

Intergenerational Support and Risk of Incident Visual Impairment among Middle-aged and Older Chinese Adults: A National Longitudinal Cohort Study

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Abstract

Background

Visual impairment is a major contributor to functional decline and reduced quality of life among older adults. While biological and demographic factors are well established, the role of family-based social support remains unclear. In China, intergenerational support from adult children—including financial assistance and regular contact—may influence access to care and health-related behaviors. This study examined whether such support is associated with the progression of visual impairment among middle-aged and older Chinese adults.

Methods

A prospective cohort design was applied using four waves (2011–2018) of nationally representative survey data from Chinese adults aged 45 years and older. A total of 56,929 person-wave observations were included in the analysis. Self-reported visual status was categorized into no impairment, mild impairment, and moderate-to-severe impairment. Intergenerational support was assessed by children's financial transfers and frequency of contact. After controlling for demographic characteristics, socioeconomic status, and health-related factors, ordinal logistic regression models with repeated measures were used to estimate adjusted odds ratios. Interaction terms were included to evaluate joint effects.

Results

Lower levels of financial support were significantly associated with a greater risk of more severe visual impairment (odds ratio 1.195, 95% confidence interval 1.088–1.313). Infrequent contact with children was also associated with increased risk (odds ratio 1.249, 95% confidence interval 1.141–1.366). A significant cumulative effect was observed: participants reporting both low financial support and low contact frequency had the highest risk of visual impairment (odds ratio 1.526, 95% confidence interval 1.304–1.786).

Conclusions

Intergenerational support is an important protective factor against visual function decline among middle-aged and older Chinese adults. Insufficient financial assistance and limited daily contact with children accelerate the progression of visual impairment, with the dual absence of support exerting a synergistic detrimental effect. These findings highlight the potential role of family-based support in strategies to maintain visual health in aging populations.

Trial registration

Clinical trial number: not applicable.

Introduction

With the acceleration of the aging of the global population, visual impairment has become a significant public health issue affecting the health and quality of life of older adults. A decline in visual function not only restricts daily activities and social participation but is also significantly associated with a range of adverse health outcomes, including an increased risk of falls, exacerbated depressive symptoms, and subjective cognitive decline (SCD)[1–5]. Epidemiological data indicate that the prevalence of visual impairment tends to markedly increase with age; this trend is particularly prominent among elderly individuals aged 65 and older[6, 7] and is often accompanied by the accumulation of multiple physical and mental comorbidities [8–11].

Past epidemiological studies on visual health have focused primarily on biological etiologies (such as refractive errors, cataracts, and fundus diseases) and demographic characteristics (such as age and sex)[12]. Although these factors define the pathological basis of visual impairment, visual health, as an integral part of overall well-being later in life, is also significantly regulated by social environmental factors. In the field of geriatric health, social support has been proven to be a crucial protective factor for maintaining physical function and mental health [13–15]. Particularly under China's traditional home-based care model[16], intergenerational support provided by adult children—including financial assistance (material support) and daily contact (emotional support)—directly affects the healthcare utilization and health behavior adherence of older adults[17]. However, existing studies have focused mostly on the impact of intergenerational support on depression, cognitive function, or self-rated health among elderly people[18–21], and longitudinal evidence for the specific outcome of visual impairment is lacking. Especially after controlling for baseline vision and systemic comorbidities, it remains unclear whether intergenerational support delays visual decline by improving medical-seeking behavior or alleviating psychological stress.

In view of this, the present study utilizes multiwave longitudinal data from the China Health and Retirement Longitudinal Study (CHARLS) from 2011 to 2018 to construct a prospective cohort. By strictly controlling for potential confounders such as sociodemographic characteristics, socioeconomic status, and baseline health conditions, this study systematically evaluated the impact of intergenerational support (including children's contact frequency and financial support) on the progression of visual impairment among middle-aged and older Chinese adults. This study aims to clarify whether intergenerational support is an independent protective factor for geriatric visual health, thereby providing an epidemiological basis for the formulation of geriatric eye health intervention strategies based on family and social support systems.

Methods

Study design and data source

This study aimed to examine the association between intergenerational support and visual impairment among middle-aged and older adults in China. A longitudinal cohort design was employed using data from the China Health and Retirement Longitudinal Study. CHARLS is a nationally representative longitudinal survey of Chinese residents aged 45 years and older designed to collect detailed information on demographic characteristics, socioeconomic status, health conditions, and family structure. The survey employed a multistage stratified probability sampling strategy covering 28 provinces in China [22].

In this study, four waves of CHARLS data collected in 2011, 2013, 2015, and 2018 were used. Participants aged 45 years and older with complete information on key variables were included. After excluding observations with missing data on visual status, intergenerational support, or major covariates, a total of 56,929 observations were included in the final analysis.

Outcome variable

The primary outcome of this study was visual impairment, which was assessed using self-reported visual status in the CHARLS. Participants were asked to rate their distance vision (e.g., recognizing people across the street) and near vision (e.g., reading newspapers). The response options included excellent, very good, good, fair, and poor.

In accordance with previous epidemiological studies, visual status was categorized into three levels: (1) no impairment: original “excellent” or “very good” responses; (2) mild impairment: original “good” response; and (3) moderate-to-severe impairment: original “fair” or “poor” responses.

Intergenerational support

On the basis of intergenerational solidarity theory, intergenerational support was measured as the core exposure across two dimensions:

Contact frequency (Emotional Support): This reflects the frequency of interaction between respondents and their children (including face-to-face visits, telephone, or digital messaging). It was categorized into three levels: low, medium, and high frequency.

Financial Support (Material Support): This reflects the net economic transfers received from children over the past year. On the basis of the distribution of support levels, this variable was binned into three categories: low, medium, and high support.

Covariates

On the basis of previous literature on visual health and aging, several potential confounding variables were included as covariates. These variables covered demographic characteristics, socioeconomic status, and baseline health conditions and included the following:

Sociodemographic characteristics: Age (continuous), sex, marital status (married/partnered vs. others), and educational attainment.

Socioeconomic Status (SES): Hukou type (agricultural vs. nonagricultural), medical insurance status, and per capita household consumption expenditure.

These variables were included in the regression models to control for potential confounding effects.

Statistical Analysis

Given the longitudinal structure of the data with repeated measurements and the ordinal nature of the dependent variable, generalized estimating equations (GEEs) were employed to construct ordinal logistic regression models. GEE effectively accounts for the intraindividual correlation of repeated observations and provides robust standard error estimates. The modeling strategy was as follows:

- Model A (Demographic Model): Adjusted for age, sex, marital status, Hukou type, and education.
- Model B (Full Model): Further adjusted for children’s contact frequency and financial support on the basis of Model A.

Additionally, interaction terms were analyzed to explore the joint effects of contact frequency and financial support on visual health. The results are presented as odds ratios (ORs) with 95% confidence intervals (CIs). All analyses were two-tailed with a significance level of $\alpha = 0.05$.

Results

Participant characteristics

A total of 56,929 observations (person-years) were included in the analysis. On the basis of self-reported visual status, the participants were categorized into three groups: no visual impairment (7,956 observations, 14.0%), mild visual impairment (10,157 observations, 17.8%), and moderate-to-severe visual impairment (38,816 observations, 68.2%).

Table 1 presents the demographic and socioeconomic characteristics of participants across different levels of visual impairment. The participants in the moderate-to-severe visual impairment group were older than those in the group without visual impairment (mean age: 62.40 vs. 59.41 years) and were more likely to be female (55.6%), reside in rural areas (81.9%), and have lower educational attainment (70.9% with primary school education or below).

Table 1
Baseline characteristics of participants by degree of visual impairment

Variable	No visual impairment (n = 7,956)	Mild visual impairment (n = 10,157)	Moderate-to-severe visual impairment (n = 38,816)
Age (years) , Mean $\pm$ SD	59.41 $\pm$ 9.50	59.79 $\pm$ 9.52	62.40 $\pm$ 9.68
Sex , n (%)			
Male	4350(54.7)	5120(50.4)	17232(44.4)
Female	3606(45.3)	5037(49.6)	21584(55.6)
Marital status , n (%)			
Married	7238(90.9)	9088(89.4)	34192(88.0)
Unmarried	723(9.1)	1083(10.6)	4645(12.0)
Hukou type , n (%)			
Rural	5863(73.6)	7754(76.2)	31788(81.9)
Nonrural	2098(26.4)	2416(23.8)	7037(18.1)
Education level , n (%)			
Low	4520(56.8)	6215(61.2)	27496(70.9)
Medium	3164(39.8)	3649(35.9)	10718(27.6)
High	270(3.4)	299(2.9)	594(1.5)
Medical insurance , n (%)			
No	174(2.3)	252(2.6)	623(1.7)
Yes	7442(97.7)	9545(97.4)	36587(98.3)
Total household expenditure , n (%)			
Low	2213(29.6)	2928(32.2)	11150(35.0)
Medium	2352(31.5)	2938(32.3)	10724(33.7)
High	2903(38.9)	3224(35.5)	9948(31.3)
Note: Continuous variables are presented as the mean $\pm$ standard deviation (SD), and categorical variables are presented as numbers (percentages). Percentages were calculated on the basis of the effective sample size for each specific variable. The degree of visual impairment was categorized into no visual impairment, mild visual impairment, and moderate-to-severe visual impairment on the basis of self-reported distant visual status. The sample size (N) refers to the number of valid cases included in the analysis.			

Variable	No visual impairment (n = 7,956)	Mild visual impairment (n = 10,157)	Moderate-to-severe visual impairment (n = 38,816)
Financial support from children, n (%)			
Low	1822(37.7)	1869(35.8)	7824(34.2)
Medium	1387(28.7)	1573(30.1)	7821(34.2)
High	1630(33.7)	1781(34.1)	7242(31.6)
Contact frequency with children, n (%)			
Low	1096(32.0)	1368(35.4)	6171(37.7)
Medium	1119(32.7)	1128(29.2)	4914(30.0)
High	1209(35.3)	1370(35.4)	5268(32.2)
Note: Continuous variables are presented as the mean $\pm$ standard deviation (SD), and categorical variables are presented as numbers (percentages). Percentages were calculated on the basis of the effective sample size for each specific variable. The degree of visual impairment was categorized into no visual impairment, mild visual impairment, and moderate-to-severe visual impairment on the basis of self-reported distant visual status. The sample size (N) refers to the number of valid cases included in the analysis.			

In terms of intergenerational support, the proportions of individuals with low-frequency contact (37.7%) and low financial support (34.2%) were greater among participants with moderate-to-severe visual impairment than among those without impairment. The detailed characteristics of the study population are shown in Table 1.

Association between intergenerational support and visual impairment

The results of the generalized estimating equation (GEE) ordinal logistic regression models are presented in Table 2 and Fig. 1. After adjusting for age, sex, marital status, Hukou type, education, medical insurance status, and per capita household expenditure, both dimensions of intergenerational support were significantly associated with visual impairment.

Table 2
GEE ordinal logistic regression for visual impairment and intergenerational support

Variable	OR	95% CI	P value
Financial support from children			
High	1.000	Reference	—
Medium	1.262	1.157–1.377	< 0.001
Low	1.195	1.088–1.313	< 0.001
Contact frequency with children			
High	1.000	Reference	—
Medium	1.116	1.020–1.222	0.017
Low	1.249	1.141–1.366	< 0.001
Age (years)	1.025	1.020–1.030	< 0.001
Sex (Female vs. Male)	0.725	0.663–0.792	< 0.001
Hukou type (Rural vs. Nonrural)	1.320	1.177–1.481	< 0.001
Marital status (Married vs. Unmarried)	1.132	0.998–1.283	0.053
Education level			
High	1.000	Reference	—
Medium	1.118	0.858–1.458	0.408
Low	1.332	1.017–1.744	0.037
Medical insurance (Yes vs. No)	0.849	0.585–1.232	0.389
Total household expenditure			
High	1.000	Reference	—
Medium	0.896	0.814–0.987	0.026
Low	0.819	0.742–0.904	< 0.001
Note: OR, odds ratio; CI, confidence interval. A generalized estimating equation (GEE) ordinal logistic regression model was used to analyze the association between intergenerational support and the degree of visual impairment. The dependent variable, degree of visual impairment, was categorized as no visual impairment, mild visual impairment, or moderate-to-severe visual impairment.			

With respect to financial support, compared with participants who received high levels of financial support from their children, those who received medium levels (OR = 1.262; 95% CI: 1.157–1.377; $P < 0.001$) and low levels (OR = 1.195; 95% CI: 1.088–1.313; $P < 0.001$) of financial support had higher odds of having more severe visual impairment.

With respect to contact frequency, participants with a low contact frequency had a greater likelihood of visual impairment than those with a high contact frequency did (OR = 1.249, 95% CI: 1.141–1.366; $P < 0.001$).

Among the covariates, older age (OR = 1.025), rural hukou status (OR = 1.320), and lower education level (OR = 1.332) were also associated with higher odds of visual impairment (Fig. 1).

A forest plot of the results from a generalized estimating equation (GEE) ordinal logistic regression model for evaluating the risk of visual impairment is shown in Fig. 1. Red points represent point estimates for odds ratios (ORs), with horizontal solid bars indicating 95% confidence intervals (95% CIs). Estimates located to the right of the vertical dashed line (OR = 1.0, no association) show increased odds of visual impairment compared with the reference group, whereas those to the left show decreased odds.

Note on implicit reference groups

Specifying the implicit reference categories for each variable is essential for interpretation. In terms of the common practices for this study type, the reference groups are likely high financial support, high contact frequency, urban hukou, high education, and male. These reference groups should be explicitly confirmed here or in the methods section. For the continuous variable “Age (per year)”, the OR represents the change in odds for each additional year of age.

Model Adjustments

The model was adjusted for multiple covariates, including age, sex, marital status, Hukou type, education, medical insurance status, and per capita household expenditure.

Joint effects of emotional and financial support

The joint effects of emotional and financial support on visual impairment are shown in Table 3. When participants with high contact frequency and high financial support were used as the reference group, different combinations of intergenerational support were associated with varying levels of visual impairment risk.

Table 3
Joint effects of contact frequency and financial support on visual impairment

Contact frequency	Financial support	OR	95% CI	P value
High	High	1.000	Reference	—
Medium	High	1.187	1.035–1.362	0.014
Low	High	1.270	1.112–1.451	< 0.001
High	Medium	1.370	1.186–1.582	< 0.001
Medium	Medium	1.444	1.248–1.670	< 0.001
Low	Medium	1.558	1.349–1.800	< 0.001
High	Low	1.141	0.985–1.322	0.078
Medium	Low	1.216	1.037–1.425	0.016
Low	Low	1.526	1.304–1.786	< 0.001
Note: OR, odds ratio; CI, confidence interval. The reference group is the combination of high contact frequency and high financial support. A generalized estimating equation (GEE) ordinal logistic regression model was used to evaluate the odds of a more severe visual impairment level. The model was adjusted for age, sex, marital status, Hukou type, education level, medical insurance status, and total household expenditure.				

When financial support remained high but contact frequency was low, the odds of visual impairment increased significantly (OR = 1.270, $P < 0.001$). A similar pattern was observed when financial support was reduced while contact frequency remained high.

The highest risk of visual impairment was observed among participants with both low contact frequency and low financial support (OR = 1.526; 95% CI: 1.304–1.786; $P < 0.001$).

Discussion

Principal findings

Using nationally representative longitudinal data from the China Health and Retirement Longitudinal Study, this study revealed that insufficient intergenerational support was significantly associated with an increased risk of visual impairment among middle-aged and older Chinese adults. Both financial support and contact frequency among adult children were independently related to visual health after adjustments were made for demographic, socioeconomic, and health-related factors. In addition, a joint effect analysis indicated that emotional and financial support exerted a synergistic protective effect, with the highest risk of visual impairment observed among older adults who experienced deficiencies in both dimensions of support.

Comparison with previous studies

Existing research consistently demonstrates that social support plays a crucial protective role in the overall health, mental well-being, and functional maintenance of older adults [23, 24]. However, longitudinal evidence concerning visual health outcomes remains limited and fragmented[25]. Most current studies focus on visual impairment as an exposure factor and explore its impact on outcomes such as depression, social participation, and quality of life [26]. For instance, vision loss exacerbates depressive symptoms through functional limitations and reduced social support [27], whereas economic status, living arrangements, and social connection levels are closely related to the degree of social participation among visually impaired older adults [28].

In studies where social support is treated as a determinant, researchers have focused predominantly on its impact on self-rated health, depression, or cognitive function. Longitudinal data from China and East Asia suggest that financial and emotional support from adult children helps improve self-rated health and reduce psychological risk among elderly people [29, 30]. Recent research based on the CHARLS database further indicates that multidimensional intergenerational support can enhance the intrinsic capacity of older adults by promoting social participation and maintaining daily functional abilities [31]. Nevertheless, longitudinal studies directly examining the association between social support and visual health remain limited. The present study extends the literature by providing longitudinal evidence linking intergenerational support to the progression of visual impairment.

Potential mechanisms

Several mechanisms may explain the observed association between intergenerational support and visual health. First, financial support from adult children may improve access to ophthalmic care. Although China's medical insurance system covers a wide range of services, certain treatments, such as cataract surgery with intraocular lens implantation or advanced therapies for retinal diseases, may still involve substantial out-of-pocket costs. For economically disadvantaged older adults, financial assistance from children may facilitate timely diagnosis and treatment, thereby preventing further deterioration of visual function.

Second, frequent intergenerational contact may promote early detection of visual problems and encourage health-seeking behaviors. The decline in visual function is often gradual, and older adults who live alone or have limited social interaction may overlook early symptoms. Regular communication or visits from adult children may help identify visual difficulties at an early stage and prompt medical consultation. In addition, emotional support may reduce psychological stress and improve adherence to medical advice, indirectly benefiting visual health.

Strengths and limitations

This study has several strengths. First, the use of longitudinal data from a nationally representative cohort allows for the examination of temporal associations and reduces the risk of reverse causality commonly observed in cross-sectional studies. Second, the large sample size provides sufficient statistical power to explore the joint effects of different dimensions of intergenerational support.

However, several limitations should be acknowledged. First, visual impairment was assessed using self-reported measures rather than objective clinical examinations, which may introduce measurement bias. Second, owing to data limitations, the study could not differentiate between specific eye diseases such as cataract, glaucoma, or age-related macular degeneration. Third, although multiple confounding factors were controlled for, residual confounding related to lifestyle factors (e.g., outdoor activity or diet) may still exist.

Implications

These findings highlight the importance of considering family support structures when addressing visual health in aging populations. In addition to medical and biological factors, social and familial environments may play a meaningful role in shaping visual health outcomes among older adults. Future public health strategies aimed at preventing visual impairment may benefit from incorporating family-based support mechanisms and focusing on older adults who experience limited financial and emotional support from their children.

Conclusions

This longitudinal study revealed that insufficient intergenerational support was significantly associated with a higher risk of visual impairment among middle-aged and older Chinese adults. Both financial support and frequent contact from adult children were independently related to better visual health, and their combined absence was associated with the greatest risk of visual impairment. These findings highlight the potential role of family-based support in shaping visual health outcomes in aging populations. Strengthening intergenerational support may therefore represent an important social pathway for preventing or delaying visual impairment among older adults.

Abbreviations

CHARLS

China Health and Retirement Longitudinal Study

GEE

Generalized Estimating Equation

OR

odds ratio

CI

Confidence interval

Declarations

Ethics approval and consent to participate

The data used in this study were obtained from the China Health and Retirement Longitudinal Study. The CHARLS study protocol was approved by the Institutional Review Board of Peking University (IRB00001052–11015), and the study was conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent before participation. The present study used publicly available anonymized data and therefore did not require additional ethical approval [22].

Consent for publication

Not applicable.

The dataset supporting the conclusions of this article is available in the China Health and Retirement Longitudinal Study (CHARLS) repository [32].

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MY conceptualized and designed the study, performed the statistical analysis, and drafted the manuscript. XL and PL contributed to data extraction, literature review, and critical revision of the manuscript. YY and LY jointly supervised the entire study, provided critical revisions to the manuscript, and are responsible for the overall content as co-corresponding authors. All authors read and approved the final manuscript.

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Authors' information (optional)

Not applicable.

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Figures

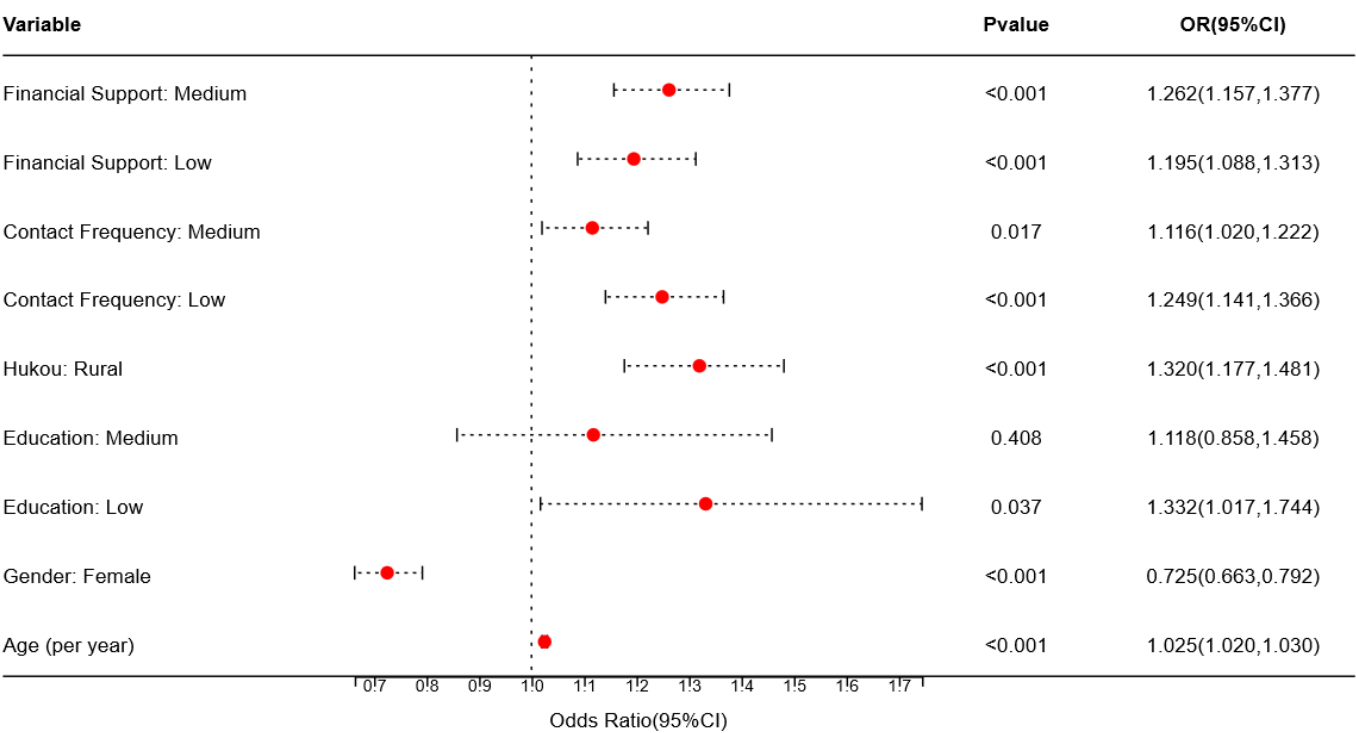


Figure 1

Forest plot of generalized estimating equation (GEE) ordinal logistic regression model results for visual impairment risk.