The impact of grandchild care on depressive symptoms of grandparents in China: The mediating effects of generational support from children

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Objectives: Despite extensive studies about the direct effect of grandchild care on caregiver depression in China, understanding of its internal influencing mechanism has been limited. After controlling for socioeconomic factors, this study investigated whether the experience of caring for grandchildren had a long-term impact on the depression levels of grandparents, either directly or indirectly through generational support from adult children.

Methods: The subjects of this study were a total of 9,219 adults over 45 who participated in the China Health and Retirement Longitudinal Surveys in 2015 and 2018. We adopted a lag-behind variable to examine the impact of grandchild care on depressive symptoms of grandparents. The proposed mediation model was analyzed using bootstrap modeling, and the KHB method was conducted further to examine differences in the effects of generational support.

Results: The experience of caring for grandchildren had a significant negative correlation with the depression level of Chinese grandparents. Moreover, children's support significantly mediated the impact of parenting experience on grandparents' depression. Significantly, instrumental support mediated the effect to the greatest extent, while emotional support from children contributed the least. The intermediary effect has urban−rural heterogeneity.

Conclusion: These findings indicated that grandchild care significantly inhibited the depression level of Chinese grandparents through increased intergenerational support from adult children. The implications of the study's findings were discussed.

1. Introduction

Grandchild care is relatively widespread in China. Approximately 50% of middle-aged and elderly couples care for their grandchildren as families or individuals (1). With increasing life expectancy, more Chinese older adults can take care of their grandchildren (2), sharing time pressure and living costs with adult children's families (3). Chinese grandparents play an increasingly important role in caring for their grandchildren.

However, care activities could be associated with grandparents' mental health. Some studies found that grandchild care could limit grandparents' time and opportunities to care for themselves and bring physical burden and emotional pressure (4), while other studies

came to a different conclusion that grandparenting may help the elderly gain respect from family members and derive emotional wellbeing through generational interaction (5, 6). In addition, empirical research results presented transnational differences and the influence of specific cultural contexts on caregivers' mental health. Due to young couples' poverty, AIDS, imprisonment, unmarried pregnancy, unemployment, and illegal drug use, grandparents in the U.S. especially African American grandparents may suffer from being forced to care for their grandchildren (7, 8). However, Chinese grandparents generally do not regard care as a burden (9). Responsibility ethics with Chinese characteristics and intergenerational reciprocity can alleviate grand-parenting pressure (10, 11). For Chinese grandparents, care is a family obligation conducive to intergenerational relations and family unity (12).

Among the elderly in China, ∼ 30% of men and 43% of women suffer from depression (13). The existing epidemiological literature shows that depression can reduce physical function, daily living ability, and cognitive ability (14); it is also the most critical factor leading to suicide in the elderly (15). In the context of healthy aging, it is necessary to explore the influencing mechanism of depression outcomes to help grandparents avoid health risks. Researchers have argued that social support plays an important role in improving the mental health of older people (16). Characterized as the care and support that members of society receive from others, social support includes formal support (e.g., government, institutions) and informal support (e.g., family, friends) (17, 18), the latter of which is likely to be affected by grandchild care (19).

Previous research has indicated the protective effects of informal social support in the relationship between caregiving and depression (20, 21), while investigating the mediating effects of different functional aspects of children's support is still lacking, which is particularly important in Chinese traditions of filial piety (22). In fact, receiving financial support from adult children in the form of rewards is associated with a reduction in the psychological stress of raising grandchildren (23). Thus, the present study aimed to explore the effects of caring for grandchildren on the depressive symptoms of Chinese grandparents, as well as the intermediary mechanism of adult children's support. Such efforts can present practical and policy suggestions to manage depression in elderly individuals.

1.1. Grandchild care and depressive symptoms

Caring for grandchildren can have positive or negative effects on older adults' depression (24). This controversy may be based on two different points: Role Accumulation Theory and Role Tension Theory. Role Accumulation Theory holds that multiple social roles can enable individuals to achieve social integration and self-satisfaction in different areas of social participation, eventually benefiting mental health (25, 26). With aging, retirement and the reduction of the degree of social integration, it may be more necessary to strengthen the social role than ever before (27). Caring for grandchildren enables grandparents to assume more social roles, which not only meets their intergenerational emotional needs

(28) but also promotes their social integration (29) and can bring higher life satisfaction and self-efficacy (30). On the other hand, Role Tension Theory suggests that individuals may face different types of role conflicts when required to perform specific obligations (31). When such role strain exceeds the individual's physical and mental abilities, it causes role pressure, which is harmful to health (32). Providing grandchild care may limit grandparents' time and opportunities to care for themselves (33), maintain personal social activities (34) and assume the role of marriage (8), making them more vulnerable to emotional stress.

1.2. Generational support from children as a potential mediator

Social Exchange Theory provides a theoretical possibility for exploring the intermediary role of children's support. According to Social Exchange Theory and Equity Theory, individuals seek equal exchange relationships in interpersonal communication, and unequal exchange may adversely affect mental health (35, 36). It is also applicable in the family field in China.

Grandparenting could strengthen intergenerational relationships and bring rewards from adult children (37). First, based on the principle of reciprocity in intergenerational exchange, providing care for grandchildren reinforces adult children's willingness to return. Second, as a form of social participation, parenting grandchildren makes it more likely for grandparents to receive adult children's support by increasing the intensity and frequency of intergenerational contact (38). Third, sharing the labor cost of parenting also strengthens adult children' capacity to reciprocate in remittances (39). The data of Class2012 confirmed that helping to care for grandchildren can significantly increase the amount of financial support and the frequency of adult children's housework and visits (40).

Financial, emotional and instrumental support have been partially verified as protective factors against depression (41). Due to the acceleration of population migration and the inadequacy of the elderly pension and medical security system, the primary source of livelihood for elderly parents, especially in rural areas of China, comes from their children (42). Additionally, money remittance reflects the return of contribution to adult children, and as a psychological reward, it helps to protect the self-esteem and self-efficacy of the elderly (43).

Chinese adult children are mainly responsible for providing emotional support for the elderly as well (44). Data from China and South Korea support that for parents who do not live together, face-to-face contact and online contact can protect the depression level of elderly parents (45, 46). It also confirms the effectiveness of online contact as a form of emotional contact to protect mental health, especially in the context of China's rapid and extensive urbanization.

Some studies have not verified the mediating effect of instrumental support (19). However, elderly individuals with physical limitations were excluded. Those without physical limitations may experience a sense of incompetence when they are offered instrumental support (47). This may cause sample selection error, and we tried to keep samples with physical limitations.

However, grandparents who receive instrumental support from their adult children are associated with poorer physical health and are therefore more likely to provide lower intensity grandchild care than those who are healthier. Considering that those respondents might gain more health benefits with less intensive grandchild care (24), we controlled for respondents' self-rated health status to lessen endogenetic problems.

1.3. Differences between urban and rural areas

The literature has mainly discussed the psychological impacts of a reciprocal pattern of behavior. Intergenerational time-for-money exchanges (39) or financial exchange (48) could reduce the depressive symptoms of older grandparents. However, the lack of view of grandparents' support and offspring's feedback as separate but related behaviors hinders further understanding of older grandparents' psychological expectations of generational relationships. We assumed that the result of social transformation brought about by modernization had changed the expectations of the elderly on generational relations. Therefore, the intermediary effect of generational support has urban–rural heterogeneity. Urban areas are characterized by a higher degree of modernization and economic wealth but a stronger emotional connection (49). Moreover, the proportion of urban elderly receiving pension is higher than that of rural elderly (22). Thus, compared with urban residents who are more financially independent, the economic support of adult children of rural residents is a stronger predictor of higher life satisfaction and happiness (41, 50), while emotional support can reduce the risk of depression in urban residents (49). We investigated how parents' expectations of children's support in return would influence whether the mental benefits of grandchild care functioned. This paper adopted a "space for time" analysis strategy, that is, through a comparative study between urban and rural areas, to describe the changes in family support relations in the process of changing from traditional society to modern society (51).

1.4. The present study

This study contributes to the literature in three ways. First, we used longitudinal and large-scale national data from China to study the impact of caring for grandchildren on Chinese grandparents' depression and therefore alleviated the deviation caused by the endogeneity of reverse causality to some extent, expanding previous studies that focused on cross-sectional (38) or specific region observation windows (19). Second, we discussed the mechanism of adult children's support in the relationship between grandchild care and caregivers' depression. Previous studies have researched the mediating effect of social participation outside the family (52), as well as the psychological effects of grandparenting, child support, and intergenerational reciprocity patterns (41, 48), and have not adequately explained the context of the relationship between caring for grandchildren and grandparents' depressive symptoms within the family field. In particular, different types of generational support

rather than a specific type were incorporated into the mediating model for a more detailed explanation. Finally, by investigating how the mediating effect of children's support changes in different areas of residence, we further explored older people's psychological expectations of intergenerational relationships and the potential realization path of the mental impact of intergenerational exchange. Based on the current evidence, we expect that the depression level of grandparents 2 years later with grandchild care experience will be significantly lower than that of non-caregivers (Hypothesis 1). Additionally, caring for grandchildren will be associated with the level of depression of grandparents 2 years later, directly or indirectly, through changes in economic, emotional and instrumental support from their adult children (Hypothesis 2). Finally, among the three types of generational support, financial support contributes most in rural areas, while emotional support contributes most in urban areas (Hypothesis 3).

2. Methods

2.1. Data and sample

The data came from the two China Health and Retirement Longitudinal Surveys (CHARLS) hosted by the National Development Research Institute of Peking University. CHARLS adopted probability proportional to size sampling to collect a nationally representative sample of Chinese residents aged 45 and above. CHARLS's follow-up survey covered 450 villages in 150 counties and districts across China. We obtained national tracking survey data in 2015 and 2018 from the official website (http://CHARLS.pseeku.edu.cn). Our analysis was limited to respondents above 45 in 2015 ($n = 20,085$)[1] who reported having at least one grandchild under 16 at baseline ($n = 13,949$), provided complete answers to the independent variable ($n = 13,882$), demographics and family characteristics ($n = 13,585$), health status ($n = 12,970$), children's support ($n = 12,806$), household per capita expenditure ($n = 11,073$), follow-ups ($n = 9,944$) and at least 8 indicators (53) in the depression level measurement in 2018 ($n = 9,219$).[2]

2.2. Measures

2.2.1. Depression

The dependent variable was the level of depression in 2018. According to the epidemiology research center Depression Scale (CESD), respondents were asked to assess their psychological and emotional states within a week. The scale included ten subitems. The 4-point responses were rescaled from little or no (0) to most of the time (3). The total score was between 0 and 30. The higher the score, the more serious the depression. In this study, Cronbach's α was 0.80.

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1   We limited the sample to people above 45. Due to the intergenerational difference in the age of first marriage, there are sufficiently young grandparents. We believe that the age limit of 45 maximizes the sample utilization rate as much as possible.

2   Due to missing values in weight variables, the final sample size of descriptive analysis was 9134.

2.2.2. Grandchild care

The independent variable was grandchild care, measured by asking the respondent "Did you spend any time taking care of your grandchildren last year" in the 2015 baseline data. If the respondent answered "Yes", the variable was assigned 1. If the answer was "No", the variable was assigned 0. The answer to this question distinguished between "caregivers" and "non-caregivers".

2.2.3. Generational support from children

Support from children includes financial, emotional, and instrumental support (50, 54, 55) respondents received in the last 12 months. Financial support was measured by the total amount of money and in-kind support respondents received from their children in the past year. We took the logarithm to realize the normal distribution. Because there are no direct measures of emotional intimacy with children in the CHARLS questionnaires, seeing children is considered a form of emotional support (22). In addition, considering the importance of telephone, SMS, and other network contact methods in daily life, we also viewed online contact as an important part of emotional support. Therefore, emotional support was measured by the frequency of respondents' offline meeting and online contact with their children in the past year, and the maximum of the two was taken as emotional support. The 9-point responses were rescaled from almost never (0) to almost every day (8), and the contact frequencies of all children were summed. It should be added that since CHARLS 2015 did not ask these questions to respondents living with their children, the emotional support of these samples was assigned the maximum value of 8. Instrumental support was measured by whether respondents would get help from their children if they needed help with basic daily activities such as eating or dressing at the time of the interview or in the future (56). The answer was a binary variable.

2.2.4. Control variables

The control variables at baseline included gender (female = 0); location (rural = 0); education level (illiterate = 0; primary school and below = 1; secondary school graduation = 2; high school graduation = 3; university and above = 4); marital status (married people living together or in different places due to different jobs were assigned as 0; separation, divorce, widowhood, never married = 1); self-rated health status (poor = 0; general = 1; good = 2); age; whether to live with children (not with children = 0); number of grandchildren under the age of 16; number of surviving children; and household per capita expenditure (logarithmic conversion).

2.3. Data analysis

In this study, the Ordinary Least Squares (OLS) model was used to determine whether there was a significant correlation between caring for grandchildren and respondents' depressive symptoms 2 years later. To avoid the endogenous problem caused by mutual cause and effect, the result that the dependent variable lagged behind one period was adopted (57, 58). To study the mediation effects of children's support, we used the bootstrap method to test the direct and indirect effects of generational support from children at baseline, which also reduced potential endogeneity. Since this paper tested several intermediary variables, to explore which intermediary variable contributes the most to the indirect effect, we used the KHB[3] method (59). Moreover, we performed a robust analysis of the mediating effect grouped according to residence. To take into account the complex sample designs, descriptive statistics used the appropriate design weights provided by the CHARLS teams. Since CHARLS data collected after 2013 only offer cross-sectional weight, weight cannot be used in regression analysis in this study. The outcomes are still acceptable, because there is literature indicating that model analysis is less susceptible to weighting whereas descriptive statistical analysis is more sensitive (60). All statistical analyses were performed with Stata 17.

3. Results

3.1. Descriptive statistics

The total depression score of Chinese grandparents with grandchildren over 45 years old was 8.513, which is close to mild depression according to the standard (61). Table 1 describes the weighted data and shows that there is a significant correlation between grandchild care and respondents' depressive symptoms 2 years later. In the sample, 58.3% of people (or spouses) provided grandchild care. In demographic and social characteristics, 49% of the samples were male, 68.2% lived in rural areas, more than 90% were married or cohabiting, and the average model education level was primary school or above. The respondents' self-rated health was close to the general level, with a mean age of 60. From family information, 36.5% of respondents lived with their children, and the average number of children and grandchildren was more than 2.

3.2. Regression analysis

Table 2 shows the linear regression results of the impact. Model 1 included all control variables and showed that grandchild care reduced grandparents' depression. H1 was verified. Additionally, rural women with a low level of education, poor health, single status at a young age, and having a larger number of grandchildren or children were associated with higher depression levels.

Next, according to the stepwise regression model, the provision of grandchild care positively impacted generational support (Model 2, Model 4, and Model 6). The impact factors of grandchild care decreased after adding generational support from adult children (Model 3, Model 5, and Model 7), which preliminarily showed that generational support could have a mediating effect.

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3 KHB model is a model that calculates the total effect, direct effect and indirect effect by Logit or Probit method. This model was created and developed by Karlson, Holm and Breen. Its main idea is that the total effect can be decomposed into direct effect and indirect effect by direct comparison of coefficients in the linear model.

TABLE 1 Descriptive statistics (with weights) and correlation coefficient matrix.

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Depression	8.513	0.179	1														
2. Grandchild care	0.583	0.010	−0.054***	1													
3. Gender	0.490	0.004	−0.185***	−0.009	1												
4. Location	0.318	0.027	−0.106***	0.059***	0.004	1											
5. Education	1.284	0.039	−0.205***	0.066***	0.309***	0.252***	1										
6. Marry	0.096	0.005	0.087***	−0.089***	−0.094***	0.0120	−0.106***	1									
7. Health	0.995	0.015	−0.302***	0.035***	0.094***	0.067***	0.119***	−0.045***	1								
8. Age	60.68	0.197	0.005	−0.156***	0.090***	0.025**	−0.155***	0.226***	−0.084***	1							
9. Co-residence	0.365	0.014	−0.002	0.124***	−0.010	0.039***	−0.003	0.021**	0.004	−0.126***	1						
10. Grandchildren	2.490	0.085	0.084***	0.067***	0.008	−0.158***	−0.149***	−0.005	−0.062***	0.153***	−0.006	1					
11. Children	2.686	0.057	0.104***	−0.171***	−0.019*	−0.155***	−0.201***	0.125***	−0.095***	0.419***	−0.007	0.486***	1				
12. Expenditure	8.947	0.042	−0.051***	0.042***	0.019*	0.191***	0.178***	−0.032***	0.038***	−0.078***	−0.333***	−0.097***	−0.109***	1			
13. Financial support	6.743	0.095	−0.008	0.028***	−0.020*	−0.056***	−0.057***	0.017	−0.019*	0.126***	−0.063***	0.123***	0.214***	0.050***	1		
14. Emotional support	18.42	0.354	0.032***	−0.038***	−0.023**	−0.069***	−0.119***	0.058***	−0.021**	0.227***	0.358***	0.360***	0.692***	−0.175***	0.164***	1	
15. Instrumental support	0.610	0.012	−0.096***	0.059***	−0.022**	−0.044***	−0.024**	0.0160	0.100***	−0.006	0.091***	0.038***	0.026**	0.004	0.063***	0.117***	1

$^{***}p < 0.01,\ ^{**}p < 0.05,\ ^{*}p < 0.1$.

TABLE 2 Regression analysis.

Variables	Model 1 Depression Coef (SE)	Model 2 Financial support Coef (SE)	Model 3 Depression Coef (SE)	Model 4 Emotional support Coef (SE)	Model 5 Depression Coef (SE)	Model 6 Instrumental support Coef (SE)	Model 7 Depression Coef (SE)
Gender	−1.482*** (−10.91)	−0.137** (−1.98)	−1.491*** (−10.98)	−0.291** (−2.31)	−1.495*** (−11.01)	−0.025** (−2.34)	−1.509*** (−11.15)
Location	−0.648*** (−4.06)	−0.275*** (−3.39)	−0.666*** (−4.17)	0.460*** (3.10)	−0.628*** (−3.93)	−0.067*** (−5.33)	−0.720*** (−4.52)
Education	−0.800*** (−10.50)	−0.035 (−0.90)	−0.802*** (−10.53)	0.131* (1.86)	−0.794*** (−10.43)	−0.008 (−1.24)	−0.808*** (−10.64)
Marry	1.377*** (6.14)	−0.143 (−1.26)	1.367*** (6.10)	−0.962*** (−4.62)	1.334*** (5.94)	0.028 (1.58)	1.407*** (6.29)
Health	−2.539*** (−27.51)	0.027 (0.57)	−2.537*** (−27.50)	0.536*** (6.26)	−2.515*** (−27.21)	0.077*** (10.50)	−2.457*** (−26.56)
Age	−0.057*** (−6.18)	0.023*** (4.89)	−0.055*** (−6.01)	−0.008 (−0.93)	−0.057*** (−6.22)	0.001 (1.20)	−0.056*** (−6.10)
Co−residence	−0.105 (−0.73)	−0.265*** (−3.63)	−0.122 (−0.85)	6.850*** (51.41)	0.201 (1.23)	0.106*** (9.35)	0.009 (0.06)
Grandchildren	0.122*** (3.05)	0.021 (1.05)	0.123*** (3.08)	0.153*** (4.15)	0.128*** (3.22)	0.006** (1.98)	0.128*** (3.23)
Children	0.233*** (3.70)	0.488*** (15.27)	0.265*** (4.16)	4.913*** (84.15)	0.453*** (5.41)	0.008 (1.52)	0.241*** (3.85)
Expenditure	−0.034 (−0.51)	0.209*** (6.28)	−0.020 (−0.30)	0.142** (2.34)	−0.027 (−0.42)	0.024*** (4.71)	−0.007 (−0.11)
Grandchild care	−0.442*** (−3.31)	0.487*** (7.19)	−0.410*** (−3.06)	0.467*** (3.77)	−0.421*** (−3.15)	0.051*** (4.85)	−0.387*** (−2.90)
Financial support			−0.066*** (−3.21)				
Emotional support					−0.045*** (−3.98)		
Instrumental support							−1.068*** (−8.15)
Constant	15.970*** (19.02)	2.142*** (5.02)	16.111*** (19.17)	0.667 (0.86)	16.000*** (19.07)	0.202*** (3.03)	16.185*** (19.34)
Observations	9,219	9,219	9,219	9,219	9,219	9,219	9,219
R^2	0.145	0.062	0.146	0.615	0.146	0.029	0.151
F	141.96***	55.76***	131.11***	1336.95***	131.65***	25.09***	136.58***

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 3 Intermediary effect analysis.

Mediator effect	β (95%CI)	SE	Z	P
Financial support				
Indirect effect	−0.032*** (−0.055, −0.014)	0.011	−2.98	0.003
Direct effect	−0.410*** (−0.692, −0.146)	0.136	−3.00	0.003
Emotional support				
Indirect effect	−0.021*** (−0.039, −0.008)	0.008	−2.67	0.008
Direct effect	−0.421*** (−0.663, −0.146)	0.130	−3.23	0.001
Instrumental support				
Indirect effect	−0.055*** (−0.086, −0.032)	0.014	−3.97	0.000
Direct effect	−0.387*** (−0.652, −0.118)	0.139	−2.79	0.005

Control variables: Gender, Location, Education, Marital status, Health, Age, Whether parents live with their children, Number of grandchildren, Number of children, Household per capita consumption expenditure.
$*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

FIGURE 1
The influence of generational support from children on depression.
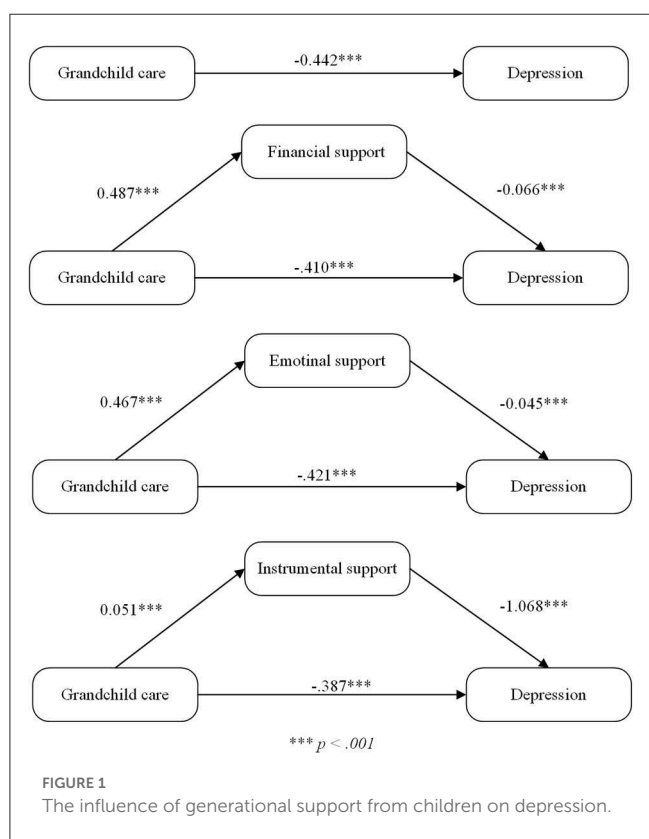
3.3. Mediating effect test

This study used the bootstrap method to repeatedly sample 1,000 times to test the mediating effect of adult children's economic, emotional, and instrumental support. It can be seen from Table 3 that the confidence intervals for the indirect effects of children's support all did not include 0, and there were intermediary effects.

Figure 1 illustrates the impact path. When the control variable was included in the model, the negative predictive effect of

TABLE 4 A comparative analysis of mediation effect based on the KHB method.

Mediating variable	β	SE	P-diff	P-reduced
Financial support	−0.026	0.011	27.53	5.84
Emotional support	−0.016	0.007	17.21	3.65
Instrumental support	−0.052	0.013	55.25	11.73

grandchild care on depressive symptoms was significant ($\beta = -0.442$, $p < 0.001$). When economic, emotional and instrumental support from adult children was included in the model as an intermediary variable, grandchild care still had a significant negative predictive effect on depression ($\beta = -0.410$, $p < 0.001$; $\beta = -0.421$, $p < 0.001$; $\beta = -0.387$, $p < 0.001$). Meanwhile, grandchild care had a significant positive effect on adult children's support ($\beta = 0.487$, $p < 0.001$; $\beta = 0.467$, $p < 0.001$; $\beta = 0.051$, $p < 0.001$), and the latter was associated with lower risk of depressive symptoms ($\beta = -0.066$, $p < 0.001$; $\beta = -0.045$, $p < 0.001$; $\beta = -1.068$, $p < 0.001$). H2 was verified.

3.4. Comparison of intermediary effects

According to Table 4, generational support mediated 9.38% of the impact. Among them, instrumental support contributed 55.25% to the indirect effect, which was the largest; economic support contributed 27.53%; and emotional support contributed 17.21%.

The results of grouping regression of urban and rural samples are shown briefly as follows, and the omitted analysis procedure is described in the Supplementary material. Generational support mediated 6.98% in rural samples ($n = 7,053$). Instrumental support contributed 77.07% to the indirect effect, and emotional support contributed 22.93%. The bootstrap model indicated that economic aid was not a mediator. In urban samples ($n = 2,166$), generational support mediated 14.56 percent of grandchild care's depression effect. Instrumental support contributed 32.46 percent; financial support contributed 67.54 percent. Emotional support did not mediate this relationship. H3 was not verified.

4. Discussion

This paper suggested that the experience of caring for grandchildren significantly inhibited grandparents' depression using a nationally representative sample. We further tested whether caring for grandchildren weakened the depression level of the grandparents by increasing their adult children's support. Moreover, the data analysis showed that instrumental support mediated the impact to the greatest extent, followed by financial and emotional support. Considering potential differences in the expectations of intergenerational relationships between urban and rural elderly people, this study further compared the intermediary effects of children's support based on residence.

First, caring for grandchildren had a significant negative correlation with the depression level of Chinese grandparents. The results of this study supported the Role Accumulation Theory that caregivers feel they are valuable and experience positive care feelings in intergenerational interaction. It also provided a robust example for discussing the impact of raising grandchildren on caregivers in the Chinese context. In Confucian filial piety culture, grandparents regard caring for grandchildren as a productive role. Similar results have been found in studies of older Chinese Americans and Taiwanese adults under cultural norms that regard care as an obligation; grandparents can give more favorable meaning to the activity of caring for grandchildren and are more willing to care for grandchildren (62, 63). In addition, the role of such cultural norms has also been verified in European countries. In a social and cultural environment where grandparents are expected to provide care, grandparents who do not care for their grandchildren may have negative emotions and experience low life satisfaction (64) and subjective wellbeing (65).

Second, raising grandchildren had a significant positive effect on the economic support, emotional support, and instrumental support from adult children, while the increase in generational support was associated with lower depression levels of grandparents. The research results are consistent with the previous cross-sectional data analysis results (38). On the one hand, the experience of raising grandchildren has a direct protective effect on Chinese grandparents' mental health. The mainstream view is that, out of responsibility and obligation, Chinese parents will raise their offspring (including grandchildren) without any condition (66). On the other hand, the experience of grandchild care can also positively impact the psychological status of grandparents by increasing support from their adult children. Caring for grandchildren can significantly improve the frequency and opportunities for Chinese grandparents to obtain financial support, visit and help with housework (40, 67). In this case, intergenerational resource exchange constitutes a reciprocal state from which the elderly can feel satisfied and happy (68). It can be said that Social Exchange Theory and intergenerational reciprocity are essential mechanisms to explain the mental benefit of grandchild care. It further shows that Social Exchange Theory and the principle of reciprocity also apply to modern Chinese families affected by Confucian culture. As Yan Yunxiang, an anthropologist, observed in the last century, Chinese society, impacted by the new morality prevailing in the market economy, has more intergenerational relations transforming into rational and balanced exchange relations than being unconditionally given by any party (69). It should be noted that this does not mean that grandparents care for grandchildren for the purpose of obtaining adult children's resources. However, the timely feedback of children on care activities, undoubtedly plays an essential role in protecting the mental health of Chinese elderly people to a large extent.

Third, instrumental support mediated the impact of caring for grandchildren on grandparents' depression to the greatest extent, while emotional support from adult children contributed the least. The data from CHARLS2011 and 2013 also support similar results that only the exchange of instrumental support between generations can significantly improve the life satisfaction of grandparents in urban and rural China (22). We also speculated that instrumental support required children to devote higher time and energy costs when compared with offline visits, online contacts, or remittances; thus, it represented a closer intergenerational bond. In addition, a literature review on social support and depression levels also shows that only a small number of research results confirm that children's emotional support is related to the prevention of depression (70). This may be because the primary source of emotional support for the elderly is their spouse, followed by their friends, and finally, their children (70). It should also be noted that, under the current background of large-scale population mobility in China, it is more difficult for elderly parents to have face-to-face contact with their children (45), which may further weaken the emotional dependence of elderly parents on their children. In other words, we can speculate that under the background of modernity, China's intergenerational relations, on the one hand, maintain a certain degree of emotional intimacy and, on the other hand, gradually have the characteristics of rationality and independence.

Finally, urban areas were more inclined to show "time-money" exchange between generations, while rural samples were more inclined to "time–time" exchange of the same type, which was different from what we assumed. The differences between urban and rural areas reflect the transformation in the expectations of the elderly for intergenerational relations in the process of changing from traditional society to modern society. Specifically, the urban elderly put more emphasis on rational logic, while the rural elderly put more emphasis on emotional sense. On the one hand, as the old-age security and social support system in rural areas is more imperfect, elderly people must rely more on their children for daily care in old age (71). On the other hand, caring for grandchild may not raise expectations for monetary compensation because such care usually occurs in three generations of families without financial separation, and people share and coordinate their labor (72). For urban areas, the concept of filial piety has lost its cultural and social foundation, and the popular new morality in the market economy makes the relationship between the two generations more rational and balanced (69).

In conclusion, there are still the following limitations. First, although the inclusion of dependent variables with a lag of one period could alleviate the resulting bias caused by the endogeneity related to reverse causality to a certain extent, we could not confirm whether there were other missing variables in the data that affect the model. Therefore, the results of this study should not be interpreted as a strict causal relationship but only a causal inference under the social science paradigm. Second, in addition to children's support, there might be other relevant factors, such as feelings of care (73), participation in social activities (29), stress, and sleep quality (74), that regulate the relationship between care experience and caregivers. As a result, the data analysis results only reflected the partial impact of care experience. Third, future studies should use more detailed measurements of instrumental support, such as frequency and intensity, and dependent variables, such as care intensities, where data permit. Although we have tried to avoid the selection bias associated with deleting samples with physical limitations occurring in previous literature, there could still be some endogenetic problems. For example, grandparents who received instrumental support provided less intensive care, which resulted in more health benefits for them than those who did not. Fourth, this paper set the intermediary variable as generational

support in the baseline data, while generational support in the 2018 data corresponded to a delayed intergenerational reciprocity model. However, Chinese parents' upbringing and adult children's support are not only a kind of immediate feedback model (66). We can try to understand and compare whether there are differences in the impact of immediate and delayed generational support on grandparents' mental health. Fifth, this paper adopted a "space for time" analysis strategy rather than tracking data to explore the influence of modernity on expectations of generational relationships. However, the differences between urban and rural areas also affect the patterns of the family division of labor and the social security system. Therefore, there may be more detailed interpretation work to be done for the conclusions found in this paper. Despite these limitations, our findings still have theoretical and practical significance. Our study supported Role Accumulation Theory and emphasized the protective effect of social integration in the family domain on the mental health of elderly individuals. Specifically, by increasing their adult children's economic support, emotional support and instrumental support, caring for grandchildren achieved intergenerational reciprocity and therefore helped grandparents weaken their negative psychological feelings. Additionally, urban areas were more inclined to "time–money" exchange, while rural samples were more inclined to "time–time" exchange. It may show a trend of rational and independent intergenerational relations in China. With the further deepening of China's aging and the continuous advancement of the active aging process, we can actively advocate for elderly individuals to participate in family care and household activities. Meanwhile, for the elderly who take care of their grandchildren, adult children should pay attention to financial support for grandparents living in urban areas and instrumental support for them in rural areas to protect their psychological state to the greatest extent. Additionally, there is a need for deeper and more comprehensive state pension coverage as well as for affordable, high-quality healthcare, particularly in rural areas where the daily care of the elderly is still largely a family responsibility and grandparents may be compelled to look after their grandchildren in order to guarantee their future care from adult children.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: http://charls.pku.edu.cn.

Ethics statement

The CHARLS was approved by the Institutional Review Board at Peking University. Ethics Approval No. IRB00001052-11015. All participants provided informed consent.

Author contributions

WX and YH designed the study. YH contributed to the collection of literature, data processing, and result analysis and drafted the manuscript. LZ contributed to the data processing, result analysis and review, of the manuscript. All authors approved the current version of this manuscript for publication. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1043969/full#supplementary-material

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