

Grandparent Caregiving and Self-Rated Health among Rural Chinese Older Adults: A Longitudinal Study Using Latent Difference Score Analysis

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Abstract

Background: Caregiving for grandchildren has effect on the physical health of older adults. Physical well-being may also affect the daily activities of grandparent caregivers. Therefore, there may be a reciprocal effect between grandparent caregiving and health. However, few studies have tested this dynamic relationship. This study examined how grandparent caregiving and self-rated health (SRH) changes over time among rural Chinese older adults and whether a reciprocal effect exists between them.

Methods: Four waves of the longitudinal study of older adults in Anhui province of China were used for this study, featuring 1,696 older grandparents who completed at least the first wave in 2001 and were followed up or not in 2003, 2006, and 2009. Latent difference score analyses were applied using Mplus 5.1 and Amos 5.

Results: Results show that both grandparent caregiving and SRH decreased significantly over time. Grandparent caregiving in a previous wave significantly predicted subsequent change in SRH, indicating that more grandparent caregiving resulted in a greater change in SRH. On the other hand, SRH had a significant effect on subsequent change in grandparent caregiving, showing that better SRH led to lesser changes in grandparent caregiving in later waves. SRH played a leading role in the prediction effect.

Conclusions and implications: This study found a reciprocal effect between grandparent caregiving and SRH. This indicates that grandparent caregiving can be physically demanding and may lead to greater changes in SRH, whereas good SRH is a necessary precondition of caring for grandchildren. The study also found a leading predicting role of SRH, which suggests that SRH as a personal resource is extremely important because it partially determines whether and how intensely rural Chinese grandparents can care for their grandchildren.

Keywords: Chinese older adults; Grandparent caregiving; Latent difference score analysis; Self-rated health

Introduction

Grandparents often serve as either primary or secondary caregivers to their grandchildren, which has an effect on their physical well-being [1,2]. Although cross-sectional studies [3,4] and short-term follow-up analyses [5] have examined the effects of grandparent caregiving type [3,6] and role transition [7] on physical well-being, few studies used data that tracked grandparents for a long period of time to examine the trajectories and association of grandparent caregiving and self-rated health. Such research is important because although many grandparents provide care to grandchildren, the intensity of caregiving differs among grandparents and may change over time. In addition, as social resources theory [8] states, physical well-being, such as SRH, is an important personal resource and may affect engagement in activities, such as caring for grandchildren. However, few studies have provided firm conclusions regarding the temporal sequence and dynamic relationship of grandparent caregiving and SRH. This topic has special significance in rural China, where grandparents and grandchildren are frequently left behind and live together when the middle generation migrates to urban cities to seek job opportunities.

Effects of Grandparent Caregiving on Health

Grandparent caregiving for grandchildren not only has an extremely important social function, it also has major influences on the physical well-being of grandparents. However, results of previous research on the health consequences of grandparent caregiving have been inconsistent.

Some studies found that grandparent caregiving may be physically demanding and result in deteriorating health conditions. For example, studies showed that among grandparents who core side with grandchildren or provide full-time care to grandchildren, grandparent caregiving involves physical demands and stress that could be detrimental to health [5,9,10]. Studies also showed that long-term caregiving results in worse health over time [11] and caregivers who recently assumed caregiving responsibilities for grandchildren may experience the greatest change in health [5]. The deteriorating health effect of grandparent caregiving is especially true in the USA, because grandparents often do not choose to take care of their grandchildren but step in to assist the middle generation [12]. In those circumstances, burden and stress associated with grandparent caregiving often lead to deteriorating health conditions.

Some studies have found the grandparent experience is rewarding. Studies in Western societies demonstrated that grandparent caregiving

may enhance a grandparent's sense of purpose in life and contribute to feelings of maintaining the family's continuing identity and well-being [13,14]. A panel study using a dataset from Taiwan showed that caring for grandchildren can be beneficial to the health of grandparents in Chinese cultural contexts [15]. A longitudinal study using health and retirement study data revealed that grandmothers who started or continued to babysit grandchildren reported better SRH than grandmothers who provided no care [16]. Using longitudinal data from the China health and nutrition survey from 1991 to 2006, Chen and Liu [17] found that grandparents living solely with grandchildren do not experience a deficit in self-reported health, particularly when they have higher family income. This study also found that paternal grandparents have a significant health advantage over maternal grandparents.

However, other researchers found no correlation between grandparent caregiving and health. Observing two intervals, 1998 to 2000 and 2000 to 2002, using data from the health and retirement study, Hughes et al. [16] found that grandparent caregiving did not have dramatic and widespread negative effects on grandparents' SRH. Another study using panel data from the national survey of families and households found no significant effects of grandparent caregiving on changes in SRH [7].

Although many studies have demonstrated that grandparent caregiving affects SRH, results have been inconclusive. In addition, most of these studies employed cross-sectional designs with small samples. Among the few two-wave longitudinal studies on this topic, there is no evidence to generate clear conclusions regarding the sequence of grandparent caregiving and health outcomes. When observed in the context of this study, it is unclear whether reciprocal effects occur between grandparent caregiving and SRH, i.e., whether either variable is a leading predictor or causality between these two variables is reciprocal.

The scarcity of related literature on this topic for studies performed outside of Western countries presents another gap. There is little available knowledge about the situation of rural Chinese older adults, who make up more than two thirds of China's older population and are often left behind with their grandchildren by migrant children who seek jobs in the economically booming cities of China [18]. This trend has led to dramatic increases in skipped-generation households that consist of older grandparents caregiving for their grandchildren [19]. Rural Chinese grandparents have good physical resources when transitioning into the grandparent role, which differs from situations in Western countries [20], and they voluntarily involve themselves in grandchild caregiving for the purpose of improving the family's financial situation. In addition, these grandparents maintain close bond with the middle generation, even when their adult children have migrated to distant geographical locations [19]. Because the implications of grandparent caregiving in China differ significantly from similar situations in Western countries, it is necessary to test whether previous findings in Western societies regarding this topic are also applicable to Chinese society.

The Present Study

In this study, we investigated the dynamic relationship between grandparent caregiving and SRH using a dataset with four repeated measurements. The purpose of this study was to examine how grandparent caregiving and SRH changed over time among rural Chinese older adults and to investigate the temporal sequence of the

predicting role between grandparent caregiving level and SRH using latent difference score (LDS) models. More specially, the following main research hypotheses were tested.

The level of grandparent caregiving would decrease among rural Chinese grandparents from 2001 to 2009, because as they age they would have less energy to take care of grandchildren.

1. SRH would decrease among rural Chinese grandparents from 2001 to 2009.
2. The decrease in grandparent caregiving level would be associated with a decrease in SRH among these rural Chinese grandparents.
3. The level of grandparent caregiving level would predict a subsequent decrease in SRH, and the level of SRH would predict a subsequent decrease in grandparent caregiving level.
4. SRH would play a leading role in prediction functions.

The present study extended previous research on grandparent caregiving and SRH in several ways. First, using a design with multiple repeated measurements allowed for estimates with higher reliability compared to cross-sectional studies or studies using two-wave designs. Second, in contrast to previous studies, we investigated reciprocal linkages between grandparent caregiving level and SRH. Third, the application of difference score models that account for not only the covariance structure but also the mean structure of the variables increased the validity of the analyses [21]. Fourth, the present study contributed to remedying the gap in research of grandparent caregiving and SRH among rural Chinese older adults.

Method

Sample

Data for this study were drawn from the well-being of elderly in Anhui Province of China, a four-wave longitudinal survey study jointly conducted by the social of social work and school of gerontology at the University of Southern California and the population research institute of Xi'an Jiaotong University in China from 2001 to 2009. Data were collected from a sample of adults aged 60 or older living in rural townships in Chaohu, Anhui province. This poor, rural region is generally known for its relatively high density of older adults and high rates of migration among working-age laborers to nearby cities [19].

The sample was identified using a stratified multistage method. First, 12 rural townships were randomly selected from all 126 townships in the Chaohu region. Second, six administrative villages were randomly selected in each township. Third, in each selected village, all people aged 60 or older were stratified to form two sampling frames based on age: (a) those aged 60-74 and (b) those 75 or older. To guarantee that only one older person per household was interviewed, two approaches were used in the sampling procedure. If household partners were in different age groups, the younger partner was dropped and a substitute respondent was randomly selected as a replacement. If household partners were in the same age group, then the partner chosen second was dropped and a substitute respondent was randomly selected as a replacement. The survey was conducted in the homes of respondents.

The baseline survey was conducted in April 2001. Of the 1,800 eligible participants randomly selected at baseline, 1,715 completed the survey, yielding a response rate of 95.3%. In November 2003, a follow-up survey was conducted with 1,368 respondents, or 79.8% of the original participants. Of those respondents who were not located, 76

had moved out of the village (6%) and 240 had died (14%). Twenty-three former respondents were located but declined to participate, terminated their interview, or were too ill to be interviewed. In December 2006, the third wave was conducted. The 2006 follow-up survey sought the 1,391 respondents who had participated in the 2001 baseline survey. Of these respondents, 236 had died, 57 had left their villages permanently or temporarily, and 31 people declined to participate in the survey or were missing. The 2006 survey thus featured 1,067 respondents. In June 2009, the fourth follow-up survey was conducted with 1,224 participants, including a new cohort of 416 participants. After excluding individuals who failed a cognitive test at all four time points, the final longitudinal sample consisted of 1,696 grandparents who participated in at least the first wave, and were followed up or not in the following three surveys. The quality of existing data has proven to be good as evidenced by high participation, follow-up rates, and excellent measurement properties (Figure 1).

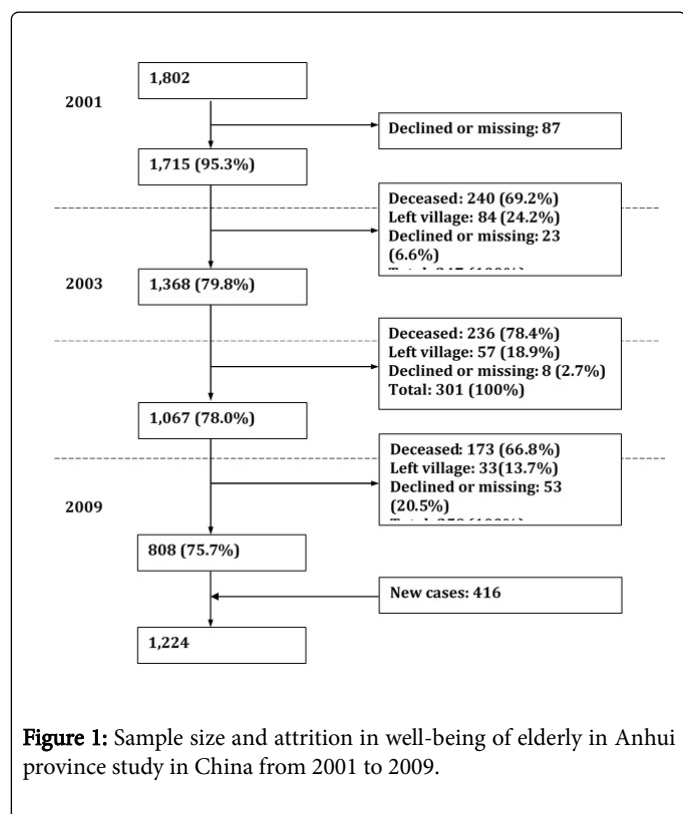


Figure 1: Sample size and attrition in well-being of elderly in Anhui province study in China from 2001 to 2009.

Measurement

Dependent variable

The dependent variable, SRH, was measured by asking the following: "How do you assess your current health situation?" Respondents rated their health on a 4-point Likert scale: 1=poor, 2=so-so, 3=good, and 4=very good. Because SRH has been consistently documented to be a valid measure of health and a robust indicator of morbidity and survival [22-25], it is appropriate to use as a dependent variable. Studies using a Chinese dataset also proved that SRH is a good measure for testing the health status of Chinese older adults [26].

Independent variable

Our key predictor variable was the grandparent caregiving. This was measured by two questions asking the participants whether they took care of each of their grandchildren during the past 12 months (0=no, 1=yes) and the intensity of that care (1=seldom, 2=once a month, 3=several times a month, 4=at least once a week, 5=several hours a day, 6=the whole day, every day). Individuals who reported not caring for grandchildren were reflected in the second question with a value of 0. Thus grandparent caregiving was measured by an interval variable with seven categories, ranging from 0=never to 6=the whole day, every day.

Control Variables

Several variables previously shown to be potential predictors of grandparent caregiving level or SRH were controlled in this study. In this study, cross-sectional correlations between the main variables and demographic variables (age, gender, education, marital status, health, and income) were analyzed first. Marital status was not correlated with either grandparent caregiving level or SRH for all four assessments; it was excluded from the final analysis. Other demographic variables such as age, gender, education, and income were all significantly associated with grandparent caregiving or SRH. Therefore, they were included in the final analysis.

Age was measured as a continuous variable at the time of survey. Educational level was originally measured using seven categories: 1=illiterate, 2=elementary school, 3=junior high school, 4=senior high school, 5=institute of college, 6=community college, and 7=college or more. This variable was recoded dichotomously due to its skewed distribution (1=educated, 0=not educated). Income is a crucial factor in determining a grandparent caregiver's well-being [27], and thus was included as control variable in this study. Income was represented as the log of the RMB value (+1) of the total income that the respondent had received from work or pension during the previous year. These four control variables were measured at the baseline wave and centered at ground mean for the analysis.

Analysis

Structural equation modeling was conducted using Amos 5 and Mplus 5.1 for the present study to examine the intra-individual change across measurements and to take into account both the covariance and mean structure of the variables. We used LDS models rather than bivariate latent growth curve models to allow for testing of reciprocal or coupling effects between the constructs; that is, the effect of one variable on subsequent intra-individual change in another variable. Another main advantage of LDS models over traditional reciprocal panel models [28] is that LDS models also account for intra-individual change in absolute values (i.e., the mean structure of the variables).

Missing data are a potential problem in longitudinal research due to the loss of information due to death or other reasons. To address missing values, we employed the full information maximum likelihood procedure included in Amos and Mplus; this method of missing value imputation yields results that are less biased and more reliable than those generated by conventional methods such as list wise or pairwise deletion [29,30]. Model fit was assessed by three fit indexes that are currently recommended as most useful [31,32]: the normed fit index (NFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). Hu and Bentler [31] suggested that good fit is indicated by values greater than or equal to 0.95 for NFI and CFI

and less than or equal to 0.06 for RMSEA. In addition to these indexes, we report chi-square statistics and confidence intervals for RMSEA.

Results

As previously mentioned, effects of demographic variables (age, gender, education, and annual income) were analyzed in the study. In general, participants had an average age of 70.83 (SD=7.39), ranging from 60 to 92. Gender was evenly divided in this sample, with 51.1% female and 48.9% male. Approximately 79% had no education. And they had an average income of 839.5 RMB or \$123.4 (SD=1,526.7 RMB or \$224.5), ranging from 0 RMB to 14,000 RMB (\$2,058.8) (Table 1).

Variables	n	M (SD)	%	Range
Age	1,696	70.83 (7.39)		60-92
Gender (female)	1,696		51.1	0-1
Educated (yes)	1,695		21.1	0-1
Income	1,694	\$123.4 (\$224.5)		0-\$2,058.8

Table 1: Sample characteristics at baseline (N=1,696).

Table 2 shows the means and standard deviations of grandparent caregiving and SRH, and Figure 2 shows the growth curves of these two main variables. The results indicated that SRH on average decreased over time (Figure 2), although some individuals had a constant or even increasing level of SRH. On the other hand, the mean values of grandparent caregiving decreased in 2003 and 2006, but increased in the 2009 wave. However, the general change of grandparent caregiving indicated a decreasing trajectory (Table 2 and Figure 2).

Year	Age			Caregiving			Self-Rated Health		
	n	M	SD	n	M	SD	n	M	SD
2001	1,696	70.83	7.39	1,444	1.25	1.48	1,677	2.05	0.86
2003	1,325	72.41	6.95	1,106	0.99	1.4	1,322	2.2	0.93
2006	1,041	74.68	6.63	837	0.88	1.39	1,041	2.04	0.89
2009	752	76.11	6.23	548	1.61	1.9	752	2	0.84

Table 2: Means and standard deviations of age, grandparent caregiving, and self-rated health.

Figure 3 shows the bivariate LDS models that were analyzed. This analysis allowed for conclusions about whether one of the variables predicted subsequent changes in the other variable because the parameters of the curves are based on the identical time interval, and for the investigation of the temporal sequence of grandparent caregiving and SRH. In LDS models, the indicators are explained by latent true score variables (denoted as Lcare and Lsrh in Figure 3) and errors. The true score variables (except for Time 1), in turn, are explained by the latent true scores for the preceding assessment and by latent difference scores (denoted as Dcare and Dsrh in Figure 3). The LDS model accounts for two types of change.

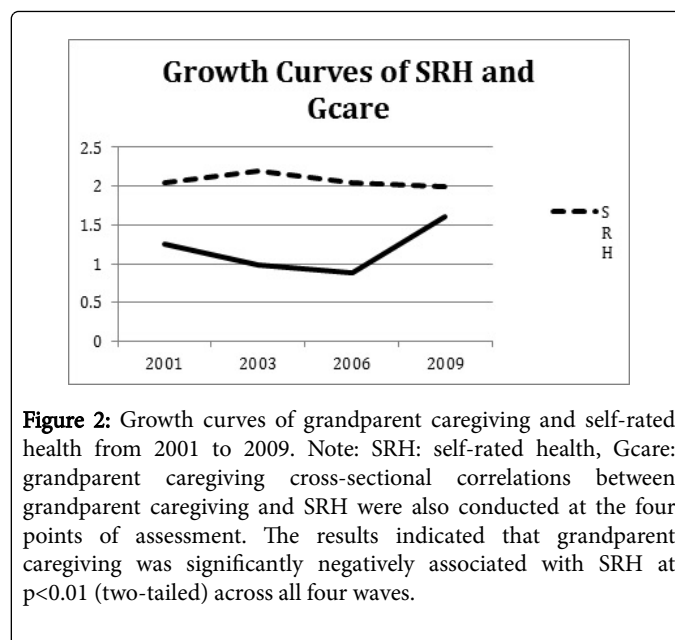


Figure 2: Growth curves of grandparent caregiving and self-rated health from 2001 to 2009. Note: SRH: self-rated health, Gcare: grandparent caregiving cross-sectional correlations between grandparent caregiving and SRH were also conducted at the four points of assessment. The results indicated that grandparent caregiving was significantly negatively associated with SRH at $p < 0.01$ (two-tailed) across all four waves.

First, the model includes a latent slope variable that accounts for constant change in the variables across time. The slope variable has a constant effect on all difference scores; for identification purposes, in this study the parameter was fixed to 1 [33]. Second, LDS models also account for a second type of change, self-feedback, which is represented by the effects of the true score at one assessment on the difference score at the next assessment (coefficients c and d in Figure 3). Finally, the bivariate LDS model includes reciprocal coupling effects between the true scores of one variable and the latent difference scores of the other variable (coefficients a and b in Figure 3). The coupling effects indicate whether the intra-individual change in one variable is explained by the true score of the other variable measured at the preceding assessment, while controlling for constant change and self-feedback. The means and variances of slopes in LDS models are not equivalent to means and variances of slopes in latent growth curve models, because the LDS model includes additional effects on the latent difference scores. To identify the model in this study, the error variances had to be set equal across time within constructs [33]. In LDS models, standardized path coefficients are not applicable, therefore we report the unstandardized coefficients, significance levels, and standard errors [33,34] (Figure 3).

The fit of the LDS model was good ($\chi^2=98.5$, $df=22$, $p < 0.001$, $RMSEA=0.045$, $NFI=0.91$, $CFI=0.94$). The main parameters are reported in Table 2. The mean intercepts and slopes of both grandparent caregiving and SRH were statistically significant. It indicates significant intra-individual differences in both the starting point and subsequent changes of grandparent caregiving and SRH. Results also showed significant decreases in both grandparent caregiving and SRH over four waves. In addition, the variances of the intercept and slope of grandparent caregiving and intercept of SRH were also significant. Thus, the results indicated significant inter-individual differences in the starting points and changes of grandparent caregiving and the starting points of SRH. However, there was no significant covariance between the individual slopes of grandparent caregiving and SRH ($b=0.64$, $p=0.423$). Results indicated that a reduction in grandparent caregiving score was not associated with a decrease in SRH (Table 3).

The proportional effects or self-feedback effects were significant in both indicators of grandparent caregiving ($b=-0.93, p=0.016$) and SRH ($b=-0.39, p=0.036$). Thus, besides the constant change explained by the growth curve portion of the LDS model, there was evidence for proportional change in both indicators of grandparent caregiving and SRH. The reciprocal effects or coupling effects of grandparent caregiving and SRH were the relevant statistics for testing Hypothesis 4. The results showed that the level of grandparent caregiving was significantly associated with the subsequent increase of SRH change ($b=0.27, p<0.001$) and the level of SRH was significantly associated with the subsequent decrease in grandparent caregiving change ($b=-8.96, p<0.001$).

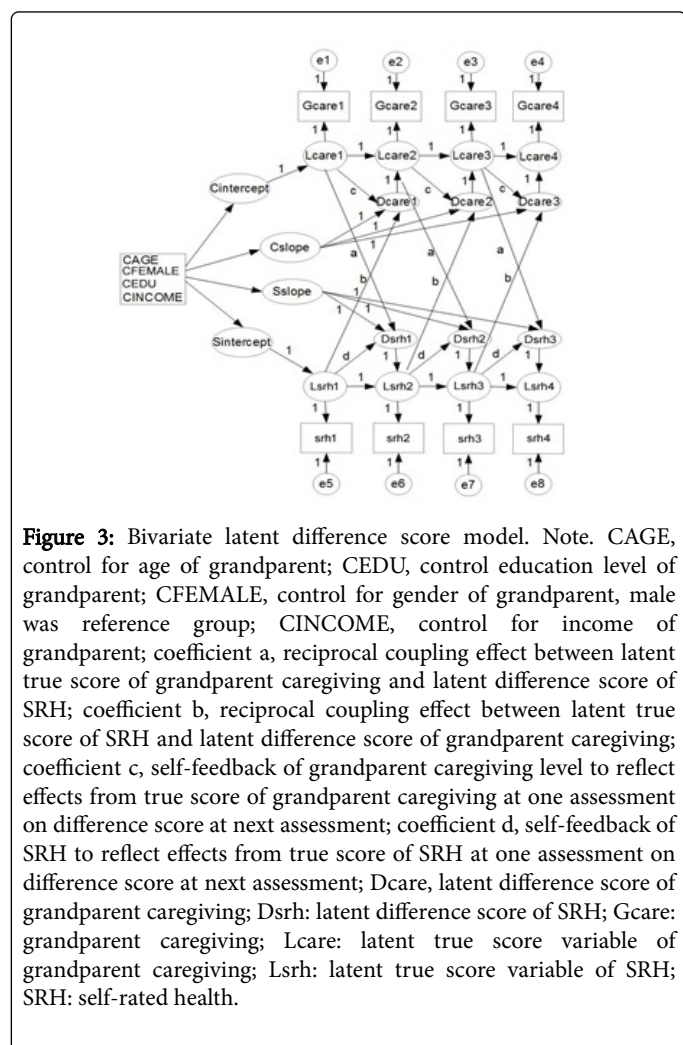


Figure 3: Bivariate latent difference score model. Note. CAGE, control for age of grandparent; CEDU, control education level of grandparent; CFEMALE, control for gender of grandparent, male was reference group; CINCOME, control for income of grandparent; coefficient a, reciprocal coupling effect between latent true score of grandparent caregiving and latent difference score of SRH; coefficient b, reciprocal coupling effect between latent true score of SRH and latent difference score of grandparent caregiving; coefficient c, self-feedback of grandparent caregiving level to reflect effects from true score of grandparent caregiving at one assessment on difference score at next assessment; coefficient d, self-feedback of SRH to reflect effects from true score of SRH at one assessment on difference score at next assessment; Dcare, latent difference score of grandparent caregiving; Dsrh: latent difference score of SRH; Gcare: grandparent caregiving; Lcare: latent true score variable of grandparent caregiving; Lsrh: latent true score variable of SRH; SRH: self-rated health.

These findings indicate that grandparent caregiving in previous wave led to a faster change in subsequent SRH, and previous SRH led to a slower change in subsequent grandparent caregiving. In addition, the results showed that SRH had a leading prediction role among the two variables, indicated by larger coefficient.

Among the demographic control variables, age at baseline had significant effects on grandparent caregiving intercept ($b=-0.03, p<0.001$), SRH intercept ($b=-0.09, p=.01$), grandparent caregiving slope ($b=-0.01, p<0.001$), and SRH slope ($b=-0.01, p=0.05$). These results indicated that as grandparents aged, they provided less care to their grandchildren.

Parameter estimate	b	t	p
Regression coefficients			
Gcare → Dcare proportional effects	-0.93	-2.41	0.016
SRH → Dsrh proportional effects	-0.39	-1.18	0.036
Gcare → Dsrh coupling effects	0.27	3.99	<0.001
SRH → Dcare coupling effects	-8.96	-5	<0.001
Means			
Gcare intercept	1.16	31.11	<0.001
SRH intercept	2.09	105.11	<0.001
Gcare slope	-0.09	-3.815	0.002
SRH slope	-0.04	-3.89	<0.001
Covariances			
Gcare intercept ↔ SRH intercept	0.13	4.76	<0.001
Gcare slope ↔ SRH slope	0.64	0.8	0.423
Gcare slope ↔ Gcare intercept	0.94	2.122	0.034
SRH Slope ↔ SRH intercept	0.07	0.82	0.414
Gcare slope ↔ SRH intercept	2.34	4.89	<0.001
SRH slope ↔ Gcare intercept	-0.25	-4.3	<0.001
Variances			
Gcare intercept	1.18	13.25	<0.001
SRH intercept	0.26	14.94	<0.001
Gcare slope	20.83	2.52	0.012
SRH slope	0.1	1.46	0.143
Gcare error	1.05	19.04	<0.001
SRH error	0.53	38.05	<0.001
Dcare error	0.08	0.17	0.62
Dsrh error	0.01	0.005	0.015

Table 3: Bivariate latent difference score analyses: Estimates and unstandardized coefficients. Note: Dcare=latent difference score of grandparent caregiving intensity; Dsrh=latent difference score of self-rated health; Gcare=grandparent caregiving level; SRH=self-rated health.

Older grandparents also had poorer SRH at baseline. In addition, fewer changes occurred in their grandparent caregiving and SRH across the four waves. Being female was only significantly associated with the starting point of SRH ($b=-0.15, p<0.001$), indicating that

grandmothers had poorer SRH at baseline. Income was significantly associated with the intercept ($b=0.03$, $p<0.001$) and slope ($b=-0.01$, $p=0.015$) of SRH. It indicated that the more money participants had, the greater SRH they had at baseline and the lesser change they experienced in SRH over time.

Discussion

In this study, we investigated the relationship between grandparent caregiving and SRH using a longitudinal dataset with four repeated measurements over 9 years. This longitudinal study revealed that grandparent caregiving decreased during the first three waves, but increased in the last wave. Thus, our first hypothesis was only partially confirmed. This may be due to the general migration phenomenon of the middle generation in large families with older adults. Often, one child migrates first and leaves his or her spouse and children at home. In this situation, grandparents often assume a lower intensity role of caring for grandchildren. Over time, after establishing a solid foundation in a city, the migrated child will bring his or her spouse and siblings to the city, introducing them to urban jobs. As a result, grandparents are left with more caregiving responsibilities, as evidenced by the increase in caregiving intensity at Wave 4. Whether this indicates that 2009 was a pivotal point at which grandparent caregiving intensity peaked and began to decline needs to be explored as additional waves of data collection are conducted [35].

The longitudinal study also revealed that the general change in SRH indicated a decreasing trajectory, even though its mean level increased a little bit in the second wave. Thus, our second hypothesis was confirmed. This finding is consistent with previous studies on the physical well-being of older adults in that health condition worsens with age.

The cross-sectional correlation between grandparent caregiving level and SRH showed that grandparent caregiving level was significantly negatively associated with SRH at all four points of assessment. However, the results of the longitudinal models of this study showed that changes in grandparent caregiving were not significantly correlated with changes in SRH. This may indicate that a decrease in caregiving level did not lead to decrease in SRH. Thus, the third hypothesis was not confirmed. The results from this longitudinal analysis are not consistent with the results of our cross-sectional analysis. This reveals the importance and uniqueness of the longitudinal study design of the present study.

Our results yielded a significant finding regarding the coupling effects between grandparent caregiving and SRH. Grandparent caregiving was positively significantly associated with subsequent changes in SRH, and SRH had a negative significant effect on subsequent changes in grandparent caregiving. These findings indicate that grandparent caregiving in a previous wave led to a faster change in subsequent SRH, and previous SRH led to a slower change in subsequent grandparent caregiving. Thus, our findings support previous research that grandparent caregiving is physically demanding, which may result in deteriorating health conditions over time. On the other hand, this physically demanding activity requires good health, a strong precondition of grandparent caregiving. Having good health thus may lead to a slower decrease in grandparent caregiving.

Unexpectedly, SRH played a leading predicting role between these two variables, which was indicated by its larger coefficient. This indicated that when older adults had greater SRH, they were more willing to provide grandchild caregiving. Physical well-being is an

important resource for older adults. This finding has important implications for policy makers, program developers, and other professionals who seek to meet the care needs of growing older adult populations. Rural Chinese communities can provide programs to improve health status of older adults, which could make them more capable of providing grandparent caregiving and thus benefiting society, families, and their psychological well-being, including enhanced life satisfaction [36].

Our study is not without limitations. First, the study design did not allow for definite conclusions regarding causality, because effects between factors theoretically may be confounded by unmeasured third variables and thus might be spurious. Nevertheless, longitudinal analyses are useful because they can indicate whether the data are in accordance with a causal model. Second, the measurement of grandchild caregiving level was somewhat crude because only a single question was used. Third, because we recruited participants from Anhui province, China, the findings may not be generalizable to other parts of China, especially urban areas given significant regional and urban-rural variations.

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