)
Other	104 (7.7)
Primary caretaker	
Parent	1128 (83.7)
Grandparent	131 (9.7)
Other	88 (6.5)

3. Results

3.1. Characteristics of study population

The study population consisted of 1347 seventh grade students across four schools. Slightly more than half of the students were male (52.4%). There were 492 (36.5%) LBC, of which 49.6% had an absent father, 15.2% an absent mother, and 35.2% absent parents. The majority of students (80.3%) lived in their own homes during the school year, and 83.7% listed parents as their primary caretaker versus grandparents (9.7%) or other adults (6.5%). Approximately one-third of the students was classified as high (34.3%), middle (31.4%), or low (34.3%) socioeconomic status (Table 1).

3.2. Mental health

Overall, the prevalence of depression symptoms was 18.1%, the prevalence of GAD symptoms was 14.4%, and the prevalence of any suicidal ideation symptoms was 10.1% (Table 1). The raw scores for symptom prevalence among LBC were greater than those among non-LBC for all three mental health disorders above the "minimal" threshold (Table 2). The difference in raw depression symptom rates between LBC and non-LBC was statistically significant ($\chi^2 = 48.8$, DF = 28, $p = 0.0089$).

The prevalence of depression symptoms by LBC parental status (i.e. father absent, mother absent, both parents absent, no parents absent) was significantly different ($\chi^2 = 21.6$, DF = 3, $p < 0.001$), but not for GAD or suicidal ideation. Other information on the distribution of mental health symptoms by population characteristic is summarized in Table 3. The difference in depression symptom prevalence by school year residence ($\chi^2 = 9.3$, DF = 3, $p = 0.026$) and primary caretaker ($\chi^2 = 6.1$, DF = 2, $p = 0.047$) was statistically significant. Additionally, there was a significant difference in the rates of suicidal ideation symptoms between male and female students ($\chi^2 = 6.4$, DF = 2, $p = 0.041$). There was no significant difference in rates of any mental health symptom based on socioeconomic status.

Table 2
Prevalence of mental health symptoms and screening raw scores by population group.

	Total (%) $N = 1347$	LBC (%) $N = 492$	Non-LBC (%) $N = 855$
PHQ-9 score[a]			
0–4 (Minimal)	782 (58.1)	254 (51.6)	528 (61.8)
5–9 (Mild)	321 (23.8)	119 (24.2)	202 (23.6)
10–14 (Moderate)	154 (11.4)	74 (15.0)	80 (9.4)
15–19 (Moderately severe)	64 (4.8)	26 (5.3)	38 (4.4)
20+ (Severe)	26 (1.9)	19 (3.9)	7 (0.8)
GAD-7 score			
0–4 (Minimal)	849 (63.0)	292 (59.3)	557 (65.1)
5–9 (Mild)	302 (22.6)	118 (24.0)	186 (21.8)
10–14 (Moderate)	134 (9.9)	50 (10.2)	84 (9.8)
15+ (Severe)	60 (4.5)	32 (6.5)	28 (3.3)
Suicidal ideation total score			
0	1062 (78.8)	384 (78.0)	678 (79.3)
1	81 (6.0)	30 (6.1)	51 (6.0)
2	29 (2.0)	12 (2.4)	17 (2.0)
3	10 (0.7)	5 (1.0)	5 (0.6)
4	16 (1.2)	7 (1.4)	9 (1.1)
No response	149 (11.1)	54 (11.0)	95 (11.1)
Prevalence of mental health symptoms			
Depression[a]	244 (18.1)	119 (24.2)	125 (14.6)
Generalized anxiety disorder	194 (14.4)	82 (16.7)	112 (13.1)
Any suicidal ideation	136 (10.1)	54 (11.0)	82 (9.6)

[a] Chi-squared test significant at $p < 0.05$ comparing LBC versus non-LBC.

Table 3
Summary of student mental health.

	Depression (%)	Generalized anxiety disorder (%)	Any suicidal ideation (%)
Total ($N = 1347$)	244 (18.1)	194 (14.4)	136 (10.1)
Sex[a]			
Females	117 (18.3)	101 (15.8)	76 (11.9)
Males	127 (18.0)	93 (13.2)	60 (8.5)
Socioeconomic status			
High	75 (16.2)	67 (14.5)	45 (7.0)
Middle	80 (18.9)	63 (14.9)	50 (11.8)
Low	89 (19.3)	64 (13.9)	41 (8.9)
Left-behind child?[b]			
Father away	60 (24.6)	43 (17.6)	23 (9.4)
Mother away	22 (29.3)	13 (17.3)	10 (13.3)
Both parents away	37 (21.4)	26 (15.0)	21 (12.1)
No	125 (14.6)	112 (13.1)	82 (9.6)
School year residence[b]			
Dormitory	34 (28.1)	27 (22.3)	15 (12.4)
Own home	183 (16.9)	146 (13.5)	102 (9.4)
Relative's house	7 (17.5)	6 (15.0)	4 (10.0)
Other	20 (19.2)	15 (14.4)	15 (14.4)
Primary caretaker[b]			
Parent	196 (17.4)	161 (14.3)	109 (9.7)
Grandparent	34 (26.0)	19 (14.5)	17 (13.0)
Other	14 (15.9)	14 (15.9)	10 (11.4)

[a] Chi-squared test significant at $p < 0.05$ for any suicidal ideation.
[b] Chi-squared test significant at $p < 0.05$ for depression.

3.3. Factors associated with mental health symptoms

3.3.1. Among the full cohort

Multivariate logistic regression was used to analyze the relationship between screening positive for mental health disorder symptoms and various family and behavioral factors (Table 4). Ten variables were significantly associated with depression symptoms. Being a LBC, experiencing bullying, loneliness, feeling stressed at home, feeling stressed at school, and feeling stressed from schoolwork were all independent risk factors for depression. Availability of adult social support, good life satisfaction, and student willingness to support suicidal friends were protective factors. Lack of a mental health teacher as a school resource was also associated with decreased likelihood of depression symptoms compared to student unwillingness to seek help from a mental health teacher when available.

Nine variables were significantly associated with GAD symptoms. Experiencing bullying, loneliness, feeling stressed at home, and feeling stressed at school were identified as risk factors. Having a father with a middle or high school education (versus elementary school or below), good life satisfaction, willingness to seek help from parents, willingness to support troubled friends, and willingness to support suicidal friends were all protective.

Seven variables were significantly associated with the presence of any suicidal ideation symptoms among students. Experiencing bullying and loneliness were independent risk factors, while a good relationship with one's father, availability of adult social support, good life satisfaction, willingness to seek help from the head teacher, and willingness to seek help from parents were protective.

3.3.2. Among left-behind children only

Multivariate logistic regression was also used to investigate relationships between mental health disorder symptoms and potential predictors for the cohort subset of LBC (Table 5). There were nine variables significantly associated with depression symptoms. Low socioeconomic status, being bullied, loneliness, feeling stressed at home, and feeling stressed at school were risk factors. A good relationship with one's mother, availability of adult social support, and good life satisfaction were protective. Lack of a school mental health teacher was also associated with decreased likelihood of depression symptoms compared to student unwillingness to seek help from a mental health teacher when available.

Seven variables were associated with GAD symptoms among LBC. The risk factors were experiencing bullying, feeling stressed at home, and feeling stressed at school. Protective factors included having a father with an education beyond elementary school, availability of adult social support, good life satisfaction, and willingness to support troubled friends.

Two variables were associated with suicidal ideation symptoms among LBC. While good life satisfaction was protective, loneliness was a risk factor.

None of the LBC-specific variables (LBC parental status, length of father's absence, length of mother's absence, frequency of father's home visits, frequency of mother's home visits) were found to be significantly associated with any mental health symptoms among LBC.

4. Discussion

The overall picture of rural adolescent mental health in China painted by this study supports what has been documented in the literature. The symptom prevalence of depression (18.1%) was comparable to previously-reported prevalence among this population (12.1%−51.4%) (Cheng and Sun, 2015; Li and Cai, 2012). Broken down further, the LBC (24.2%) and non-LBC (14.6%) depression symptom rates were again approximately the same as the rates from separate surveys (14.2%−36.8% among LBC, 12.6%−20.8% among non-LBC) (Guo and Huang, 2011; Shen et al., 2015). Despite the variety of depression measurement scales, most studies also find a significant difference in depression rates between LBC and non-LBC (Fan et al., 2011).

The prevalence of anxiety symptoms in our population (14.4%) fell within the existing range of prevalence (13.2%−57.6%) (Cheng and Sun, 2015), and the difference in rates between LBC and non-LBC in an existing study was not statistically significant either (Shen et al., 2015). Given this agreement, the PHQ-9 and GAD-7 screening scales used in our study appear to be appropriate substitutes for the more in-depth mental health scales selected by other authors. In future investigations that prioritize efficiency, it may therefore make sense to obtain baseline data via the PHQ-9 and GAD-7, as these tools simplify the mental health

Table 4
Risk factors for mental health symptoms among the full cohort.

Variables[a,b]	Depression				Generalized anxiety disorder				Suicidal ideation			
	Univariate		Multivariate		Univariate		Multivariate		Univariate		Multivariate	
	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Family												
Left-behind child	1.86 (1.41–2.47)	<0.0001*	1.84 (1.32–2.57)	0.0003*	1.33 (0.97–1.81)	0.0732			1.16 (0.80–1.67)	0.4190		
Good relationship with father	0.42 (0.31–0.56)	<0.0001*	0.73 (0.51–1.04)	0.0809	0.48 (0.35–0.65)	<0.0001*			0.32 (0.21–0.47)	<0.0001*	0.53 (0.34–0.82)	0.0046*
Good relationship with mother	0.45 (0.34–0.59)	<0.0001*			0.48 (0.35–0.65)	<0.0001*			0.39 (0.27–0.56)	<0.0001*		
Father's highest education level												
Elementary or less	1.00				1.00		1.00		1.00			
Middle/high school	0.68 (0.45–1.04)	0.0701			0.47 (0.31–0.73)	0.0005*	0.50 (0.30–0.81)	0.0055*	0.76 (0.46–1.32)	0.3070		
College or above	0.51 (0.25–0.99)	0.0514			0.36 (0.17–0.72)	0.0058*	0.51 (0.22–1.21)	0.1262	0.64 (0.27–1.44)	0.2990		
Not sure	0.82 (0.51–1.34)	0.4257			0.46 (0.27–0.78)	0.0036*	0.46 (0.25–0.83)	0.0099*	0.62 (0.32–1.18)	0.1420		
Interpersonal relationships												
Bullied	3.00 (2.24–4.01)	<0.0001*	1.97 (1.40–2.77)	0.0001*	3.18 (2.32–4.35)	<0.0001*	2.00 (1.40–2.87)	0.0001*	3.06 (2.12–4.41)	<0.0001*	2.15 (1.44–3.20)	0.0002*
Feel lonely	6.64 (4.81–9.20)	<0.0001*	2.23 (1.51–3.30)	<0.0001*	5.18 (3.68–7.28)	<0.0001*	1.75 (1.16–2.64)	0.0074*	5.62 (3.81–8.29)	<0.0001*	2.57 (1.65–3.99)	<0.0001*
Available social support from adults	0.25 (0.18–0.35)	<0.0001*	0.62 (0.40–0.96)	0.0303*	0.28 (0.19–0.40)	<0.0001*			0.26 (0.17–0.40)	<0.0001*	0.61 (0.38–1.00)	0.0478*
Available social support from friends	0.29 (0.20–0.42)	<0.0001*			0.29 (0.20–0.44)	<0.0001*			0.30 (0.19–0.47)	<0.0001*		
Good life satisfaction	0.25 (0.19–0.33)	<0.0001*	0.51 (0.36–0.73)	0.0002*	0.28 (0.20–0.38)	<0.0001*	0.52 (0.36–0.74)	0.0004*	0.29 (0.20–0.42)	<0.0001*	0.63 (0.41–0.96)	0.0317*
Health behaviors												
Stress at home	5.72 (4.17–7.86)	<0.0001*	2.52 (1.73–3.67)	<0.0001*	4.74 (3.39–6.62)	<0.0001*	2.05 (1.38–3.06)	0.0004*	2.92 (1.95–4.31)	<0.0001*		
Stress at school	5.07 (3.79–6.80)	<0.0001*	1.90 (1.30–2.78)	0.0009*	4.53 (3.31–6.23)	<0.0001*	1.82 (1.21–2.75)	0.0042*	2.20 (1.52–3.16)	<0.0001*		
Stress from schoolwork	4.62 (3.45–6.22)	<0.0001*	1.62 (1.11–2.36)	0.0129*	3.93 (2.87–5.43)	<0.0001*	1.39 (0.92–2.11)	0.1162	2.64 (1.84–3.81)	<0.0001*		
Willing to communicate feelings	0.40 (0.29–0.54)	<0.0001*	0.76 (0.53–1.10)	0.1527	0.44 (0.31–0.62)	<0.0001*			0.74 (0.51–1.07)	0.1160		
Willing to seek help from friends	0.37 (0.28–0.50)	<0.0001*			0.37 (0.27–0.50)	<0.0001*			0.34 (0.24–0.50)	<0.0001*		
Willing to seek help from head teacher	0.42 (0.32–0.56)	<0.0001*			0.39 (0.29–0.54)	<0.0001*			0.25 (0.17–0.37)	<0.0001*	0.51 (0.33–0.80)	0.0034*
Willing to seek help from parents	0.30 (0.22–0.40)	<0.0001*	0.73 (0.51–1.05)	0.0926	0.26 (0.19–0.36)	<0.0001*	0.50 (0.35–0.72)	0.0002*	0.23 (0.16–0.33)	<0.0001*	0.57 (0.37–0.88)	0.0116*
Willing to support troubled friends	0.33 (0.22–0.49)	<0.0001*			0.24 (0.16–0.36)	<0.0001*	0.58 (0.34–0.99)	0.0478*	0.45 (0.28–0.75)	0.0015*		
Willing to support suicidal friends	0.28 (0.18–0.43)	<0.0001*	0.58 (0.33–1.00)	0.0492*	0.20 (0.13–0.31)	<0.0001*	0.46 (0.25–0.85)	0.0129*	0.41 (0.24–0.73)	0.0015*		
Willing to seek help from mental health teacher												
No	1.00				1.00				1.00			
Yes	0.48 (0.36–0.65)	<0.0001*	0.97 (0.67–1.41)	0.8859	0.43 (0.30–0.59)	<0.0001*			0.46 (0.31–0.68)	<0.0001*		
No mental health teacher available	0.46 (0.29–0.71)	0.0008*	0.47 (0.27–0.83)	0.0097*	0.69 (0.43–1.07)	0.1030			0.72 (0.41–1.22)	0.2400		

[a] The following variables (not shown) were also included in univariate analysis but did not test significant at $p < 0.05$: sex, age, socioeconomic status, number of bedrooms in home.

[b] The following variables (not shown) tested significant at $p < 0.05$ in univariate analysis but were not selected by stepwise regression for inclusion in multivariate analysis: school year residence, primary caretaker, mother's highest education level, primary caretaker's highest education level, relationship with classmates, relationship with head teacher, number of good friends.

* Indicates the variable was statistically significant at $p < 0.05$.

Table 5
Risk factors for mental health symptoms among left-behind children.

Variables[a,b]	Depression				Generalized anxiety disorder				Suicidal ideation			
	Univariate OR (95% CI)	*P*-value	Multivariate OR (95% CI)	*P*-value	Univariate OR (95% CI)	*P*-value	Multivariate OR (95% CI)	*P*-value	Univariate OR (95% CI)	*P*-value	Multivariate OR (95% CI)	*P*-value
Socioeconomic status												
High	1.00		1.00		1.00				1.00			
Middle	1.28 (0.75–2.19)	0.3638	1.25 (0.64–2.45)	0.5171	1.49 (0.83–2.70)	0.1860			1.58 (0.79–3.22)	0.1970		
Low	1.66 (1.01–2.77)	0.0475*	1.98 (1.05–3.74)	0.0354*	1.16 (0.64–2.11)	0.6260			1.05 (0.51–2.17)	0.9010		
Family												
Good relationship with father	0.35 (0.22–0.59)	<0.0001*			0.30 (0.18–0.52)	<0.0001*			0.29 (0.15–0.53)	0.0001*		
Good relationship with mother	0.22 (0.13–0.38)	<0.0001*	0.52 (0.31–0.88)	0.0149*	0.21 (0.12–0.37)	<0.0001*			0.28 (0.15–0.51)	<0.0001*	0.55 (0.27–1.11)	0.0946
Father's highest education level												
Elementary or less	1.00				1.00		1.00		1.00			
Middle/high school	1.08 (0.55–2.32)	0.8242			0.47 (0.24–0.97)	0.0337*	0.38 (0.17–0.87)	0.0228*	1.28 (0.51–3.88)	0.6270		
College or above	1.01 (0.28–3.23)	0.9868			0.40 (0.08–1.39)	0.1825	0.17 (0.03–0.99)	0.0487*	1.55 (0.29–7.06)	0.5750		
Not sure	1.51 (0.71–3.43)	0.3022			0.52 (0.24–1.17)	0.1103	0.39 (0.15–1.03)	0.0586	1.18 (0.40–3.94)	0.7710		
Interpersonal relationships												
Bullied	2.41 (1.56–3.71)	<0.0001*	1.89 (1.12–3.18)	0.0170*	2.67 (1.64–4.35)	<0.0001*	1.91 (1.07–3.42)	0.0289*	2.94 (1.64–5.27)	0.0003*	1.67 (0.87–3.22)	0.1260
Feel lonely	5.52 (3.40–9.01)	<0.0001*	1.85 (1.00–3.43)	0.0496*	5.42 (3.22–9.14)	<0.0001*			7.75 (4.21–14.40)	<0.0001*	3.58 (1.79–7.13)	0.0003*
Available social support from adults	0.23 (0.13–0.39)	<0.0001*	0.43 (0.22–0.84)	0.0138*	0.19 (0.11–0.34)	<0.0001*	0.39 (0.19–0.80)	0.0107*	0.23 (0.12–0.44)	<0.0001*		
Available social support from friends	0.29 (0.17–0.50)	<0.0001*			0.23 (0.13–0.40)	<0.0001*	0.59 (0.29–1.18)	0.1352	0.56 (0.28–1.20)	0.1170		
Good life satisfaction	0.19 (0.11–0.30)	<0.0001*	0.49 (0.29–0.83)	0.0087*	0.12 (0.07–0.20)	<0.0001*	0.38 (0.21–0.69)	0.0014*	0.21 (0.11–0.40)	<0.0001*	0.39 (0.19–0.81)	0.0111*
Health behaviors												
Stress at home	5.36 (3.26–8.88)	<0.0001*	2.72 (1.48–5.00)	0.0013*	6.04 (3.55–10.31)	<0.0001*	3.62 (1.92–6.82)	<0.0001*	3.84 (2.03–7.15)	<0.0001*		
Stress at school	5.01 (3.24–7.81)	<0.0001*	2.63 (1.50–4.59)	0.0007*	4.48 (2.74–7.42)	<0.0001*	2.15 (1.20–3.88)	0.0106*	2.23 (1.24–3.98)	0.0066*		
Stress from schoolwork	4.07 (2.65–6.32)	<0.0001*	1.53 (0.88–2.68)	0.1329	3.05 (1.88–5.00)	<0.0001*			2.28 (1.28–4.09)	0.0051*		
Willing to communicate feelings	0.61 (0.39–0.95)	0.0130*			0.44 (0.25–0.75)	0.0033*			0.80 (0.43–1.44)	0.4610		
Willing to seek help from friends	0.40 (0.26–0.62)	<0.0001*			0.37 (0.23–0.60)	<0.0001*			0.30 (0.16–0.53)	<0.0001*		
Willing to seek help from head teacher	0.52 (0.34–0.79)	0.0023*			0.41 (0.25–0.67)	0.0004*			0.25 (0.13–0.46)	<0.0001*	0.55 (0.26–1.15)	0.1133
Willing to seek help from parents	0.36 (0.23–0.55)	<0.0001*			0.40 (0.19–0.80)	0.0115*	0.60 (0.33–1.08)	0.0874	0.19 (0.10–0.34)	<0.0001*	0.49 (0.24–1.03)	0.0596
Willing to support troubled friends	0.32 (0.18–0.55)	<0.0001*			0.22 (0.12–0.39)	<0.0001*	0.39 (0.19–0.79)	0.0089*	0.51 (0.25–1.10)	0.0684		
Willing to support suicidal friends	0.33 (0.17–0.64)	0.0009*			0.27 (0.14–0.54)	0.0001*			0.31 (0.14–0.71)	0.0036*		
Willing to seek help from mental health teacher												
No	1.00				1.00				1.00			
Yes	0.56 (0.36–0.87)	0.0099*	1.09 (0.64–1.87)	0.7486	0.40 (0.23–0.66)	0.0006*			0.47 (0.25–0.86)	0.0160*		
No mental health teacher available	0.40 (0.18–0.81)	0.0157*	0.35 (0.13–0.94)	0.0376*	0.67 (0.31–1.35)	0.2804			0.60 (0.22–1.45)	0.2910		

[a] The following variables (not shown) were also included in univariate analysis but did not test significant at $p < 0.05$: sex, age, number of bedrooms in home, school year residence, primary caretaker, left-behind parental status, length of father's absence, length of mother's absence, frequency of father's visits, frequency of mother's visits, mother's highest education level.

[b] The following variables (not shown) tested significant at $p < 0.05$ in univariate analysis but were not selected by stepwise regression for inclusion in multivariate analysis: primary caretaker's highest education level, relationship with classmates, relationship with head teacher, number of good friends.

* Indicates the variable was statistically significant at $p < 0.05$.

screening process with no discernible loss of accuracy. The overall prevalence of suicidal ideation symptoms from this study (10.1%, 11.0% among LBC, 9.6% among non-LBC) was also similar to the prevalence found among rural middle school students elsewhere in China (8.64%, 9.80% among LBC, 7.03% among non-LBC) (Chen et al., 2013).

The comprehensive nature of our questionnaire allowed consideration of a broader range of factors potentially influential on rural adolescent mental health. The variables explored in this study can be generally categorized as home-related or school-related. Home-related variables (e.g., family profiles, demographics) have been more commonly explored in the literature as determinants of mental health among rural students in China (Wang et al., 2014; Wang, 2011; Li and Tao, 2009; Lin et al., 2010; Yang et al., 2011). For example, our results indicate that LBC are 84% more likely than non-LBC to screen positive for depression. This agrees with existing research and theory in China (Yan and Chen, 2013; Yang et al., 2011). However, while other studies have found LBC status to also be a risk factor for significantly higher symptom rates of anxiety and suicidal ideation, our data showed no difference (Wang et al., 2014; Li and Tao, 2009; Lin et al., 2010).

Children of middle or high school-educated fathers fared better with anxiety symptoms than their peers with less educated fathers, suggesting that students' perceptions of employment prospects for their parent are influential, independently of the family's actual socioeconomic status. Parental relationships were critical, as students with better relationships with their fathers had decreased odds of suicidal ideation symptoms, while students who were willing to seek help from their parents exhibited lower symptom levels of both anxiety and suicidal ideation. Stress stemming from the home was associated with depression and GAD symptoms. Importantly, loneliness and life satisfaction were significant determinants of all mental health symptoms.

Though factors outside the home are rarely assessed in cross-sectional studies of rural student mental health, our investigation shows that these variables play major roles in outcomes. Interestingly, the odds of depression symptoms were 53% lower among students who did not have a mental health teacher than students who had such a teacher but were unwilling to ask them for help. In other words, unwillingness to seek help was a more serious obstacle than resource availability. Coupled with the result that willingness to ask their head teacher for help was associated with a 49% decrease in odds of suicidal ideation, school teachers are key figures in student mental health. Stress from schoolwork was linked to depression symptoms, while general stress in the school environment was associated with both depression and anxiety symptoms.

Interpersonal relationships were important determinants of mental health as well. Students who were willing to support troubled friends had decreased odds of GAD symptoms, and students who were supportive of suicidal friends had decreased symptom odds of both depression and anxiety. It is possible that these students who were willing to be a peer support system had this support system to draw on in return. Additionally, students who reported that social support from adults was available demonstrated a nearly 40% decrease in depression and suicidal ideation symptoms. Bullying was associated with increased odds of all mental health symptoms.

Among LBC only, home-related variables such as low socioeconomic status and a poor mother-child relationship were symptom risk factors for depression, reaffirming the unique family pressures faced by LBC. Having a better educated father was again associated with decreased odds of anxiety symptoms. Experiencing stress at home was related to both depression and GAD symptoms. While loneliness increased the symptom odds of depression and suicidal ideation but not anxiety, good life satisfaction was protective against all three. The recurring significance of these two measures highlights the significance of emotional fulfillment. Despite previous reports to the contrary, sex was not a determinant of mental health in our study (Guo and Huang, 2011; Wang et al., 2014; Wang, 2011).

Most surprisingly, none of the LBC-specific variables investigated were significantly associated with a positive mental health disorder screen. While there has been no consensus on how LBC parental status (i.e., which parent is absent) affects children's mental health (Lu et al., 2014; Wang et al., 2014; Yang et al., 2013), some studies have documented that an absent mother was equivalent to absent parents and produced worse outcomes than an absent father (Wang, 2011). Another study controversially found that having one absent parent was better than being non-LBC (Fan et al., 2011), possibly due to increased resilience from separation (Jiang et al., 2013). Our results demonstrate no effect on mental health related to LBC parental status. The identity of LBC's primary caretaker was also not found to be significant, though Wang et al. previously determined that single parent caretakers were preferable to grandparents, who were preferable to other relatives (Wang et al., 2014). Length of the migrant parent's absence and frequency of parental visits were not significant determinants either, contrary to our expectations from the literature (Lu et al., 2014).

LBC mental health was influenced by factors outside the home similar to the ones associated with the full cohort. Students who did not have a school mental health teacher were again less likely to screen positive for depression symptoms than students who refused to seek help from this teacher when available. A willingness to comfort troubled friends was associated with decreased odds of GAD symptoms. Stress at school and bullying were symptom risk factors for the three mental health disorders, while the availability of adult social support was protective against all of them.

On account of the unique family situation of LBC, many efforts to address their documented mental health troubles have focused on improving family dynamics (Wang et al., 2014; Wei et al., 2013; Feng 2014). Family interventions, such as the one implemented by Wang et al., that promote more frequent communication with and understanding between LBC and their parents have been successful (Wang et al., 2014). Our results confirming the significance of good parental relationships and loneliness to the mental health of both LBC and non-LBC rural students support such programs. However, our results also indicate that home variables are not the only ones that affect adolescent mental health.

There is abundant evidence from this study that factors outside the home are strong determinants of student mental health. Indeed, the inclusion of non-home factors in our questionnaire that explained more variability in the odds of mental health symptoms may be the reason that none of the LBC-specific home variables were statistically significant. School-related variables, such as stress from sources outside the home (school and schoolwork) and willingness to seek help from teachers, were commonly associated with mental health outcomes. Interpersonal relationships were also key. Since both positive (friends, adults) and negative (bullying) relationships are typically present at school in the form of peers and teachers, we propose schools as suitable environments for mental health promotion interventions.

We do not go so far as to recommend increasing the number of boarding schools, as Cheng suggested (Cheng, 2008), since school year residence was not a significant determinant of mental health in our study. Rather, while mental health problems cannot be solved by exclusively transplanting children to schools, we believe that schools do have enormous potential as arenas of change. Family and community programs can be difficult to implement given the challenge of addressing diverse home situations, especially for LBC. The great benefit of school-based mental health interventions is that all students, both LBC and non-LBC, reliably inhabit this setting most days throughout the year. The consistency of such an environment that also contains peers and adults who can be leveraged for mental health promotion is an asset for rural adolescents. Other authors have previously made this same recommendation (Wang et al., 2014b; Cheng, 2008; Bai, 2013), but to the best of our knowledge, this study is the first to directly support this conclusion with school-based data.

There are several limitations to our work. First, because the Mandarin-adapted version of the GAD-7 has a higher specificity (91%)

than sensitivity (43%) for the chosen score threshold of 10, there is greater risk for false negatives in the GAD screen. The true positive screening rate for GAD may therefore be higher than what is reported here. The score threshold of 10 was chosen based on the recommendation of the original developers of the scale (Spitzer et al., 2006). In addition, our investigation focuses on symptoms for three specific mental health disorders rather than gauging a broader panel of psychological symptoms. Because these results reflect the baseline data collected in preparation for an intervention study, the overall design emphasis was on evaluating the effectiveness of the intervention rather than on cataloguing the various mental health problems present among students. Therefore, we used simple and proven screening scales instead of more detailed assessment tools such as the SCL-90. Finally, the geographic scope of our population was restricted to a workable size for the intervention pilot study. These results consequently may not be reflective of all rural adolescents in China.

5. Conclusions

Despite these limitations, we present a comprehensive cross-sectional study of both home and external factors associated with mental health symptoms among a high-risk cohort of students. Schools may be ideal sites for future rural mental health promotion programs in China.

Ethics approval and consent to participate

The Institutional Review Board of Xiangya School of Public Health, Central South University, approved this protocol (No. XYGW-2017-43). Parents or guardians of seventh-grade students enrolled in the four schools gave permission for minors to participate in this study, and students provided informed consent prior to beginning the anonymous, web-based questionnaire.

Consent for publication

Not applicable.

Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

JW and JZ contributed equally as co-first authors. JW and QL conceptualized the study and decided on methodology with the additional help of MH. JW, JZ, JL, HL, QY, YO, MH, and QL carried out the investigation using resources provided by JZ, JL, HL, QY, YO, and QL. JW and JZ performed formal analysis. JW, MH, and QL prepared and revised manuscript drafts. All authors read and approved the final manuscript.

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Authors' information

JW completed this study while working as a Fulbright U.S. Student research grant recipient under the guidance of QL. JW completed her undergraduate degree at Yale University and is a current first-year M.D. candidate at Harvard Medical School.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.03.004.

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