

Health Inequality of Left-behind Children in Rural Regions: Evidence from China

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Abstract

Background: In China, large-scale population movement and increased childcare costs have brought about a "care crisis" for rural children left-behind when their parents migrate to cities. The unprecedented scale of internal population migration poses multiple challenges to the health of left-behind children in rural areas. Rural left-behind children are currently experiencing insufficient caregiving capacity of intergenerational guardians; the impact of serious parental absences; inadequate nutritional and dietary support and healthy behaviours; limited health service utilization; and abnormally high levels of poor mental health.

Purpose: Using 2016 China Family Panel Studies' micro-data two issues were explored: What is the current status of health inequality in rural left-behind children, including the degree of health inequality and differences in health inequalities of left-behind children in different regions and different age groups; and, second, what are the socioeconomic factors (income deprivation, access to medical services, migrating parents) and inter-generational care arrangements that impacted the health inequality of left-behind children?

Method: The health indicators of left-behind children were measured by the concentration index (CI), and the contribution of each socio-economic variable to health inequality was decomposed through the RIF-I-OLS model.

Results: The health inequality of left-behind children in rural areas was pro-rich. Left-behind children under 5 years of age had the highest health inequality in all regions; the availability of medical services had a significant negative impact on the health inequality of left-behind children in rural areas, especially in the western provinces; income deprivation had a significant positive effect on the health inequality of left-behind children in rural areas, most notably in the eastern provinces; migrant parents had a negative, and intergenerational caregivers a positive, impact on the health inequality of left-behind children; and left-behind children in the western provinces suffered the largest negative impact on their health. Finally, left-behind children experienced relative health inequality due to their sex, education level and health endowments. Policy recommendations are advanced to address issues of health inequalities in rural left-behind children.

1. Introduction

The "care crisis" of Chinese children challenges the management of children's well-being, with population mobility identified as a major factor impacting children's health (Yue and Fan, 2018). Separation of children from their parents while growing up due to parental migration is common in rural China. The total number of migrant populations whose actual place of residence is different from their place of household registration reached 245 million in 2016. China's first rural left-behind children survey in 2016 by the Ministry of Civil Affairs estimated 9.02 million left-behind children in rural China and more recent estimates suggest 69.7 million left-behind children in 2020 (Tong et al., 2019).

The literature examining the impact of mass migration on the health of children left behind has grown rapidly. With some exceptions (Gibson et al., 2011), evidence on left-behind child health from transnational migration from developing countries has tended to be positive, reducing child mortality (Hildebrandt and McKenzie, 2005; Zhunio et al., 2012), increasing life expectancy (Hamilton et al., 2009) and height (Carletto et al., 2011; Mansuri, 2007; Stillman et al., 2012) and reducing the chance of low birth weights (Sunil et al., 2012) and underweight (Frank and Hummer, 2002). China's migration has been overwhelmingly internal, with parents migrating from rural areas to cities and from the central and western rural regions to the eastern developed coastal areas, while leaving their children in the care of grandparents, other family members and friends (Chang et al., 2011). In contrast to the impact of developing country transnational migration on children's health, China's rural-to-urban migration has seen left-behind children suffer health inequalities, including malnutrition (Ban et al., 2017; Robson et al., 2008; Zhou et al., 2015), the probability of getting sick (Li et al., 2015), prevalence of being underweight (De Brauw and Mu, 2011), adverse mental health issues (Lee, 2011; Qin and Albin, 2010) and bad health behaviors (Gao et al., 2010).

The unprecedented large-scale flow of rural labor to cities and towns has weakened the stability of the traditional Chinese family structure and family care system. While their grown children work in distant cities, the rural elderly, who had planned to spend their old age as part of an extended family, have been drafted into the primary childcare giver role. Urban-rural resource imbalances, including inequalities in the health and socioeconomic status of left-behind households, have consolidated inequalities between generations, especially in rural regions (Peng and Wang, 2017). Studies have argued that the health differences between children are due to inequalities in family socioeconomic status (Currie et al., 2008; Elgar et al., 2015; Victorino and Gauthier, 2009; Viner et al., 2012; Emerson and Hatton, 2007; Currie and Stabile, 2003; Power and Matthews, 1997; Marmot, 2005), where children in disadvantaged families are denied equal access to medical resources and healthcare services (Schellenberg et al., 2003; Majeed et al., 2008; Spencer, 2010). Empirical evidence from poor rural areas in China shows that the utilization of health services for preschool left-behind children was extremely low (Ouyang et al., 2019) and inequalities in the utilization of medical services has widened the gap between the health of children in rural areas and their urban counterparts (Lin, 2006; Song, 2007). When both parents migrate, the risk of illness for left-behind children increased significantly (Li et al., 2015) and grandparents are usually called upon to provide care for left-behind children (Nyland et al., 2009). Studies have shown that although grandparents might provide a healthier eating environment (Farrow, 2014; Jongenelis et al., 2019), the impact on left-behind children's health is complex (Sadruddin et al., 2019), where intergenerational care can have some positive effects on children's height and weight in Australia and the UK, but also a higher BMI, delayed physical development and decreased physical function on children's health in the United States, Japan, and Sweden.

While socioeconomic status, health service utilization, parental migration patterns, and intergenerational care impact child health, these influences were magnified for left-behind children. However, most left-behind children studies examined the impact of health inequalities from the perspective of a single factor, and the magnitude of the contribution of multiple factors on the health inequalities among left-behind

children remains unclear. Further, considering the significant differences in regional development in China, research has examined health inequalities among left-behind children from a sub-regional perspective. We examine the health inequalities of rural left-behind children by focusing on the extent to which socioeconomic status, health service utilization, parental migration patterns and intergenerational care contribute to health inequalities of rural left-behind children in general and across different regions. By identifying specific factors that impact the health of left-behind children, we inform decision makers on policies to address the health and well-being of left-behind children. Compared to existing studies (Peng and Wang, 2017; Elgar et al., 2015; Viner et al., 2012), our research makes two contributions. First, we used a decomposition approach based on national-level child survey data to examine the relative importance of the factors impacting health inequalities among left behind children. Importantly, our analysis clarified key factors that may affect children's adaptation to parental migration, including access to medical services, parental outings, income deprivation, and inter-generational care, extending the existing literature. Second, we further examine the decomposition of factors influencing health inequalities among left-behind children by region, assessing differences between eastern, central, and western China.

2. Study Design

2.1 Data Sources

Peking University's China Social Survey Center created the 2016 China Family Panel Studies (CFPS) multi-level sample survey database. Covering 25 provinces, municipalities and autonomous regions, the CFPS sample included 16,000 households, comprising four main questionnaires: community questionnaires, family questionnaires, individual level adult questionnaires and individual level child questionnaires. We used the relevant survey data in the children questionnaire, adult questionnaire, and family questionnaire in the third phase of the CFPS2016 survey data to analyze and test the impact of the health of left-behind children in rural areas. The research object of our article is 0-15 years old children, who live in rural areas and have rural household registration. After matching data from each survey, we analyzed a total of 5729 valid observations, of which girls accounted for 53.2% of the total sample, and boys accounted for 46.8% of the total sample. From the individual level and the family level sample, we extracted the factors affecting the health inequality of left-behind children in rural areas.

2.2 Variables

The indicators of the physical health of children are divided into subjective health rated variables and objective health indicators (Du et al., 2020; Idler and Benyamini, 1997; Boardman, 2006; Breidablik et al., 2009; Wei and Feeny, 2019). In CFPS, self-rated health was obtained by asking respondents "What do you think of your health?". The five options (exceptionally healthy, very healthy, relatively healthy, normal and unhealthy) were assigned values 1-5 to the five options, and the health concentration index (CI) of self-rated health calculated. The health status of left-behind children in the China Family Panel Studies (CFPS) is reported by the caregiver. International research on children's self-assessed health concluded

that parents' or parents' agent's reports on their children's health are accurate (Eiser and Morse, 2001; Theunissen et al., 1997; Waters et al., 2010). Second, the self-rated health results independently completed by older children are basically consistent with the results reported by their parents (Okuda et al., 2013).

The accessibility of health services refers to the actual amount of personal enjoyment of medical services and the degree of convenience or hindrance to access to medical and health services. We calculate the accessibility of medical services based on the responses to adults' satisfaction with the overall medical resources at the point of care, the distance to the doctor and the convenience of transportation to medical facilities, from low to high in 1-5 levels, which comprises the conditions of medical treatment, medicine, medical treatment and hospitalization, distance to seek medical treatment and the convenience of transportation.

The literature defines father migration or mother migration or both parent migration as parental migration (Schmeer, 2009; Hamilton et al., 2009), but following the China National Bureau Statistics formal definition of rural left-behind children as "parents going out", we code both parents migrating as 1 and otherwise 0. Rural individual income inequality was measured by the Kakwani index, which has superior characteristics, mainly non-dimensionality, regularity, and transfer invariance, compared to other indexes, including the Gini coefficient. Intergenerational care measured whether the elderly take care of their grandchildren during the day or night. According to the CFPS questionnaire, "Who will take care of the child during the day or night", is coded 1 when the child's grandparents and other elderly people take care of children, or 0 otherwise.

Parents and family characteristics impact their children's health. In terms of parental characteristics, existing studies have focused on parental genetic factors. The height and weight of the children are related to the height and weight of their parents (Botton et al., 2010; Griffiths et al., 2007). Second, parental job displacement has a significant negative impact on the health of the baby, significantly reducing the birth weight by approximately 4.5% (Lindo, 2011). Third, the empirical evidence based on adopted children shows that after excluding many factors, such as genetics, the education level of female caregivers was an important determinant of children's health (Chen and Li, 2009). A growing body of empirical evidence also suggests that father's education may be equally important (Semba et al., 2008; Breierova and Duflo, 2004). In addition, the education level of parents can also indirectly improve the health of children by raising income levels (Case et al., 2002). Finally, in terms of family characteristics, empirical evidence from China shows that the larger the family size, the more detrimental to children's health (Fang and Xing, 2012). Table 1 sets out the other standard control variables at the child, parent and family levels.

Table 1
Descriptive statistics

variable	meaning	Observations	Mean	variance
Health	Self-rated health	5729	4.6422	2.0522
Access to medical services	From low to high: 1-5	5729	1.3967	0.6288
Migrant parents	Both parents migrate=1, otherwise =0	5729	0.7851	0.4107
Income deprivation	Kakwani Index	5729	0.3264	0.2940
Intergenerational care	Yes=1; No=0	5729	0.3359	0.4723
Child age	Child's age (years)	5729	7.0489	4.3410
Child age squared term	Age squared	5729	68.5301	67.4312
Child sex	Male=1; female=0	5729	0.5324	0.4989
Child education level	Grade	5729	2.9760	1.6655
Parent age	Average age of parents (years)	5729	41.2551	13.1648
Parent weight	Weight (kg)	5729	120.3415	21.9848
Parent height	Height (cm)	5729	161.8202	7.1623
Parent employment	Work=1; not work=0	5729	1.4842	0.8751
Parent education	Parents' years of education	5729	5.1347	1.4734
Family size	Number family members	5729	5.4660	2.1416
Household income per capita	Family income per capita (RMB)	5729	1403.5250	1310.9850

2.3 Methods

Decomposing the factors that affect health inequality not only identifies their relative importance, but also the strategies to address health inequality in left-behind children. While we employ the concentration index (CI) method, which is widely used in health research (Kjellsson and Gerdtham, 2014), we also used the RIF-I-OLS (Recentered Influence Function—Ordinary Least Squares) method (Heckley et al., 2016; Monti, 1991; Wagstaff et al., 2001; Firpo et al., 2009) to avoid some of the CI method restrictive assumptions, such as rank ignorability and weighting function ignorability (Heckley et al., 2016). The RIF approach is a general decomposition method applicable to all forms of bivariate rank dependent indices of socioeconomic inequality in health, including the concentration index (Heckley et al., 2016). The decomposition of the concentration index requires the calculation of the RIF of the concentration index

and then regressing the RIF on a set of covariates yielding the marginal effects of the covariates on the index (Cai et al., 2017).

3. Results

3.1 Age distribution and regional distribution of health concentration index

Table 2 reports the health concentration index of left-behind children in rural areas, where the positive CI indicates that rural left-behind children from higher income families enjoy better health than those from lower income rural families. The size of the health concentration index represents the degree of inequality in the health of left-behind children in rural areas.

Table 2
Health Concentration Index

Region (number observations)	Age	CI
Overall(5729)	Under 5 years old	0.0607
	5-10	0.2567
	11-15	0.1579
East(1934)	Under 5 years old	0.3683
	5-10	0.2835
	11-15	0.0817
Central(1993)	Under 5 years old	0.3545
	5-10	0.0945
	11-15	0.1745
West(1802)	Under 5 years old	0.3760
	5-10	0.1553
	11-15	0.2790

Analyzing the age distribution of left-behind children's health inequality in Table 2, at the national level the change in the age distribution presents an "inverted U-shape", with the CI the under 5 year olds lowest (0.0607), rising to its maximum value for aged 5 to 10 (0.2567), before falling for children aged 11 to 15 (0.1579). The changes in age distribution of rural left-behind children in the central and western regions show a diverged from the national pattern, with the highest CI in the under 5 age group, next highest in the 11-15 age group and lowest in the 5-10 age group. While the health inequality of left-behind children under the age of 5 in the East, Central and West was the highest, in the East the next highest CI was in the

5-10 age group, diverging from the Central and West regions, where the 11-15 age group had the next highest CI. Across all regions, the under 5 age group, which was the most important period for children's physical development, had the highest health inequality. Disparities in China's regional development display high to low differences in economic development, health service levels and quality of life (Liao et al., 2020). The regional health inequality was associated with not only the distribution of wealth, but also the distribution of health resources and primary health care services (Fang et al., 2010).

3.2 Analysis of the decomposition results of health inequality

Table 3 presents the results of RIF-I-OLS decomposition. Model 1 is the uncontrolled result for the total sample, and Model 2 is the decomposition result of the health concentration index after adding the control variables for the total sample. Model 3, Model 4, and Model 5 are the results obtained by decomposing samples from the eastern, central, and western regions after adding the control variables. The magnitude and sign of the value directly reflect the magnitude and direction of the impact of the factor on the health inequality of rural left-behind children.

In general, access to medical services, parents migrating, income deprivation, inter-generational care, children's age, parents' height and age, children's and parents' education levels, family size, and per capita income all played a significant, but different role, in the health inequality of left-behind children. The accessibility of medical services (-0.0548) had a significant negative impact on the health inequality of left-behind children. From the demand-side access, the long travel distance to medical services, inconvenient transport and the lack of financial support to enjoy high-quality medical resources promoted the health inequality of left-behind children. From the perspective of supply accessibility, the quality of medical institutions in rural areas failed to meet the growing medical service needs of rural left-behind children, prolonging the health inequality of left-behind children. As shown from the decomposition results in Models 3-5, the impact of the accessibility of medical services on the health inequality of left-behind children varied by region. The coefficients of the accessibility of medical services show that the impact on the health inequality in West (-0.1211) was significantly greater than in the East (-0.0518) and Central regions (-0.0489). The economic development level and health facilities in the western region was lower than that of the eastern and central regions. Second, the complex and steep terrain and inconvenient transport in the western region greatly affected the distance from, and time to reach, medical treatment, increasing the health inequality of left-behind children.

Table 3
RIF-I-OLS decomposition results

	Total sample	Total sample	East	Central	West
	Model 1	Model 2	Model 3	Model 4	Model 5
Access to medical services	-0.1081*** (0.0307)	-0.0548*** (0.0210)	-0.0518*** (0.0079)	-0.0489** (0.0201)	-0.1211*** (0.0267)
Migrant parents	0.0933** (0.0078)	0.0327** (0.0136)	0.0515** (0.0234)	0.0838*** (0.0063)	0.0530*** (0.0171)
Income deprivation	0.1003*** (0.0249)	0.0431*** (0.0065)	0.0815*** (0.0049)	0.0416*** (0.0072)	0.0446*** (0.0083)
Intergenerational care	-0.0645** (0.0010)	-0.0498*** (0.0056)	-0.0293*** (0.0060)	-0.0339*** (0.0112)	-0.0904*** (0.0171)
Child age		0.0006 (0.0095)	0.0005 (0.0072)	0.0037 (0.0121)	0.0101 (0.0082)
Child squared age		0.0286*** (0.0029)	0.1015*** (0.0115)	0.0691** (0.0328)	0.0230*** (0.0079)
Child sex (Boys=0; Girls=1)		0.0052 (0.0375)	0.0332*** (0.0057)	0.0216*** (0.0074)	0.0176*** (0.0045)
Child education grade		0.0205*** (0.0039)	0.0357*** (0.0044)	0.0213*** (0.0079)	0.0368* (0.0214)
Parent age		0.0798*** (0.0033)	0.0297*** (0.0057)	0.0342*** (0.0111)	0.0507*** (0.0116)
Parent weight		-0.0093 (0.0084)	-0.0118** (0.0058)	-0.0217*** (0.0064)	-0.0515*** (0.0123)
Parent height		0.0933*** (0.0078)	0.0183*** (0.0054)	0.0263* (0.0141)	0.0299** (0.0131)
Parent employment		0.0872*** (0.0312)	0.0172** (0.0079)	0.0244*** (0.0042)	0.0233*** (0.0064)

Notes: Robust standard errors in parentheses, *p<0.05, **p<0.01, ***p<0.001.

	Total sample	Total sample	East	Central	West
	Model 1	Model 2	Model 3	Model 4	Model 5
Parent education		0.0195*	0.0419***	0.0365*	0.0048***
		(0.0109)	(0.0110)	(0.0211)	(0.0011)
Family size		-0.0702***	-0.0750***	-0.0308*	-0.1097
		(0.0094)	(0.0148)	(0.0173)	(0.1145)
Household income per capita		-0.0274***	-0.0349**	-0.0123**	-0.0859***
		(0.0096)	(0.0154)	(0.0062)	(0.0140)
constant	8.6671***	0.5781***	0.4422***	0.9222***	1.3218**
	(2.8435)	(0.0231)	(0.1143)	(0.2585)	(0.6339)
Sample size	5729	5729	1934	1993	1802
R-squared	0.1495	0.3575	0.3339	0.3296	0.3286
Adj R-squared	0.1341	0.3341	0.3284	0.3116	0.3166
<i>Notes:</i> Robust standard errors in parentheses, *p<0.05, **p<0.01, ***p<0.001.					

For the full sample in Table 3, migrant parents had a positive impact on the health inequality of left-behind children. Regional patterns in Model 1-3, show that migrant parents in the central (0.0838) and western regions (0.0530) had a significant impact on the health inequality of their left-behind children, usually put down to "lack of care". The impact of migrating parents on health inequality in the eastern region (0.0515) was also significant.

We speculate that distance and travel time by migrating parents impacted the regional health inequality of left-behind children. Migrating rural eastern parents mainly moved to near-by eastern developed cities, remaining relatively close to their home villages, which allowed them to regularly visit their left-behind children. Migrating parents from central and western regions travelled to distant eastern cities, with many western and central migrants not returning home to visit their children for several years.

Income deprivation had a significant positive effect on the health inequality of left-behind children. Overall, the decomposition result of income deprivation on the health inequality of rural left-behind children was 0.0431, but the impact of income deprivation on health inequality had obvious regional differences. Income deprivation in the eastern region was 0.0815, which was much higher than the overall national level and the central (0.0416) and western (0.0446) regions. The economic development level of the eastern region was much higher than that of the central and western regions, so the income gap

between different groups in the eastern region was wider than other regions, especially for migrant workers, so there will be a larger gap in the expenditure on child health.

In Table 3, intergenerational care had a significant negative impact on the health inequality of left-behind children. The decomposition results show that the overall influence coefficient of intergenerational tending was -0.0498, where an increase in intergenerational care partially replaces the parent's care function, significantly attenuating the health inequality of left-behind children. From the perspective of regional distribution, the impact of intergenerational care on the health inequality of rural left-behind children in the western region was significantly greater (-0.0904) than that in the eastern (-0.0293) and central (-0.0339) regions. The central and western provinces of China are the main areas of population outflow, while the eastern provinces are important geographical magnets for population inflow. As a result, distance constraints prevent migrating parents from reuniting with their children for long periods of time, and intergenerational childcare in the west and central regions from grandparents took on a large part of childcare, which makes intergenerational care a significant factor in alleviating health inequality.

As shown in Table 3, the age of left-behind children in rural areas had no significant impact on health inequality, but the square term of children's age had a significant impact on health inequality. The sex decomposition results in the eastern, central and western regions were all positive, indicating that girls were discriminated against. Reflecting traditional values, when a rural family has both girls and boys, the family's health resources were often biased towards male children (Lin and Zhao, 2014). To improve child health, it is necessary to address sex inequality in rural areas. The decomposition results in Table 3 also show that, except for the western region, the education level of left-behind children had a significant impact on health inequality, where the higher the education level, the greater the child's health knowledge, which was conducive to healthy living habits.

The age of parents (0.0798) also has a significant impact on the health inequality of left-behind children. In Table 3, the older the parents, the lower their working capacity and the less their contribution to family income and childcare, and the wider the health inequality of left-behind children. This impact was most obvious in the western region (0.0507). Generally speaking, parental weight reflects the current nutritional status of the family. For the whole sample, the decomposition results show that parental weight had a negative, but not significant impact, on the health inequality of left-behind children. But, the weight of parents in the central (-0.0217) and western (-0.0515) regions had significant impact on the health inequality of left-behind children, indicating that the nutritional status of parents in the central and western regions was closely related to the health differences of left-behind children. The better the nutritional status of the family, the more conducive to alleviating health inequality. Like weight, height of parents reflects the family's health endowments, where the height of parents (0.0933) had a significant positive impact on the health inequality of left-behind children. In addition, whether parents work or not had a significant impact on the health inequality of left-behind children. Whether parents work determines the amount of family income and indirectly affects the nutritional environment and the level of medical services available to left-behind children. In Table 3, for the overall sample, the effect of parental education on health inequalities of left-behind children was not significant.

Overall, family size (-0.0702) and family income per capita (-0.0274) had a significant negative effect on the health inequality of left-behind children. The larger the family size, the greater the number of workers to contribute to family income and to family members to care for left-behind children, replacing the care function of absent parents. Family income per capita contributed negatively to the health inequality of left-behind children. Increases in family income per capita, nutritional resources and health services all alleviate health inequality of rural left-behind children.

4. Discussion And Conclusion

China's rapid, but unbalanced, economic development has given rise rural-to-urban migration, creating a special subgroup of the population—rural left-behind children. We utilized cross-sectional data from the China Family Panel Studies (CFPS) and the concentration index to measure health inequalities among left-behind children. To assess the impact of different factors on the health inequalities of left-behind children, we adopted the RIF-I-OLS decomposition method, evaluating the contribution of relative deprivation, healthcare accessibility, parental migration patterns and intergenerational parenting to the health inequalities of left-behind children. Finally, our results identify policy targets for improving the health inequalities of left-behind children to address long-term negative impacts on the health and development of rural left-behind children.

It has been well established that, as a whole, children left-behind have significantly lower health outcomes than children of non-migrant parents (Fellmeth et al., 2018). However, much of the research has focused on the comparison of left-behind children with non-left-behind children (Wen and Lin, 2012), with less attention paid to the health inequalities within left-behind children in different regions and to the differential contribution of different factors on health inequalities. The concentration index based on regression analysis showed that the health concentration index for left-behind children in rural areas by region and age group was positive, indicating the existence of pro-rich health inequalities for left-behind children in rural China, with better health outcomes for left-behind children from high-income families. This is consistent with the findings of the literature on child health inequalities (Chalasan, 2012; Propper et al., 2007).

Our first contribution has been the simultaneous testing of the crucial factors influencing health inequalities among left-behind children. With the help of a new decomposition approach—RIF-I-OLS—we decomposed the extent to which these factors contribute to health inequalities, comparing the contribution of different influencing factors. We found that accessibility to health services can significantly curb health inequalities among left-behind children, and this effect was variable, with the greatest impact in the western provinces of China. The relationship between income inequality and health is more controversial (Subramanian and Kawachi, 2004; Wilkinson and Pickett, 2005). The relationship between relative deprivation and child health has been explored mainly in terms of its impact on infant birth weight (Reagan et al., 2007; Lhila and Simon, 2010), with less attention paid to the impact on the health of left-behind children. Our results show that relative income deprivation significantly increased the health disparities among rural left-behind children, and that the impact of relative income deprivation was

particularly severe in the eastern provinces. Relative income deprivation may restrict the left-behind children's access to adequate nutritious food and a clean-living environment, and may also interfere with their mental health, creating negative emotions, such as sadness, grief and dissatisfaction, which can lead to poor health behaviors. Our evidence indicates that the simultaneous absence of both parents significantly increases the health inequalities of left-behind children.

The evidence on the impact of parental migration on the health of left-behind children is mixed and varies across countries (Viet Nguyen, 2016). Evidence suggests that the simultaneous absence of both parents significantly increases the health inequalities of left-behind children. Possible reasons for this are the lack of care caused by the absent parents, which prevents left-behind children from having access to a healthy lifestyle, daily living routines and a balanced and nutritious diet during their formative years. In addition, the absence of parents may lead to a lack of emotional care, resulting in adverse psychological emotions. The absence of parents as the main caregivers has seen the redistribution of childcare arrangements mainly to intergenerational carers, especially grandparents. To a certain extent, intergenerational care replaced parental care and supported left-behind children to develop healthy eating habits, maintain a reasonable routine and receive emotional care, thus alleviating health inequalities among left-behind children.

There are several limitations of our analysis. Our study is based on cross-sectional empirical evidence within China, which means that the temporal causal inferences of the findings are limited. Our study may not be generalizable beyond China. In terms of health indicators, we focused on self-rated health, which is a subjective assessment that may suffer from potential response bias. Future studies should expand other dimensions of health. Further study is required of the differential impact on the health of left-behind children when both or only one parent migrates (Meng and Yamauchi, 2017; Viet Nguyen, 2016). Finally, there may be other potential factors that influence health inequalities among left-behind children, such as daily diet, lifestyle habits, that should be included in future studies.

Importantly, our study informs the development of policies related to reducing health inequalities within left-behind children. First, the key to addressing socio-economic related inequalities in the health of left-behind children is to increase the income of those in the lower socio-economic strata (Wagstaff et al., 2004), improving access to material standards and health services. Second, the level of health insurance coverage should be improved, and the vulnerable groups of left-behind children included in the health insurance network and the level of coverage increased. Third, regional policies should address disparities in medical services in the central and western provinces. Fourth, the support system for left-behind children in rural areas, should be increased by increasing the provision of nutritious meals, providing sports facilities and implementing regular comprehensive and free medical check-ups.

Declarations

Ethical Approval and Consent to participate

Ethical approval for this type of study is not required by our institute.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analysed during the current study are available in the [China Family Panel Studies] repository, [China Family Panel Studies“CFPS” (pku.edu.cn)]

Competing interests

The authors declare no conflict of interest.

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Authors' contributions

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