



Longitudinal Associations Between Prosociality and Depressive Symptoms in Chinese Children: The Mediating Role of Peer Preference

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Abstract

Despite empirical findings that prosociality is related to decreased depressive symptoms in children, little is known about the directionality of the relations and the mechanisms that may explain the relations. To address these gaps, this study examined bi-directional associations between prosociality and depressive symptoms and the mediating effects of peer preference on the associations in Chinese children. Multi-wave longitudinal data were collected each year from Grades 3 to 6 in a sample of children in China (initial $N = 1012$; 51.6% girls; initial $M_{\text{age}} = 8.68$ years). The results showed that prosociality and depression negatively contributed to each other over time. Prosociality also predicted increased peer preference, which in turn contributed to fewer depressive symptoms, suggesting that peer preference was a mediator of the contributions of prosociality to depressive symptoms. These findings indicate the temporal ordering of prosociality and depressive symptoms and the processes in the development of depressive symptoms in Chinese children.

Keywords Prosociality · Depressive symptoms · Peer preference · Chinese children

Introduction

The relation between prosociality and depressive symptoms in childhood and adolescence is an important issue in developmental science and psychopathology (Memmott-Elison et al., 2020). Prosociality refers to one's tendency to act to benefit others, such as helping, sharing, and caring (Caprara et al., 2012). As a major aspect of social functioning, prosociality is believed to have pervasive implications for individual adjustment across domains (Eisenberg

et al., 2015). The links between prosociality and indexes of social and school adjustment, such as social status and academic achievement, in children and adolescents have been well documented (e.g., Carlo et al., 2018; Zhang et al., 2018). However, relatively little is known about the relations between prosociality and psychological problems, such as depressive symptoms (see Memmott-Elison et al., 2020 for a recent review). Further, the directionality of the relations and the underlying mechanisms in the relations are unclear because the existing studies have been largely cross-sectional and clarifying these issues is thus a priority for research (Memmott-Elison et al., 2020). This may be particularly the case in group-oriented societies, such as China. To address the gaps, the present study examined the reciprocal relations between prosociality and depressive symptoms and the potential role of peer preference in mediating the relations in Chinese children.

Prosociality and Depressive Symptoms in Chinese Context

In Chinese society where group wellbeing is emphasized, prosociality is highly valued and regarded as a behavioral virtue that is critical to harmonious collective functioning

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and interpersonal relationships (Chen & French, 2008). In this context, individuals are encouraged to prioritize the interests of the group over those of their own, and children are socialized to cooperate with others and to learn prosocial attitudes and behaviors from the early years (Jung et al., 2020). Children with low prosociality are often perceived as selfish or anti-collective whereas those with high prosociality are praised and well accepted by peers and adults. Longitudinal research has demonstrated that prosocial children and adolescents in China tend to perform better in school and are less involved in substance use and deviant activities than others (Chen et al., 2019; Guo et al., 2018).

As a major internalizing problem, depression has traditionally been regarded as unimportant and thus largely neglected in Chinese society (Chen, 2010). During socialization, children are taught to repress their negative feelings in public because the display of these feelings may disrupt social harmony and is thus considered socially inappropriate (Liu et al., 2018). Nevertheless, it has been found that, compared with their Western counterparts, children in China displayed equal, or even higher, levels of affect disturbances including depression (e.g., Xu et al., 2020). Psychological problems have received increased attention from professionals and the public in recent years as a high rate of malicious incidents, such as suicide, in youth has often been reported in the media (e.g., Caskie, 2018), and, at the same time, the importance of individual socioemotional wellbeing has been gradually recognized in the society. Thus, it is necessary to investigate factors that are associated with psychological problems including depressive symptoms and potential mechanisms in the associations among Chinese children.

Relations Between Prosociality and Depressive Symptoms

A major feature of depression is the experience of ongoing negative mood or affect (Rouhani & Niv, 2019). Research has indicated that prosocial behaviors may induce positive moods in individuals (e.g., Schacter & Margolin, 2019), which in turn may contribute to reduced depressive symptoms. Engagement in actions that benefit others may elevate individual's mood and alleviate negative emotions through distraction from stressors or an increase in a sense of purpose and belief in one's ability to succeed (Brown & Brown, 2015; Raposa et al., 2016). Moreover, according to the self-regulation theory (Eisenberg et al., 2015), self-regulation, as an integral part of prosociality, is conducive to the control of one's own negative emotions. Self-control that prosocial children display helps them monitor and modulate their negative emotional reactivity (e.g., Eisenberg et al., 2010; Paschke et al., 2016). At the same time, the experiences of depression may undermine one's social

interest and participation in interpersonal interactions (de Wit et al., 2010), which are an important context for the expression of prosociality. Individual depressive symptoms may also lead to a depletion of individuals' cognitive resources to attend to the need of others, exert self-control, and weaken the capacity to act prosocially (Osgood & Muraven, 2015).

Nevertheless, there is inadequate evidence for the arguments about the bi-directional contributions because most existing studies have been cross-sectional or focused on the contributions of prosociality to depression (e.g., Flouri & Sarmadi, 2016; Hutchinson et al., 2016). There appear to be only three studies that have explicitly explored the mutual contributions of prosociality and children's depressive symptoms and the results were inconsistent. Specifically, the first study demonstrated that adolescents' altruistic behaviors and depressive symptoms negatively predicted each other 6 months later (Davis et al., 2016). Similarly, the second study indicated that prosocial behavior negatively predicted adolescents' psychological distress including depressive symptoms and loneliness, and that psychological distress negatively predicted prosocial behavior (Stotsky et al., 2020). The third study, however, failed to find direct cross-time links between prosocial behaviors and adolescents' depression (Padilla-Walker et al., 2015). Thus, the issue needs to be further examined, preferably using multi-wave longitudinal data, to obtain a better understanding of the developmental patterns.

The Role of Peer Preference in Relations Between Prosociality and Depressive Symptoms

According to the developmental cascade model (Masten & Cicchetti, 2010), the effects of child behaviors in one domain may spread to another domain progressively over time. From this perspective, the contributions of prosociality to depressive symptoms and of depressive symptoms to prosociality are likely to occur in a progressive manner through a combination of direct and indirect pathways. Peer relationships may provide an important social context for the cascading processes in the links between children's prosociality and psychological wellbeing (Rubin et al., 2015). Peer preference, conceptualized as the extent to which a child is liked and accepted by peers, as a major indicator of peer relationship quality (Cillessen & Bukowski, 2018), has been well documented to be associated with children's social behaviors and psychological adjustment (e.g., Zhang et al., 2018). For example, a longitudinal study conducted with Chinese youth found that youth depressive symptoms led to decreased peer acceptance, which in turn heightened the risk for subsequent experience of depression (Yang et al., 2020). Therefore, it seems reasonable to argue that the interplay among

prosociality, peer preference, and depressive symptoms may occur over time in direct synchronized as well as indirect mediated manners.

The argument of peer preference as a mediator of the associations between prosociality and depressive symptoms is in line with the contextual-developmental perspective (Chen, 2012), which asserts that peer attitudes toward children's behaviors determine, in part, their developmental outcomes. The high endorsement of prosocial behavior in Chinese society is likely to be reflected in peer attitudes, which may in turn affect the adaptive and maladaptive adjustment, such as depressive symptoms, of children who display the behaviors. At the same time, negative peer responses to the display of depressive symptoms may create an unfavorable social environment for prosocial development (Rubin et al., 2015; Yang et al., 2020).

The present study examined gender differences in the associations among prosociality, peer preference, and depressive symptoms. Some evidence indicates that prosociality is associated with depressive symptoms more strongly in girls than boys (e.g., Flynn et al., 2015). It has also been suggested that due to gender-stereotypical ideologies, girls are often expected to be more interested in social relationships than boys (e.g., Chen et al., 2011). Thus, the relations between prosociality and depressive symptoms and the mediating effects of peer preference might be more evident in girls than in boys. Because parental educational level might play a role in children's prosociality and depressive symptoms (Miller et al., 2015), it was included as a control variable along with gender in all models.

The Current Study

Little is known about the directionality of the relations between prosociality and depressive symptoms and the underlying mechanisms in the relations. The primary aim of the present study was to address two main research questions: first, how would prosociality and depressive symptoms contribute to each other longitudinally?, and second, would peer preference mediate the longitudinal relations between prosociality and depressive symptoms? Four waves of longitudinal data were collected from a sample of Chinese children. Based on the literature and the previous discussion, it was hypothesized that prosociality and depressive symptoms would negatively contribute to each other over time (Hypothesis 1). In addition, it was expected that peer preference would have mediating effects on the longitudinal associations. More specially, prosociality was expected to have an indirect effect on depressive symptoms via peer preference, and depressive symptoms were also expected to have an indirect effect on prosociality via peer preference (Hypothesis 2).

Method

Participants

Participants included 1012 third-grade children (522 girls, $M_{\text{age}} = 8.68$ years, $SD = 7.56$ months) recruited from five randomly selected regular public elementary schools in Anhui province, China. The schools were in a region consisting mostly of towns, small cities, and surrounding areas, which is home to a population of approximately 2.7 million located in the lower Yangtze River drainage basin and Yangtze River Delta in East China. There were 20 classes, with approximately 50 students in each class. Of the children in the original sample, 47% were only children and the others had one or more siblings. Sibling status had no significant effects on all the study variables, $F(12, 731) = 1.62$, $p = 0.081$. Of the mothers and fathers, 88.3% and 76% had a junior high school education or below, 11.7% and 24% had a senior high school or above senior high school education. Almost all participants in this sample were of the Han nationality, which is the predominant ethnic group in China. The follow-up data were collected each year in the same schools for Grades 4–6. From the original sample, 86.8% to 91.9% of students participated in the follow-up studies. Children who participated at T2 ($N = 930$) and those who did not ($N = 82$) did not differ on T1 peer preference, $F(1, 934) = 1.19$, $p = 0.275$, and T1 depressive symptoms, $F(1, 934) = 0.47$, $p = 0.492$, yet the children who participated had higher scores on T1 prosociality than those who did not, $F(1, 934) = 4.21$, $p = 0.041$, $\eta^2 = 0.004$. Children who participated at T3 ($N = 878$) and those who did not ($N = 134$) did not differ on T1 prosociality, $F(1, 934) = 2.24$, $p = 0.135$, T1 peer preference, $F(1, 934) = 0.31$, $p = 0.579$, or T1 depressive symptoms, $F(1, 934) = 0.41$, $p = 0.524$. Children who participated at T4 ($N = 896$) and those who did not ($N = 116$) did not differ on T1 peer preference, $F(1, 934) = 0.55$, $p = 0.461$, and T1 depressive symptoms, $F(1, 934) = 0.71$, $p = 0.400$, yet the children who participated had higher scores on prosociality than those who did not, $F(1, 934) = 4.89$, $p = 0.027$, $\eta^2 = 0.005$.

Measures

Prosociality

Prosociality was measured using a peer-nomination measure adapted from the *Revised Class Play (RCP)* (Chen et al., 1992). Consistent with the procedure outlined by Masten et al. (1985), children were asked to nominate up to three classmates who could best fit each of four descriptors assessing aspects of prosociality (e.g., “Helps others when they need it”, “Is polite to others”, “Someone you can trust”). Both same-gender and cross-gender nominations were allowed, as suggested by other researchers (Terry & Coie, 1991). Subsequently, nominations

each child received from all classmates for each item were totaled and standardized within the class to form an index of prosociality, with higher scores indicative of greater prosociality. The measure was used and shown to be reliable and valid in other studies with Chinese children (e.g., Chen et al., 2000). Internal reliabilities (Cronbach's alphas) of the measure ranged from 0.80 to 0.85 in this study.

Peer preference

Children were asked to nominate up to three classmates within the class with whom they most liked to be (i.e., positive nominations) and three classmates with whom they least liked to be (i.e., negative nominations). Cross-gender nominations were allowed. Nominations received from all classmates were totaled and standardized within each class. An index of peer preference was formed by subtracting standardized negative nomination scores from standardized positive nomination scores (Coie et al., 1995), with higher scores indicative of greater peer preference. The procedure has been used in Chinese children (e.g., Ding et al., 2020).

Depressive symptoms

Children's depressive symptoms were assessed using a 14-item measure of the *Children's Depression Inventory (CDI; Kovacs, 1992)*. The measure included all 10 items in the short version (*CDI-S*) and 4 additional items from the full version. The 14-item form was developed through pilot studies and psychometric analysis mainly to reduce the time that participants needed to spend on the task while capturing relevant information in assessing Chinese children's depressed mood (the 14-item version was highly correlated with the full version in several large samples, with $r = 0.95-0.96$, $ps < 0.001$). Each of the items provides three alternative responses (e.g., "I feel like crying every day," "I feel like crying most days," "I feel like crying once in a while") from which the participants choose one that best describes them in the past two weeks. The items center on a given thought, feeling, or behavior associated with depression, such as self-deprecation, reduced social interest, anhedonia, fatigue, and self-blame. Following the procedure outlined by Kovacs (1992), the average score of depressive symptoms was computed, with higher scores indicative of more depressive symptoms. The measure was used and shown to be reliable and valid in other studies with Chinese children (e.g., Coplan et al., 2017). The internal reliabilities of this measure were 0.75 to 0.86 in this study.

Procedure

At each time, a peer-assessed measure of prosociality, a sociometric nomination measure, and a self-report measure of depressive symptoms were group administered to students

during class time on a school day. All measures were administered in Mandarin. The members of the research team carefully examined the items in the measures, using a variety of strategies (e.g., repeated discussion in the research group, interviews with children and teachers, psychometric analysis). The measures have been shown to be appropriate in the Chinese society (e.g., Yang et al., 2015). The administration of the measures was carried out by a group of psychology faculty and graduate students in China. Extensive explanations of the procedure were provided during data collection. No evidence was found that the children had difficulties understanding the procedure or the items in the measures. All students in the schools were invited to participate with no criteria for exclusion. The study was approved by the Institutional Review Board. The first wave of data was collected in the spring of 2012. Written assent was obtained from all participating children and written consent was obtained from their parents through the school. The participation rate was approximately 95% at each time.

Analytical Strategy

Little's MCAR test (Little, 1988) was significant, $\chi^2(220) = 301.77$, $p < 0.001$, but the normed χ^2/df was 1.37 (i.e., smaller than the recommended cut-off of 2; Ulman, 2013), indicating that the pattern of the missing data was not substantially different from a random pattern (Bollen, 1989). Full-information maximum likelihood (FIML) estimation was used to handle the missing data for children in the follow up studies on the variables, as suggested by other researchers (e.g., Graham, 2009). Measurement invariance tests were first conducted for the measures with multiple indicators (4 peer assessment items for prosociality and 14 self-report items for depressive symptoms) across four times of measurement (Putnick & Bornstein, 2016). To improve model estimation and convergence, 14 depressive symptoms items were randomly combined into three parcels as indicators of depressive symptoms.

Next, two separate cross-lagged panel models (CLPMs) were tested, following the procedure suggested in the literature (Kuster et al., 2012; Tavernier & Willoughby, 2015). The first model included the direct and reciprocal associations between prosociality and depressive symptoms across times. The second model included the indirect associations between prosociality and depressive symptoms via peer preference, using the bias-corrected (BC) bootstrapping. For both models, lag-1 cross-lag paths and autoregressive paths for all study variables were included. Concurrent associations between prosociality and depressive symptoms within each wave were also included (Cole & Maxwell, 2003). In addition, this study examined whether autoregressive and cross-lagged effects were time invariant to enhance model parsimony and interpretability (Orth et al., 2021). To detect significant model fit differences in the comparisons, at least two of these three criteria needed to be

satisfied: $\Delta\chi^2_{SB} < 0.05$ (Satorra & Bentler, 2001), $\Delta CFI \geq 0.010$, and $\Delta RMSEA \geq 0.015$ (Chen, 2007). If the difference in fit between these models is not significant, then the more parsimonious model with more structural constraints was favored.

Multigroup analyses were conducted to examine gender differences in the models. The fit of a model in which each of the paths of interest was constrained to be equal across boys and girls was compared to the fit of an unconstrained model, in which these paths were freely estimated. A significant difference in the fit between the constrained and unconstrained models suggests that the path is variant across gender.

All the analyses were conducted using Mplus 7.0 (Muthén & Muthén, 1998–2015). Model fit was evaluated with the comparative fit index (CFI) and the root-mean-squared error of approximation (RMSEA). Acceptable and good fit was indicated by RMSEA values below 0.08 and 0.05 and CFI values greater than 0.90 and 0.95 (Hu & Bentler, 1999; Marsh et al., 2004).

Results

Descriptive Statistics

Means and standard deviations for and intercorrelations among the study variables are presented in Table 1. A multivariate analysis of variance (MANOVA) revealed a significant main effect of gender on study variables, $F(12, 737) = 5.58, p < 0.001, \eta^2 = 0.083$. Follow-up univariate analyses indicated that compared to boys, girls scored higher on prosociality and peer preference across all four times, and scored lower on depressive symptoms in Grades 3, 4, and 5. At each wave, prosociality was positively correlated with peer preference and negatively correlated with depressive symptoms. Peer preference was negatively correlated with depressive symptoms. ANOVA showed significant mean-level differences in depressive symptoms across time, $F(2.75, 2064.51) = 17.04, p < 0.001$, and nonsignificant mean-level differences in prosociality, $F(2.81, 2343.19) = 0.28, p = 0.825$. Scores of depressive symptoms were lower in waves 3 and 4 than in waves 1 and 2 and the scores at wave 2 were significantly lower than those at wave 1. Classroom- and school-level intraclass correlations (ICC) were less than 0.05 and nonsignificant for all the variables, indicating no cluster effects for the classroom and school in the present study.

Longitudinal Measurement Invariance Tests

Measurement invariance tests for the latent constructs of prosociality and depressive symptoms over time were

Table 1 Means, standard deviations, and correlations among study variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Prosociality G3												
2. Prosociality G4	0.76***											
3. Prosociality G5	0.68***	0.74***										
4. Prosociality G6	0.64***	0.72***	0.75***									
5. Peer Preference G3	0.45***	0.39***	0.40***	0.40***								
6. Peer Preference G4	0.34***	0.44***	0.38***	0.40***	0.55***							
7. Peer Preference G5	0.35***	0.40***	0.49***	0.45***	0.56***	0.63***						
8. Peer Preference G6	0.30***	0.37***	0.39***	0.52***	0.53***	0.56***	0.65***					
9. Depressive symptoms G3	-0.22***	-0.21***	-0.20***	-0.20***	-0.23***	-0.20***	-0.25***	-0.20***				
10. Depressive symptoms G4	-0.20***	-0.21***	-0.19***	-0.20***	-0.23***	-0.23***	-0.24***	-0.19***	0.54***			
11. Depressive symptoms G5	-0.19***	-0.19***	-0.17***	-0.19***	-0.25***	-0.21***	-0.24***	-0.21***	0.38***	0.57***		
12. Depressive symptoms G6	-0.11**	-0.13***	-0.08*	-0.17***	-0.22***	-0.22***	-0.21***	-0.22***	0.28***	0.42***	0.54***	
M	0.00	0.04	0.01	0.03	0.00	0.02	0.00	0.02	0.36	0.32	0.30	0.29
SD	0.99	1.04	1.00	1.01	1.49	1.54	1.57	1.56	0.28	0.32	0.31	0.31
M (SD) boys	-0.23 (0.66)	-0.21 (0.65)	-0.20 (0.70)	-0.18 (0.74)	-0.17 (1.43)	-0.07 (1.53)	-0.08 (1.51)	-0.06 (1.54)	0.38 (0.28)	0.34 (0.33)	0.31 (0.34)	0.29 (0.34)
M (SD) girls	0.31 (1.25)	0.31 (1.28)	0.27 (1.20)	0.26 (1.15)	0.32 (1.41)	0.20 (1.51)	0.21 (1.51)	0.20 (1.51)	0.34 (0.27)	0.29 (0.29)	0.26 (0.26)	0.29 (0.29)
η^2	0.064	0.058	0.052	0.046	0.029	0.008	0.009	0.007	0.007	0.008	0.008	0.000
G grade												

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

conducted. The results showed that full metric models (loading invariance; $\chi^2(83) = 204.62, p < 0.001, \chi^2/df = 2.47, CFI = 0.968, RMSEA = 0.038$) did not differ significantly from the configural models (unconstrained models, $\chi^2(74) = 169.04, p < 0.001, \chi^2/df = 2.28, CFI = 0.975, RMSEA = 0.036$) for the measurement of prosociality across times ($\Delta CFI = -0.007, \Delta RMSEA = 0.002$). Similarly, full metric models ($\chi^2(1433) = 2331.65, p < 0.001, \chi^2/df = 1.63, CFI = 0.904, RMSEA = 0.025$) did not differ significantly from the configural models ($\chi^2(1394) = 2316.25, p < 0.001, \chi^2/df = 1.66, CFI = 0.902, RMSEA = 0.026$) for the measurement of depressive symptoms across times ($\Delta CFI = 0.002, \Delta RMSEA = -0.001$). Hence, item-level longitudinal metric invariances were established for prosociality and depressive symptoms measures.

Longitudinal Relations Between Prosociality and Depressive Symptoms

Models with and without autoregressive paths, cross-lagged paths, and a combination of both, constrained to be time invariant were compared. As shown in Table 2, all unconstrained and constrained models fit the data well and the model comparisons showed that the most parsimonious model (Model 1.4) was favored, $\chi^2(384) = 772.37, p < 0.001, \chi^2/df = 2.01, CFI = 0.965, RMSEA = 0.032$. For subsequent analyses, the longitudinal constraints on autoregressive and cross-lagged paths were retained.

The standardized parameter estimates for Model 1.4 are presented in Fig. 1. All autoregressive paths were significant, suggesting rank-order stability in both constructs over time: prosociality (average $\beta = 0.88, p < 0.001$) and

depressive symptoms (average $\beta = 0.64, p < 0.001$). In line with Hypothesis 1, all cross-lagged paths were also significant, indicating a bidirectional relation between children’s prosociality and depressive symptoms, such that initial prosociality predicted decreases in depressive symptoms over time (average $\beta = -0.04, p = 0.043$), and initial depressive symptoms predicted decreases in prosociality over time (average $\beta = -0.03, p < 0.001$). There were no significant gender differences in the cross-lagged paths from prosociality to depressive symptoms, $\Delta\chi^2_{SB}(1) = 3.64, p = 0.056, \Delta CFI = 0.000, \Delta RMSEA = 0.000$, and from depressive symptoms to prosociality, $\Delta\chi^2_{SB}(1) = 0.72, p = 0.396, \Delta CFI = 0.000, \Delta RMSEA = 0.000$.

Indirect Effects of Peer Preference

To assess the potential mediating role of peer preference between prosociality and depressive symptoms, a second set of cross-lagged panel models (Model 2) was estimated in which peer preference was added as a longitudinal mediator. The same procedure for other parameters was followed as for Model 1. The bias-corrected (BC) bootstrapping was used. This method produces bootstrapped confidence intervals, with mediation occurring when the indirect effect is significant, and its 95% bias-corrected confidence interval does not contain zero (Preacher & Hayes, 2008).

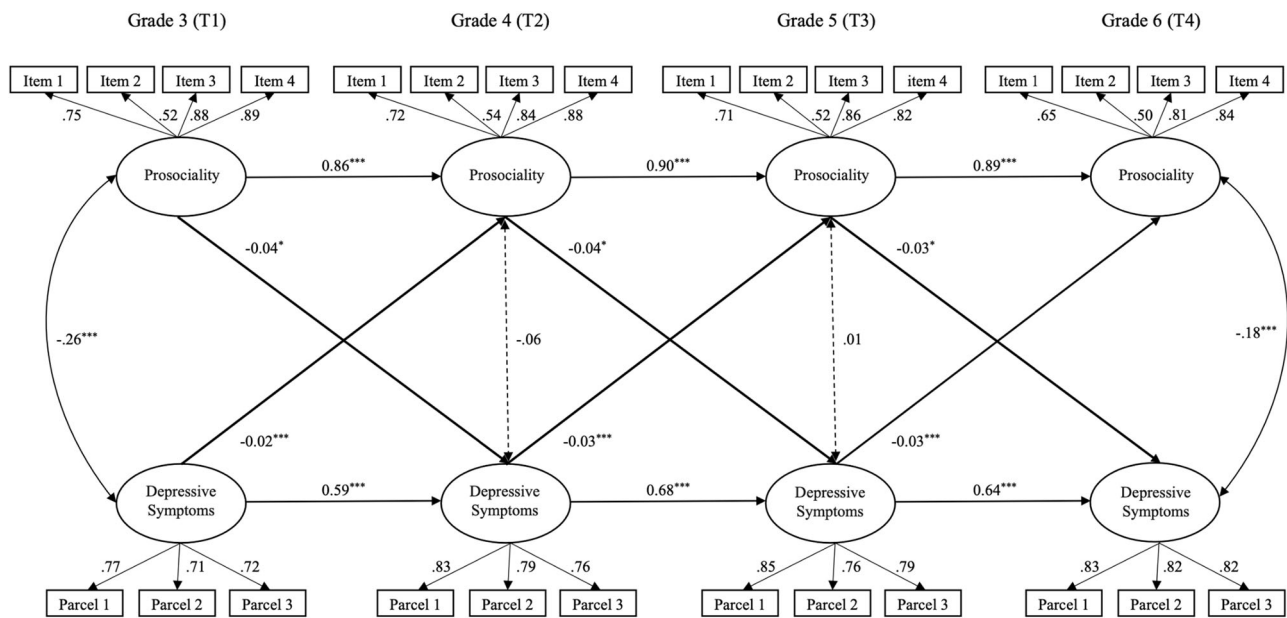
Again, compared to the unconstrained model, the more constrained models did not significantly impair model fit (see Table 2). Thus, the most parsimonious Model 2.4 was favored, $\chi^2(492) = 1476.20, p < 0.001, \chi^2/df = 3.00, CFI = 0.925, RMSEA = 0.044$, and the longitudinal constraints on

Table 2 Fit indices and model comparisons

Model	Model fit indices			Model comparisons				
	χ^2 (df)	CFI	RMSEA	Comparison	$\Delta\chi^2_{SB}$ (Δdf)	<i>p</i>	ΔCFI	$\Delta RMSEA$
Model 1								
Model 1.1: Baseline	764.49 (376)	0.965	0.032					
Model 1.2: Time-invariant autoregressive paths	765.10 (380)	0.965	0.032	1.2 vs. 1.1	4.31 (4)	0.366	0.000	0.000
Model 1.3: Time-invariant cross-lagged paths	770.69 (380)	0.964	0.032	1.3 vs. 1.1	5.36 (4)	0.252	-0.001	0.000
Model 1.4: Time-invariant autoregressive and cross-lagged paths	772.37 (384)	0.965	0.032	1.4 vs. 1.1	10.13 (8)	0.256	0.000	0.000
Model 2								
Model 2.1: Baseline	1459.50 (474)	0.925	0.045					
Model 2.2: Time-invariant autoregressive paths	1456.85 (480)	0.926	0.045	2.2 vs. 2.1	6.22 (6)	0.399	0.001	0.000
Model 2.3: Time-invariant cross-lagged paths	1471.57 (486)	0.925	0.045	2.3 vs. 2.1	9.58 (12)	0.653	0.000	0.000
Model 2.4: Time-invariant autoregressive and cross-lagged paths	1476.20 (492)	0.925	0.044	2.4 vs. 2.1	21.55 (18)	0.253	0.000	-0.001

Gender and parental educational level were included as covariates in all models. $\Delta\chi^2_{SB}$ model comparisons were based on Satorra and Bentler’s (2001) scaled difference chi-square test statistic

CFI comparative fit index, RMSEA root-mean-square error of approximation



Note. Standardized coefficients are shown. Gender and parental educational level were controlled for as covariates. * $p < .05$. *** $p < .001$.

Fig. 1 Cross-lagged panel model with prosociality and depressive symptoms (Model 1.4)

autoregressive and cross-lagged paths were retained for subsequent analyses.

The standardized parameter estimates for Model 2.4 are presented in Fig. 2. All autoregressive paths were significant, suggesting stability in all three constructs over time: prosociality (average $\beta = 0.88, p < 0.001$), peer preference (average $\beta = 0.54, p < 0.001$), and depressive symptoms (average $\beta = 0.63, p < 0.001$). With regard to the mediation analysis, results showed that children’s initial levels of prosociality predicted higher peer preference (average $\beta = 0.12, p < 0.001$), which in turn predicted lower levels of depressive symptoms (average $\beta = -0.08, p = 0.003$). Using bias-corrected bootstrapping, a significant indirect effect from Grade 3 prosociality to Grade 5 depressive symptoms through Grade 4 peer preference was established, $\beta = -0.01, 95\% \text{ CI } [-0.017, -0.004], p = 0.001$. Similarly, a significant indirect effect from Grade 4 prosociality to Grade 6 depressive symptoms through Grade 5 peer preference was also established, $\beta = -0.01, 95\% \text{ CI } [-0.016, -0.004], p = 0.001$. For the reverse directionality (i.e., from depressive symptoms to later prosociality), results showed that depressive symptoms were associated with lower peer preference at later waves (average $\beta = -0.08, p < 0.001$), but peer preference was not associated with later prosociality (average $\beta = 0.01, p = 0.486$). Consequently, for the mediating effect of peer preference on relations between depressive symptoms and later prosociality was not significant ($\beta = -0.001, 95\% \text{ CI } [-0.003, 0.001], p = 0.499$). Thus, Hypothesis 2 was partially supported.

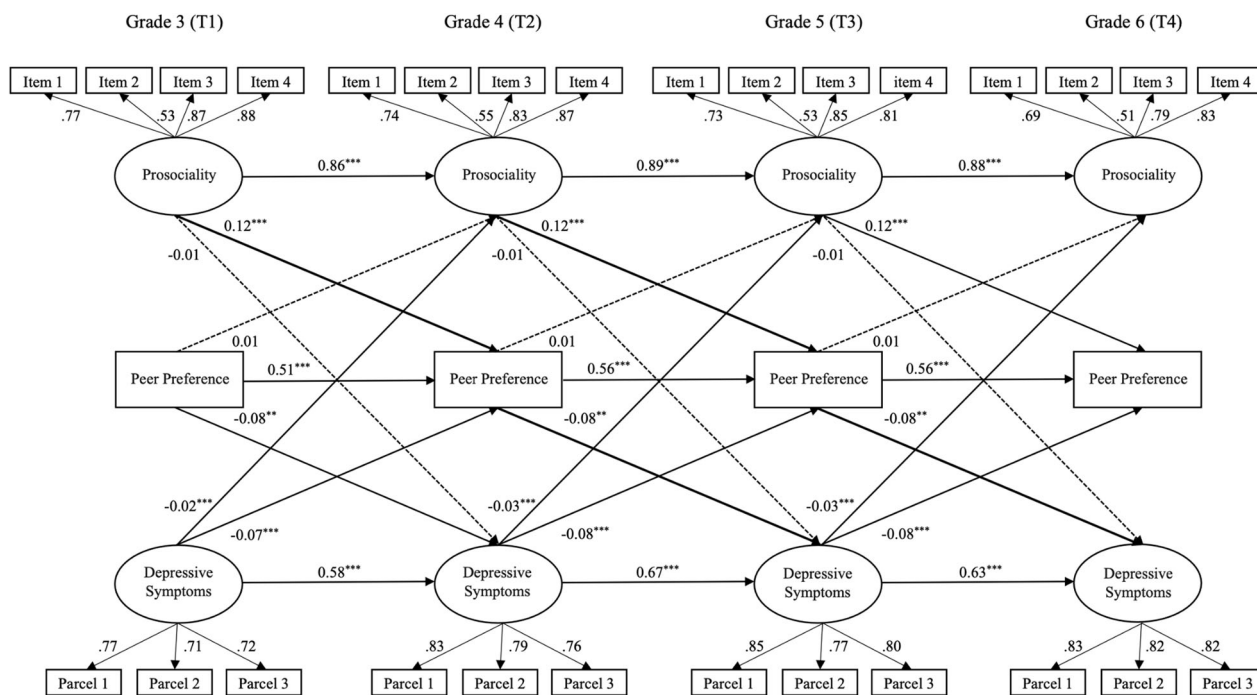
Multigroup analyses were conducted to compare gender differences in the mediating effects of peer preference. The

results showed no significant gender differences in the cross-lagged paths from prosociality to peer preference, $\Delta\chi^2_{SB}(1) = 3.13, p = 0.077, \Delta CFI = -0.001, \Delta RMSEA = 0.000$, or from peer preference to depressive symptoms, $\Delta\chi^2_{SB}(1) = 0.34, p = 0.559, \Delta CFI = 0.000, \Delta RMSEA = 0.000$.

Discussion

The role of prosociality in children’s social and school adjustment has been well established in the literature (e.g., Carlo et al., 2018; Zhang et al., 2018). However, relatively little research has been conducted on relations between prosociality and psychological problems and the underlying mechanism in the relations from a developmental perspective (Memmott-Elison et al., 2020). The present multi-wave longitudinal study examined the reciprocal contributions of prosociality and depressive symptoms and the role of peer preference, a major indicator of peer relationship quality, in mediating the relations in Chinese children. The results showed that prosociality and depressive symptoms negatively predicted each other over a 3-year period and that peer preference mediated the longitudinal contributions of prosociality to depressive symptoms.

The results supported the first hypothesis about reciprocal contributions of prosociality and depressive symptoms over time. As indicated earlier, prosocial behaviors may help create an environment that reduces adverse psychological experiences, such as stress and distress (e.g., Schacter & Margolin, 2019). Self-control abilities of prosocial children may help them modulate their negative emotional



Note. Standardized coefficients are shown. For the sake of clarity, the figure omits concurrent correlations of residual variances. Gender and parental educational level were controlled for as covariates. * $p < .05$. ** $p < .01$. *** $p < .001$.

Fig. 2 Cross-lagged panel model with prosociality, peer preference, and depressive symptoms (Model 2.4)

reactivity (e.g., Eisenberg et al., 2010; Paschke et al., 2016). On the other hand, experiencing high levels of depression may inhibit children from behaving prosocially in social settings. Impaired cognitive and emotional abilities associated with depression are likely to reduce adolescents’ interest in social activities and increase their self-focused attention and attitudes (de Wit et al., 2010), which in turn may weaken their awareness of the needs of others and the tendency to engage in prosocial actions.

The results indicated no significant gender differences in the relations between prosociality and depressive symptoms, suggesting that their reciprocal contributions were similar for boys and girls. Given the arguments that prosociality may play a more salient role in psychological adjustment in girls than boys and that girls are expected to be more interested in social relationships than boys (e.g., Flynn et al., 2015), the issue needs to be further investigated in future research.

The present study filled a gap in the literature by examining the role of peer preference in mediating the longitudinal associations between prosociality and depressive symptoms. As expected, it was found that children with higher levels of prosociality were more preferred by their peers, which in turn reduced their experiences of depression over time. The mediating processes are likely to involve favorable peer treatments, including provisions of social support and interpersonal connectedness that prosocial children tend to obtain, and their positive emotional responses in social interactions. The results were consistent with the contextual-developmental perspective

(Chen, 2012) which posits that social evaluations in peer relationships serve to regulate the development of social behaviors and their implications for developmental outcomes.

Peer preference did not mediate the prospective effects of depressive symptoms on prosociality. The results may be related to less evident peer reactions to adolescents’ depressive symptoms, which may be particularly the case in Chinese context where psychological adjustment is often neglected by others (Chen, 2010). It is also possible that prosociality is highly stable during development (e.g., Flynn et al., 2015), making it less susceptible to the influence of other factors including depressive symptoms and peer relationships. Future studies should examine whether other factors, such as self-control (Eisenberg et al., 2010), are more predictive of prosociality or mediate the contributions of depressive symptoms to prosocial development.

Several limitations and weaknesses in the study should be noted. First, the study was conducted in elementary school children. One needs to be careful in generalizing the results to other developmental periods. For example, as children experience more extensive and intensive challenges and stress in social and academic adjustment in middle school (e.g., Tu et al., 2020), individual psychological functioning, such as depressive symptoms, may be more likely to affect peer relationships and social behaviors in adolescence.

Second, this study focused on peer preference as a mediator of the relations between prosociality and depressive symptoms. It will be important to study how other

aspects of peer relationships, such as friendships and peer groups, play a role in shaping the relations.

Third, it has been argued that prosociality may include different aspects, such as helping, sharing, and comforting (Dunfield, 2014) and may be directed to different targets, such as strangers, friends, and family members (Padilla-Walker & Carlo, 2014). Therefore, studies on whether and how the relations between prosociality and depressive symptoms vary across domains and targets are warranted.

Finally, the present study was conducted in a sample of Chinese children. Whereas the results meshed well with the literature, the specific results were not directly comparable with those in the Western studies because of the differences in the design, measurement, and context. For example, longitudinal panel data were collected from multiple waves in this study, which allowed the examination of the mediating effects of peer preference in explaining the longitudinal relations between prosociality and depressive symptoms. The evident effects of prosociality found in this study may be related to the great emphasis on group orientation and interpersonal connectedness in Chinese society (Chen et al., 2000). Thus, the study needs to be replicated in other societies. Relatedly, the present study was conducted in a region consisting mostly of towns, small cities, and surrounding areas in South China. There are substantial differences across regions in China in social and economic development. Thus, generalization of the results to other regions, such as large cities (e.g., Beijing, Shanghai), should be made with caution.

Conclusion

How prosociality and depressive symptoms are associated with each other and how social-relational experiences play a role in linking the associations are important issues in human development. The present study examined the longitudinal associations between prosociality and depressive symptoms and the mediating effects of peer preference on the associations in Chinese children. The results indicated that prosociality and depressive symptoms contributed to the development of each other over time in a reciprocal manner and that peer preference mediated the contribution of prosociality to later depressive symptoms. The study provided evidence for the connections among different aspects of Chinese children's social and psychological functioning and the role of peer relationships from a developmental perspective.

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Authors' Contributions G.J. conceived of the topic of the present study, performed the statistical analysis, and drafted the manuscript; R.F. helped perform the statistical analysis and write the manuscript; D.L. participated in the design and coordination of the project and helped draft the

manuscript; X.C. participated in conceptualization and design of the project and helped write the manuscript; and J.L. participated in the design and coordination of the project and interpretation of the data. All authors read and approved the final manuscript.

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Data Sharing and Declaration The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Compliance with Ethical Standards

Conflict of Interest The authors declare no competing interests.

Ethical Approval We have adhered to APA ethical standards in conducting this study and this study has been approved by the Institutional Review Board of Shanghai Normal University.

Informed Consent Written assent was obtained from all participating children and written consent was obtained from their parents through the school.

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