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Impact of health shocks on social capital: How long will it persist?

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ABSTRACT

Adverse health shocks impoverish over 150 million individuals worldwide annually. These shocks harm the health, wealth accumulation, and well-being of patients and their families. However, the effect of health shocks on social capital and their persistence remains uncertain. This cross-sectional study conducted in 2023 in socioeconomically deprived rural areas of Shandong, China, employed Ordinary Least Squares regression to examine the impact and persistence of health shocks on social capital. The results indicated that 29.24 % of households experienced health shocks. Households affected by health shocks within the past year showed a significant decrease in social capital ($\beta = -2.82$, $P < 0.001$).This impact diminished over time (between one and three years ago: $\beta = -1.49$, $P = 0.21$; more than three years ago: $\beta = -1.10$, $P = 0.36$). The findings also reveal a stronger impact on cognitive social capital compared to structural social capital (cognitive social capital: $\beta = -1.78$, $P = 0.001$; structural social capital: $\beta = -1.038$, $P = 0.006$). Policymakers should not only offer financial aid to families suffering from health shocks but also focus on restoring their social capital.

1. Introduction

Health shocks negatively affect households, influencing their physical and mental health, labour supply, household income, assets, and health behaviours (BajiBíró, 2018; Lee & Kim, 2007; Wang Yajie, Jin, & Yuan, 2023). The impacts of these shocks may be either temporary or persistent. Research on the impact of non-communicable diseases on economic well-being, the effect of hospitalisation on household out-of-pocket expenses, and the influence of three specific health shocks – cancer, heart disease, and stroke – on subjective survival probabilities consistently indicates that these impacts are short-term (BajiBíró, 2018; Lee & Kim, 2007; Pan, Palmer, Mahal et al., 2020; Song et al., 2023). Other studies suggest that the impact of health shocks on health expenditures may persist for at least five years (Wang Yajie, Jin, & Yuan, 2023). Research conducted in China demonstrates that the impact of health shocks on life satisfaction persists over time (Song et al., 2023). Research on older adults in the United States indicates that non-communicable diseases have both short- and long-term impacts on wealth (Lee & Kim, 2007).

Sustainable livelihood refers to the household's ability to withstand shocks, recover from them, and maintain resilience against future challenges (Chambers &Urbanization, 1995; DFID, 1999). Social capital is one of the five core components of sustainable livelihood capital and is defined as the trust, norms of reciprocity, and networks that facilitate coordination and cooperation for mutual benefit (Putnam et al., 1993). Social capital is categorised based on its nature, scope, function, hierarchy and status. These categories include structural and cognitive social capital; bridging and bonding social capital; horizontal and vertical social capital; individual and collective social capital; formal and informal social capital; and internal and external social capital (Harpham, Grant, & Thomas, 2002; Krishna & Shrader, 2000; Putnam, 2000). Among these, the cognitive and structural types are the most commonly used classifications (Krishna & Shrader, 2000). Structural social capital refers to objective social structures, such as social organisations and networks, whereas cognitive social capital encompasses norms, values, attitudes, beliefs, trust, reciprocity, and other psychological processes (Islam, Merlo, Kawachi et al., 2006; Liu L., Wang, Qin et al., 2020; Zhou, Ogihara, Chen et al., 2017).

Health shocks disrupt sustainable livelihood capital (Bai & Li, 2021; Pan, Palmer, Mahal et al., 2020; Timire, Pedrazzoli, Boccia et al., 2023;

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Yu & Hu, 2024), including social capital (Huang & Chuong, 2023). However, previous studies have primarily focused on the impact of health shocks on human, financial, and physical capital, with limited attention to the negative impacts on social capital (Pan, Palmer, Mahal et al., 2020; Thanh & Duong, 2022; Ting et al., 2024).

Health shocks reduce social capital through various mechanisms (Alam & Mahal, 2014; BajiBíró, 2018; Lee & Kim, 2007; Qiu Y. & F. Zhang, 2024; Wang Yajie, Jin, & Yuan, 2023). First, illnesses may hinder individuals from engaging in their usual social activities by impairing their activities of daily living (ADL) and other essential functions (Croda, 2015; Heimrich et al., 2023; Sundar, Brucker, Pollack et al., 2016; Zhang & Lu, 2019). Prolonged isolation or restrictions can gradually decrease the frequency of social interactions and estrange individuals from their established social networks (Heimrich et al., 2023; Sundar, Brucker, Pollack et al., 2016). When a family member takes on the role of primary caregiver (e.g. parents caring for a critically ill child), their involvement in social activities often diminishes, leading to a shrinking of their social circle (Zhang N., Zhang, Zou et al., 2023). Second, the economic strain from health shocks can lead to the erosion of social capital. A heavy medical burden may force households to reduce other expenditures, accumulate debts, or liquidate assets, thereby undermining reciprocal relationships (Hao, Guo, Ren et al., 2023; Qiu Y. X. & F. Zhang, 2024). Additionally, illness-induced unemployment may also result in the loss of workplace-based social capital for individuals (Pohlan, 2024). Consequently, the level of structural social capital declines within the family. Similarly, the level of cognitive social capital may also be affected. Long-term illness or treatment-related stress may lead to depression and anxiety in individuals, thereby reducing their willingness to actively seek social support or to help others (Casati, Toner, De Rooy et al., 2000; Trindade, Duarte, Ferreira et al., 2018). According to Coleman's rational choice theory, health-related income loss can destabilise reciprocal exchange norms, as individuals burdened with medical debt may withdraw from mutual aid obligations to avoid perceived indebtedness (Coleman & Fararo, 1992). Moreover, societal prejudices associated with the illness can lead to social exclusion, resulting in a decline in social cohesion and trust (Cooray, Tsakos, Heilmann et al., 2023; Kerrigan, Vazzano, Bertoni et al., 2017; Laporte, 2014; Prattley, Buffel, Marshall et al., 2020; Switaj, Grygiel, Anczewska et al., 2015).

Although previous studies have examined the short- and long-term effects of health shocks on human, financial, and physical capital (Pan, Palmer, Mahal et al., 2020; Song et al., 2023), relatively few have focused on their impact on social capital. Research conducted in various countries has demonstrated a positive relationship between mental health and social capital (Downward et al., 2020; Lebenbaum et al., 2021; Xin & Li, 2021). Moreover, some studies have highlighted a positive correlation between self-rated health and social capital (Ashrafi, Montazeri, Mousavi et al., 2012; Lebenbaum et al., 2021).

Therefore, this study examines the correlation between health shocks and social capital, and explores whether this correlation weakens over time. Furthermore, we investigate potential differences in the correlations between health shocks and structural and cognitive social capital.

2. Methods

2.1. Sample and data

This study was conducted in Shandong Province, China, which is the second-most populated province in the country. The province has significant economic disparity between the eastern and western regions. A cross-sectional study was conducted from July 31 to August 22, 2023, specifically targeting households in socioeconomically deprived areas of Shandong Province.

A multistage stratified sampling method was used to select participants. The survey was conducted in six counties, which were selected from among the 20 counties identified for poverty alleviation efforts in Shandong Province in 2016. First, based on the geographical distribution and administrative jurisdiction of the 20 counties, three cities with relatively concentrated poverty counties were selected. Second, two relatively impoverished counties were selected in each city. Third, three economically underdeveloped towns with a high concentration of impoverished residents were selected. Fourth, four administrative villages were randomly selected within each town, and approximately 35 households were interviewed in each village. A total of 2527 samples were obtained. The social capital of a household was represented by the social capital level of the head of the household. Therefore, 882 household samples in which the head of the household lacked social capital were excluded. Finally, 1645 households were included in the analysis.

To ensure quality of the survey, all interviewers received professional face-to-face training. They spent approximately 40 min conducting each interview. They were organised into four distinct groups, with particular individuals assigned to perform quality control inspections. At the end of each day, the questionnaires within each group were thoroughly examined to identify logical inconsistencies or missing information. Furthermore, after completing the questionnaires for one sample county, a day was used to cross-check questionnaires, enabling rapid detection and rectification of any problems via telephone communication or subsequent visits. Additionally, the data were double-entered. EpiData3.1 was used to ensure accuracy, and Stata14.0 was used to clean the database.

2.2. Measurement of the dependent variable

Social capital served as the dependent variable in this study. Household social capital was represented by the social capital of the head of the household, who, as the core authority within the family, possesses a representative level of social capital (Wang Yaping, Liang, Liu et al., 2023). Social capital was measured using a scale developed by Hu Zhi and his research team, based on the World Bank's Social Capital Assessment Tool (Bai Z., Xu, Xu et al., 2020; Cao C., Cao, Zheng et al., 2023). The scale covered six dimensions: social connection, social participation, social support, trust, cohesion, and reciprocity (Cao W., Li, Zhou et al., 2014; Kritsotakis, Vassilaki, Melaki et al., 2013; Liu L., Wang, Qin et al., 2020; Zhang & Lu, 2019). The scale has good reliability and validity and has been tested and applied in China (Bai Z., Wang, Shao et al., 2020; Bai Z., Xu, Xu et al., 2020; Cao C., Cao, Zheng et al., 2023). Cronbach's alpha was 0.86, and the Kaiser–Meyer–Olkin value was acceptable (KMO = 0.82). The feature values for all six dimensions exceeded 1, and the sum of the squared loadings after rotation in the total variance solution surpassed 60 %, indicating that the scale used demonstrated strong reliability and validity. The Social Capital Scale comprises 25 items (Table 1).

This study measured two types of social capital: cognitive social capital and structural social capital. Cognitive social capital encompassed trust, cohesion, and reciprocity, while structural social capital included social participation, social connection, and social support (Kritsotakis, Vassilaki, Melaki et al., 2013; Liu L., Wang, Qin et al., 2020; van Sint Fiet, de la Rie, van der Aaet al., 2022). The total social capital score ranged from 20 to 115, with cognitive social capital ranging from 14 to 70 and structural social capital ranging from 6 to 45. Higher scores indicated greater level of social capital.

2.3. Measurement of independent variables

Based on previous studies (Wang Yajie, Jin, & Yuan, 2023), health shocks refer to the potential for catastrophic economic and health consequences arising from health crises (Bejakovic, Skare, & Prziklas Druzeta, 2021; Schiele & Schmitz, 2023; Thanh & Duong, 2022). Drawing upon the methodology outlined in previous studies (Bonfrer & Gustafsson-Wright, 2017; Kim C. O., 2022), we employed Catastrophic Health Expenditure (CHE) to evaluate whether a household has

Table 1
Definitions and characteristics of social capital.

Variable	Category	Question	Answer
	Social connection	How often do you contact with your relatives or family/ friends?	1 = never, 2 = seldom, 3 = usually, 4 = often, 5 = more often
Structural social capital	Social participation	In the past 12 months, how often would you participate in political parties, sports organisations, professional associations, colleague circles, classmate circles, and comrade circles?	0 = none, 1 = ordinary member, 2 = positive member, 3 = organizational leadership
	Social support	When you are in trouble, is there someone/any formal or informal groups that provides you with mental/material support?	1 = never, 2 = seldom, 3 = usually, 4 = often, 5 = more often
	Trust	Do you trust in most people/your family members or relatives/ friends/neighbours/ doctors in general hospitals/community doctor/neighborhood committee or village committee?	1 = never, 2 = seldom, 3 = usually, 4 = often, 5 = more often
Cognitive social capital	Reciprocity	When your relatives/ friends/neighbours/ strangers are in trouble, will you provide help to them?	1 = never, 2 = seldom, 3 = usually, 4 = often, 5 = more often
	Cohesion	Do you/others living in the community or village care about what happened in your community/village? Do you feel reluctant if you have to move away from the community lived now?	1 = never, 2 = seldom, 3 = usually, 4 = often, 5 = more often

experienced health shocks. This metric is commonly employed by the World Health Organization to assess poverty attributable to illness (Xu, Evans, Carrin et al., 2007; Xu Ke, David B. Evans, Kei Kawabata et al., 2003). A household was considered to have experienced CHE if its out-of-pocket medical expenses exceeded a specific threshold of their Capacity To Pay (CTP) (Lee, LeeChoiet al., 2020; Xu K., D. B. Evans, K. Kawabata et al., 2003; Zhao S. W., Zhang, Dai et al., 2020). A 40 % threshold is commonly adopted to define CHE, and this threshold was used in the present study (Xu Ke, David B. Evans, Kei Kawabata et al., 2003; Zhao Y., Oldenburg, Mahal et al., 2020). Family out-of-pocket medical expenses include all expenses incurred for outpatient care, inpatient care, and pharmaceuticals (Li X., Mohanty, Zhai et al., 2023). In this study, a household's CTP was measured based on the total household income, which included the total income of family members over the previous 12 months, encompassing subsidies from migrant workers to the family, agricultural income, work income, government subsidies, pensions, and other sources of income (Gu, Kou, Yan et al., 2017). The specific calculation formula for CHE is as follows:

$$CHE = \begin{cases} 0, \text{if} \dfrac{OOP}{CTP} < 40\% \\ 1, \text{if} \dfrac{OOP}{CTP} \geq 40\% \end{cases} \quad (1)$$

As this study investigated the duration of the impact of health shocks on families' social capital, the independent variable was defined as the occurrence and duration of health shocks. Health shocks were categorised into four timeframes: 0 = never experienced CHE, 1 = experienced CHE within the past year, 2 = experienced CHE between one and three years ago, 3 = experienced CHE more than three years ago.

2.4. Measurement of control variables

Drawing upon prior research on the determinants of social capital (KangDuWanget al., 2022; Lebenbaum et al., 2021; Sauter et al., 2021), this study selected control variables at both the household level and head-of-household levels. Research has demonstrated that socioeconomic status influences opportunities for social network formation (Browne-YungZierschBaum, 2013). Therefore, in addition to demographic characteristics, we included the socioeconomic status of households as a control variable. Other key variables influencing social capital included gender, age, education level, Body Mass Index (BMI), village cadre, housing structure, and gifting expenditure (Huang J., Maassen Van Den Brink, & Groot, 2009; KangDuWanget al., 2022; Lebenbaum et al., 2021; Sauter et al., 2021). In addition to the content in Table 2, explanations regarding the control variables are as follows. BMI was divided into four categories: lean (BMI<18.5), normal (18.5≤BMI<24), overweight (24≤BMI<28), and obese (BMI≥28) (National Health Commission, 2019). Gifting expenditure was calculated based on the mean household expenditure on gifts. Family structure was classified into three categories: living with family = 0, living alone = 1, and empty nest = 2. Socioeconomic status was measured using subjective social classes. Participants were asked, "In our society, some people belong to the upper classes, whereas others belong to the lower classes. Where do you place yourself ?" The responses were rated on a 10-point scale and subsequently grouped into three levels: low (1–3 points), medium (4–5 points), and high (6–10 points) (Cai et al., 2017).

2.5. Statistical analysis

Differences in social capital based on household demographic characteristics were analysed using the Mann-Whitney *U* test or the Kruskal-Wallis test. Ordinary Least Squares (OLS) regression was performed to examine the impact of health shocks on social capital while controlling for confounding factors. The F-test results indicated that the overall regression model was statistically significant ($P < 0.05$). Regression with robust standard errors was applied to improve the precision of standard error estimates and mitigate potential bias due to heteroscedasticity. The Variance Inflation Factor test yielded a value of 1.8, indicating no significant multicollinearity among the variables. Additionally, a Q-Q plot analysis suggested that residuals were approximately normally distributed, justifying the use of OLS method. Data analysis were conducted using SPSS 21.0 and STATA 14.0.

2.6. Mechanism analysis

To further investigate the mechanisms underlying the differential impact of health shocks on cognitive and structural social capital, logistic regression was employed to examine associations between the duration of health shocks and variables such as depression, ADL, gifting expenditure, food expenditure and reciprocity (relative, neighbour, friend, and stranger) respectively. Depression was assessed using the 10-item Center for Epidemiological Studies Depression Scale (CES-D) (Andresen, Malmgren, Carter et al., 1994). The CES-D scale ranged from 0 to 30, and participants were categorised as depressed and non-depressed, using a cutoff total score of ≥10 to identify depression (Andresen, Malmgren, Carter et al., 1994). The Chinese version of the Lawton and Brody Activities of Daily Living Scale was used to assess ADL (Liu X., Yin, Tan et al., 2018). Household heads' ADL status was classified into three categories: sound (sum-score ≤14), ADL decline (14 < sum-score ≤21), and ADL impairment (sum-score >21) (Lawton &

Table 2
Social capital by independent variable and controlling variables (N = 1645).

Variable	Freq N(%)	Social capital		Cognitive social capital		Structural social capital	
		Z/χ^2	P-value	Z/χ^2	P-value	Z/χ^2	P-value
Time of shock		27.601[b]	<0.001	23.804[b]	<0.001	17.285[b]	<0.001
None	1164 (70.76)						
Within the past year	284 (17.26)						
Between one and three years ago	109 (6.63)						
More than three years ago	88 (5.35)						
Out-of-pocket medical expenses	1645 (100)	670.425[b]	0.677	677.568[b]	0.604	661.557[b]	0.759
Annual household income	1645 (100)	1177.774[b]	0.464	1171.702[b]	0.513	1203.901[b]	0.266
Age of household head		14.859[b]	<0.001	6.846[b]	<0.05	21.992[b]	<0.001
Age<45	110 (6.69)						
45≤Age<60	366 (22.25)						
Age≥60	1169 (71.06)						
Gender of household head		3.767[a]	<0.001	3.741[a]	<0.001	2.201[a]	<0.05
Man	1256 (76.35)						
Woman	389 (23.65)						
Marital status of household head		7.441[a]	<0.001	7.08[a]	<0.001	5.354[a]	<0.001
Married	1079 (65.59)						
Others	566 (34.41)						
Education level of household head		59.178[b]	<0.001	40.642[b]	<0.001	51.301[b]	<0.001
Illiterate	426 (25.9)						
8 years and below	951 (57.81)						
9 years and above	268 (16.29)						
BMI of household head		39.983[b]	<0.001	38.489[b]	<0.001	21.851[b]	<0.001
BMI<18.5	163 (9.91)						
18.5≤BMI<24	757 (46.02)						
24≤BMI<28	529 (32.16)						
BMI≥28	196 (11.91)						
Village cadres		−5.934[a]	<0.001	−4.016[a]	<0.001	−6.379[a]	<0.001
No	1509 (91.73)						
Yes	136 (8.27)						
Gifting expenditure	1645 (100)	172.986[b]	<0.001	162.724[b]	<0.001	132.959[b]	<0.001
Housing structure		2.739[a]	<0.01	2.318[a]	<0.05	2.586[a]	<0.01
Reinforced concrete	404 (24.56)						
Others	1241 (75.44)						
Family structure		35.615[b]	<0.001	35.898[b]	<0.001	17.689[b]	<0.001
Living together	1056 (64.19)						
Living alone	477 (29.00)						
Empty nest	112 (6.81)						
Socioeconomic status		147.201[b]	<0.001	99.791[b]	<0.001	130.00[b]	<0.001
Low	476 (28.94)						
Middle	779 (47.36)						
High	390 (23.71)						

[a] Nonparametric test: Mann-Whitney *U* test result Z values.
[b] Nonparametric test: Kruskal-Wallis result and H values.

Brody, 1969). Reciprocity concerning relatives, neighbours, friends, and strangers was originally measured on a five-point scale and subsequently converted into binary variables (0 = never, seldom, usually; 1 = often, more often). Gifting and food expenditures were assessed based on the total household spending on gifts and food over the past year, with both variables undergoing logarithmic transformation. We utilized ADL to explore the potential mechanism underlying the deterioration of social relationships, while economic burden on households was assessed through gifts and food expenditures (Zhang & Lu, 2019). Furthermore, we explored the mechanism behind psychological burdens by analysing depression status and examining subjective willingness to reciprocate.

3. Results

3.1. Descriptive statistics

The characteristics of study participants are presented in Table 2. A total of 1164 households (70.76 %) had not experienced health shocks, 284 households (17.26 %) had encountered health shocks within the past year, 109 households (6.63 %) had experienced health shocks between one and three years ago, and 88 households (5.35 %) had experienced health shocks more than three years ago. Households without health shocks exhibited a higher mean social capital score, whereas, those that had experienced health shocks within the past year had a lower mean score. A significant correlation was found between health shocks and social capital (chi-square $\chi^2 = 27.60$, $P < 0.001$). Similarly, significant associations were observed between health shocks and cognitive social capital ($\chi^2 = 23.80$, $P < 0.001$) and structural social capital ($\chi^2 = 17.29$, $P < 0.001$).

Households headed by individuals aged 45–60 years (22.25 %) had a significantly higher mean social capital score than those with heads aged 60 years and above (71.06 %) ($\chi^2 = 14.86$, $P < 0.001$). The mean structural social capital score followed the same trend; however, the pattern observed for the mean cognitive social capital differed. The mean social capital score was significantly higher in households with male heads than in those with female heads (76.35 % vs. 23.65 %, $P < 0.001$). A significant difference was also observed in both cognitive and structural social capital scores based on the gender of the household head ($P < 0.001$ and $P < 0.05$, respectively). Households with married individuals or individuals who had attained a higher level of education tended to have higher mean social capital scores. Additionally, factors such as having a family member serving as a village cadre, living in a concrete house, or possessing a higher socioeconomic status, were positively associated with higher mean social capital scores. Higher BMI was also linked to increased social capital. Among household structures, empty-nest families exhibited the highest mean social capital scores. Furthermore, social capital scores varied significantly with differences in gifting expenditures.

Without adjusting for other influencing factors, the OLS regression analysis indicated a negative correlation between health shocks and social capital (Table 3).

3.2. OLS regression

The duration of health shocks was found to be negatively correlated with social capital ($\beta = -2.82$, $P < 0.001$). However, this negative effect gradually weakened over time (between one and three years ago: $\beta = -1.49$, $P = 0.21$; more than three years ago: $\beta = -1.10$, $P = 0.36$). Notably, the coefficients for households that had experienced health shocks more than one year ago were statistically insignificant, suggesting that the adverse impacts of health shocks on social capital diminishes over time. A similar negative relationship was observed between health shocks and both cognitive and structural social capital in households that had experienced health shocks within the past year (cognitive social capital: $\beta = -1.78$, $P = 0.001$; structural social capital: $\beta = -1.038$, $P = 0.006$) (Table 4). The correlation was stronger for cognitive social capital than for structural social capital, indicating that cognitive aspects of social capital are more sensitive to recent health shocks.

When controlling for additional variables, a significant association was found between social capital and demographic variables, including gender, age, education level of household members, marital status, and BMI ($P < 0.05$). The relationship between the age of the household head and cognitive social capital was more pronounced than its relationship with structural social capital. In addition, the gender of the household head was positively correlated with structural social capital. Furthermore, BMI was significantly negatively associated with cognitive social capital, but showed no significant relationship with structural social capital. At the household level, having a family member serving as a village cadre and higher socioeconomic status were both significantly positively associated with social capital. However, other household factors, such as gifting expenditures, housing structure, and family structure, did not show a significant correlation with social capital.

3.3. The results of mechanism analysis

Table 5 shows that the duration of health shocks is negatively associated with ADL, food expenditures ($P < 0.05$) and reciprocity ($P < 0.05$), and positively associated with depression ($P < 0.05$).

4. Discussion

This study is among the first to explore the relationship between the duration of health shocks and social capital in rural China. Our findings indicate that health shocks are negatively associated with social capital, consistent with prior economic models and empirical studies examining the impact of health on social capital (Ashrafi, Montazeri, Mousavi et al., 2012; Downward et al., 2020; Laporte, 2014; Lebenbaum et al., 2021). One possible explanation is that poor health increases the costs associated with investing in social capital while reducing productivity (Laporte, 2014). Additionally, health shocks can impose financial strain on households, compelling them to allocate more resources to healthcare expenses, thereby limiting their ability to invest in social capital and ultimately exerting a detrimental effect on the level of social capital (Kim C.-O., 2021; Ma, Xiang, Yan et al., 2022; Wang Yajie, Jin, & Yuan, 2023). Furthermore, declines in social capital may result from caregiving responsibilities, which can restrict family members from participating in social interactions or social organisations when a household member experiences a health shock (Zhang N., Zhang, Zou et al., 2023).

Fortunately, our results suggest that the negative impact of health shocks on social capital diminishes over time, implying a short-term effect. This aligns with previous research conducted in China on the effects of health shocks on food consumption (Pan, Palmer, Mahal et al., 2020). However, studies conducted in the UK and the USA indicate that the impact of health shocks on social capital is long-term, persisting from childhood into adulthood (Allen, Gilbody, Atkin et al., 2023; Lebenbaum, De Oliveira, Gagnon et al., 2024), which contrasts with our findings. The discrepancy may be attributed to differences in the origins, functions, and impacts of social capital in China (Zhang H., Han, Wang et al., 2019). Unlike Western countries, where individuals rely more on government and community support, Chinese families often serve as the primary safety net when households face health shocks (Zhang H., Han, Wang et al., 2019). The strong tightly knit family support networks within Chinese families enables them to provide both emotional and financial assistance when households face health shocks, facilitating a quicker recovery from health shocks (Bian, 2019). Additionally, Chinese families exhibit resilience and adaptability when facing health shocks (ChengFengAnet al., 2024; Li Y., Wang, Yin et al., 2018), allowing families to adjust their mindset and behaviour in the short term, thereby mitigating the long-term negative effects of health shocks on social capital.

This study examined three mechanisms through which health shocks impact social capital: weakening of social networks and participation due to physical functional limitations, reduction in social participation and reciprocity because of economic burdens, and diminution of social trust and cohesion caused by psychological distress arising from illness. First, our findings indicate that health shocks negatively affect ADL, restricting the ability of both affected individuals and their family members to engage in social activities (Dauda, 2018; Zhang & Lu, 2019). Second, the decline in social capital following health shocks may be linked to financial constraints, as households prioritise medical expenses over maintaining social networks (Hao, Guo, Ren et al., 2023; Laporte, 2014; Qiu Y. & F. Zhang, 2024). Our study found a negative association between health shocks and expenditures on food and gifting. Additionally, we observed that households experiencing health shocks had a higher risk of depression than those not experiencing health shocks, which is consistent with previous research (Wang Yaping, Liang, Liu et al., 2023). Poor health may reduce optimism, hope, and opportunities to participate in social organisations (Roychowdhury, 2021), thereby diminishing willingness to reciprocate social interactions (Laporte, 2014).

Consistent with previous studies, we found that the association of health shocks with cognitive social capital was stronger than that with structural social capital (Dai & Gu, 2021; Zhou, Ogihara, Chen et al., 2017). As cognitive social capital is primarily based on subjective values and emotions, it is more sensitive to changes in individual psychological state and the social environment (Islam, Merlo, Kawachi et al., 2006). Negative health events can trigger emotional distress and erode trust

Table 3
Regression analysis of social capital.

Variable	Social capital			Cognitive social capital			Structural social capital		
	β	95 % confidence interval		β	95 % confidence interval		β	95 % confidence interval	
Time of shock (ref: None)									
Within the past year	−4.1784***	−5.7372	−2.6195	−2.5700***	−3.6161	−1.5239	−1.6083***	−2.3353	−0.8814
Between one and three years ago	−1.8094	−4.1687	0.5498	−1.2918	−2.8750	0.2915	−0.5177	−1.6179	0.5825
More than three years ago	−1.3856	−3.9896	1.2183	−1.2467	−2.9942	0.5008	−0.1390	−1.3532	1.0754

*p < 0.05 **p < 0.01 ***p < 0.001.

Table 4
OLS regression analysis of social capital.

Variable	Social capital			Cognitive social capital			Structural social capital		
	β	95 % Confidence interval		β	95 % Confidence interval		β	95 % Confidence interval	
Time of shock (ref: None)									
Within the past year	−2.8207***	−4.3798	−1.2615	−1.7828**	−2.8657	−0.6999	−1.0379**	−1.7725	−0.3033
Between one and three years ago	−1.4882	−3.7905	0.8141	−1.2634	−2.9150	0.3882	−0.2248	−1.1914	0.7418
More than three years ago	−1.0992	−3.4486	1.2502	−1.1692	−2.7844	0.4460	0.0700	−1.0138	1.1538
Age of household head (ref: Age<45)									
45≤Age<60	3.8259**	1.4639	6.1879	2.4127**	0.8133	4.0121	1.4132*	0.3369	2.4895
Age≥60	3.0755**	0.7723	5.3788	2.5890**	1.0146	4.1635	0.4865	−0.5671	1.5402
Gender of household head (ref: Man)									
Woman	2.1531*	0.2140	4.0921	1.1012	−0.2248	2.4272	1.0519*	0.1435	1.9603
Marital status of household head (ref: Married)									
Others	−4.0498**	−6.4562	−1.6434	−2.7464***	−4.4400	−1.0528	−1.3034*	−2.4297	−0.1771
Education level of household head (ref: None)									
8 years and below	0.9163	−0.6828	2.5153	0.8620	−0.2362	1.9601	0.0543	−0.6953	0.8039
9 years and above	2.8227**	0.7943	4.8511	1.4766*	0.1115	2.8418	1.3460**	0.3730	2.3191
BMI of household head (ref: 18.5≤BMI<24)									
BMI<18.5	−2.6135*	−4.6687	−0.55823	−2.4889**	−3.8991	−1.0787	−0.1246	−1.0970	0.8478
24≤BMI<28	0.8520	−0.4014	2.1054	0.3941	−0.4599	1.2481	0.4579	−0.1288	1.0446
BMI≥28	1.2144	−0.5830	3.0118	0.6412	−0.5610	1.8433	0.5733	−0.2978	1.4442
Village cadres (ref: No)									
Yes	3.9571***	2.2928	5.6214	1.4312**	0.3592	2.5033	2.5259***	1.6301	3.4217
Gifting expenditure	0.0003	−0.0001	0.0006	0.0003*	<0.0001	0.0005	<0.001	−0.0002	0.0002
Housing structure (ref: Reinforced concrete)									
Others	−0.0557	−1.3801	1.2687	−0.0408	−0.9300	0.8484	−0.0149	−0.6676	0.6377
Family structure (ref: Living together)									
Living alone	1.2914	−1.1124	3.6951	0.8688	−0.8198	2.5574	0.4226	−0.6918	1.5369
Empty nest	1.4692	−0.5433	3.4816	1.6972*	0.4044	2.9900	−0.2280	−1.2913	0.8352
Socioeconomic status (ref: Low)									
Middle	2.4933**	1.0879	3.8986	1.7178***	0.7543	2.6812	0.7755*	0.1358	1.4152
High	7.5741***	5.9888	9.1594	4.1788***	3.1046	5.2531	3.3953***	2.6467	4.1439

*p < 0.05 **p < 0.01 ***p < 0.001.

Table 5
The results of potential mechanisms analysis.

Variable	Depression	ADL	Relative reciprocity	Neighbours' reciprocity	Friends' reciprocity	Strangers' reciprocity	Gifting expenditures	Food expenditure
	OR	RRR	OR	OR	OR	OR	β	β
Time of shock (ref: None)								
Within the past year	1.8000***	0.6846	0.5191***	0.5275***	0.6064**	0.8529	0.1637	−0.2156***
Between one and three years ago	2.0758**	0.3173*	0.6432	0.6921	0.7388	0.6406	0.2209	−0.0612
More than three years ago	1.6156*	0.7146	0.6414	0.6832	0.7612	0.8610	0.0507	−0.0706

Notes: Different control variables were included in each model.
*p < 0.05 **p < 0.01 ***p < 0.001.

(Umer & Li, 2024). Additionally, health shocks impose a significant economic burden on households, leading to reduced social expenditures and disrupting social reciprocity mechanisms (Alam & Mahal, 2014; Hao, Guo, Ren et al., 2023; Laporte, 2014; Qiu Y. & F. Zhang, 2024; Yilma, Mebratie, Sparrow et al., 2021). Households unable to bear the financial strain of illness may resort to borrowing money, which can affect social trust (Alam & Mahal, 2014; Hu et al., 2021; Qiu Y. & F. Zhang, 2024; Sichali, Khan, Gama et al., 2019; Xiang et al., 2021; Yilma, Mebratie, Sparrow et al., 2021).

Additionally, our findings highlight variations in social capital among household heads based on different demographic and economic characteristics, such as gender, age, education level, and marital status, when they experience health shocks. These factors were also found to be significantly associated with social capital at the household level. Notably, we observed a positive correlation between gifting expenditure and cognitive social capital, offering valuable insights for future research on the determinants of influence social capital.

This study had some limitations. First, its cross-sectional design limits the ability to establish causal relationships. Second, measuring social capital based on the household head's responses may not fully capture the social capital of the entire family, potentially introducing selection bias. Third, self-reported household income and healthcare expenditures may be subject to recall bias. Finally, the sample size of 1645 households may not be large enough to fully capture the variability and complexity of the relationship between health shocks and social capital, affecting the generalisability of the findings.

5. Conclusion

Health shocks are significantly associated with social capital, including both cognitive and structural dimensions. Our results indicate that health shocks contribute to a decline in social capital. These findings have important policy implications for supporting families recovering from health shocks. Policymakers should focus on providing targeted assistance to households, particularly during the first year after a health shock. Mitigating the burden of medical expenses and easing

the strain on family health are of utmost importance. Therefore, medical assistance programmes should be developed, and the insurance system strengthened. Additionally, welfare subsidies for out-of-pocket medical expenditures should be increased to support low-income households. A high level of social capital can reduce the impact of health shocks. Therefore, governments should develop targeted public health strategies that account for demographic differences to enhance social capital and encourage participation in social organisations, such as senior citizens groups and volunteer associations. For older individuals at moderate health risk, fostering a supportive social environment can enhance their engagement and well-being.

CRediT authorship contribution statement

Jinghan Yin: Writing – original draft, Visualization, Software, Methodology, Formal analysis, Conceptualization. **Shuwen Bi:** Writing – review & editing, Validation, Conceptualization. **Shiju Dong:** Writing – review & editing, Validation. **Jin Hao:** Writing – review & editing, Validation. **Siqian Zhang:** Writing – review & editing, Methodology. **Jiajia Li:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization.

Ethical statement

The study was approved by Ethics Committee of the School of Public Health, Shandong University, validating the research protocol.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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