Impact of Childhood Rural Residence Experience on Health in Old Age: Evidence from China

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Abstract

The challenge of population aging is currently a pressing global issue, with the health status of elderly individuals playing a critical role in determining whether governments can meet the challenges of this demographic shift. This study analyzes the relationship between childhood rural life experiences and health status in old age in the context of China's underdeveloped rural areas and lagging public services. Specifically, it examines whether childhood educational resources and socioeconomic status play a mediating role in this relationship. Employing data from 2823 elderly individuals in CGSS2021, this paper uses OLS regression to analyze the effect of growing up in a rural area during childhood on health in old age. Additionally, Bootstrap methodology was used to analyze the sequential mediation of childhood educational resources and socioeconomic status. The findings revealed a negative association between growing up in a rural area during childhood and health status in old age, with childhood educational resources and socioeconomic status sequentially mediating this relationship. This study emphasizes the importance of analyzing the impact of growing up in a rural area during childhood on the health of elderly individuals and designing targeted interventions to improve their health and quality of life.

I. Introduction

The level of health is a critical indicator of social well-being, an essential measure of individual survival, and a necessary requirement for pursuing a high quality of life (Vickers, 2017). The United Nations' 2030 Agenda for Sustainable Development emphasizes that all countries should achieve universal health coverage, recognizing health as a universal right and an essential resource for daily life for individuals of all ages. Although health is a life-long process, both subjective and objective factors throughout one's life course contribute to a complex impact on an individual's health status in old age (Stucki et al., 2018).It is crucial to intervene proactively on health influencing factors early in life to promote universal health and improve living standards for all (Diener & Suh, 1997).

Population aging poses a significant global challenge that affects social, economic, and cultural development (Dhakal et al., 2022). According to data released by the United Nations, World Population Aging 2022, the proportion of individuals aged 65 and over has increased from 6% in 1990 to 10% in 2022 worldwide, with further projections that it will rise to 16% by 2050. The health status in old age is gradually receiving more attention from society, given the pressures of declining birth rates and aging (Hu & Sheng, 2023). Health is an important indicator of the well-being of the elderly and a key element of healthy aging (Zhang & Liu, 2022). The health of the elderly is related to the overall development of society, involving social policies, family life, and individual life cycles (Foucault, 2012). Therefore, it is crucial to provide new insights into the health status in old age from multiple mechanisms at the individual, family, and societal levels, and to tackle the issue of improving their health and quality of life. Given the wave of global aging, addressing this issue is an urgent priority (Dhakal et al., 2022).

The early formative environment is crucial for an individual's health, especially during childhood (Hertzman, 1999). Exposure to poor socio-economic conditions during this period leads to persistent and long-term negative health outcomes, and improvements in socio-economic conditions later in life do not offset these disadvantages (Almond & Currie, 2010, 2011). A whole life cycle perspective provides new insights into human health development by exploring the impact of childhood experiences on health in middle and old age. According to the cumulative disadvantage theory, an individual's health status in middle and old age results not only from present-day habits and environment but also from the accumulation of health risk factors over the life course. Negative experiences during childhood can indirectly affect an individual's health status in old age (Lynch, 2003; Mayer, 2009; Shuey & Willson, 2008) ; Latent health risks, via intergenerational transmission and cascading effects, as well as the influence of the socioeconomic environment, ultimately lead to an increased likelihood of impaired health during later life (Mckenzie et al., 2011) . Social Learning Theory suggests that the environment in which individuals live significantly influences their behavior. According to this theory, negative influences from childhood residences may impact individuals' health philosophy and health status, potentially influencing their health outcomes in later life (Bleakley, 2010). Therefore, individuals' childhood rural living experience may influence their health outcomes in later life.

In China, the institutional disconnect between rural and urban development has resulted in an underdeveloped socioeconomic environment with fewer development resources, and living in rural areas has become an important determinant of lower socioeconomic status. The economic development gap between urban and rural areas leads to the relatively backward development of rural China, which in turn leads to inadequate nutritional intake and psychological depression, thereby adversely affecting the physical health of individuals (Wilkinson, 2002). Thus, the experience of childhood rural living experience may negatively affect the health status in old age in terms of nutrition and psychological aspects.Socio-conomic status has a significant impact on childhood health, with factors such as economic recession and hunger contributing to health disparities (Neelsen & Stratmann, 2011). Individuals who live in lower socioeconomic areas during early childhood are more likely to experience physical illness and mental health problems in later life (Zhong et al., 2017), and this group is also more likely to suffer from chronic diseases (Galobardes et al., 2008).

II. Theoretical analysis and research hypotheses

Life course theory integrates social and individual levels of analysis, emphasizing the analysis of experiences and events in the context of historical events and spaces in which individuals live (Elder et al., 2003). Various factors, including structural, social, and cultural factors, may impact an individual's life and development (Elder Jr, 1998). The overall lifespan of an individual provides a richer explanation for health in old age (Mayer, 2009). Life course theory assumes that individual development is sequential and continuous, rooted in unique socio-historical periods and geographic spaces, and focuses on the entire life course of individual development (Mayer, 2009) Childhood is a critical period in an individual's life course, and its impact on all aspects of an individual's life is significant; experiences in childhood affect individual development in adulthood and old age (Liu et al., 2021). The theory of cumulative disadvantage is a crucial tool in explaining how early risk factors in an individual's life course impact their health status in old age. According to the theory, an individual's health status in old age is closely associated with their early-life environment and habits. Shaw (2005) noted that health disadvantage in later life is associated with poor nutritional supplementation and quality of life during childhood. Meanwhile, the accumulation of disadvantage is the outcome of the interaction between institutional arrangements and individual actions in a society over time (Dannefer, 1987; O'Rand, 1996). Merton (1968)emphasized that the factors behind this process involve both the microscopic environmental factors that affect individual growth and the macroscopic social selection processes.

In combination with life course theory and cumulative disadvantage theory, structural disadvantages accumulate over time and become increasingly superimposed as the life course progresses, leading to poorer individual or group development outcomes. In the context of the current study's focus on health levels at older ages, this accumulation can be described as the accumulation of structural disadvantages over the life course, resulting in systematic differences in health levels among individuals or groups and indicating that

health outcomes at older ages are the result of cumulative experiences throughout the life course (Dannefer, 2003).

Because of the urban-rural development gap and the less efficient agricultural production compared to industrial production, China's rural areas are relatively backward in economic, social, cultural and infrastructure development, resulting in rural development lags and the relatively lower socio-economic status of rural residents (Fan et al., 2004). According to life course theory and accumulation of disadvantage theory, this lag in economic development leads to health inequality. The allocation of social public resources, including information blockage, lack of knowledge, and low levels of medical care, contributes to the accumulation of health-level disadvantages that can affect individuals in old age (Chan, 2013; Long et al., 2016). We propose hypothesis 1 based on the above theoretical analysis.

H1: Childhood rural living experience has a significant effect on the health of older adults.

Childhood rural living experiences have a negative impact on access to educational resources. Educational resources are more scarce in rural areas compared to urban areas, resulting in rural children being at a disadvantage in terms of educational opportunities and having difficulty accessing high-quality educational resources. For example, rural schools are usually small in size, have inadequate teachers, poor teaching facilities, and lack advanced educational technology (Roberts & Hannum, 2018). In addition, the economic level of rural families is relatively low, and parents often cannot afford the high cost of education and are unable to provide quality educational resources for their children (Liu et al., 2023). In addition, the high mobility of the rural population leads to frequent school transfers for rural students, making it difficult to maintain a stable academic process (Gao et al., 2013). Therefore, the negative impact of childhood rural living experiences on children's access to educational resources cannot be ignored.

The negative impact of less access to educational resources on the health of the elderly is complex and involves multiple mechanisms. Firstly, elderly individuals with less access to educational resources may lack cognitive stimulation, such as learning new skills or accepting new challenges, which could lead to a decline in cognitive abilities, such as memory and attention, and thus increase the risk of cognitive disorders, such as dementia (Christopher Auld & Sidhu, 2005). Individuals with higher educational levels are more likely to develop healthy eating and lifestyle habits (Mokdad et al., 2004). Secondly, elderly individuals with less access to educational resources may lack social networks, which could lead to feelings of loneliness and social isolation in their later years, which could further affect their physical and mental health (Xu et al., 2003). Lastly, individuals with higher levels of education are more likely to fully utilize social resources such as medical insurance and public health services, which helps to establish their own health security (Van Kippersluis et al., 2011). Therefore, individuals with lower educational levels and rural living experiences may have their health in old age affected by their cognitive abilities, social networks, and use of social resources.

H2: Educational resources have a significant effect on the health of older adults with childhood rural living experience.

The relatively lower socio-economic status of rural residents resulting from the large income gap between urban and rural areas has implications for health across individuals in rural and urban areas (Link & Phelan, 1995; Williams, 1990; Winkleby et al., 1992). Socioeconomic status plays an important role in health in almost all diseases and at all stages of life, and has different mechanisms of influence at different ages (Winkleby et al., 1992).This effect is cumulative and begins in childhood, becoming more pronounced with age. Thus, individuals with higher socio-economic status over time have a better health foundation (Lowry & Xie, 2009). For those who lived in rural areas as children, their socioeconomic status is typically low. Even if they achieve higher socio-economic status through their later efforts, their health status does not improve significantly. This is because individuals suffer from lower socio-economic status in childhood and have fewer related resources, making it more difficult for them to obtain higher socio-economic status in adulthood, which can lead to physical illness and psychological stress. This, in turn, can have a negative impact on health in old age (Cardano et al., 2004; Elstad & Krokstad, 2003).

According to the health selection theory, individuals with better health status have an increased likelihood

of achieving higher socio-economic status as it serves as one of the screening mechanisms for social mobility (West, 1991).Furthermore, a higher socio-economic status is also associated with better health status in old age (Braveman, 2006). However, individuals from socioeconomically disadvantaged groups during childhood may experience relatively poorer health status and a higher rate of health deterioration in old age due to physiologically hidden illnesses caused by life stress, nutritional status and developmental status, lifestyle, and health resource inequities. Moreover, the health status gap between groups at different socio-economic status levels increases progressively with age (Cohen et al., 2010; Ferraro et al., 2016; Pearlin et al., 2005). Thus, socio-economic status inequalities during childhood can lead to health status inequalities that persist into adulthood and old age (Hayward & Gorman, 2004). Based on the above discussion in the literature, hypothesis 3 is proposed in this paper:

H3: Ssocio-economic status has a significant effect on the health of older adults with childhood rural living experience.

Education is known to have a positive impact on people's health, as more educated individuals tend to feel more fulfilled and satisfied with their work, have better life and health management skills, and therefore are less likely to develop chronic illnesses compared to those with lower levels of education (Ross & Mirowsky, 2010). Education serves as a platform for socioeconomic advancement, leading to better-paying jobs and higher earnings (Moen, 1999). This can provide individuals with sufficient financial resources to meet their nutritional and material needs (Cutler & Lleras-Muney, 2010), and also raise awareness of the importance of investing in health, thus improving the overall socio-economic status and well-being of individuals (Ettner, 1996). Childhood experiences in rural areas often lead to educational inequalities and lower socio-economic status, which can result in cumulative health disadvantages and health inequalities over the course of an individual's life (Zhang et al., 2012). Based on the literature discussed above, Hypothesis 4 is proposed in this paper:

H4:Growing up in a rural environment with limited access to educational resources can result in a reduction in one's socio-economic status, resulting in negative health outcomes in later life.

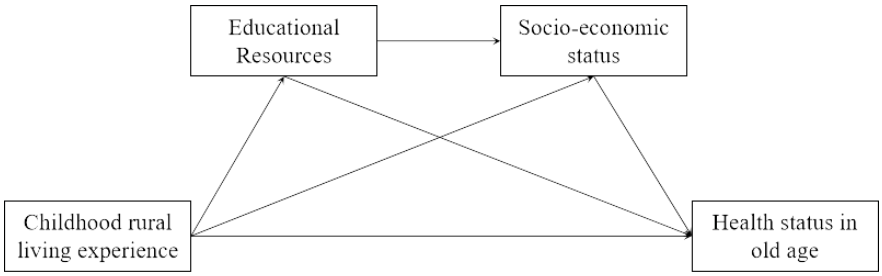

Fig. 1 Theoretical model

III.Data, measurement, and method

The China General Social Survey (CGSS) is a comprehensive and continuous nationwide survey project managed by the China Survey and Data Center for the Chinese People's University. Since 2003, it has been conducted 14 times across all 31 provincial regions in China. The latest CGSS 2021 survey data was released in 2023, containing 8,148 samples and 700 variables. For this study, we utilized the effective data from a sample of 2,823 elderly individuals, excluding non-elderly and invalid samples such as missing values and extreme outliers.

Dependengt Variables:This study utilized the self-rated health measure to assess the health status of individuals. Self-rated health was chosen due to several reasons. Firstly, health status is a comprehensive indicator that reflects an individual's overall health, in contrast to single indices such as morbidity and disability rates. Secondly, existing literature has demonstrated that self-rated health can predict objective health indicators

like mortality, loss of function, and absence from work due to illness. Thirdly, self-rated health was readily available and unambiguous (Liu et al., 2021). The self-rated health question in the CGSS2021 survey questionnaire is "How would you rate your current health status? (1=very unhealthy, 2=unhealthy, 3=fair, 4=healthy, 5=very healthy)". A higher score indicates higher self-rated health. The distribution of health scores for the sample is presented in Table 1, where scores of 10%, 26.89%, 31.82%, 21.92%, and 9.37% were obtained. Notably, 63.11% of the sample reported self-rated health scores lower than 3, indicating that the health level of elderly individuals in China is relatively poor.

Table 1 Distribution of self-rated health.

The score of self-rated health	1	2	3	4	5
Percentage	9.37%	21.92%	31.82%	26.89%	10%
Accumulated	9.37%	31.29%	63.11%	90%	100%

Independent variables: This study examines the impact of childhood rural living experience on individuals using the CGSS2021 survey questionnaire. The independent variable in this study is whether individuals lived in rural areas during their childhood. To measure the variable, we use the question "Where did you usually live when you were 14 years old?" from the survey questionnaire. The answer options for this question are binary, with 1 representing rural residency and 0 representing urban residency.

Mediating variables: The mediating constructs in this article are education and socio-economic status. Education is measured by the question "What is your highest level of education?" and represents the individual's years of education. Socio-economic status is measured by the question "Overall, how would you rate your own socio-economic status in society?" using a five-point scale ranging from very low to very high.

Control variables: The control variables in this study are categorized into three dimensions, namely individual, family, and social levels. The individual level will examine five aspects, including gender (male=1, female=0), age (difference between survey year and year of birth), marital status (married=1, unmarried or widowed=0), political affiliation (party member=1, non-party member=0), and religious belief (has religious belief=1, no religious belief=0). The family level will examine two aspects, namely family income (total annual family income, logarithmic) and family size (total number of family members). The social level will mainly focus on determining the individual's degree of importance to health by examining whether individuals participate in pension insurance (participate=1, not participate=0) and medical insurance (participate=1, not participate=0).

IV. Results

(i) Descriptive Statistical Analysis

Table 2 presents the mean and standard deviation of 2823 samples of elderly individuals aged 60 or older in CGSS2021. Regarding the dependent variable, the average health score for the elderly group is 3.062 and the standard deviation is 1.122. Regarding the mediator variables, the average number of years of education for the elderly group is 3.939 and the standard deviation is 2.227, indicating that the cultural level of the elderly group is relatively low in China. The average socio-economic status is 2.283, with a standard deviation of 0.965, indicating that the socio-economic status of the elderly group is relatively low as well. Regarding the independent variables, most (79.7%) of the farmers have had childhood rural living experience, with a standard deviation of 0.402, indicating that the majority of the elderly lived in rural areas during their childhood.

In terms of individual characteristics, the surveyed group consisted of 48.6% men, with an average age of 69.619. Of the older adults surveyed, 70.6% were married, 16.1% were enrolled in the Communist Party of China, and 9% had religious beliefs. In terms of family characteristics, the household annual income level was 9.580 (log), and the average number of family members was 2.32. In terms of social characteristics,

94.2% of the older adults surveyed were enrolled in medical insurance, and 81.2% were enrolled in pension insurance.

Table 2 Descriptive Statistical Analysis

VARIABLES	VARIABLES	Indicator Meaning	Mean	Sd
Dependent variable	Health status	self rated health	3.062	1.122
Mediating variables	Educational resources	years of education	3.639	2.227
	Socio-economic status	very low=1, low=2, average=3, high=4, very high=5	2.283	0.965
Independent variable	Childhood rural living experience	rural=1, urban=0	0.797	0.402
Characteristic Variable of Individual	Gender	male=1, female=0	0.486	0.500
	Age	difference between survey year and year of birth	69.619	6.708
	Marital status	marital status (married=1, unmarried or widowed=0)	0.706	0.456
	Political affiliation	party member=1, non-party member=0	0.161	0.368
	Religious belief	has religious belief=1, no religious belief=0	0.090	0.286
Characteristic Variable of Family	Family income	total annual family income, logarithmic	9.580	2.961
	Family size	total number of family members	2.320	2.174
Characteristic Variable of Society	Medical insurance	participate=1, not participate=0	0.942	0.233
	Pension insurance	participate=1, not participate=0	0.812	0.390

(ii) Correlation analysis

We conducted a correlation analysis to test the correlation between variables (see Table 3). Firstly, there was a negative correlation between childhood rural living experience and the health status in old age. The correlation coefficient between childhood rural living experience and health status in old age was 0.114, indicating a significant negative prediction of childhood rural living experience on health status in old age. Secondly, there was a significant negative correlation between childhood rural living experience and the education level of the elderly population, with a correlation coefficient of 0.360. Childhood rural living experience was also significantly negatively correlated with the socio-economic status of the elderly population, with a

correlation coefficient of 0.134. Thirdly, there was a significant positive correlation between the education level and socio-economic status of the elderly population, with a correlation coefficient of 0.184. Finally, the education level and socio-economic status of the elderly population were significantly positively correlated with health status, with correlation coefficients of 0.159 and 0.242, respectively.

Table 3 Correlation Analysis

	Health status	Childhood rural living experience	Educational resources	Socio-econ
Health status	1			
Childhood Rural living experience	-0.114***	1		
Educational resources	0.159***	-0.360***	1	
Socioeconomic status	0.242***	-0.134***	0.184***	1
Gender	0.083***	0.00800	0.212***	-0.00200
Age	-0.083***	0.0210	-0.106***	0.067***
Marital status	0.071***	-0.0100	0.126***	0.049***
Political affiliation	0.103***	-0.138***	0.367***	0.169***
Religious belief	0.00500	-0.033*	-0.041**	0.0130
Family income	0.135***	-0.258***	0.274***	0.184***
Family size	-0.0120	0.127***	-0.058***	0.00800
Medical insurance	0.00200	-0.053***	0.093***	0.074***
Pension insurance	0.046**	-0.118***	0.139***	0.063***

Note:*** p<0.01, ** p<0.05, * p<0.1

(iii)Basic regression results

Table 4 presents the baseline regression results of the effect of childhood rural living experience on an individual's health status in old age. Model (1) does not include any control variables. The results show that living in a rural area during childhood has a negative impact on an individual's health status in old age. Model (2) includes individual characteristic variables, and the results demonstrate that the negative effect of childhood rural living experience on health in old age remains significant with a coefficient of 0.159 and a statistical level of 1%. Model (3) includes family characteristic variables, and the results show that an individual's childhood rural living experience has a significant negative impact on their health in old age, with a coefficient of 0.127 and a statistical level of 5%. Finally, Model (4) includes social characteristic variables, and it is found that childhood residence in rural areas has a negative impact on an individual's health status in old age, with a coefficient of 0.109 and a statistical level of 10%. In summary, the results in Table 4 show a significant negative association between an individual's childhood residence in rural areas and their health status in old age.

Controlling for other factors, individual characteristics, such as gender, age, education, and socio-economic status, along with family and social characteristics, all have a significant impact on the health status in old age . For instance, in Model (4), elderly males tend to have higher health levels than their female counterparts. Moreover, as age increases, there is a gradual decline in health status in old age. In addition, those with higher levels of education and socio-economic status tend to have better health outcomes. Family income also plays a critical role in maintaining good health, with higher levels of income associated with better health outcomes in old age. Furthermore, participating in medical insurance programs is associated with higher health status in old age.

Table 4 The impact of childhood rural living experience on health in old age

Variables	Health status (1)	Health status (2)	Health status (3)	Health status (4)
Childhood rural living experience	-0.317***	-0.159***	-0.127**	-0.109*

	(-6.07)	(0.055)	(0.062)	(0.063)
Gender		0.163***	0.192***	0.191***
		(0.043)	(0.048)	(0.048)
Age		-0.015***	-0.014***	-0.013***
		(0.003)	(0.004)	(0.004)
Marital status		0.054	0.079	0.087
		(0.048)	(0.056)	(0.056)
Educational resources		0.030***	0.025**	0.028**
		(0.011)	(0.012)	(0.012)
Socio-economic status		0.262***	0.290***	0.301***
		(0.022)	(0.025)	(0.025)
Political affiliation		0.070	0.119*	0.105
		(0.062)	(0.067)	(0.068)
Religious belief		0.080	0.121	0.127
		(0.073)	(0.082)	(0.083)
Family income			0.020**	0.020**
			(0.008)	(0.008)
Family size			-0.011	-0.010
			(0.012)	(0.012)
Medical insurance				-0.247**
				(0.105)
Pension insurance				0.050
				(0.063)
Constant	3.315***	3.373***	3.033***	3.124***
	(71.04)	(0.251)	(0.296)	(0.313)
Observations	2,819	2,718	2,127	2,090
R-squared	0.013	0.088	0.114	0.118

Note:*** p<0.01, ** p<0.05, * p<0.1

(iv) Heterogeneity analysis

Regarding the current development stage of China, the health status of men and women in the elderly population varies considerably, and their childhood experiences may have varying effects on their health in old age. Therefore, this article conducts heterogeneity analysis based on gender to explore the differential impact of childhood rural living experience on health in old age. Table 5 reports the heterogeneous impact of childhood rural living experience on the health levels of men and women. On the one hand, model (1) omitted any control variables, and the results showed that childhood rural living experience has an adverse effect on the health status of men in old age. However, after successively adding personal characteristics, family characteristics, and social characteristics variables, the adverse effect of childhood rural living experience on the health of the elderly population was insignificant. On the other hand, model (5) omitted any control variables, and the results showed that childhood rural living experience has an adverse effect on the health status of women in old age. Models (6), (7), and (8) successively added personal characteristic variables, family characteristic variables, and social characteristic variables, and childhood rural living experience has an adverse effect on health in old age. Taking column (8) as an example, childhood rural living experience has an adverse effect on health in old age at the 10% statistical significance level, and the coefficient of influence is 0.159.

Table 5: Heterogeneity Analysis

Panel A: male	Variables	male	male	male	male
		(1)	(2)	(3)	(4)

	Childhood rural living experience	-0.250***	-0.095	-0.081	-0.067
		(-3.35)	(0.077)	(0.086)	(0.088)
	Constant	3.359***	3.475***	3.122***	3.365***
		(50.17)	(0.354)	(0.420)	(0.450)
	Observations	1,369	1,330	1,078	1,060
	R-squared	0.008	0.086	0.100	0.104
Panel B: female	Variables	female	female	female	female
		(5)	(6)	(7)	(8)
	Childhood rural living experience	-0.382***	-0.229***	-0.175*	-0.159*
		(-5.27)	(0.080)	(0.091)	(0.091)
	Constant	3.275***	3.451***	3.095***	3.025***
		(50.66)	(0.360)	(0.420)	(0.440)
	Observations	1,450	1,388	1,049	1,030
	R-squared	0.019	0.078	0.110	0.115

Note:*** p<0.01, ** p<0.05, * p<0.1

(v) Robustness test and endogeneity treatment

To enhance the credibility of the research findings, this paper utilizes the method of alternative indicators to conduct robustness tests. Specifically, the indicator "the frequency of health problems affecting work or daily activities in the past four weeks (1=always, 2=often, 3=sometimes, 4=rarely, 5=never)" in the survey questionnaire of the Chinese General Social Survey 2021 (CGSS2021) is chosen for further analysis. The results of the robustness test are presented in Table 6, with Model (1) not including any control variables. The findings reveal that childhood rural living experience has a significant negative impact on elderly health, with a coefficient of 0.469 at the 1% level. As Models (2), (3), and (4) gradually incorporate personal characteristics, family characteristics, and social characteristics variables, the negative impact of childhood rural living experience on elderly health persists. Taking Model (4) as an example, childhood rural living experience has a significant negative impact on elderly health at the 1% level, with a coefficient of 0.145. These results are consistent with previous research, providing indirect support for the scientificity and credibility of the research findings.

Table 6: Robustness Test

Variables	Health condition	Health condition	Health condition	Health condition
	(1)	(2)	(3)	(4)
Childhood rural living experience	-0.469***	-0.258***	-0.172**	-0.145*
	(-7.41)	(0.066)	(0.076)	(0.076)
Gender		0.201***	0.195***	0.195***
		(0.052)	(0.059)	(0.059)
Age		-0.018***	-0.018***	-0.017***
		(0.004)	(0.005)	(0.005)
Marital status		0.116**	0.129*	0.128*
		(0.057)	(0.068)	(0.068)
Educational resources		0.060***	0.060***	0.062***
		(0.013)	(0.015)	(0.015)
Socio-economic status		0.279***	0.274***	0.283***
		(0.027)	(0.030)	(0.031)

Political affiliation		0.034	0.089	0.061
		(0.075)	(0.082)	(0.083)
Religious belief		-0.017	-0.025	-0.020
		(0.088)	(0.100)	(0.101)
Family income			0.039***	0.039***
			(0.010)	(0.010)
Family size			-0.002	0.001
			(0.015)	(0.015)
Medical insurance				-0.177
				(0.128)
Pension insurance				0.112
				(0.077)
Constant	3.873***	3.944***	3.421***	3.394***
	(68.62)	(0.303)	(0.360)	(0.382)
Observations	2,814	2,714	2,127	2,090
R-squared	0.019	0.095	0.112	0.113

Note:*** p<0.01, ** p<0.05, * p<0.1

During the argumentation presented here, potential endogeneity issues may arise, including omitted variables and measurement errors. Childhood rural living experiences are influenced by factors such as family income, family size, as well as parental characteristics, making complete observation challenging. Moreover, self-reported health status is subjectively evaluated, which can easily result in measurement errors in statistical analysis.

The binary nature of the "childhood rural living experience" variable makes it difficult to satisfy the assumption that "endogenous variables are continuous" in the traditional instrumental variable estimation model (2SLS). To test whether there is significant endogeneity between "childhood rural living experience" and "elderly health status," this article employs the conditional mixed process (CMP) estimation method. CMP estimation is a two-stage process that requires interpreting results in two steps. First, the correlation between the instrumental variable and the endogenous explanatory variable is estimated. If the coefficient of the instrumental variable is significant, it meets the correlation conditions. Second, the results are applied to the benchmark model regression to judge the exogeneity of the explanatory variable based on the significance level of the endogeneity test parameter (i.e., Atanhrho_12). If the parameter significantly does not equal zero, the explanatory variable is considered endogenous, and the CMP estimation results are deemed more reliable. Conversely, if the explanatory variable is exogenous, the benchmark regression results are more reliable.

We chose "the mother's place of residence at birth (rural or urban)" and "the mother's employment status at the age of 14 (full-time farmer, part-time farmer, or other)" as instrumental variables, using methods with. First, considering whether individuals lived in rural areas during their childhood is closely related to their mother's place of residence at birth and their mother's occupation during childhood. If an individual's mother frequently resided in rural areas at the time of their birth, the individual also had rural living experience during their childhood. During childhood, individuals need to be taken care of by their parents, and individuals often live with their mother. If their mother's occupation during childhood was mainly farming, then the individual would also mainly reside in rural areas. Second, on the other hand, when controlling for multiple variables, "the mother's place of residence at birth (rural or urban)" and "the mother's employment status at the age of 14 (full-time farmer, part-time farmer, or other)" are relatively exogenous and have a smaller direct impact on an individual's health in old age.

We selected "the mother's place of residence at birth (rural or urban)" and "the mother's employment status at the age of 14 (full-time farmer, part-time farmer, or other)" as instrumental variables, utilizing appropriate methodology. Firstly, a close association exists between childhood location and the mother's

place of residence at birth, and her occupation during that period. Consequently, if an individual's mother primarily resided in rural areas at the time of the individual's birth, it can be assumed that the individual has had experience living in rural areas during their childhood. In most cases, children require parental care during childhood, and they usually live with their mother. If the mother's occupation was primarily farming during that time, it follows that the individual would also have resided in rural areas. Secondly, "the mother's place of residence at birth (rural or urban)" and "the mother's employment status at the age of 14 (full-time farmer, part-time farmer, or other)" are considered to be relatively exogenous and have a lesser direct impact on an individual's health in old age when multiple variables are controlled for.

Table 7: Endogenous treatment

Variables	First stage (1)	First stage (2)	Second stage (3)	Second stage (4)
Childhood rural living experience			-0.214***	-0.423***
			(-3.23)	(-3.40)
Mother's place of residence at birth (rural or urban)	3.237***			
	(27.44)			
Mother's employment status at age of 14		1.566***		
		(19.63)		
Control variables	YES	YES	YES	YES
Atanhrho-12			0.013 (0.23)	0.165 (1.94)
Wald chi^2	993.75	716.61	993.75	716.61
Sample number	2,154	2,154	2,154	2,154

Note:*** p<0.01, ** p<0.05, * p<0.1

V. Analysis of the Influence mechanism

This study employs hierarchical regression analysis to investigate the chain-mediated effects of childhood rural living experience and elderly health through education resources and socio-economic status (refer to Table 8). To better demonstrate the mediating role of Educational Resources and Socio-economic status in the chain of causation between Childhood rural living experience and Health status in old age, this study generated a path diagram of the mediating chain, as shown in Fig 2. The analysis demonstrates that childhood rural living experience significantly and positively impacts elderly health at the 1% statistical level, as well as significantly and positively predicts socio-economic status and health status in old age. Education resources also significantly and positively impact socio-economic status at the 1% statistical level. When childhood rural living experience, education resources, and socio-economic status are all included in the regression equation, childhood rural living experience, education resources, and socio-economic status all significantly and positively impact elderly health. Therefore, education resources and socio-economic status exhibit a chain-mediated effect in the relationship between childhood rural living experience and elderly health.

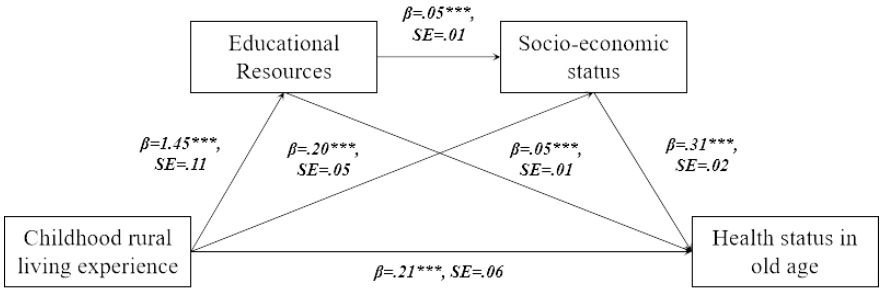

Fig. 2 Intermediary model estimation

The study controlled for individual, family, and social characteristics and used Stata 17.0 to obtain a Bootstrap sample of 1000 for testing the chain-mediated effect. Table 9 shows that childhood rural living experience has a direct effect on elderly health, and the Bootstrap 95 percent confidence interval does not include 0. The Bootstrap 95 percent confidence intervals for the indirect effects of education resources, socio-economic status, and education resources - socio-economic status do not include 0, indicating significant mediating effects in the relationship between childhood rural living experience and elderly health. The total mediating effect is 0.139, accounting for 51.48 percent of the total effect (0.270). Childhood rural living experience affects elderly health through three paths: childhood rural living experience - education resources - elderly health (0.054, accounting for 20 percent of the total effect), childhood rural living experience - socio-economic status - elderly health (0.059, accounting for 21.85 percent of the total effect), and childhood rural living experience - education resources - socio-economic status - elderly health (0.026, accounting for 9.63 percent of the total effect). These results support hypotheses 2, 3, and 4.

Table 8 Multiple Mediation Model Analysis of Childhood Rural Living Experience and Elderly Health Level

	Educational resources	Socio-economic status	Health status
Variables	(1)	(2)	(3)
Childhood rural living experience	-1.455***	-0.139**	-0.109*
	(-13.76)	(-2.55)	(-1.75)
Educational resources		0.044***	0.028**
		(4.06)	(2.26)
Socio-economic status			0.301***
			(11.98)
Control variables	YES	YES	YES
Constant	5.570***	0.455*	3.124***
	(10.52)	(1.67)	(9.98)
Observations	2,141	2,093	2,090
R-squared	0.297	0.085	0.118

Note:*** p<0.01, ** p<0.05, * p<0.1

Table 9 Analysis of the Mediating Effect of Education Resources on Social-Economic Status

Path	b	Bootstrap
Direct effect		
Childhood rural living experience-Health status in old age	-0.130	0.056
Mediating effect		
Childhood rural living experience-Educational resources-Health status in old age	-0.054	0.020
Childhood rural living experience-Socio-economic status-Health status in old age	-0.059	0.016

Childhood rural living experience-Educational resources-Socio-economic status-Health status in old age	-0.026	0.006
Total effect	-0.270	0.056

Note:*** p<0.01, ** p<0.05, * p<0.1

People who grew up in rural areas often have limited access to educational resources, and this can lead to a shorter duration of education. However, education is a key factor in shaping an individual's socio-economic status. The more years of education one obtains, the higher their socio-economic status is likely to be. Additionally, individuals with higher socio-economic status are more likely to access high-quality healthcare resources and services. As a result, access to educational resources and socio-economic status positively impact individuals' health in old age. However, rural life may disrupt this positive trend, resulting in a lower duration of education, lower socio-economic status, and ultimately, worse health in old age.

VI. Conclusion and Discussion

Exploring the factors that influence the health of individuals in mid- and late-life is of great academic and practical value as it is a prerequisite for achieving healthy aging. Life course theory suggests that events and personal experiences during this period have a profound and far-reaching impact on individuals' health. The health status of individuals in mid- and late-life is the result of the accumulation, superposition, and interaction of a series of events, experiences, and risks over the life course. Therefore, analyzing these long-term effects not only contributes to our understanding of life course health factors, but also provides insight into the social and life course health factors (Elder Jr, 1998).

The analysis reveals that a person'schildhood rural living experience has a significant negative impact on their health in old age. Educational resources and socio-economic status acquired during childhood play a chain-mediated role in the relationship between childhood rural living experience and elderly health (Mckenzie et al., 2011; Zhong et al., 2017). Limited access to educational resources creates difficulties in improving their socio-economic status, resulting in most individuals remaining in a lower socio-economic status throughout their lives. This lower social status limits access to high-quality health services and ways to supplement nutrition, coupled with backward health and lifestyle concepts, which brings disadvantages to elderly health (Grossman, 1997). This study contributes to the understanding of elderly health status from a life-cycle perspective and provides suggestions and reflections for promoting lifelong health of rural residents.

First, this paper finds that childhood rural living experience has a significant negative effect on individual health status in old age, supporting hypothesis 1. In rural China, the lack of access to nutrition and quality medical resources causes health disadvantages to accumulate from childhood, resulting in malnutrition and early accumulation of chronic diseases, which are reflected in health status in old age (Hannum & Meiyan, 2006). Therefore, nutrition and health in childhood have an important impact on the lifelong health status of individuals, and access to health resources and growth environment in childhood need to be emphasized (Neelsen & Stratmann, 2011).

Second, educational resources, as one of the mediating effects, had a significant impact on the health in old age of the childhood rural living experience group; overall, the higher the level of education, the better the health in old age (Yang et al., 2014)At the same time, the higher the level of education, the more socioeconomic resources and more development opportunities are available, and thus better access to health services and nutrition. This proves the hypothesis of this paper.2 Education not only benefits people through the accumulation of intellectual capital, but also adds further value to human capital through its impact on health, and the improvement of rural educational resources will help to reduce the cumulative disadvantage of health in the process of personal development (Aizer & Stroud, 2010).

Moreover, the socio-economic status had a mediating effect. The upbringing in rural areas, with a generally lower socio-economic status compared to urban areas due to the developmental imbalanc (Almond & Currie, 2010), resulted in rural residents being more likely to spend their income on necessary daily expenses, thus forgoing nutritional and health care products. This disadvantage in health accumulation had a negative

impact on health in later life, supporting the hypothesis of this study. According to the above conclusions, the development of the rural economy is of great importance for the health of rural residents, and the improvement of the socioeconomic level can promote the residents' attention to their nutritional intake and health, and give them the ability to provide themselves with more healthful products, thus eliminating the poor health status brought about by their lower socio-economic status.

Finally, we found that childhood rural living experience have an indirect effect on health in old age, which is mediated by educational resources and socio-economic status. Individuals with greater access to educational resources tended to receive more years of education, which in turn had an impact on their future socio-economic status. This was reflected in their income and social class, and accumulated over the course of their life to affect their health status in old age. The impact of this chain was amplified in rural areas, where educational and economic resources are relatively scarce, leading to poor health outcomes in old age (Zhang et al., 2012) . Therefore, it is important to address the shortcomings of rural areas in terms of educational and socioeconomic resources, in order to promote health for all.

This study has certain limitations. Firstly, the study utilizes cross-sectional data from 2021, which makes it difficult to capture temporal changes over time. Secondly, the data selected for this analysis is relatively homogeneous and limited to mainland China, thus limiting its generalizability to other regions or countries. Thirdly, the potential mediating effects of education and socio-economic status in the relationship between childhood rural living experience and old-age health may be influenced by various social structural factors such as social class, occupation, and workplace, which need further investigation with the inclusion of other contextual variables.

REFERENCES

Aizer, A., & Stroud, L. (2010). *Education, knowledge and the evolution of disparities in health* .

Almond, D., & Currie, J. (2010). Human Capital Development before Age Five. NBER Working Paper No. 15827. *National Bureau of Economic Research* .

Almond, D., & Currie, J. (2011). Killing me softly: The fetal origins hypothesis. *Journal of Economic Perspectives* , *25* (3), 153-172. *https://doi.org/10.1257/jep.25.3.153*

Bleakley, H. (2010). Malaria eradication in the Americas: A retrospective analysis of childhood exposure. *American Economic Journal: Applied Economics* , *2* (2), 1-45.

https://doi.org/10.1257/app.2.2.1

Braveman, P. (2006). Health disparities and health equity: concepts and measurement. *Annual Review of Public Health* , *27* , 167-194.

https://doi.org/10.1146/annurev.publhealth.27.021405.102103

Cardano, M., Costa, G., & Demaria, M. (2004). Social mobility and health in the Turin longitudinal study. *Social Science and Medicine* , *58* (8), 1563-1574.

https://doi.org/10.1016/S0277-9536(03)00354-X

Chan, R. K. (2013). Book review: The Elderly and Old Age Support in Rural China: Challenges and Prospects. *China Information* ,*27* (2), 258-259. *https://doi.org/10.1177/0920203X13485669h*

Christopher Auld, M., & Sidhu, N. (2005). Schooling, cognitive ability and health. *Health Economics* , *14* (10), 1019-1034.

Cohen, S., Janicki-Deverts, D., Chen, E., & Matthews, K. A. (2010). Childhood socioeconomic status and adult health. *Annals of the New York Academy of Sciences* , *1186* (1), 37-55.

https://doi.org/10.1111/j.1749-6632.2009.05334.x

Cutler, D. M., & Lleras-Muney, A. (2010). Understanding differences in health behaviors by education. *Journal of Health Economics* ,*29* (1), 1-28.

https://doi.org/10.1016/j.jhealeco.2009.10.003

Dannefer, D. (1987). Aging as intracohort differentiation: Accentuation, the Matthew effect, and the life course. Sociological forum,

Dannefer, D. (2003). Cumulative advantage/disadvantage and the life course: Cross-fertilizing age and social science theory. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* , *58* (6), S327-S337.

https://doi.org/10.1093/geronb/58.6.S327

Dhakal, S. P., Burgess, J., & Nankervis, A. (2022). Population Ageing: Challenges in the Asia Pacific and Beyond. In *Ageing Asia and the Pacific in Changing Times: Implications for Sustainable Development*(pp. 3-15). Springer.

https://doi.org/10.1007/978-981-16-6663-6_1

Diener, E., & Suh, E. (1997). Measuring quality of life: Economic, social, and subjective indicators. *Social Indicators Research* , 189-216.

Elder, G. H., Johnson, M. K., & Crosnoe, R. (2003). *The emergence and development of life course theory* . Springer.

https://doi.org/10.1007/978-0-306-48247-2_1

Elder Jr, G. H. (1998). The life course as developmental theory.*Child Development* , *69* (1), 1-12.

https://doi.org/10.1111/j.1467-8624.1998.tb06128.x

Elstad, J. I., & Krokstad, S. (2003). Social causation, health-selective mobility, and the reproduction of socioeconomic health inequalities over time: panel study of adult men. *Social Science and Medicine* , *57* (8), 1475-1489.

https://doi.org/10.1016/S0277-9536(02)00514-2

Ettner, S. L. (1996). New evidence on the relationship between income and health. *Journal of Health Economics* , *15* (1), 67-85.

https://doi.org/10.1016/0167-6296(95)00032-1

Fan, S., Zhang, L., & Zhang, X. (2004). Reforms, investment, and poverty in rural China. *Economic Development and Cultural Change* ,*52* (2), 395-421. *https://doi.org/10.1086/380593*

Ferraro, K. F., Schafer, M. H., & Wilkinson, L. R. (2016). Childhood disadvantage and health problems in middle and later life: Early imprints on physical health? *American Sociological Review* ,*81* (1), 107-133. *https://doi.org/10.1177/0003122415619617*

Foucault, M. (2012). *Discipline and punish: The birth of the prison* . Vintage. *https://doi.org/10.1016/0047-2352(96)00031-1*

Galobardes, B., Lynch, J. W., & Smith, G. D. (2008). Is the association between childhood socioeconomic circumstances and cause-specific mortality established? Update of a systematic review. *Journal of Epidemiology and Community Health* , *62* (5), 387-390.

https://doi.org/10.1136/jech.2007.065508

Gao, V., Shrivastava, V., Zhang, L., Chen, S., & Gao, K. (2013). Synchronizing Rural Students' Cognition: An International Case Study about Rural Education Gap in China. *education* , *4* (9).

Grossman, M. (1997). Effect of education on health *The social benefits of education* .

Hannum, E., & Meiyan, W. (2006). Geography and educational inequality in China. *China Economic Review* , *17* (3), 253-265.

https://doi.org/10.1016/j.chieco.2006.04.003

Hayward, M. D., & Gorman, B. K. (2004). The long arm of childhood: The influence of early-life social conditions on men's mortality.*Demography* , *41* (1), 87-107.

https://doi.org/10.1353/dem.2004.0005

Hertzman, C. (1999). The biological embedding of early experience and its effects on health in adulthood. *Annals of the New York Academy of Sciences* , *896* (1), 85-95.

Hu, M., & Sheng, F. (2023). Blockchain-enabled cross-chain collaboration model for elderly health information from a whole process perspective. *Frontiers in Public Health* , *11* .

https://doi.org/10.3389/fpubh.2023.1081539

Link, B. G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. *Journal of Health and Social Behavior* , 80-94.

https://doi.org/0.2307/2626958

Liu, W., Li, J., & Zhao, R. (2023). The effects of rural education on poverty in China: a spatial econometric perspective. *Journal of the Asia Pacific Economy* , *28* (1), 176-198.

https://doi.org/10.1080/13547860.2021.1877240

Liu, Y., Diao, L., & Xu, L. (2021). The impact of childhood experience of starvations on the health of older adults: Evidence from China.*The International Journal of Health Planning and Management* ,*36* (2), 515-531. *https://doi.org/10.1002/hpm.3099*

Long, H., Tu, S., Ge, D., Li, T., & Liu, Y. (2016). The allocation and management of critical resources in rural China under restructuring: Problems and prospects. *Journal of Rural Studies* , *47* , 392-412. *https://doi.org/10.1016/j.jrurstud.2016.03.011*

Lowry, D., & Xie, Y. (2009). Socioeconomic status and health differentials in China: convergence or divergence at older ages?

Lynch, S. M. (2003). Cohort and life-course patterns in the relationship between education and health: A hierarchical approach.*Demography* , *40* (2), 309-331.

https://doi.org/10.1353/dem.2003.0016

Mayer, K. U. (2009). New directions in life course research.*Annual Review of Sociology* , *35* , 413-433.

https://doi.org/10.1146/annurev.soc.34.040507.134619

Mckenzie, S. K., Carter, K. N., Blakely, T., & Ivory, V. (2011). Effects of childhood socioeconomic position on subjective health and health behaviours in adulthood: how much is mediated by adult socioeconomic position? *BMC Public Health* , *11* , 1-9.

https://doi.org/10.1186/1471-2458-11-269

Merton, R. K. (1968). The Matthew effect in science: The reward and communication systems of science are considered. *Science* ,*159* (3810), 56-63.

https://doi.org/10.1126/science.159.3810.56

Moen, E. R. (1999). Education, ranking, and competition for jobs.*Journal of Labor Economics* , *17* (4), 694-723.

https://doi.org/10.1086/209936

Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States, 2000. *JAMA* ,*291* (10), 1238-1245.

https://doi.org/10.1001/jama.291.10.1238

Neelsen, S., & Stratmann, T. (2011). Effects of prenatal and early life malnutrition: Evidence from the Greek famine. *Journal of Health Economics* , *30* (3), 479-488.

https://doi.org/10.1016/j.jhealeco.2011.03.001

O'Rand, A. M. (1996). The precious and the precocious: Understanding cumulative disadvantage and cumulative advantage over the life course. *The Gerontologist* , *36* (2), 230-238.

https://doi.org/10.1093/geront/36.2.230

Pearlin, L. I., Schieman, S., Fazio, E. M., & Meersman, S. C. (2005). Stress, health, and the life course: Some conceptual perspectives. *Journal of Health and Social Behavior* , *46* (2), 205-219.

https://doi.org/10.1177/002214650504600206

Roberts, P., & Hannum, E. (2018). Education and equity in rural China: A critical introduction for the rural education field. *Australian and International Journal of Rural Education* , *28* (2), 1.1-1.13.

Ross, C. E., & Mirowsky, J. (2010). Why education is the key to socioeconomic differentials in health. *Handbook of medical sociology* , *6* , 33-51.

Shaw, M. (2005). Health Inequality: An Introduction to Theories, Concepts and Methods. Mel Bartley. Cambridge: Polity Press, 2004, pp. 224,£ 16.99 (PB), ISBN: 0745627803. *International Journal of Epidemiology* , *34* (2), 500-502.

https://doi.org/10.1093/ije/dyi053

Shuey, K. M., & Willson, A. E. (2008). Cumulative disadvantage and black-white disparities in life-course health trajectories. *Research on Aging* , *30* (2), 200-225.

https://doi.org/10.1177/0164027507311151

Stucki, G., Bickenbach, J., Gutenbrunner, C., & Melvin, J. L. (2018). Rehabilitation: The health strategy of the 21st century.

https://doi.org/10.1016/j.apmr.2019.05.019

Van Kippersluis, H., O'Donnell, O., & Van Doorslaer, E. (2011). Long-run returns to education does schooling lead to an extended old age? *Journal of Human Resources* , *46* (4), 695-721.

Vickers, N. J. (2017). Animal communication: when i'm calling you, will you answer too? *Current Biology* , *27* (14), R713-R715.

https://doi.org/10.1016/j.cub.2017.05.064

West, P. (1991). Rethinking the health selection explanation for health inequalities. *Social Science and Medicine* , *32* (4), 373-384.

https://doi.org/10.1016/0277-9536(91)90338-D

Wilkinson, R. G. (2002). *Unhealthy societies: the afflictions of inequality* . Routledge.

Williams, D. R. (1990). Socioeconomic differentials in health: A review and redirection. *Social Psychology Quarterly* , 81-99.

https://doi.org/10.2307/2786672

Winkleby, M. A., Jatulis, D. E., Frank, E., & Fortmann, S. P. (1992). Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *American Journal of Public Health* , *82* (6), 816-820.

https://doi.org/10.2307/2786672

Xu, G., Meyer, J. S., Huang, Y., Du, F., Chowdhury, M., & Quach, M. (2003). Adapting mini-mental state examination for dementia screening among illiterate or minimally educated elderly Chinese.*International Journal of Geriatric Psychiatry* , *18* (7), 609-616. *https://doi.org/10.1002/gps.890*

Yang, J., Huang, X., & Liu, X. (2014). An analysis of education inequality in China. *International Journal of Educational Development* , *37* , 2-10.

https://doi.org/10.1016/j.ijedudev.2014.03.002

Zhang, J., Giles, J., & Rozelle, S. (2012). Does it pay to be a cadre? Estimating the returns to being a local official in rural China.*Journal of Comparative Economics* , *40* (3), 337-356.

https://doi.org/10.1016/j.jce.2012.04.006

Zhang, P. r., & Liu, Y. (2022). The Higher the Children's Achievements, the Better the Elderly Health? Evidence From China. *Frontiers in Public Health* , *10* , 871266.

https://doi.org/10.3389/fpubh.2022.871266

Zhong, Y., Wang, J., & Nicholas, S. (2017). Gender, childhood and adult socioeconomic inequalities in functional disability among Chinese older adults. *International journal for equity in health* , *16* (1), 1-11. *https://doi.org/10.1186/s12939-017-0662-3*