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A Potential Vicious Cycle between School Refusal and Depression among Chinese Adolescents: A Cross-Lagged Panel Model Analysis

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ABSTRACT: Background: Adolescent depression and school refusal (SR) are prevalent and important global concerns that need to be understood and addressed. Cross-sectional associations have been reported but prospective relationships between them remain unclear. This longitudinal study investigated the bidirectional relationships between these two problems among Chinese adolescents. **Methods:** A longitudinal study was conducted in Taizhou, China, surveying students of three junior high schools, three senior high schools, and one vocational high school. A total of 3882 students completed the questionnaire at baseline (T1); 3167 of them completed an identical follow-up questionnaire after 6 months (T2). Depression was assessed via the Patient Health Questionnaire (PHQ-9) and SR via the modified Chinese version of The School Refusal Assessment Scale-Revised (SRAS-R). Cross-lagged panel modeling (CLPM) analysis was conducted to test the reciprocal relationships, adjusting for socio-demographic factors. Multiple group analysis was conducted to test whether the CLPM differed by gender and grade. **Results:** Statistically significant bidirectional relationships were found. A higher level of SR assessed at T1 is prospectively associated with a higher level of depression at T2 ($\beta = 0.07, p = 0.006$); a higher level of depression at T1 also is prospectively associated with a higher level of SR at T2 ($\beta = 0.14, p < 0.001$). Such models differed significantly by neither gender nor grade. **Conclusion:** SR and depression should be seen as each other's mutually reinforcing association. The bidirectional relationships potentially result in a vicious cycle. Early interventions may target both problems concurrently. Future studies may involve more time points and test some mediators.

KEYWORDS: Adolescent depression; school refusal; cross-lagged panel model; bidirectional effects; Chinese adolescents



1 Introduction

Globally, mental disorders accounted for 31.1 million of the 153.6 million years lived with disabilities (YLDs) [1]. Depression, anxiety and behavioral disorders are among the leading causes of adolescent illness and disability [2]. According to the World Health Organization key facts, one in seven of the 10–19-year-olds experiences a mental disorder, accounting for 13% of the global burden of disease in this age group. The prevalence of lifetime prevalence of depression was between 11% and 14% among American adolescents aged 15 to 18 [3,4], and was 24.6% among Chinese adolescents according to a meta-analysis and 28.4% according to a national report [5,6]. Depression is prospectively associated with suicidal acts among adolescents and untreated adolescent depression may persist into adulthood [7]. School refusal (SR) is closely related to adolescent depression [8,9] but is it a cause or a consequence or both? This study investigated this interesting and implicative research question.

SR and absenteeism are related but unidentical constructs. Absenteeism refers to the habitual pattern of total absences from schools [8]. SR involves a wider scope and refers to intention and behaviors related to difficulties attending classes or remaining in school for the entire day [10], tardiness, skipped classes, morning misbehaviors to miss school, and school attendance with reluctance [11]. SR often involves strong negative emotions [12]. Also, students may use SR to fulfill specific socio-emotional functions that are not considered in absenteeism. According to the Functional Behavioral Model [10], SR is maintained by four primary reinforcement avoidance/reward-related functions: avoidance of negative affectivity, escape from aversive social-evaluative situations, attention-seeking, and pursuit of tangible rewards. A validation study conducted in Chinese adolescents modified them into five dimensions (i.e., avoiding negative emotions at school, pursuit of reinforcement outside school, frequent absenteeism to reduce psychosocial problems, conditions that would increase motivation to go to school, and preference to stay with family over going to school) [9]. Such functions or ‘reasons’ of SR are informative in understanding the causes or consequences of depression. For instance, the SR function of avoiding negative emotions and reduction of psychosocial problems may imply unpleasant experiences at school, which are expected to be associated with depression. The push factors (e.g., reinforcement outside of the school or staying with family or low reinforcement at school) may reflect unrewarding school experiences (e.g., boredom and frustrations) that may be associated with depression. González et al. [13] found differential effects between specific function and depression—adolescents reporting avoidance-based SR functions reported significantly higher depression than others. The study hence allows testing the relative strengths of the bidirectional associations between specific SR functions and depression. Thus, by utilizing the validated multidimensional scale of SR (SRAS-R) [9], this study moved beyond using generic absenteeism metrics to investigate whether depression and specific SR functions affect each other reciprocally. Knowledge of such relationships with depression would facilitate design of interventions.

The prevalence of SR ranged from 28% to 35% in the children and adolescents in the U.S. and at global level [14,15] and was 22.5% to 30% in various parts of China [16]. According to Havik and Ingul [12], school refusers are more likely than others to develop internalizing symptoms and mental health problems (e.g., anxiety and depression). Our literature found over a dozen cross-sectional studies reporting associations between SR and depression conducted in countries such as China [9,17,18], Ecuador [13,19], Germany [20], Netherland [21], U.S. [22–24], Britain [25], Sweden [26,27] and Turkey [28]. To our knowledge, however, no longitudinal studies have looked at the causal relationships from depression to SR and from SR to depression, although two longitudinal studies investigated the casual directions between absenteeism and adolescent depression in the U.S. [29,30]. In the first study, a cross-lagged panel analysis found bidirectional relationships between absenteeism and depression [29]. In the second study, level of depression at the spring term of the fifth grade was significantly correlated with absenteeism at the fall term of the sixth grade [30].

There are cultural differences and more studies are needed. As mentioned, absenteeism and SR are not equivalent. It is hence warranted to clarify the causal relationships between SR functions and depression among Chinese adolescents.

Another novel feature of this study was investigating moderations of the potential reciprocal relationships between SR and depression. Literature has found moderations between risk factors and depression by gender and school grade [31,32]. It is known that prevalence of depression and level of academic stress are higher among females [33,34] than males and increase with age [31,32] and both SR and depression are related to emotion regulation/coping [35]. Depression-related experiences are stressors, and stressors may induce maladaptive coping and maladaptive emotion regulation that may lead SR. Conversely, SR are often emotion driven [10,19] and such negative emotions increase the risk of depression. As previous studies found that females and higher school grade students were more likely than their counterparts to adopt maladaptive emotion regulation such as rumination [36], there are reasons to believe that the bidirectional relationships between SR and depression would be stronger among females and higher grade students than those among males and lower grade students. Possibly for the first time, such moderation hypotheses were tested in this study.

This longitudinal study investigated prevalence of depression and level of SR functions at two time points six months apart among secondary school students in a southeastern Chinese city. Its cross-lagged panel analysis investigated the prospective reciprocal relationships between the level of depression and SR. First, it was hypothesized that a higher level of depressive symptoms at Time 1 (T1) is prospectively associated with a higher level of SR at Time 2 (T2). Second, it was hypothesized that a higher level of SR at T1 would be prospectively associated with a higher level of depressive symptoms at T2. Multiple group analysis was also conducted to investigate whether the cross-lagged panel model differed significantly by gender and across school grades. It is hypothesized that relationships between SR and depression would be stronger in the group of females than males and in the group students of higher grades than lower grades.

2 Methods

2.1 Participants and Data Collection

A 2-wave longitudinal survey was conducted in seven schools from March 2022 to September 2022 located in Taizhou city, Zhejiang Province, China. All grades 1 and 2 students of three junior middle schools, all grade 2 students of three senior high schools, and all grade 1 students of a vocational high school were invited to join the study. In the classroom, the fieldworkers provided a brief explanation of the purpose of the study to the students and informed them that the return of the completed questionnaire implied informed consent to participate in the study. The participants were reminded that they could quit anytime without bearing negative consequences. This information was also printed on the cover page of the questionnaire. They then self-administered the structured questionnaire in the absence of teachers. Furthermore, parents were notified about the study and given the option to decline their child's participation by sending a note to the teachers, in which case the child would not be invited to participate in the study. Such a procedure has been used in other studies [37]. No incentives were provided to the participants. The questionnaires were passed directly to the researchers without being copied to the schools. This study was approved by the Ethics Committee of the Affiliated Kangning Hospital of Wenzhou Medical University (No. KNLL-2022007).

A total of 3882 students completed the baseline survey (T1) in March 2022. The follow-up survey (T2) was administered in September 2022. Data obtained from 3167 of these students were matched by their grade, class, and seat number for the two waves (81.6%) and were used for data analysis.

2.2 Measures

2.2.1 Background Variables

Background information included school type (junior middle school, senior high school, vocational high school), age, gender, and perceived family financial situation (five-point response from very poor to very good).

2.2.2 Depression

Depression was assessed at both two-time points. The 9-item Patient Health Questionnaire (PHQ-9) was used to evaluate depression [38], which is a multipurpose tool for screening, diagnosing, and monitoring the severity of depression. It has been validated in Chinese adolescents and showed excellent psychometric properties [38–40]. A sample item is “Feeling down, depressed or hopeless”. Participants were asked to evaluate the frequency of each of the 9 items over the last two weeks on a 4-point Likert scale (0 = not at all to 3 = nearly every day). The Cronbach’s alpha of the scale was 0.89 at T1 and 0.92 at T2. The results of Confirmatory Factor Analysis (CFA), including model fit indices and factor loading for depression T1 and T2 were demonstrated in the supplementary information (Supplementary Tables S1 and S2).

2.2.3 School Refusal

The validated Chinese version School Refusal Assessment Scale-Revised (SRAS-R) was used to assess SR [9], modified from the 24-item English version SRAS-R [41,42]. It is a 21-item scale consisting of five subscales: avoiding negative emotions at school, pursuit of reinforcement outside school, frequent absenteeism to reduce psychosocial problems, conditions that would increase motivation to go to school, and preference to stay with family over going to school. Sample items are “How often do you have bad feelings about going to school because you are afraid of something related to school (e.g., tests, school bus, teacher, fire alarm)?”. “When you are not in school during the week (Monday to Friday), how often do you leave the house and do something fun?”. “How often do you stay away from school because it is hard to speak with the other kids at school?”. “How much would you rather be taught by your parents at home than by your teacher at school?”. “How often do you feel you would rather be with your parents than go to school?”. The items were rated with 7-point Likert scales (0 = never to 7 = always). The Cronbach’s alpha of the scale was 0.88 and 0.91 for T1 and T2, respectively. The McDonald’s Omega of the scale was 0.89 and 0.92 for T1 and T2, respectively. The results of Confirmatory Factor Analysis (CFA), including model fit indices and factor loading for the SR T1 and T2 were presented in the Supplementary Tables S1 and S3.

2.3 Data Analysis

Descriptive statistics were presented. Attrition analysis was performed by using independent sample *t*-test and chi-square test. SPSS 26.0 (IBM Corp., Armonk, NY, USA) was used for such analyses. In the descriptive and correlation analyses, listwise deletion was used to handle missing data. Given the low proportion of missing data (less than 1%), this method was considered suitable, as it was unlikely to introduce bias or meaningfully impact statistical power.

Cross-lagged panel model (CLPM) analysis using Maximum Likelihood (ML) estimation was conducted to test the longitudinal association between SR and depression, with the adjustment of the covariates (school type, age, gender, and perceived family financial situation). The latent variable of SR was derived from the five subscales. Satisfactory model fit indices included $\chi^2/df \leq 5$, the values of CFI and Tucker-Lewis index (TLI) ≥ 0.90 , and the values of RMSEA and SRMR ≤ 0.08 [43]. Multi-group analyses were further conducted to test the differences in the CLPM models between the two genders and across school

types (i.e., junior middle school, senior high school, and vocational high school); a series of models, each constraining a specific individual path, were fit and compared to the unconstrained model which tested all the paths freely. Measurement invariance was tested in the multiple group analysis. A good configural model should demonstrate acceptable fit indices, including the values of Comparative Fit Index (CFI) ≥ 0.90 ; the values of Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) ≤ 0.08 . Compared to the configural model, changes in CFI and RMSEA should not exceed the critical thresholds (i.e., $\Delta\text{CFI} \leq 0.01$, $\Delta\text{RMSEA} \leq 0.015$) to indicate metric and scalar measurement invariance [44]. A Wald test result of $p < 0.05$ denotes that there was a significant gender or school type difference in one of the paths. The present study reported standardized regression coefficients (β s). These analyses were conducted using Mplus 8.3. The proportion of missing was low ($<1\%$). Listwise deletion was used to handle missing data in the descriptive and correlation analyses. In the SEM analyses, the Mplus version 8.3 (Muthén & Muthén, Los Angeles, CA, USA) was used and its Full Information Maximum Likelihood (FIML) estimation used all the available data to generate efficient and unbiased parameter estimates [45] without the need for imputation. Statistical significance was defined as a two-tailed p -value < 0.05 .

3 Results

3.1 Descriptive Analysis

As shown in Table 1, the characteristics of the two waves' samples were largely stable over time. The two surveys' proportions of students sampled from junior middle schools ($\sim 65\%$), male gender ($\sim 56\%$ male), self-reported poor/very poor conditions ($\sim 10\%$), and no depression ($\sim 53\%$) were comparable.

Table 1: Participant's characteristics at baseline (T1) and follow-up (T2)

Variables	T1 (n = 3882)		T2 (n = 3167)	
Categorical variables	n	%	n	%
School type				
Junior middle school	2532	65.2	2101	66.3
Senior high school	1121	28.9	914	28.9
Vocational high school	229	5.9	152	4.8
Gender				
Male	2180	56.2	1760	55.6
Female	1682	43.3	1377	43.5
Not reported	20	0.5	30	0.9
Perceived family financial situation				
Very poor/poor	355	9.1	324	10.2
Average	2739	70.6	2302	72.7
Good/very good	605	15.6	434	13.7
Not reported	183	4.7	11	0.3
Depression status (PHQ-9 score range)				
Normal (0–4)	2056	53.0	1698	53.6
Mild (5–9)	1109	28.6	904	28.5
Moderate to moderately severe (10–19)	621	16.0	473	14.9

(Continued)

Table 1 (continued)

Variables	T1 (n = 3882)		T2 (n = 3167)	
Categorical variables	n	%	n	%
Severe (20–27)	96	2.5	92	2.9
Continuous variables	Mean	SD	Mean	SD
Age	14.5	1.5	14.7	3.3
Depression (PHQ-9)	5.5	5.4	5.4	5.7

3.2 Attrition Analysis

The results are presented in [Table 2](#). Attrition analysis comparing those being followed up and loss to follow-up found statistically significant differences in age ($p < 0.001$) and school type ($p < 0.001$); older age and higher proportions of vocational high school students (33.6%) were found in the loss-to-follow-up group than the junior middle (17.0%) and senior high (18.5%). The gender difference, family financial background, and depression levels were non-significant. Significant group differences of small effect sizes (Cohen's d of -0.09 and -0.12) were observed in the variables of pursuit of reinforcement outside school ($p = 0.026$) and frequent absenteeism to reduce psychosocial problems ($p < 0.001$), respectively. Comparisons of the other three SR functions were statistically non-significant ($p = 0.203$ to 0.590). The results are presented in [Table 2](#).

Table 2: Attrition analysis

Variables	Follow-Up (n = 3167)		Lost to Follow-Up (n = 715)		p-Value#
Categorical variables	n	%	n	%	
School type					<0.001
Junior middle school	2101	66.3	431	60.3	
Senior high school	914	28.9	207	29	
Vocational high school	152	4.8	77	10.8	
Gender					0.131
Male	1767	55.8	413	57.8	
Female	1388	43.8	294	41.1	
Not reported	12	0.4	8	1.1	
Perceived family financial situation					0.410
Very poor/poor	280	8.8	75	10.5	
Average	2253	71.1	486	68	
Good/very good	490	15.5	115	16.1	
Not reported	144	4.5	39	5.5	
Continuous variables	Mean	SD	Mean	SD	
Age	14.5	1.5	14.7	1.5	<0.001
School refusal					
ANES	10.61	5.23	10.9	5.37	0.203
PRS	10.78	5.27	11.27	5.32	0.026

(Continued)

Table 2 (continued)

Variables	Follow-Up (n = 3167)		Lost to Follow-Up (n = 715)		p-Value#
Categorical variables	n	%	n	%	
FARPP	4.57	1.76	4.81	2.08	0.001
CRM	10.31	5.21	10.06	5.18	0.233
PSF	10.41	5.21	10.54	5.35	0.590
Depression (PHQ-9)	5.4	5.3	5.7	5.9	0.166

Note. ANES, Avoiding negative emotions at school; PRS, Pursuit of reinforcement outside school; FARPP, Frequent absenteeism to reduce psychosocial problems; CRM, Conditions that would increase motivation to go to school; PSF, Preference to stay with family over going to school; SD, Standard deviation. #, Chi-square test and independent-sample *t*-test were used when appropriate. Mean value and SD were reported for continuous variables.

Second, loss-to-follow-up (about 20%) may introduce attrition bias to the findings as the loss-to-follow-up group involved older students and more vocational high school students than junior middle and senior high schools. However, since school type did not significantly moderate the cross-lagged models, the magnitude of the bias might be relatively small. The attrition group also showed higher scores in two SR functions which are understandable as the survey was conducted in the school setting and would not involve absent students. The effect sizes were, however, small and would not have caused a strong bias in the analysis.

3.3 Measurement Invariance across Gender and School Type

Measurement invariance between gender and between school type demonstrated good fit indices for configural invariance (all values of CFI > 0.90; all values of RMSEA SRMR < 0.08), indicating consistent factor structures between gender and between school type. Metric invariance was supported with $\Delta\text{CFI} \leq 0.01$ and $\Delta\text{RMSEA} \leq 0.015$, confirming equivalent factor loadings across gender. Scalar invariance was also established ($\Delta\text{CFI} \leq 0.01$, $\Delta\text{RMSEA} \leq 0.015$), suggesting that item intercepts were equivalent, and any group differences in variables could be attributed to true differences, not measurement bias (Supplementary Tables S4 and S5).

3.4 CLPM

Fig. 1 showed the results of the CLPM. The model adjusted covariates including school type, age, gender, and perceived family financial situation. It showed satisfactory goodness of fit to the data, with $\chi^2(74) = 1315.98$, $p < 0.001$, CFI = 0.924, TLI = 0.901, RMSEA = 0.073, and SRMR = 0.063. Level of SR at T1 is prospectively associated with level of depression at T2 ($\beta = 0.07$, $p = 0.006$) and level of depression at T1 also is prospectively associated with level of SR at T2 ($\beta = 0.14$, $p < 0.001$). Within-time or synchronous correlations between level of SR at T1 and level of depression at T1 ($\beta = 0.66$, $p < 0.001$) and between level of SR at T2 and level of depression at T2 were also statistically significant ($\beta = 0.65$, $p < 0.001$). The two autoregressive effects were statistically significant (SR: $\beta = 0.37$, $p < 0.001$; depression: $\beta = 0.42$, $p < 0.001$).

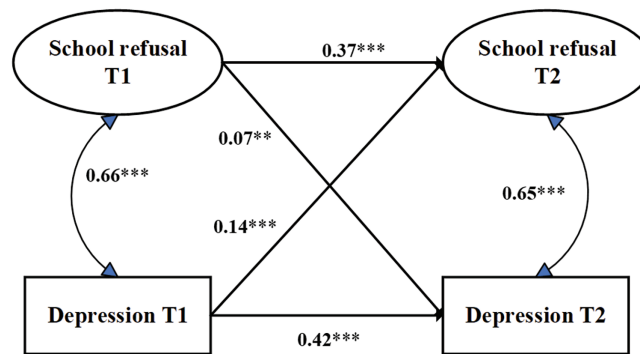


Figure 1: The cross-lagged panel model with bidirectional effects between school refusal and depression, with adjustment of school type, age, gender, and perceived family financial situation. ** $p < 0.01$, *** $p < 0.001$

As presented in Table 3, gender did not moderate the path from SR at T1 to depression at T2 ($p = 0.970$) and the path from depression at T1 to SR at T2 ($p = 0.575$). Similarly, Table 4 shows that school type (junior middle school, senior high school, and vocational high school) did not moderate the path from SR at T1 to depression at T2 ($p = 0.724$, 0.620 , and 0.511 , respectively) and the path from depression at T1 to SR at T2 ($p = 0.716$, 0.769 , and 0.955 , respectively).

Table 3: Invariance test across gender

Path	Male β	Female β	Wald test p
SR T1 → Depression T2	0.09**	0.07**	0.970
Depression T1 → SR T2	0.13***	0.14**	0.575

Note. SR, School refusal. ** $p < 0.01$, *** $p < 0.001$.

Table 4: Invariance test across school type

Path	JMS β	SHS β	Wald test p	JMS β	VHS β	Wald test p	SHS β	VHS β	Wald test p
SR T1 → Depression T2	0.10**	0.08**	0.724	0.10**	0.14***	0.620	0.08**	0.14***	0.511
Depression T1 → SR T2	0.17***	0.12***	0.716	0.17***	0.11**	0.769	0.16***	0.16***	0.955

Note. JMS, junior middle school; SHS, senior high school; VHS, vocational high school. ** $p < 0.01$, *** $p < 0.001$.

4 Discussion

The present study finds prevalence of probable moderate or above depression of close to 20% at T1 and T2. These findings corroborate previous studies [5,6,46], reinstating that adolescent depression has become a severe and pervasive issue. The prevalence further increased with grade [47]. The high prevalence obtained from this and other studies signify an urgent need for early and targeted interventions to address the mental health challenges faced by adolescents. The results found bidirectional significant prospective associations between SR and depression, with level of depressive symptoms at T1 prospectively associated with level of SR at T2 and level of SR at T1 also prospectively associated with level of depression at T2. It has added to literature knowledge about temporalities between these two variables. The present study also extends the findings presented by Wood et al. [29] and Kingery et al. [30], which documented reciprocal relationships between absenteeism and depression.

Apparently, the significant cross-lagged coefficients look ‘small’. However, as discussed in Orth et al. [48], cross-lagged effects in longitudinal panel models are typically modest and benchmarks have been proposed ($\beta = 0.03$ as small; $\beta = 0.07$ as medium, and $\beta = 0.12$ (large)). In our study, the cross-lagged effects from SR to depression ($\beta = 0.07$) and from depression to SR ($\beta = 0.14$) fell within the medium-to-large range according to the guideline. The reason for the modest coefficients is that the cross-lagged effects are net of the auto-regressive effects, which are expected to be quite large in most circumstances. Such net cross-lagged effects are, however, important as they are capturing unique contributions to the non-autoregressive prospective associations, which is the essential statistics assessing directions of such prospective associations. The findings are hence meaningful.

The two significant bidirectional relationships between SR and depression have strong theoretical and conceptual foundations. Thambirajah et al. [49] highlight that when youths experience SR, they may lose peer support and face social isolation. They may also fall behind academically, making it harder to reintegrate into school and intensifying their fear of failure. These losses in both the peer and academic domains elevate the risk of depression. Specifically, SR deprives adolescents of positive reinforcement, such as peer support and academic rewards, while amplifying negative self-appraisals, such as feelings of incompetence and alienation. As a result, avoidance behaviors like SR, which initially reduce negative emotions (such as anxiety and depression), can exacerbate depression in the long term. This is because the inactivity, social isolation, and poor academic performance stemming from SR may further increase the risk of depression [4]. Stressors related to SR experiences may also trigger maladaptive emotional regulation, such as rumination, which in turn heightens the risk of depression [50]. Thambirajah et al. [49] and Havik and Ingul [12] propose that behavioral avoidance directly fuels negative affectivity, creating conditions conducive to the onset and escalation of depression. Therefore, the path from SR to depressive symptoms illustrates how avoidance behaviors can initiate a harmful psychosocial cascade.

Conversely, the pathway from depressive symptoms to SR is also theoretically grounded. Depression is often closely linked with low self-confidence [51], and the systemic integrated cognitive model [12] suggests that depression can lead to SR. When adolescents encounter stressors, they may appraise the situation as unmanageable, generating mental distress, such as depression. This distress can trigger negative behavioral responses, from emerging SR to social alienation, eventually leading to established SR [12]. Depressive symptoms—such as social withdrawal, loss of motivation, sleep disturbances, and low energy—can impair an adolescent’s ability to attend school. Furthermore, the experience of depression creates stressors, such as stigma, which may further reinforce maladaptive avoidance behaviors, including SR. Future studies are needed to explore mediators of these bidirectional associations and to test the proposed theories.

Havik and Ingul [12] identified several factors contributing to the vicious cycle of SR. The systemic cognitive model posits that depressive emotions lead to avoidant coping, which then triggers emerging SR, alienation from school, and eventually established SR. SR, in turn, fosters social isolation, fear of academic failure, low self-confidence, and mental distress, which further exacerbates depressive symptoms. This mental distress fuels additional avoidance behaviors, thereby solidifying SR. The reciprocal relationships found by the cross-lagged analysis thus suggest that a potential vicious cycle of depression \rightarrow SR \rightarrow depression may occur, i.e., students with depression would have a higher likelihood of developing SR, which would in turn increase depressive symptoms, resulting in a ‘spiral’ vicious cycle. As the study cannot establish causality, it remains a speculation but if such is true, the already high prevalence of SR of 23% to 35% [4,15,19,52] would soar further as the prevalence of depression has been increasing over time [53]; unfortunately, the increase in SR would then cause more depression cases. To break the potential vicious cycle, stakeholders (clinicians, educators, and parents) need to work together to create comprehensive treatment plans that include not only mental health support to prevent depression but also strategies to help students gradually re-engage

with school. Interestingly, the multi-group cross-lagged models did not differ between genders and across age groups. Similar intervention strategies may be employed to break the potential vicious cycle in students of different genders and age groups. The initial hypotheses that females would show stronger prospective associations were not supported by the data. It is beyond the scope of this preliminary study to explain the non-significance of the hypothesis as this study did not measure emotional regulation. Further research may test moderated mediations of the two prospective paths.

The present study incurs practical implications. The findings call for a paradigm shift toward integrated, multi-targeted prevention and intervention strategies. Specifically, evidence-based mental health interventions should concurrently address depressive symptoms and SR (e.g., via functional behavioral assessment, and targeted academic/social support). Effective depression prevention programs include those involving family, peer, and teacher support [50,54], mindfulness stress reduction [55,56], academic support [57,58], social emotional development [59], emotional regulation [60] and cognitive behavioral therapy [55,61]. Some effective interventions have been able to reduce SR, including cognitive behavioural therapy (CBT) [49], social work programs, multi-systemic interventions [62–65]. Interventions reducing SR need to be socio-ecological and involve various levels [66]. At the personal level, in particular, it is essential to understand the causes (or functions) of the SR, such as avoidance of emotional distress, escape from stressful social relationship, and attention seeking [41] and to develop tailored interventions to remove such obstacles. Three of the SR functions are related to incentive of attendance versus absence; it is hence important to shift the reward structure from outside/home back to the school. Research has shown that application of generative AI learning tools has been able to boost learning motivation [67]; teaching needs to be innovative and make use of new technologies. Family support is also important in reducing the SR of home-staying. If the SR function were related to avoidance of emotional avoidance, training on emotional regulation is potentially important [36]. For those with a SR function involving social relationships, training for social acceptance and communication skills may also be important [68]. Training to foster socio-emotional skills is potentially important in reducing both emotional and interpersonal problems. Interpersonal issues such as bullying need to be address as it is potentially related to the SR function of avoidance of emotional problems and psychosocial problems [69]. Effective interventions are available. At the school level, improvements in school climate and school identification are useful as they were negatively associated with SR [70] and may counteract the SR functions of reward obtained outside the school. At the clinical level, back-up is important. As depression predicted SR, parents and teachers need to understand that SR may have a clinical base [71,72]. It should be considered within a mental health context and professional help seeking may sometimes be necessary to treat school refusers [73]. Stakeholders' involvement is very essential. Teachers and parents need to understand that blaming the school refusers is not a good strategy as it might increase the already heightened risk of depression [12,74]. As frontline workers, teachers require support and mandatory training to identify the co-occurrence of SR and depression and to implement stigma-free re-engagement support. To prevent depression potentially caused by SR, the emotional state of the school refusers may be monitored through careful observations and periodic screening for depression, if possible, and followed up by counselling, secondary interventions, diagnostic assessment, and treatment if necessary.

This study is novel but has several limitations. First, the self-reported data may introduce a bias, as students might underreport or overreport their depressive symptoms or SR due to social desirability. Second, loss-to-follow-up (about 20%) may introduce attrition bias to the findings as the loss-to-follow-up group involved older students and more vocational high school students than junior middle and senior high schools. However, since school type did not significantly moderate the cross-lagged models, the magnitude of the bias might be relatively small. The attrition group also showed slightly higher scores in two SR functions which are understandable as the survey was conducted in the school setting and would not

involve absent students; the effect sizes of the difference in SR scores were, however, small and would not have caused a strong bias. Third, although the 6-month interval between T1 and T2 allowed us to capture bidirectional relationships, a longer follow-up period and more points of time would be preferred. Fourth, the current study employed CLPM to examine the longitudinal associations among the study variables. This approach, however, cannot distinguish between within-person and between-person effects. The Random Intercept Cross-Lagged Panel Model (RI-CLPM) is more suitable for separating various sources of variance. Its estimation, however, requires at least three waves of data [75]. It was not feasible as this study only involved two time-points. Despite its limitations, the traditional CLPM remains a valid and widely accepted method for analyzing directional associations over time in two-wave panel data [76]. The findings should be interpreted with caution, as the observed effects might reflect stable between-person differences instead of pure within-person changes. Fifth, this study only looked at the temporal relationships between SR and depression and did not investigate mediators between the two problems. Also, the present study only tested two moderators (gender and school type) and it would be useful to test other moderators such as resilience. Sixth, the study was limited to adolescents in one region of China, which may limit the generalizability of the findings to other regions or countries with different educational and cultural contexts.

5 Conclusions

In conclusion, this longitudinal study provides valuable evidence of the bidirectional positive prospective relationships between SR and depression in Chinese adolescents. Our findings suggest that SR not only would exacerbate depressive symptoms, but SR may also be fueled by the elevated symptoms, creating a vicious cycle potentially. This research underscores the need for early detection and comprehensive dual treatment strategies that address both SR and depression simultaneously, paying attention to the SR functions of individual students. Future cross-lagged studies may involve a longer follow-up period, more time points, some other mediators, and cross-cultural comparisons.

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