



Intergenerational Transmission of Depressive Symptoms from Mothers to Adolescents: A Moderated Mediation Model

Kexin Sun¹ · Meijing Chen¹ · Danjun Feng¹ · Cong Cao¹

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Abstract

Substantial literature investigating the intergenerational transmission of depressive symptoms has primarily focused on mothers and adolescents, whereas less is known about the potential role of fathers, especially their parenting behaviors. This study aimed to address this gap by examining the mediating role of maternal parenting, and the moderating role of paternal parenting in this intergenerational transmission pathway. A total of 528 Chinese community adolescents ($M_{age} = 12.70 \pm 1.49$ years; 48.7%, girls) and their mothers participated. After adolescent sex, age, maternal educational levels, and monthly household income were controlled for, both maternal warmth and rejection mediated the association between maternal and adolescent depressive symptoms. More importantly, paternal warmth buffered the adverse effect of maternal depressive symptoms and maternal rejection on adolescent depressive symptoms. These findings highlight the buffering role of paternal parenting in blocking the intergenerational transmission risk of depressive symptoms from mothers to adolescents and emphasize the need for father-focused interventions.

Keywords intergenerational transmission · depressive symptoms · maternal parenting · paternal parenting

Introduction

The mechanisms underlying intergenerational transmission of depressive symptoms from mothers to adolescents have received great attention [1, 2]. Maternal parenting has been found to play an important mediating role in this intergenerational transmission pathway [3, 4]. However, it is worth noting that, besides mothers, the fathers, especially their parenting behaviors, are also important for offspring development [5]. Nevertheless, most studies investigating this intergenerational transmission pathway have primarily focused on mothers and adolescents, regardless of the role of fathers [1, 2]. The current study aimed to explore the intergenerational transmission mechanism of depressive symptoms from mothers to adolescents, in which (i) the mediating role of maternal parenting, and (ii) the moderating role of paternal parenting were particularly focused on.

Intergenerational Transmission of Depressive Symptoms from Mothers to Adolescents: The Mediating role of Maternal Parenting

Depression is intergenerational transmission in nature. Of which, the intergenerational transmission pathway from *mothers to adolescents* has been mainly focused on [1, 2, 6]. This may be primarily due to two reasons. On the one hand, adolescence is a critical period for understanding the nature and course of depression [7]. During this period, the incidence rates and levels of depressive symptoms increase dramatically [8]. For instance, approximately 20% ~ 50% of U.S. adolescents experience depressive symptoms [9]. On the other hand, compared to fathers, mothers are more likely to be involved in daily care of adolescents and thus usually spend more time with adolescents. Moreover, women are 1.5 ~ 3 times more likely than men to experience major depressive disorder and subclinical depressive symptoms [10]. A large number of studies have shown that adolescents of depressed mothers are more likely to exhibit mood disorders and subclinical depressive symptoms than adolescents of non-depressed mothers [11]. Notably, based on a community sample, the current study focused on the intergenerational transmission pathway of depressive symptoms rather

✉ Cong Cao
caocong@sdu.edu.cn

¹ School of Nursing and Rehabilitation, Shandong University, No. 44 West Wenhua Road, 250012 Jinan, Shandong Province, China

than that of diagnostic depressive disorders. As suggested by the transdiagnostic model and recent evidence, mental health symptoms including depression are not all-or-none phenomena, but are better conceptualized along continuous dimensions within the population as opposed to categorical diagnoses [12]. Research based on the diagnostic depressive disorders may lead to an underestimation of the severity of the problems caused by depression [9]. For instance, there is evidence that adolescents suffering from subclinical depressive symptoms exhibit similar impairments (e.g., poor school performance, bad interpersonal relationships, and an increased risk of suicide) as those who meet diagnostic criteria do [13, 14]. Accordingly, a dimensional measure of depressive symptoms was used in the current study to capture the variations in depression and to examine the underlying intergenerational transmission mechanisms, which would inform preventive intervention strategies for high-risk adolescents before they develop diagnostic depressive disorders.

The Integrative Model of the Transmission of Risk to Children of Depressed Mothers (the Integrative Model) [15] proposes that, one of the most important mediating variables for the link between maternal and adolescent depressive symptoms is maternal parenting behaviors. The model suggests that depressed mothers may show poor parenting quality (e.g., high rejection and lack of warmth), making adolescents feel “not worthy of being loved” or “incapable”, both of which underlie depressive symptoms. Besides, the Process Model of the Determinants of Parenting [16] holds that, mothers’ mental health, especially maternal depression is an important factor affecting their parenting behaviors; depressed mothers are more likely to provide a hostile, rejecting home environment for their children, which would in turn damage children’s mental health. Many studies have consistently demonstrated the mediating role of both maternal positive and negative parenting in this intergenerational transmission of depressive symptoms [1, 3, 4]. Given warmth and rejection are two important dimensions of parenting behaviors that are often examined [17], the first aim of the current study was to verify the mediating role of maternal warmth and rejection in the relationship between maternal and adolescent depressive symptoms.

Intergenerational Transmission of Depressive Symptoms from Mothers to Adolescents: The Moderating role of Paternal Parenting

The extant literature regarding on the intergenerational transmission of depressive symptoms has primarily focused on mothers and adolescents, whereas, in the family, the role of fathers, especially their parenting behaviors, should not be ignored [1, 2]. The family system theory emphasizes

the wholeness of the family, and proposes the mother-child relationship could be undeniably affected by the father [18]. Focusing on the Chinese families, due to the effect of Confucianism, although Chinese mothers have more responsibility for caring for their children, Chinese fathers are more involved in disciplining children [19]. An increasing body of evidence shows that paternal characteristics, especially paternal parenting, are tightly associated with the development of adolescent depressive symptoms [20]. However, the extent to which the effects of paternal parenting are similar to or different from the effects of maternal parenting remains less clear [21–23]. For instance, a recent meta-analysis has demonstrated that the effects of parental warmth and control on adolescent depressive symptoms do not vary between mothers and fathers [22]. In contrast, a study including 12 cultural groups in 9 countries has found that the effects of parental warmth and control on child internalizing behaviors appear to depend on who is providing the parenting, and paternal parenting effects are more pronounced than maternal parenting effects [23]. More importantly, according to the Integrative Model [15], paternal parenting may moderate the intergenerational transmission pathway of mother and adolescent depressive symptoms in two ways: moderate (i) the direct path of intergenerational transmission (see Fig. 1, m_1) and (ii) the second half of the mediating path of maternal parenting (see Fig. 1, m_2 and m_3).

Moreover, based on previous research and related theory [24–26], there may be six primary models for such potential moderating effect of paternal parenting, especially in the mediating path of maternal parenting, i.e., the interaction between maternal and paternal parenting (see Fig. 2). First, when parenting behaviors are consistent across parents, the adverse effects of negative parenting of mothers and fathers may reflect as an enhanced effect of $1+1>2$ (Model 1: the risk-enhancing model, Fig. 2a) or a diminished effect of $1+1<2$ (Model 2: the reverse risk-enhancing model, Fig. 2b). These two models are in line with the positive and negative acceleration models of cumulative risk theory, respectively. That is, when risks are accumulated, the total effect of each risk is either greater or less than the sum of the effects of each risk [25]. Similarly, the protective effect of positive parenting for mothers and fathers may also reflect as an enhanced effect (Model 3: the protective-protective model, Fig. 2c), or a diminished effect (Model 4: the reverse protective-protective model, Fig. 2d). These two models are also both consistent with the cumulative risk theory, in that two protective factors may have enhanced or diminished effects [25].

Second, when parenting behaviors are inconsistent across parents, there may be two moderating models: the stress-buffering model (Model 5) and the stress-vulnerability model (i.e., reverse stress-buffering model) (Model 6).

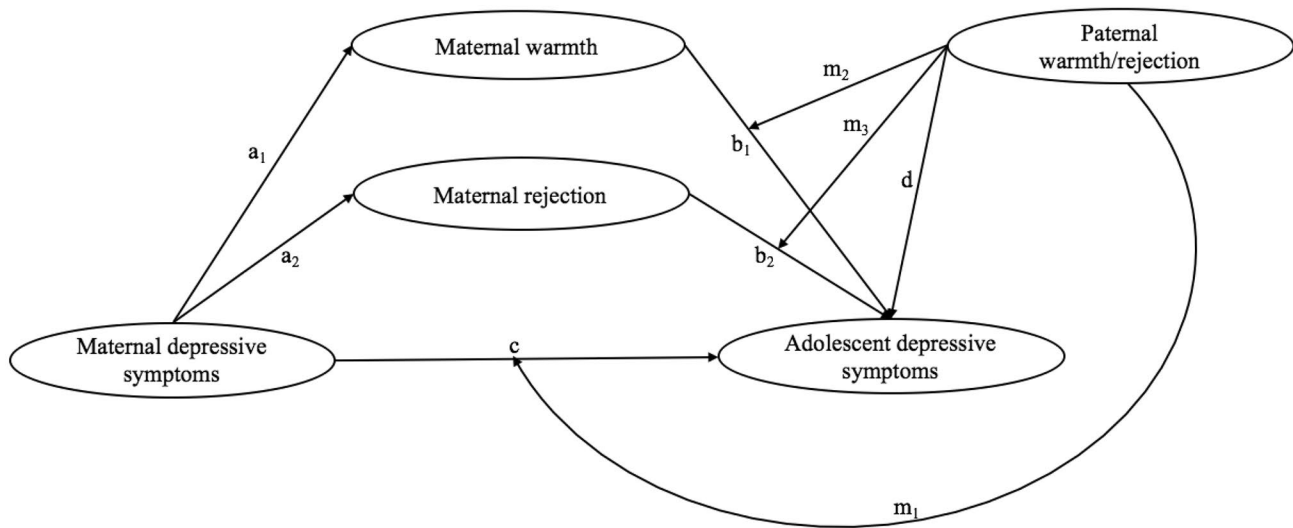


Fig. 1 Intergenerational transmission of depressive symptoms from mothers to adolescents: A hypothetical moderated mediation model. The path coefficients of each variable are present in this Figure. Regarding the mediation pathways, the mediating effect of maternal warmth and rejection is $a_1 \times b_1$, $a_2 \times b_2$, respectively; the direct path between maternal and adolescent depressive symptoms is c . Regarding the

moderating pathways, the moderating effect of parental warmth/rejection in the direct path of intergenerational transmission from mothers to adolescents is m_1 ; the moderating effect of parental warmth/rejection in the second half of the mediating path of maternal warmth and rejection (i.e., in the association between maternal warmth/rejection and adolescent depressive symptoms) is m_2 and m_3 , respectively

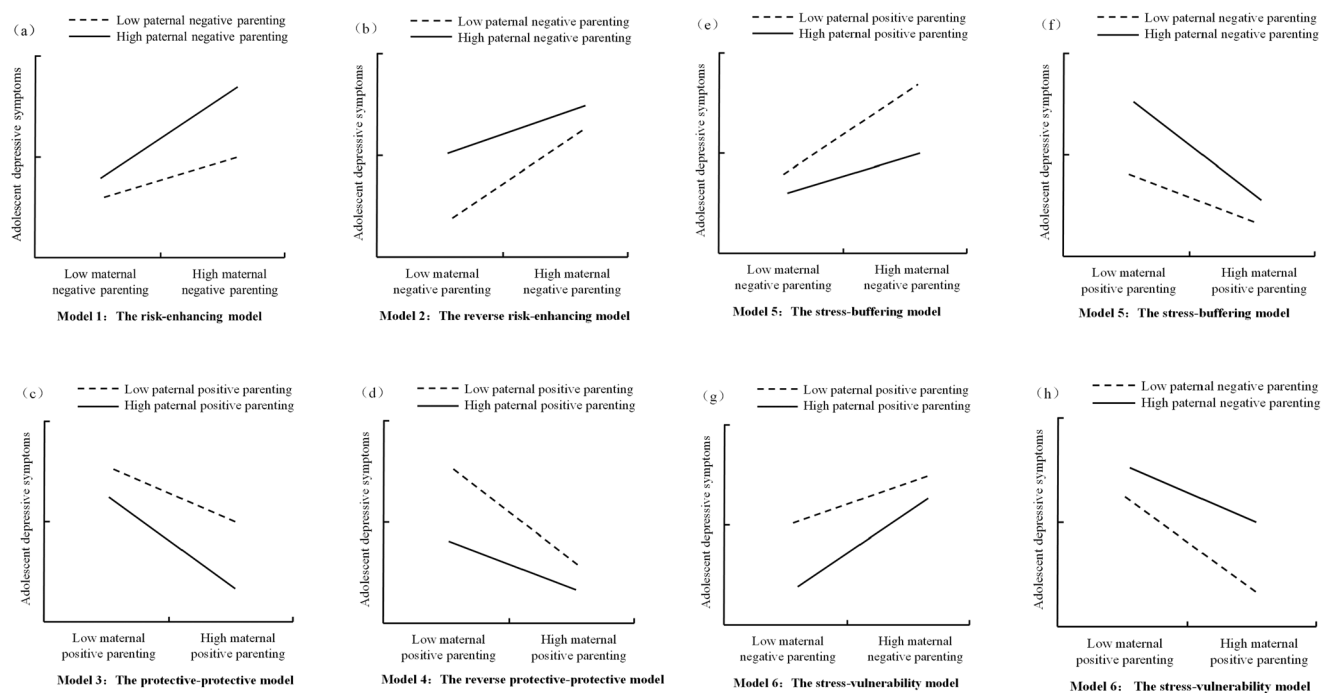


Fig. 2 The six primary models for the potential moderating effect of paternal parenting on the association between maternal parenting and adolescent depressive symptoms

The stress-buffering model is consistent with the opinion of resilience theory that individuals can mobilize their factors or external resources to deal with unfavorable environments and avoid negative outcomes [24]. Thus, the stress-buffering model mainly refers to that a protective factor could buffer

the adverse effects of another risk factor, which may be reflected in two ways: paternal positive parenting may buffer the adverse effects of maternal negative parenting (Fig. 2e), or maternal positive parenting may protect adolescents from the adverse effects of paternal negative parenting (Fig. 2f).

However, a few researchers have challenged this traditional view, arguing that resilience rarely occurs when individuals are exposed to greater risk [27, 28]. From this perspective, the stress-vulnerability model refers to that a protective factor may be not sufficient to buffer the adverse effects of another risk factor, which also may include two situations (see Fig. 2g and 2h). For example, consistent with the stress-vulnerability model, one study including 1145 Chinese adolescents found that the direct relationship between cyber victimization and alcohol use was stronger in adolescents who experienced high perceived social support [28]. Considering that maternal depressive symptoms is a negatively valenced variable, the moderating role of paternal parenting in the direct pathway of intergenerational transmission (m_1 in Fig. 1) may be mainly reflected as the Model 1, 2, 5 and 6, but not the Model 3 and 4 (i.e., enhanced and diminished models for two protective factors).

However, to our knowledge, only two studies have examined such moderating role of paternal parenting in this transmission pathway. One study including 350 American preschoolers and their parents showed that paternal warmth significantly mitigated the adverse effects of maternal depressive symptoms on children's internalizing problems [29]. In another cross-sectional study which focused on 184 Chinese preschool children and their parents, paternal positive encouragement was found to buffer the adverse effects of maternal depressive symptoms on children's internalizing problems, but failed to moderate the mediating path of maternal punishment [30]. By solely examining the positive dimension of paternal parenting, these two studies appear to support the stress-buffering model but not stress-vulnerability model. However, a fact that cannot be ignored is that, even in the family with depressed mothers, fathers may show both positive and negative parenting behaviors (rather than always positive parenting). To date, less is known about the full picture of the effects of paternal parenting that included both positive and negative dimensions in the association between maternal and adolescent depressive symptoms.

Current Study

Based on the family system theory and the Integrative Model, this study aimed to investigate the intergenerational transmission pathway of depressive symptoms from mothers to adolescents (See Fig. 1). First, we examined to what extent maternal warmth and rejection played a mediating role in the association between maternal and adolescent depressive symptoms. Second, by the positive and negative dimensions of maternal and paternal parenting were both included, whether and how paternal warmth and rejection moderated the direct path and the second half of the mediating path of maternal parenting was comprehensively

Table 1 Demographic Characteristics of the Current Sample ($N = 528$)

| Sample characteristics | M (SD) |
|--|--------------|
| Adolescent | |
| Sex (%girl) | 48.7 |
| Age | 12.70 (1.49) |
| Chinese Han (%) | 100 |
| Mother | |
| Educational levels | |
| None or primary school (%) | 3.5 |
| Secondary school (%) | 18.8 |
| High school (%) | 20.4 |
| Junior college (%) | 20.8 |
| Undergraduate (%) | 27.4 |
| Postgraduate (%) | 9.1 |
| Monthly household income in ¥ ^a | |
| < 5000 (%) | 17.4 |
| 5000–9999 (%) | 30.0 |
| 10,000–14,999 (%) | 21.6 |
| 15,000–19,999 (%) | 11.4 |
| > 20,000 (%) | 18.6 |

Note. ^a1000¥=153USD.

Unless otherwise specified, values are M (SD).

All percentages are valid percentages

examined. Which models (i.e., Model 1 to Model 6, Fig. 2) the moderating role of parenting was consistent with, were particularly focused on.

Methods

Participants and Procedure

All participants were recruited from four public schools (two junior high schools and two senior high schools) in Jinan, Shandong Province, China, via our electronic recruitment brochure. A total of 528 Chinese adolescents ($M_{age} = 12.70 \pm 1.49$ years; 48.7%, girls) and their mothers participated in the study. All the adolescents were of Chinese Han ethnicity and from intact families in which the primary caregivers were parents without any current diagnosis of mental disorders. Moreover, all included adolescents had no history of chronic physical diseases or severe cognitive impairment, and had no current diagnosis of major depressive disorders or other mental disorders. All the families were permanent residents of community, and the adolescents were not left-behind or migrant. The demographic characteristics of the participants are shown in Table 1.

The study was approved by the Ethics Committee of School of Nursing and Rehabilitation, Shandong University. After adolescents, their mothers and school headmasters gave their consents, questionnaires in sealed envelopes were distributed to adolescents and their mothers, separately. The

questionnaires were filled out independently by adolescents and their mothers in two different rooms at home, then collected by the teachers and forwarded to the research team.

Measures

Adolescent Depressive Symptoms

Adolescents reported their depressive symptoms in the last two weeks by the widely-used Chinese version of the Children's Depression Inventory (CDI) [31]. The CDI contains 27 items, including 5 dimensions: negative mood (7 items, e.g., "sadness"), interpersonal problems (4 items, e.g., "fights"), ineffectiveness (4 items, e.g., "school performance decrement"), anhedonia (8 items, e.g., "reduced appetite"), and negative self-esteem (4 items, e.g., "feeling unloved"). Each item is rated on a 3-point scale, ranging from 0 ("no symptoms") to 2 ("severe symptoms"). In this study, the Cronbach's α of CDI was 0.90.

Maternal Depressive Symptoms

Mothers reported their depressive symptoms in the last two weeks by the Chinese version of the Beck Depression Inventory-II (C-BDI-II) [32, 33]. The C-BDI-II includes 21 items and each item is rated on a 4-point scale, ranging from 0 ("no symptoms") to 3 ("severe symptoms"). The study used three-factor model of Beck [31]: cognitive factors (8 items, e.g., "past failure"), somatic factors (9 items, e.g., "tiredness or fatigue"), and affective factors (5 items, e.g., "loss of pleasure"). The Cronbach's α of C-BDI-II in this study was 0.86.

Maternal and Paternal Parenting Behaviors

The widely-used short form of Egna Minnen Barndoms Uppfostran (S-EMBU) [34] was used to assess adolescents' perceived warmth and rejection of mothers and fathers, respectively, in the past year. The scale consists of 12 items per parents and yields warmth (6 items, e.g., "my parents praised me") and rejection (6 items, e.g., "my parents get angry with me without letting me know the reason") scores for the mothers and the fathers, respectively. Each item is rated on a 4-point scale, ranging from 1 ("never") to 4 ("always"). The Cronbach's α s for warmth and rejection of mothers and fathers ranged from 0.82 to 0.98.

Covariates

Four variables that are related to adolescent depressive symptoms were considered as covariates [4, 35],

including adolescent sex, age, maternal educational levels, and monthly household income.

Data Analysis

Descriptive statistics and correlation analysis were conducted using SPSS 23.0. The structural equation modeling (SEM) was performed using Mplus 7.4. When the variables are seriously non-normally distributed, robust maximum likelihood (MLR) estimation is more sensitive to model mis-specification than Bootstrapping¹ [36]. Thus, MLR estimation was adopted due to the non-normal distributions of maternal and adolescent depressive symptoms. The full information maximum likelihood (FIML) estimation was applied to handle missing data. The hypothetical moderated mediation model (Fig. 1) was analyzed in the following steps:

First, confirmatory factor analysis was used to test the measurement model. The acceptance of the measurement model indicates that the observed variables represented their respective latent variables well and shows that the structural model can be established. To control for inflated measurement errors due to multiple items of latent variables of both maternal and paternal parenting, three parcels were created, each consisting of two selected items [37]; adolescent and maternal depressive symptoms were packaged according to their respective dimensions. The measurement model showed a good fit to the data ($\chi^2/df=2.55$, CFI=0.96, TLI=0.95, RMSEA=0.05, SRMR=0.03), and all the standardized loadings of the observed variables on the corresponding latent variables were significant ($\beta_s \geq 0.67$, $p < .001$), suggesting that this structural model was well established.

Second, the parallel mediation model was established to simultaneously investigate the mediating role of maternal warmth and rejection in the intergenerational transmission pathway, where the residuals of the two mediators were allowed to be correlated.

Third, latent moderated structural equation (LMS) [38] was used to examine the moderating role of paternal warmth and rejection. Considering the simplicity of models, paternal warmth and rejection were modeled respectively. Specifically, the baseline model solely with main effects of paternal warmth or rejection (M0) was firstly constructed, and then the interaction effects of paternal warmth or rejection were added into the baseline model (M1). The log-likelihood ratio test ($-2LL = -2[(\log\text{-likelihood for M0}) - (\log\text{-likelihood for M1})]$) was used to compare these two nested models [39]. If M1 fitted significantly better than M0, then

¹ Supplementary analysis using Bootstrapping was conducted and showed that the results using Bootstrapping were consistent with those estimated by MLR.

Table 2 Descriptive statistics and correlations among study variables ($N=528$)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------------------------------|----------|----------|----------|----------|---------|---------|--------------------|-------|---------|------|
| 1 Maternal depressive symptoms | | | | | | | | | | |
| 2 Maternal warmth | -0.22*** | | | | | | | | | |
| 3 Maternal rejection | 0.26*** | -0.42*** | | | | | | | | |
| 4 Paternal warmth | -0.20*** | 0.65*** | -0.32*** | | | | | | | |
| 5 Paternal rejection | 0.24*** | -0.29*** | 0.65*** | -0.41*** | | | | | | |
| 6 Adolescent depressive symptoms | 0.26*** | -0.34*** | 0.42*** | -0.40*** | 0.40*** | | | | | |
| 7 Adolescent sex | 0.01 | 0.05 | -0.05 | -0.03 | -0.07 | 0.03 | | | | |
| 8 Adolescent age | 0.07 | -0.07 | 0.06 | 0.01 | 0.004 | 0.18*** | 0.01 | | | |
| 9 Maternal educational levels | -0.20*** | 0.22*** | -0.04 | 0.17*** | -0.05 | -0.12** | 0.04 | 0.04 | | |
| 10 Monthly household income | -0.20*** | 0.23*** | -0.07 | 0.16*** | -0.09* | -0.12** | -0.04 | 0.02 | 0.54*** | |
| <i>M</i> | 6.10 | 17.88 | 8.47 | 15.99 | 8.60 | 12.02 | 48.7% ^a | 12.70 | 3.77 | 2.82 |
| <i>SD</i> | 6.91 | 4.50 | 2.98 | 4.64 | 2.92 | 8.52 | — | 1.49 | 1.36 | 1.36 |

Note. ^asex: 0=boys, 1=girls;

* $p < .05$, ** $p < .01$, *** $p < .001$

M1 would be chosen. A simple slope analysis was followed to further examine the pattern of the significant moderating effect of paternal warmth or rejection. Besides, to ensure the robustness of the results of above separate models, an integrated model was constructed to examine the moderating effects of paternal warmth and rejection simultaneously.

Finally, the sex moderation effect for the moderated mediation model was tested, despite this was not the focus of the current study.

Results

Preliminary Analyses

Descriptive statistics and bivariate correlations of study variables are shown in Table 2. Maternal depressive symptoms were negatively correlated with maternal and paternal warmth ($r_s \leq -0.20$), and positively correlated with maternal and paternal rejection, and adolescent depressive symptoms ($r_s \geq 0.24$). All the parenting dimensions of fathers and mothers were significantly correlated with each other ($|r_s| \geq 0.29$). Maternal and paternal warmth negatively related to adolescent depressive symptoms ($r_s \leq -0.34$), whereas maternal and paternal rejection positively related to adolescent depressive symptoms ($r_s \geq 0.40$). In addition, there was significant positive correlation between adolescent age and their depressive symptoms. Maternal educational levels and monthly household income were both negatively linked to maternal and adolescent depressive symptoms.

Intergenerational transmission of depressive symptoms from mothers to adolescents: The mediating role of maternal parenting behaviors

After covariates (i.e., adolescent sex, age, maternal educational levels, and monthly household income) were controlled for, the parallel mediation model of maternal warmth and rejection fitted the data well, $\chi^2/df=1.60$, CFI=0.98, TLI=0.98, RMSEA=0.03, SRMR=0.04, $R^2=0.31$. Maternal depressive symptoms were significantly associated with adolescent depressive symptoms ($\beta=0.13$, $p=.020$). Maternal warmth and rejection both exerted a mediating role in the relationship between maternal and adolescent depressive symptoms. Specifically, maternal depressive symptoms significantly related to maternal warmth ($\beta=-0.29$, $p<.001$), and maternal warmth significantly associated with adolescent depressive symptoms ($\beta=-0.18$, $p=.002$). The mediating effect of maternal warmth (a_1b_1) was 0.06, $p=.009$, 95% CI [0.02, 0.11], accounting for 16% of the total effect. Maternal depressive symptoms were also significantly linked with maternal rejection ($\beta=0.33$, $p<.001$), and maternal rejection related to adolescent depressive symptoms ($\beta=0.33$, $p<.001$). The mediating effect of maternal rejection (a_2b_2) was 0.14, $p<.001$, 95% CI [0.06, 0.21], accounting for 38% of the total effect. However, there was no significant difference in the mediating effects between maternal warmth and rejection ($a_1b_1 - a_2b_2=0.07$, $p=.122$, 95% CI [-0.02, 0.17]).

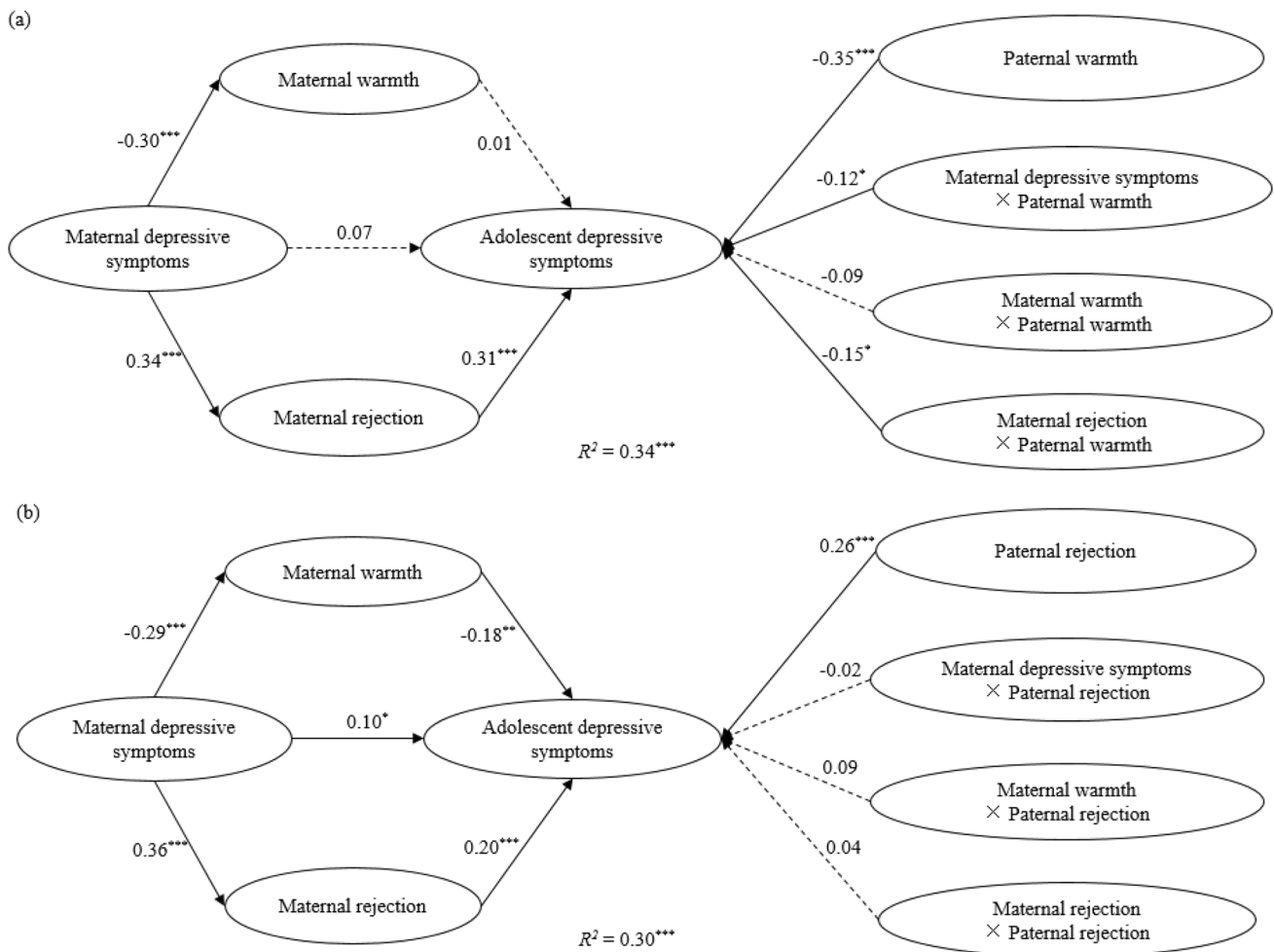


Fig. 3 The moderating effect of (a) paternal warmth and (b) paternal rejection in the intergenerational transmission pathway of depressive symptoms from mothers to adolescents. The coefficients listed are standardized coefficients; the residuals of maternal warmth and rejection were allowed to be correlated; adolescent sex and age, maternal

educational level and monthly household income were controlled for, and they are not shown for ease of presentation; dashed lines indicate nonsignificant paths, and black lines indicate significant paths; * $p < .05$, ** $p < .01$, *** $p < .001$

Intergenerational transmission of depressive symptoms from mothers to adolescents: The moderating role of paternal parenting behaviors

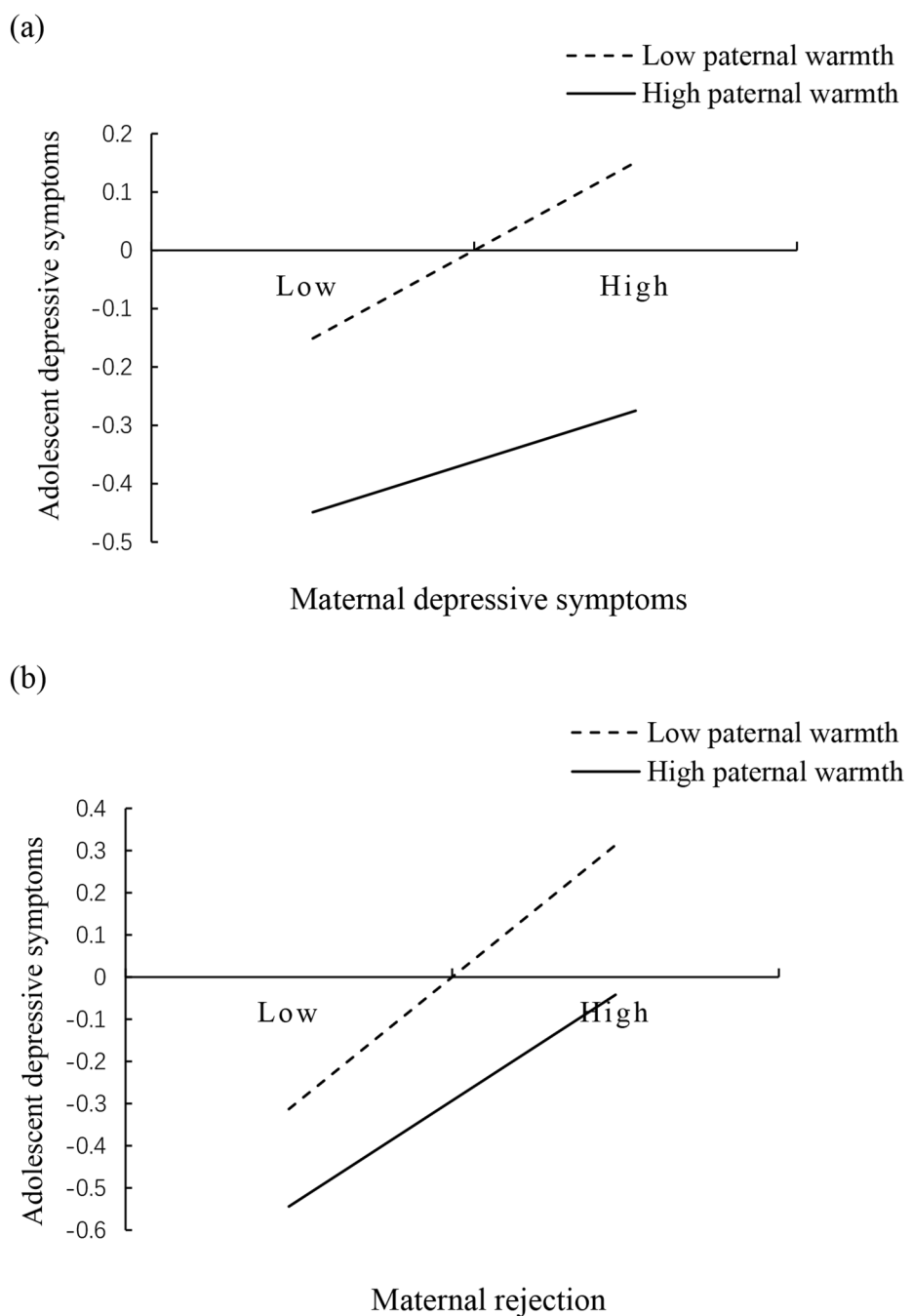
The Moderating role of Paternal Warmth

The results of the moderating effect of paternal warmth are shown in Fig. 3a. First, the model M0 where the main effect of paternal warmth was added into the above-constructed parallel mediation model, demonstrated an acceptable fit to the data, $\chi^2/df = 3.77$, CFI = 0.91, TLI = 0.89, RMSEA = 0.07, SRMR = 0.11, $R^2 = 0.34$. Then, three latent interaction items (maternal depressive symptoms \times paternal warmth, maternal warmth \times paternal warmth, maternal rejection \times paternal warmth) were added into M0 to

construct the moderating mediation model M1. The M1 fitted better than the M0 ($-2LL = 20.38$, $p < .001$). As shown in Fig. 3, paternal warmth significantly moderated (i) the direct path of intergenerational transmission of depressive symptoms from mothers to adolescents ($\beta = -0.12$, $p = .042$, 95% CI $[-0.23, -0.004]$), (ii) as well as the mediating path of maternal rejection ($\beta = -0.15$, $p = .022$, 95% CI $[-0.28, -0.02]$). However, paternal warmth failed to moderate the mediating path of maternal warmth ($\beta = -0.09$, $p = .211$, 95% CI $[-0.23, 0.05]$).

To further reveal the moderating models of paternal warmth, paternal warmth was divided into high ($M + 1SD$) and low levels ($M - 1SD$) for simple slope analysis. To be specific, the moderating effect of paternal warmth in the direct transmission path was consistent with the stress-buffering model (see Fig. 4a). Only when adolescents perceived

Fig. 4 The moderating effect of paternal warmth in the association (a) between maternal and adolescent depressive symptoms, and (b) between maternal rejection and adolescent depressive symptoms



low levels of paternal warmth, maternal depressive symptoms significantly related to adolescent depressive symptoms (*Simple slope*=0.22, *SE*=0.05, *p*<.001); however, adolescent perceived high levels of paternal warmth blocked the direct pathway of intergenerational transmission of depressive symptoms from mothers to adolescents (*Simple slope*=0.09, *SE*=0.05, *p*=.108). Similarly, the moderating effect of paternal warmth in the mediated path of maternal rejection was also consistent with the stress-buffering model (see Fig. 4b). Specifically, only when adolescents perceived

low levels of paternal warmth, maternal rejection significantly associated with adolescent depressive symptoms (*Simple slope*=0.38, *SE*=0.12, *p*=.002), and significantly mediated the intergeneration transmission pathway (*Simple slope*=0.20, *SE*=0.06, *p*=.001, 95% CI [0.09, 0.31]). However, adolescents’ perceived high levels of paternal warmth blocked the mediated effect of maternal rejection (*Simple slope* for *b*₂=0.25, *SE*=0.15, *p*=0.098; *Simple slope* for *a*₂*b*₂=0.03, *SE*=0.04, *p*=.455, 95%CI [-0.05, 0.12]).

The Moderating role of Paternal Rejection

The moderating effect of paternal rejection in the parallel mediation model was tested (see Fig. 3b). First, the M0 with solely main effects of paternal rejection fitted the data well, $\chi^2/df=3.09$, CFI=0.93, TLI=0.91, RMSEA=0.06, SRMR=0.09. Then, three latent interaction items (maternal depressive symptoms \times paternal rejection, maternal warmth \times paternal rejection, maternal rejection \times paternal rejection) were added to construct the moderated mediation model M1. However, the model M1 with latent interaction terms fitted worse than the model M0 ($-2LL = -12.86$, $p > .999$). None of the three latent interaction items were significantly correlated with adolescent depressive symptoms ($ps \geq .365$). These results demonstrated that paternal rejection failed to moderate the intergenerational transmission pathway of depressive symptoms from mothers to adolescents.

The Integrated Model of Paternal Warmth and Rejection

An integrated model of the moderating effects of both paternal warmth and rejection was constructed. The results were in line with the separate models: paternal warmth significantly moderated the direct path of intergenerational transmission and the mediating path of maternal rejection ($ps \leq .047$); however, paternal rejection did not play a moderating role in this intergenerational transmission pathway.

Supplemental Analysis: Sex Moderation Effect

In this supplementary analysis, adolescent sex was no longer considered as a control variable, but instead was tested its potential moderation effect in the above-constructed moderated mediation models using multiple group analysis. First, constrained models were established where path coefficients were fixed to equality across boys versus girls. This constrained model was compared to an unconstrained model where all path parameters were freely estimated for each sex group. A chi-square difference test comparing the constrained and unconstrained models was non-significant, $\Delta\chi^2(16) = 25.60$, $p = .060$, suggesting adolescent sex had no significant moderating effect.

Discussion

Based on the family system theory and Integrative Model, the current study investigated the mediating role of maternal parenting in the intergenerational transmission of depressive symptoms from mothers to adolescents and particularly focused on the potential moderating role of paternal

parenting in this mediating model. The results showed that both maternal warmth and rejection mediated the intergenerational link between maternal and adolescent depressive symptoms. Moreover, paternal warmth both moderated the (i) direct path of the intergenerational transmission and (ii) the second half of the mediating path of maternal rejection. Specifically, consistent with the stress-buffering model, high levels of paternal warmth buffered or blocked the adverse effect of maternal depressive symptoms directly and indirectly via the mediating role of maternal rejection.

Intergenerational Transmission of Depressive Symptoms from Mothers to Adolescents: The Mediating role of Maternal Parenting

Maternal depressive symptoms were significantly related to adolescent depressive symptoms, and both maternal warmth and rejection mediated this intergenerational transmission. The results were consistent with the opinion of the Integrative Model and the Process Model of the Determinants of Parenting that, impaired parenting behaviors of depressed mothers lead to an increased risk of adolescent depressive symptoms [15, 16]. On one hand, depressed mothers tend to make negative judgments about their adolescents [40]. This may be because depressive symptoms of mothers could lower their threshold for aversive experiences, facilitate the retrieval of negative information in memory, and disrupt their ability to induce adolescent responsiveness and compliance [26]. Mothers' negative evaluations of their children in turn could make them tend to use more negative and less positive childrearing practice. On the other hand, impaired parenting behaviors of depressed mothers could predispose adolescents to perceive more stress. This could make adolescents refuse those mother-child interactions that are usually beneficial for adolescent development, and diminish adolescents' self-efficacy and ability to interact with others, leading to an increased risk of adolescent depressive symptoms [41]. These above findings have shown important implications for clinical practice that improving positive parenting behaviors for high-risk mothers may reduce adolescent depressive symptoms. For example, mothers experiencing high levels of depressive symptoms could participate in Positive Parenting Program (Triple P) to promote their positive parenting and reduce the risk of transmitting depressive symptoms to their children [42].

Intergenerational Transmission of Depressive Symptoms from Mothers to Adolescents: The Moderating role of Paternal Parenting

By including both positive and negative dimensions of paternal parenting behaviors, the current study was the first

to comprehensively examine the moderating role of paternal parenting in the intergenerational transmission pathway of maternal and adolescent depressive symptoms. Consistent with the family system theory and expanding the two existing related studies [29, 30], the results showed that paternal warmth significantly moderated both the direct path of the intergenerational transmission and the mediating path of maternal rejection in which. Specifically, in line with the stress-buffering model, high levels of paternal warmth not only directly blocked the association between maternal and adolescent depressive symptoms, but also indirectly blocked this intergenerational transmission pathway via blocking the mediating path of maternal rejection. The results may be explained by the resilience theory that maternal depression or consequent maternal rejection may leave adolescents in a state of deprivation [43], and due to their resilience, these adolescents may receive compensation from their paternal warmth, reducing the likelihood of their mental problems. In addition, according to the attachment theory, paternal warmth could increase adolescent secure attachment to their fathers, allowing them to have more ability to withstand adverse environmental stimuli [44]. The findings suggest that, in addition to focus on relieving maternal depressive symptoms, interventions for families with maternal depressive symptoms could focus on enhancing paternal parenting quality, which seem to be effective in buffering the adverse effect of maternal depressive symptoms on adolescent development.

It is worth noting that this study did not find any significant moderating effects of paternal warmth in the mediating pathway of maternal warmth. The findings were in accord with a survey based on 343 low-income families [45]: there was no significant interaction between maternal and paternal support on children's cognitive development. This may be due to the fact that when mothers are involved in their children's development with supportive, positive parenting, fathers may perceive mothers as competent and thus choose to be less involved in childrearing activities [40]. In addition, paternal rejection failed to play a significant moderating role in the direct pathway of intergenerational transmission, or the mediating pathway of maternal warmth and rejection. This non-significant moderating effect of paternal rejection might be due to its lower mean score in this community-based sample, and the effect might be more likely to be significant in high-risk families, such as in the families of abused adolescents. To confirm this possibility, we examined the moderating effect of paternal rejection in the mediation model among adolescents with paternal rejection scores above $M + 1SD$ ($N = 88$). The results showed that within high-risk subsamples, paternal rejection indeed played a significant moderating role in both the direct

pathway of intergenerational transmission and the mediating pathway of maternal warmth and rejection ($ps < .001$).

The current study not only verified the important mediating role of maternal warmth and rejection in the intergenerational transmission of maternal and adolescent depressive symptoms, but also simultaneously examined the moderating role of paternal warmth and rejection in the intergenerational transmission pathway for the first time, deepening the intergenerational transmission mechanism of depressive symptoms. However, there are some limitations in this study. First, this study was based on a cross-sectional design and could not test the causal relationship between variables. However, the moderated mediating model of maternal and paternal parenting in the intergenerational transmission was theory-driven and constructed according to the Integrative Model and the family system theory. Future research with a longitudinal design is needed to further validate this model. Second, the current study only included adolescents from intact families, and it was unclear if they had siblings or grandparents. Existing studies have demonstrated that family structure and composition can affect adolescent depressive symptoms. For instance, children from single-parent families exhibit higher levels of depressive symptoms than those from intact families [46]. Moreover, relationships with siblings and grandparents may also have an impact on adolescent depressive symptoms [47, 48]. With the implementation of the two- and three-child policy in China over recent years, co-parenting between parents and grandparents has greatly increased. Future research on the intergenerational transmission of depressive symptoms could examine the effects in different types of family structure and composition. Third, the current study examined parenting behaviors perceived by adolescents. Little is known about the extent to which our findings could be replicated based on parenting behaviors reported by parents or observed by others, and multiple informants might be more likely to reduce measurement error. However, evidence has shown that the development of adolescent psychopathology symptoms are more influenced by parenting perceived by adolescents rather than that reported or observed by others [49].

Last but not least, focusing on the intergenerational transmission of depressive symptoms in a sample of Chinese community families, the current study only included adolescents and parents without any current diagnosis of mental disorders. Therefore, the measures of depressive symptoms in the current study were designed for epidemiological surveys; as was done in previous community research [26, 50], no information about the duration, severity, or type of depression (e.g., major depressive disorder or bipolar disorder) as well as the presence of other comorbid disorders was collected by direct evaluation or observation using diagnostic measures. However, although evidence suggests that parental mood

disorders still uniquely predict adolescent depressive symptoms after controlling for other comorbid parental psychopathology, the presence of other disorders in parents, such as schizophrenia and anxiety, could further increase the intergenerational transmission risk for depressive symptoms [51]. Moreover, the duration, severity, or type of depression may also have different influences [52]. The generalization of the current findings in families with clinical depressive disorders needs further validation. Future studies based on clinical participants would benefit from (i) assessing the presence of other comorbid disorders and the duration, severity, and type of depression, and (ii) clarifying the potential influence of these factors on the transmission pathway. In addition, other mediators (e.g., gene or stressful environments) and moderators (e.g., adolescent temperament) that may be involved in the intergenerational transmission of depressive symptoms could be explored in future [15].

Summary

The extant literature regarding on the intergenerational transmission of depressive symptoms has primarily focused on mothers and adolescents, whereas fewer studies have focused on the role of fathers, especially their parenting behaviors. This study demonstrated that maternal warmth and rejection mediated the relationship of maternal and adolescent depressive symptoms. More importantly, paternal warmth significantly moderated both the direct path of this intergenerational transmission and the mediating path of maternal rejection, both of which were consistent with the stress-buffering model. Overall, the present study highlights the importance of examining the role of fathers in the intergenerational transmission pathway of depressive symptoms from mothers to adolescents and emphasizes the need for father-focused interventions.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in the study were in accordance with the ethical standards of the Ethics Committee of the School of Nursing and Rehabilitation, Shandong University and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from the adolescents, mothers and school headmasters.

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