

Health Shocks and Debt Risk Among Middle-Aged and Elderly Individuals in China: The Mediating Roles of Informal Self-Treatment and Formal Healthcare Utilization

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Background: The correlation between health shocks and debt risk among middle-aged and elderly individuals in China remains inadequately explored. This study seeks to investigate the relationship between health shocks and household debt risk, considering the mediating roles of self-treatment, outpatient care, and inpatient care.

Methods: A cross-sectional study used data from the China Health and Retirement Longitudinal Study (CHARLS) 2018 wave, including 19,670 middle-aged and older adults in China. Linear regression models were first employed to examine the association between health shocks and household debt risk. Sobel tests were then employed to explore the mediating roles of informal self-treatment, outpatient care, and inpatient care.

Results: The findings reveal a significant and positive association between health shocks and cash debt risk among middle-aged and elderly individuals in China. Notably, individuals with a higher burden of chronic diseases, particularly those in middle age, exhibit an elevated risk of cash debt. Furthermore, informal self-treatment emerges as a crucial mediator in the relationship between health shocks and cash debt risk. Conversely, formal healthcare utilization demonstrates no significant mediating effect.

Conclusion: This study underscores the urgent need to strengthen financial protection for individuals with chronic diseases and multimorbidity. Policy efforts should focus on expanding outpatient reimbursement, improving the capacity and integration of primary healthcare services, and establishing more effective and coordinated management strategies for multimorbidity in order to alleviate long-term debt risk.

Keywords: health shocks, debt risk, mediating roles, self-treatment, healthcare utilization, sobel test

Introduction

The rising prevalence of age-related chronic diseases in China has led to frequent health shocks among middle-aged and elderly individuals.¹ Such shocks not only impose a heavy economic burden but also increase the risk of indebtedness, primarily through escalating healthcare expenditures and reduced labor income.^{2,3} When multiple chronic conditions coexist—a situation known as multimorbidity—the financial strain becomes even greater, amplifying the debt risks faced by affected individuals.^{4–7}

Previous research has largely focused on short-term financial outcomes, such as catastrophic health expenditure (CHE).^{8,9} However, accumulating evidence indicates that health shocks are also associated with longer-term debt risks.^{10–12} Empirical studies have shown that health-related borrowing is common and often persistent. For example, survey evidence based on 5000 households indicates that approximately 28% of households facing health expenditures reported borrowing to finance healthcare, and among those borrowers, about 55% relied on interest-bearing loans. Moreover, only 22% of these households were able to fully repay their health-related debts within 12 months.¹¹ Similarly,

evidence from household surveys suggests that around 12% of households used formal loans for health expenses, while as many as 50% relied on informal borrowing, which is frequently associated with higher interest rates.¹³ Despite this emerging literature documenting the association between health shocks and household indebtedness, existing studies have paid limited attention to the underlying pathways through which health shocks are translated into long-term debt risk, particularly among individuals with multimorbidity. Debt risk can arise from various sources, including loans, credit card debt, and cash debt, with evidence suggesting that cash debt constitutes a particularly large share of the financial burden among this population.^{14,15} For this reason, this study emphasizes cash debt as the primary indicator of debt risk.

Debt risk constitutes a substantial threat to patients and their families. To repay debts, chronic patients and their families may need to dedicate more time to work, potentially forcing their children to abandon educational pursuits and enter the labor market prematurely.¹⁶ The escalating demand for healthcare services and corresponding medical expenditure represent a paramount reason for debt risk among individuals with chronic diseases.^{14,17} Although China has established a multi-tiered health security system—including basic medical insurance, critical illness insurance, and medical assistance—its primary focus remains on inpatient reimbursement.^{18,19} In recent years, reforms have introduced outpatient compensation mechanisms to alleviate the rising burden of outpatient costs.²⁰ However, while these reforms have broadened outpatient reimbursement—often including chronic-disease outpatient care—they do not constitute a nationally standardized, targeted reimbursement scheme specifically designed for patients with multimorbidity. Consequently, individuals with multiple chronic conditions remain exposed to substantial economic burdens and debt risks.^{5,21} Previous studies have highlighted multimorbidity as a pressing public health challenge and noted the insufficient preparedness of health and insurance systems in many developing contexts.¹⁰

At the same time, informal self-treatment has become increasingly prevalent in China; however, its associated risks have received limited scholarly attention. Factors influencing informal self-treatment behavior include the proliferation of the Internet, accessibility to formal healthcare, and outpatient care costs.^{22–24} Due to inadequate professional support and primary healthcare capacity, formal healthcare frequently fails to meet the needs of patients with severe and complex chronic diseases, such as multimorbidity.^{25,26} Consequently, self-treatment behavior, particularly among patients with multimorbidity, may be more prevalent, thereby amplifying the attendant risks.

Both formal healthcare utilization and informal self-treatment may contribute to the debt risk faced by individuals with multimorbidity. Elucidating the relationship among health shocks, debt risk, and healthcare utilization patterns among middle-aged and elderly individuals is crucial. Using nationally representative cross-sectional data from the 2018 China Health and Retirement Longitudinal Study (CHARLS), this study examines the association between health shocks and debt risk, with a particular focus on the mediating roles of informal self-treatment and formal healthcare utilization. The contributions of this paper are twofold. First, it broadens the theoretical perspective by shifting the focus from short-term catastrophic health expenditure to long-term debt risk, thereby enriching the understanding of the financial consequences of health shocks. Second, it provides theoretical and empirical evidence to inform future health policy adjustments, particularly in outpatient compensation and primary care capacity, to better address the long-term debt risk of individuals with multimorbidity.

Theoretical Framework and Research Hypotheses

Andersen's theoretical model has long served as a foundational framework for understanding patterns of healthcare utilization.²⁷ Originally formulated in Western contexts, the model has since been empirically applied and validated across diverse healthcare systems and populations worldwide. By conceptualizing healthcare use as the outcome of interactions among predisposing characteristics, enabling factors, and demand factors at both individual and societal levels, the model offers a comprehensive theoretical lens for examining determinants of health service utilization.^{28,29} Building upon the Andersen's theoretical model, this study incorporates informal self-treatment and formal outpatient/inpatient care utilization as intermediary variables to explore the mechanism underlying the impact of health shocks on debt risk, representing an extension of this theoretical model. In line with the literature review and Anderson's theoretical model, the proposed relationship model is depicted in [Figure 1](#). Predisposing characteristic variables encompass age, gender, education, marital status, and living area. Enabling resource variables include the type of basic medical insurance, DiBao (basic life and medical expenditure assistance system in China), and family doctor. Health shocks represent

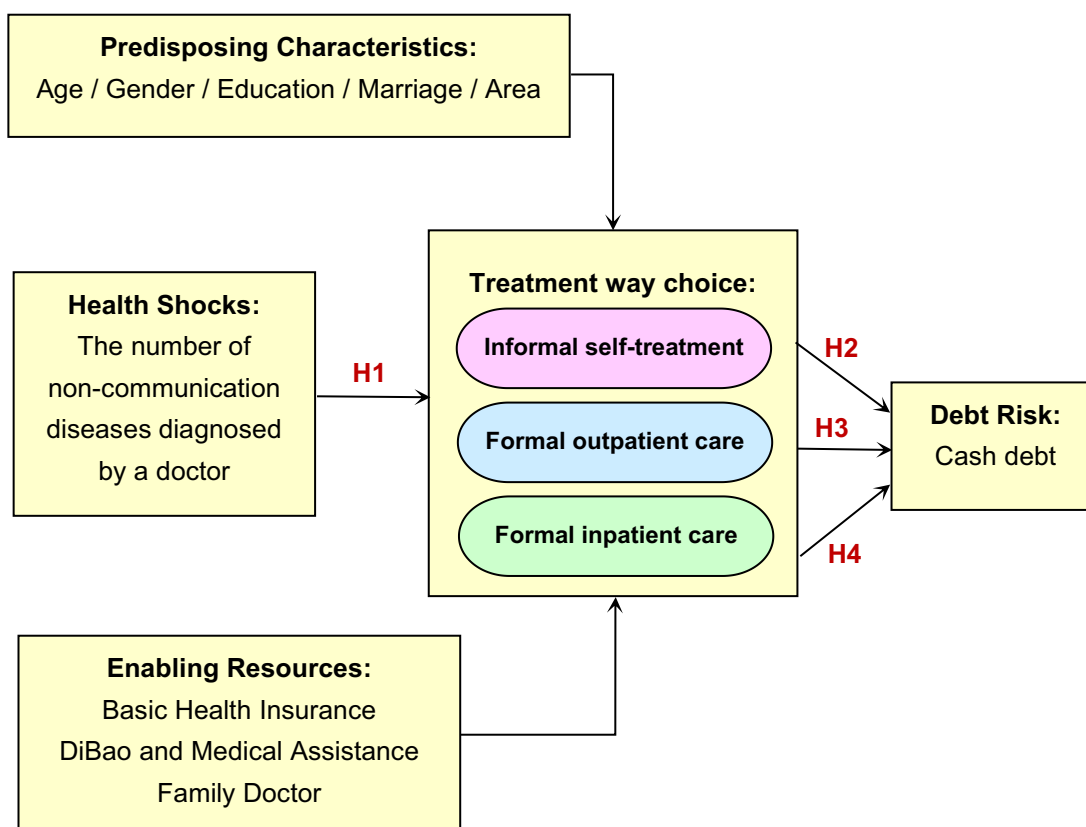


Figure 1 The effects of health shock and the mediating effects of treatment way choice on debt risk: proposed model.

demand factors, denoting the number of diseases diagnosed by a physician, while debt risk refers to cash debt, excluding loans and credit card debt.

We hypothesize that both informal self-treatment and formal outpatient/inpatient care utilization play pivotal roles in mediating the relationship between health shocks and debt risk. Expenditures arising from formal healthcare utilization can, to some extent, be offset by basic medical insurance and medical assistance, thereby effectively mitigating debt risk. Conversely, informal self-treatment behavior may also significantly impact debt risk, often overlooked despite its relevance to chronic patients. Thus, health shocks may not only exert a direct effect on debt risk but also indirectly shape it through pathways involving self-treatment and outpatient/inpatient care utilization.

Based on the preceding analysis, the following hypotheses are proposed:

H1. Health shocks have a positive impact on debt risk.

H1a. Health shocks increase the debt risk of middle-aged individuals (<60 years).

H1b. Health shocks increase the debt risk of elderly individuals (≥ 60 years).

H2. Informal self-treatment mediates the impact of health shocks on debt risk.

H2a. Informal self-treatment mediates the impact of health shocks on debt risk among middle-aged individuals (<60 years).

H2b. Informal self-treatment mediates the impact of health shocks on debt risk among elderly individuals (≥ 60 years).

H3. Outpatient care utilization mediates the impact of health shocks on debt risk.

H3a. Outpatient care utilization mediates the impact of health shocks on debt risk among middle-aged individuals (<60 years).

H3b. Outpatient care utilization mediates the impact of health shocks on debt risk among elderly individuals (≥ 60 years).

H4. Inpatient care utilization mediates the impact of health shocks on debt risk.

H4a. Inpatient care utilization mediates the impact of health shocks on debt risk among middle-aged individuals (<60 years).

H4b. Inpatient care utilization mediates the impact of health shocks on debt risk among elderly individuals (≥ 60 years).

Materials and Methods

Data Sources

This study employed a cross-sectional design using data drawn from the 2018 wave of the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative survey that collects detailed information on demographic characteristics, health status, healthcare utilization, and socioeconomic conditions of Chinese residents aged 45 years and above. CHARLS is a large-scale longitudinal survey designed to monitor aging-related changes in health and economic well-being in China and employs multi-stage stratified Probability Proportionate to Size sampling (PPS) to ensure national representativeness. The 2018 wave includes 19,670 respondents from 28 provinces across China. Given that China's stringent epidemic control measures implemented after 2020 substantially altered healthcare-seeking behaviors, the 2018 CHARLS wave was selected to better capture healthcare utilization patterns under normal conditions.^{30,31} Missing data were minimal in the 2018 CHARLS sample. Observations with missing values in key variables were excluded during data cleaning, and analyses were conducted using complete cases. The CHARLS dataset is publicly available and can be accessed through the official website (<http://charls.pku.edu.cn>).

Ethical Approval

The China Health and Retirement Longitudinal Study (CHARLS) obtained ethical clearance from the Institutional Review Board of Peking University (IRB00001052-11015). All participants provided informed consent at the time of the original survey. The present analysis was conducted using anonymized, publicly accessible data, and did not involve any direct interaction with study participants.

Measure

Dependent Variable

Debt risk was measured using the CHARLS (2018) question: "What is the total amount of money you owe to other families, individuals, or employers?" For this study, loans and credit card debts were excluded, and only cash debts were considered.

Mediating Variables

Self-treatment was assessed with the question: "Did you consume any purchased medicine in the past month? (Excluding prescription medications)"

Outpatient care was assessed with the question: "In the last month, have you visited a public hospital, private hospital, public health center, clinic, or been visited by a health worker or doctor for outpatient care? (Excluding physical examinations)"³²

Inpatient care was assessed with the question: "Have you received inpatient care in the past year?"³²

Independent Variables

Health shocks were measured based on physician-diagnosed non-communicable diseases (NCDs) captured in CHARLS (2018). In total, fourteen chronic conditions were considered, spanning multiple disease domains, including cardiometabolic, respiratory, digestive, neurological, musculoskeletal, renal, oncological, and mental health conditions. These comprised cardiometabolic

disorders (such as hypertension, dyslipidemia, diabetes, heart disease, and stroke), chronic respiratory illnesses (including chronic lung disease and asthma), digestive and metabolic diseases (eg, liver and stomach conditions), neurological and cognitive disorders, mental health problems, kidney disease, arthritis or rheumatism, and cancer, with minor skin cancers explicitly excluded.⁹

Control Variables

Control variables encompass personal characteristics and social security-related factors. Personal characteristics included age, gender, marital status, education level, and residential area. Social security factors included the type of basic healthcare insurance, whether a minimum living allowance is guaranteed, and whether the household had a contracted family doctor.

Statistical Analyses

All analyses were carried out using STATA 15.0, and all statistical tests were two-sided ($\alpha=0.05$). The distribution of cash debts across categorical demographic characteristics was assessed by one-way ANOVA, while the distribution of self-treatment, outpatient, and inpatient care utilization across demographic groups was examined using the Chi-square test. Pearson correlation analysis was conducted to evaluate the associations among health shocks, self-treatment, outpatient care, inpatient care, and cash debt. To assess the mediating effects of healthcare utilization patterns, the causal steps approach proposed by Baron and Kenny (1986) was applied.³³ Specifically, (1) in step 1, health shocks and control variables were regressed on cash debt; (2) in step 2, logit regressions were performed with self-treatment, outpatient care, and inpatient care as dependent variables to examine the association between health shocks and the mediators; (3) in step 3, the mediators were added to the regression model to assess their effects on cash debt and the change in the coefficient of health shocks. The statistical significance of mediation was further verified using the Sobel test. The regression equations for multiple mediating effects corresponding to the theoretical model (Figure 1) of this study are as follows:

$$Y = \alpha_1 + \beta_1 X + \gamma_1 \text{Controls} + \varepsilon \quad (1)$$

$$M_1 = \alpha_{11} + \beta_{11} X + \gamma_{11} \text{Controls} + \varphi_{11} \quad (2a)$$

$$M_2 = \alpha_{21} + \beta_{21} X + \lambda_{21} M_1 + \gamma_{21} \text{Controls} + \varphi_{21} \quad (2b)$$

$$M_3 = \alpha_{31} + \beta_{31} X + \lambda_{31} M_1 + \lambda_{32} M_2 + \gamma_{31} \text{Controls} + \varphi_{31} \quad (2c)$$

$$Y = \alpha_2 + \beta_2 X + \lambda_1 M_1 + \lambda_2 M_2 + \lambda_3 M_3 + \gamma_2 \text{Controls} + \delta \quad (3)$$

where, Y represents the level of cash debt, M1, M2, and M3 refer to self-treatment, outpatient care, and inpatient care utilization, respectively. X denotes the number of chronic diseases, and Controls represents individual characteristic variables, including predisposing characteristics and enabling resources. γ_1 and γ_2 represent the total effect and direct effect, respectively, of individual characteristics on cash debt. γ_{11} , γ_{21} , and γ_{31} represent the effect of individual characteristics on intermediary variables. ε , φ , and δ are random interference terms. Equation (1) estimates the total effect of health shocks on cash debt (β_1). Equation (2a-2c) capture the effects of health shocks on the mediators (β_{11} , β_{21} , β_{31}). Equation (3) assesses the direct effect of health shocks (β_2) and the effects of mediators (λ_1 , λ_2 , λ_3) on cash debt. Furthermore, the intermediary effect of health shock on cash debts is calculated as $\beta_{11} * \lambda_1$, $\beta_{21} * \lambda_2$, $\beta_{31} * \lambda_3$.

Results

Demographic Characteristics and Distribution of Cash Debt and Healthcare Utilization

The demographic characteristics of participants and the distribution of self-treatment, healthcare utilization, and cash debts across categorical variables are summarized in Table 1. Significant differences in mean cash debt were observed across age, marital status, and gender groups, with middle-aged, male, and rural patients bearing a higher debt burden.

Table 1 Demographics Variables of the Participants and Distribution of Self-Treatment, Healthcare Utilization and Cash Debt

Variable	N (%)	Self-Treatment	Outpatient Care	Inpatient Care	Cash Debt (log(debt+1))
		N (%)	N (%)	N (%)	Mean (SD)
The number of chronic diseases		P=0.000	P=0.000	P=0.000	P=0.050
0	4123 (21%)	1510 (37%)	317 (8%)	205 (5%)	1.119 (3.236)
1	4932 (25%)	2540 (52%)	598 (12%)	518 (11%)	1.212 (3.351)
2	4149 (21%)	2545 (61%)	695 (17%)	675 (16%)	1.111 (3.201)
3	2798 (14%)	1974 (71%)	606 (22%)	658 (24%)	1.256 (3.391)
4	1772 (9%)	1295 (73%)	442 (25%)	512 (29%)	1.120 (3.190)
≥5	1899 (10%)	1473 (78%)	579 (30%)	741 (39%)	1.353 (3.409)
Age		P=0.000	P=0.212	P=0.000	P=0.000
<60	8614 (44%)	4673 (41%)	1449 (45%)	1022 (31%)	1.946 (4.086)
≥60	11,054 (56%)	6662 (59%)	1786 (55%)	2286 (69%)	0.590 (2.352)
Marriage		P=0.188	P=0.050	P=0.000	P=0.000
1=married	16,745 (85%)	9618 (85%)	2718 (84%)	2657 (80%)	1.265 (3.403)
0= single, divorced, widowed	2923 (15%)	1717 (15%)	517 (16%)	651 (20%)	0.712 (2.550)
Education		P=0.013	P=0.248	P=0.000	P=0.000
1=no	4455 (23%)	2606 (23%)	726 (22%)	866 (26%)	0.842 (2.790)
2=primary	8423 (43%)	4922 (43%)	1410 (44%)	1450 (44%)	1.311 (3.423)
3=middle/high	6365 (32%)	3575 (32%)	1017 (31%)	926 (28%)	1.273 (3.450)
4=college	425 (2%)	232 (2%)	82 (3%)	66 (2%)	0.865 (2.983)
Gender		P=0.000	P=0.000	P=0.570	P=0.000
Male	9270 (47%)	5145 (45%)	1345 (42%)	1574 (48%)	1.291 (3.431)
Female	10,398 (53%)	6190 (55%)	1890 (58%)	1734 (52%)	1.086 (3.168)
BMI (basic medical insurance)		P=0.012	P=0.187	P=0.000	P=0.000
No ins	589 (3%)	307 (3%)	76 (2%)	51 (2%)	1.160 (3.189)
UEMI	2777 (14%)	1576 (14%)	474 (15%)	555 (17%)	0.629 (2.565)
URBMI	2392 (12%)	1394 (13%)	392 (12%)	376 (12%)	1.097 (3.177)
URMI	834 (4%)	510 (5%)	137 (4%)	153 (5%)	1.047 (3.203)
NCM	12,697 (66%)	7332 (66%)	2086 (66%)	2102 (65%)	1.348 (3.471)
DiBao		P=0.000	P=0.021	P=0.000	P=0.045
1=Impoverished households	1491 (8%)	956 (8%)	277 (9%)	399 (12%)	1.349 (3.394)
0==Non impoverished households	18,157 (92%)	10,373 (92%)	2954 (91%)	2906 (88%)	1.170 (3.289)
Family doctor		P=0.919	P=0.000	P=0.000	P=0.2408

(Continued)

Table 1 (Continued).

Variable	N (%)	Self-Treatment	Outpatient Care	Inpatient Care	Cash Debt (log(debt+1))
		N (%)	N (%)	N (%)	Mean (SD)
1=Signed with a family doctor	811 (4%)	466 (4%)	185 (6%)	175 (5%)	1.316 (3.456)
0=no signed family doctor	18,857 (96%)	10,869 (96%)	3050 (94%)	3133 (95%)	1.177 (3.289)
Place of living		P=0.455	P=0.810	P=0.303	P=0.000
1=Rural	14,388 (73%)	8315 (73%)	2361 (73%)	2396 (72%)	1.243 (3.342)
0=Urban	5280 (27%)	3020 (27%)	874 (27%)	912 (28%)	1.021 (3.164)

Individuals with chronic diseases were significantly more likely to incur cash debt, and among insurance groups, those covered by the New Cooperative Medical System (NCM) exhibited the highest risk. Education level was also associated with debt risk, with participants holding only a primary degree reporting the greatest mean debt.

Patterns of healthcare utilization also varied across demographic and socioeconomic groups. Elderly and female participants were more likely to engage in self-treatment, and individuals with multiple chronic conditions reported higher rates of self-treatment. Outpatient and inpatient care utilization differed significantly across DiBao and family doctor groups, with those receiving DiBao assistance and those contracted with a family doctor more likely to seek both outpatient and inpatient care. Patients with a higher number of chronic diseases were also more inclined to utilize formal healthcare services.

Pearson Correlations Analysis

The results of Pearson correlation analysis among health shock, self-treatment, healthcare utilization, and debt risk are shown in Table 2. Health shock was significantly correlated with debt ($r=0.0164$, $p<0.05$) and significantly associated with self-treatment, outpatient care, and inpatient care ($r=0.2568$, 0.1919 , 0.2764 , $p<0.01$). Individuals choosing self-treatment and outpatient care were found to have a higher debt level ($r=0.0311$, 0.0285 , $p<0.01$), while inpatient care had a negative impact on debt level ($r=-0.0009$, $p=0.902$).

The Mediating Roles of Self-Treatment and Healthcare Utilization

In Table 3, Model 1 evaluates the impact of health shock on cash debt, revealing a significant positive correlation between health shock and debt level ($p < 0.001$). Model 3 incorporates self-treatment, outpatient care, and inpatient care variables into Model 1. There is a significant positive correlation between informal self-treatment, formal outpatient care, inpatient care, and cash debt, indicating that these variables are important in affecting the cash debt of middle-aged and elderly individuals. Among them, the regression coefficient between self-treatment and cash debt among middle-aged and elderly individuals is the highest, suggesting that informal self-treatment has a greater impact on cash debt than outpatient and inpatient care utilization. After adding intermediary variables, the regression coefficients of health shock

Table 2 Means, Standard Deviations (SD) and Correlations of All Variables

	Mean	S. D	Debt	Chronic Disease	Self-Treatment	Outpatient	Inpatient
Debt	1.183	3.296	1.0000				
Chronic disease	2.027	1.783	0.0164 (0.021)	1.0000			
Self-treatment	0.576	0.494	0.0311 (0.000)	0.2568 (0.000)	1.0000		
Outpatient	0.165	0.371	0.0285 (0.001)	0.1919 (0.000)	0.0929 (0.000)	1.0000	
Inpatient	0.168	0.374	-0.0009 (0.902)	0.2764 (0.000)	0.0692 (0.000)	0.1279 (0.000)	1.0000

Table 3 Regression Results of Chronic Disease, Self-Treatment, Healthcare Utilization and Debt Risk

	Cash Debt		Self-Treatment	Outpatient Care	Inpatient Care
	Model (1)	Model (3)	Model (2a)	Model (2b)	Model (2c)
Number of chronic disease	0.135*** (0.013)	0.108*** (0.014)	0.333*** (0.011)	0.256*** (0.011)	0.32*** (0.011)
Self-treatment		0.212*** (0.048)		0.293*** (0.043)	0.018 (0.044)
Outpatient care		0.144** (0.064)			0.542*** (0.05)
Inpatient care		0.124* (0.065)			
Age	-0.078*** (0.003)	-0.078*** (0.003)	0.003** (0.002)	-0.01*** (0.002)	0.026*** (0.002)
Married	-0.143** (0.071)	-0.148** (0.071)	0.135*** (0.047)	-0.054 (0.06)	-0.013 (0.058)
Edu	-0.071** (0.036)	-0.075** (0.036)	0.069*** (0.023)	0.0093*** (0.031)	-0.045 (0.032)
Male	0.369*** (0.05)	0.38*** (0.05)	-0.152*** (0.032)	-0.257*** (0.043)	0.097** (0.044)
UEMI	-0.416*** (0.123)	-0.432*** (0.123)	0.087 (0.079)	0.095 (0.107)	0.649*** (0.112)
URBMI	-0.026 (0.123)	-0.041 (0.123)	0.192** (0.079)	0.041 (0.107)	0.345*** (0.115)
URMI	-0.095 (0.156)	-0.114 (0.156)	0.259** (0.102)	-0.014 (0.136)	0.501*** (0.142)
NCM	0.179* (0.108)	0.165 (0.108)	0.162** (0.069)	0.056 (0.094)	0.402*** (0.101)
DiBao	0.219** (0.089)	0.209** (0.089)	0.091 (0.061)	-0.022 (0.074)	0.371*** (0.07)
Family doctor	0.181 (0.116)	0.173 (0.116)	-0.103 (0.076)	0.403*** (0.09)	0.167* (0.095)
Rural	0.016 (0.065)	0.015 (0.065)	0.03 (0.043)	0.038 (0.057)	-0.019 (0.059)
_cons	5.727*** (0.244)	5.664*** (0.244)	-0.902*** (0.158)	-1.896*** (0.211)	-4.494*** (0.223)

(Continued)

Table 3 (Continued).

	Cash Debt		Self-Treatment	Outpatient Care	Inpatient Care
	Model (1)	Model (3)	Model (2a)	Model (2b)	Model (2c)
Observations	19282	19281	19340	19340	19340
A-R ² /Pseudo R ²	0.058	0.059	0.054	0.046	0.098

Note: ***, **, and * represent significance levels of 1%, 5%, and 10%, respectively.

on cash debt decrease from 0.135 to 0.108, indicating that informal self-treatment, formal outpatient, and inpatient care utilization may mediate the impact of health shock on cash debt.

Table 4 presents the results of the mediation analysis. In step 2, the regression coefficients of health shock on self-treatment (path α_{11}), outpatient care (path α_{21}), and inpatient care (path α_{31}) are all significant. To further verify the mediating effects, the Sobel test was conducted. The results show that for path α_{11} , the Sobel statistic is $z = 4.437$ ($p < 0.001$), confirming a significant mediating effect of self-treatment. For path α_{21} , $z = 2.400$ ($p = 0.016$), indicating that outpatient care utilization also plays a significant mediating role. However, for path α_{31} , $z = 1.900$ ($p = 0.057$), the effect is not statistically significant, suggesting that inpatient care does not mediate the relationship between health shock and cash debt.

Table 5 reports the differential impact of health shocks on cash debt and the mediating roles of self-treatment and healthcare utilization across two age groups. Among middle-aged individuals under 60, neither outpatient nor inpatient care utilization mediates the association between health shocks and cash debt. Instead, self-treatment significantly increases debt risk. The Sobel test results confirm this mediating effect, with $z = 3.612$ ($p = 0.0003$). By contrast, the mediating effect of outpatient care is not significant ($z = 1.553$, $p = 0.120$), nor is that of inpatient care ($z = 0.924$, $p = 0.355$).

For elderly individuals over 60, neither outpatient nor inpatient care utilization mediates the relationship between health shocks and cash debt. Instead, self-treatment behavior emerges as a significant mediator. The Sobel test confirms

Table 4 Sobel Test Check Result of Health Shock on Cash Debt

Step	Total (n=19281)		
	β/λ	S. R	t
Step 1	$Y = 0.1352X$	0.0135	10.04***
Step 2	$M1 = 0.0702X$	0.0020	35.09***
	$M2 = 0.0394X$	0.0016	25.12***
	$+0.0338M1$	0.0055	6.17***
	$M3 = 0.0495X$	0.0016	31.68***
	$-0.0046M1$	0.0054	-0.86
	$+0.0817M2$	0.0071	11.57***
Step 3	$Y = 0.1077X$	0.0145	7.45***
	$+0.2121M1$	0.0485	4.37***
	$+0.1435M2$	0.0639	2.24*
	$+0.1237M3$	0.0650	1.90

Note: *** and * represent significance levels of 1% and 10%, respectively.

Table 5 Sobel Test Check Result of Health Shock on Cash Debt by Different Age Group

Step	Middle-Aged People (age<60, n=8573)			Elderly People (age≥60, n=10,708)		
	β/λ	S.R	t	β/λ	S.R	t
Step 1	Y=0.2505X	0.0277	9.04***	Y= 0.0631X	0.0123	5.12***
Step 2	M1=0.083X	0.0032	25.29***	M1=0.062X	0.0025	24.51***
	M2=0.046X	0.0026	17.95***	M2=0.0358X	0.0020	18.07***
	+0.053M1	0.0082	6.45***	+0.0169M1	0.0074	2.30***
	M3=0.047X	0.0022	20.96***	M3=0.0514X	0.0021	23.91***
	−0.010M1	0.007	−1.45	+0.0013M1	0.0079	0.17
	+0.0655M2	0.0092	7.07***	+0.0939M2	0.0103	9.08***
Step 3	Y=0.208X	0.0299	6.94***	Y=0.0488X	0.0132	3.70***
	+0.3227M1	0.091	3.55***	+0.0943M1	0.0471	2.00*
	+0.1785M2	0.1203	1.48	+0.0597M2	0.0621	0.96
	+0.1294M3	0.1399	0.93	+0.1129M3	0.0578	1.95

Note: *** and * represent significance levels of 1% and 10%, respectively.

this effect, with $z = 2.023$ ($p = 0.043$), indicating statistical significance. By contrast, the mediating effects of outpatient care ($z = 1.134$, $p = 0.257$) and inpatient care ($z = 1.948$, $p = 0.051$) are not statistically significant.

The percentage of total effect of health shocks on cash debt, as well as the mediating influence of self-treatment, outpatient care, and inpatient care utilization, were further quantified.

(1) The overall percentage of health shock's total effect on cash debt across the entire sample is 13.51%. This percentage varies significantly across age groups: it stands at 25.05% for individuals under 60, and notably lower at 6.31% for those aged 60 and above. These results indicate that the impact of health shocks on cash debt is considerably stronger for middle-aged individuals than for the elderly.

(2) Within the complete sample, informal self-treatment and outpatient care serve as partial mediators in the relationship between health shock and cash debt. Informal self-treatment contributes to 11.26% of the total effect, while outpatient care contributes 5.05%. Importantly, the mediating effect of informal self-treatment outweighs that of formal outpatient care. Among both middle-aged individuals under 60 and the elderly over 60, only informal self-treatment demonstrates a partial mediation effect, constituting 11.03% and 9.40% of the total effect, respectively. It's noteworthy that for middle-aged individuals under 60, not only is there a heightened risk of debt due to health shocks, but also the mediating impact of informal self-treatment surpasses that of the elderly over 60.

Discussion

This study examines the relationship between health shocks, debt risk, and healthcare utilization patterns among middle-aged and elderly individuals in China. The findings indicate that chronic diseases and multimorbidity are strongly associated with increased cash debt risk and that healthcare utilization patterns—particularly informal self-treatment—play a crucial mediating role in this relationship. These findings are broadly consistent with existing international evidence showing that health shocks substantially increase households' financial vulnerability and indebtedness. Studies from high-income countries, such as the United States and European nations, have documented that the onset of chronic diseases is associated with higher medical expenditures, income loss, and a greater likelihood of medical debt.^{34,35} Similarly, evidence from low- and middle-income countries suggests that health shocks often lead households to rely on borrowing—both formal and informal—to finance healthcare costs, thereby increasing long-term debt

risk.^{10,36,37} Our results corroborate these findings by demonstrating a positive association between health shocks and household debt risk in the Chinese context.

While prior research has primarily focused on short-term financial outcomes such as catastrophic health expenditure, less attention has been paid to the behavioral pathways linking health shocks to longer-term debt risk. This study reveals the mediating role of self-treatment behavior in the link between multimorbidity and debt risk. Specifically, health shocks, defined here as the accumulation of chronic diseases, are closely associated with increasing health complexity. This complexity not only heightens the demand for formal outpatient and inpatient care but also fosters greater reliance on informal self-treatment. This reliance may be shaped by two systemic factors. First, China's medical insurance system continues to place greater emphasis on inpatient expense reimbursement than on outpatient coverage. Existing studies have shown that although recent policy reforms have expanded outpatient reimbursement, the overall reimbursement structure remains inpatient-oriented.^{38,39} The system provides limited financial protection for the outpatient-centered healthcare needs of individuals with multimorbidity, including long-term treatment, chronic disease management, and health promotion.^{39,40} Second, China has not yet established unified and effective management strategies for multimorbidity. The management of multiple chronic conditions typically requires long-term treatment planning, continuous follow-up, and coordinated care across providers. However, the lack of integrated management frameworks for complex chronic diseases, together with fragmented information systems across healthcare institutions, constrains physicians' ability to deliver sustained medical guidance and to monitor patients' long-term treatment trajectories.⁴¹ These systemic constraints may further interact with patient-level factors. Prior studies have suggested relatively high rates of non-adherence among individuals with chronic diseases, particularly in developing country contexts,^{42,43} where barriers such as time constraints, geographic distance, transportation difficulties, and financial limitations frequently impede regular follow-up and medical consultations.⁴⁴ Under such conditions, individuals experiencing health shocks, especially those with multimorbidity, may increasingly resort to self-treatment as a coping strategy.

The findings also reveal notable age-related differences. Middle-aged individuals exhibit a significantly higher vulnerability to debt risk compared with older adults. This may be due to differences in labor market attachment, household financial responsibilities, and social security among different age groups. This finding is consistent with previous studies indicating that middle-aged individuals who remain active in the labor market are more likely to experience financial strain following health shocks than retired older adults.^{45,46} Middle-aged individuals are more likely to be actively engaged in the labor market and to shoulder substantial family obligations, including housing costs, child education, and intergenerational support. Consequently, health shocks that disrupt labor market participation or increase medical spending may translate more directly into income loss and borrowing needs for this group.^{47,48} In contrast, older adults who have exited the labor market may be relatively buffered against the economic consequences of health shocks by more stable income sources such as pensions and accumulated wealth.^{49,50}

Despite the valuable insights provided by this study regarding the mediating role of multimorbidity and self-treatment in the relationship between health shocks and cash debt risk, two limitations merit consideration. Firstly, the assessment of health shocks relies on self-reported chronic diseases, potentially introducing bias by overlooking acute or infectious diseases. Secondly, the study solely focuses on personal cash debt, excluding credit card debt and loans. Future research incorporating more objective parameters and additional influencing factors will yield a deeper understanding of the complex interplay among health shocks, healthcare utilization patterns, and financial risk. Moreover, given the cross-sectional nature of this study, prospective research is warranted to establish causality and validate the findings presented herein.

Conclusions

This study demonstrates that chronic diseases and multimorbidity are significant predictors of cash debt risk among middle-aged and elderly populations in China. Health shocks are positively associated with cash debt, and individuals with a heavier burden of chronic conditions—particularly those in middle age—face an elevated risk. Moreover, informal self-treatment emerges as a crucial mediator in the relationship between health shocks and cash debt risk, whereas formal healthcare utilization demonstrates no significant mediating effect.

The findings of this paper have important policy implications. First, it is essential to regulate informal self-treatment by expanding outpatient reimbursement and improving the affordability and accessibility of medicines. Second, strengthening the integration of formal healthcare delivery is crucial. This includes improving coordination across primary care, outpatient, and inpatient services, as well as enhancing the service capacity of primary healthcare institutions to better meet the complex needs of individuals with multimorbidity. Third, there is a pressing need to establish unified and effective management strategies for multimorbidity. Such strategies should emphasize long-term care planning, continuous follow-up, and coordinated management across healthcare providers. These improvements can provide patients—especially those with multimorbidity—with more reliable and continuous care, thereby reducing reliance on self-treatment and preventing long-term debt risks.

Abbreviations

CHARLS, China Health and Retirement Longitudinal Study; UEMI, Urban Employees Medical Insurance; URMI, Urban Residents Medical Insurance; URBMI, Urban Resident Basic Medical Insurance; NCM, New Cooperative Medical System.

Ethics Approval and Consent to Participate

All CHARLS surveys received ethical approval from the Institutional Review Board of Peking University (IRB00001052-11015), and all respondents provided written informed consent at the time of data collection. In accordance with the “Measures for Ethical Review of Life Science and Medical Research Involving Human Subjects” (February 18, 2023), this secondary data analysis meets the criteria for ethical exemption under item [1 or 2] of Article 32. Consequently, additional ethical approval from the authors’ institution was not required.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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