

ORIGINAL RESEARCH ARTICLE

Out-of-pocket medical expenditures, remittances and health outcomes in China

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Hewei Li¹, Xuehui Zhang², Fengyi Ma^{3*} and Romanus Osabohien^{4,5*}

Science and Technology Department, Guilin Medical University, Guilin 541004, China¹; School of Electronic Information and Automation, Guilin University of Aerospace Technology, Guilin 541004, China²; Department of Foreign Languages, Guilin Medical University, Guilin 541199, China³; Institute of Energy Policy and Research (IEPRE), Universiti Tenaga Nasional (UNITEN), Kajang, Malaysia⁴; DEPECOS Institutions and Development Research Centre (DlDeRC), Ota, Nigeria⁵

***For Correspondence:** Email: fengyima@163.com; romik247@gmail.com

Abstract

This study examines the relationship between out-of-pocket medical expenditures, remittances and health outcomes in China using Ordinary Least Squares (OLS) and Propensity Score Matching (PSM) methods. The analysis is based on data from the Global Financial Inclusion database by the World Bank (2021), encompassing a sample of 3,446 individuals. The results indicate that out-of-pocket expenditure has a negative impact on health outcomes, while remittance shows a positive association across all age groups, including reproductive and non-reproductive populations. These findings suggest that high out-of-pocket medical costs may hinder access to healthcare services and lead to poorer health outcomes. Conversely, remittance plays a beneficial role in improving health outcomes, highlighting the potential of financial support to positively impact the well-being of individuals. (*Afr J Reprod Health* 2024; 28 [8]: 122-132).

Keywords: : Healthcare management, healthcare services, financial barriers, remittances, health outcomes

Résumé

Cette étude examine la relation entre les dépenses médicales directes, les envois de fonds et les résultats de santé en Chine à l'aide des méthodes des moindres carrés ordinaires (OLS) et de l'appariement des scores de propension (PSM). L'analyse est basée sur les données de la base de données Global Financial Inclusion de la Banque mondiale (2021), portant sur un échantillon de 3 446 personnes. Les résultats indiquent que les dépenses directes ont un impact négatif sur les résultats en matière de santé, tandis que les envois de fonds montrent une association positive dans tous les groupes d'âge, y compris les populations reproductrices et non reproductrices. Ces résultats suggèrent que des frais médicaux élevés peuvent entraver l'accès aux services de santé et conduire à de moins bons résultats en matière de santé. À l'inverse, les envois de fonds jouent un rôle bénéfique dans l'amélioration des résultats en matière de santé, soulignant le potentiel du soutien financier à avoir un impact positif sur le bien-être des individus. (*Afr J Reprod Health* 2024; 28 [8]: 122-132).

Mots-clés: Gestion des soins de santé, services de santé, barrières financières, envois de fonds, résultats en matière de santé

Introduction

The interplay between healthcare financing, remittances, and health outcomes has become a critical area of research, particularly in developing and transitional economies. In China, rapid economic growth has been accompanied by significant changes in healthcare provision and financing, leading to increased out-of-pocket medical expenditures for many households¹⁻⁵. Simultaneously, internal and international migration has resulted in substantial remittance flows within the country and from abroad⁵. This study aims to

investigate the relationships between out-of-pocket medical expenditures, remittances and health outcomes in China, using data from the Global Financial Inclusion (Global Findex) (2021) database by the World Bank⁶.

Further, out-of-pocket medical expenditures have been a growing concern in developing countries⁷⁻¹¹, including China since the market-oriented reforms of the 1980s. Despite efforts to expand health insurance coverage, many Chinese households still face significant financial burdens when accessing healthcare services^{12,13}. These expenses can lead to catastrophic health

expenditures, potentially pushing families into poverty or deterring them from seeking necessary medical care^{14,8,1,15}. Remittances, both domestic and international, have emerged as important sources of income for many Chinese households. These financial transfers can potentially play a crucial role in healthcare financing, especially for rural and migrant families¹⁶. Previous studies have shown that remittances can increase healthcare spending and improve health outcomes in various developing countries^{17,18}. However, the specific impact of remittances on out-of-pocket medical expenditures and health outcomes in China remains understudied.

This research addresses this gap by examining how remittances influence healthcare spending and subsequent health outcomes in Chinese households. We employ two complementary methodological approaches: Ordinary Least Squares (OLS) regression and Propensity Score Matching (PSM). The OLS regression allows us to estimate the relationship between remittances, out-of-pocket medical expenditures, and health outcomes while controlling for various socioeconomic factors. The PSM technique helps address potential selection bias by comparing remittance-receiving households with similar non-receiving households, providing a more robust estimation of the impact of remittances¹⁹.

Our study contributes to the existing literature in several ways. First, it provides updated insights into the role of remittances in healthcare financing in China, using the most recent Global Findex data. Second, it examines both the direct effects of remittances on out-of-pocket medical expenditures and their indirect effects on health outcomes. Third, by employing PSM alongside OLS, we offer a more comprehensive and robust analysis of the relationships between these variables. We defined and operationalized health.

Methods

As a way of commencing the methodology, first, the data and source are described and how they collected. The Global Financial Inclusion (Global Findex) database, developed by the World Bank⁶,

provides extensive data on financial inclusion trends worldwide, including in China. Key indicators include account ownership, access to credit, savings and expenditure behaviour, digital payment usage, and financial literacy. The data is collected through nationally representative surveys targeting adults aged 15 and older across over 150 economies, ensuring diverse population representation⁶. Among the countries surveyed, this study focused on China.

The study focused on China due to its economic transformation, which has shifted from a centrally planned to a market-oriented system, leading to high out-of-pocket healthcare costs. The stark urban-rural disparities in healthcare access highlight the influence of socioeconomic factors. Additionally, the role of migrant workers and remittances offers insights into financial burdens on families. Ongoing healthcare reforms present opportunities for evidence-based policy development. Lastly, China's health challenges and solutions can provide valuable lessons for other nations, contributing to a broader understanding of the interplay between economic factors and health system dynamics.

The World Bank employs a rigorous methodology for data collection, utilising random sampling and standardized questionnaires to gather insights into individuals' financial behaviours. This process involves thorough data processing and analysis to ensure accuracy, with findings published in accessible reports⁶. The Global Findex database serves as a vital resource for policymakers, researchers, and practitioners. By analysing this data, stakeholders can identify gaps in financial service access and inform initiatives aimed at enhancing financial inclusion among underserved populations. The most recent data collection occurred in 2021, offering valuable insights into the state of financial inclusion and guiding efforts to improve access to financial services globally⁶. This study is interested in understanding the relationship between out-of-pocket medical expenditure, remittance, and health outcomes (see equation 1). To test the linear relationship among these series, we use the Ordinary Least Squares (OLS) regression as shown in equation (1).

$$\text{Age}_i = \vartheta + \gamma \text{OPMX}_i + \alpha \text{REM}_i + \psi X'_i + e \quad (1)$$

Dependent variable

From the model, the dependent variable is age (in years) is used as a proxy for health outcome, following the approach of several studies that consider longevity as an indicator of overall health status²⁰. In the study, age serves as a dependent variable to assess health outcomes, reflecting the cumulative effects of various health determinants over time. By analysing age-related health indicators, researchers can identify trends and patterns in morbidity and mortality associated with different age groups. Furthermore, age serves as a significant proxy for health outcomes due to various interconnected factors. As individuals age, they accumulate health experiences and exposures that can lead to chronic conditions, such as diabetes and heart disease, which are more prevalent in older populations.

The biological aging process also results in physiological changes, including reduced immune function and slower recovery from illnesses, increasing susceptibility to diseases. Also, access to healthcare often varies by age, with older adults typically utilising healthcare services more frequently, leading to better monitoring of their health. Lifestyle choices also correlate with age; younger individuals may engage in riskier behaviours, while older adults might adopt healthier habits due to increased health awareness. Social determinants of health, such as income and education, further intersect with age, influencing overall health outcomes. Mortality rates rise significantly with age, making it a crucial factor in studies of life expectancy. Overall, understanding the relationship between age and health can inform public health policies and interventions tailored to specific age groups, highlighting the importance of age as a valuable indicator in health assessments. While age alone may not capture all aspects of health, it provides a quantifiable measure that can reflect the cumulative effects of healthcare access and quality over time.

Independent variables

Two independent variables were included in the model. First, out-of-pocket medical expenditure (γOPMX_i) (measured as Yes (1) if the respondents save or borrow solely for medical purposes, 0 (No) otherwise). This variable represents the financial burden of healthcare on households. Higher out-of-pocket expenditures have been associated with reduced healthcare access and poorer health outcomes²¹. The second independent variable is remittances (αREM_i) (coded as 1 (Yes) if the respondents receive remittance from friend or relatives from abroad or domestic, and 0 (No) otherwise). Remittance can affect health outcomes by providing additional resources for healthcare spending and improving overall household welfare. Studies have shown positive associations between remittances and health outcomes in various contexts²².

Control variables

The control Variables ($\psi X'_i$) included in the model are - gender of the respondents (female =1, and Male =0); financial inclusion and income level of the household. In line with this, previous studies have posited that health outcomes and healthcare utilization often vary by gender due to biological differences and socio-cultural factors²³. Access to financial services can influence health outcomes by affecting the ability to save for healthcare needs and manage health-related financial risks²⁴. Similarly, income (measured by income level of the households, 1 if the households within the fourth 20% and the richest 20%, and 0 if the household is within the income group of poorest 20%, second 20% and middle 20%) is a well-established determinant of health outcomes, influencing access to healthcare, nutrition, and overall living conditions²⁵. Also, education (1 if the household head/respondents is educated, that is, completed secondary education or more and can read and write in English, and 0 they never went to school, or completed primary school and less, or cannot read and write in English).

Data analysis

Data for the study was obtained from the Global Financial Inclusion (Global Findex) database by World Bank⁶ for China and applied the OLS. The World Bank Global Financial Inclusion database provides a valuable resource for studying the relationship between out-of-pocket medical expenditure, remittances, and health outcomes in China. By using the data from this database, we analyse the extent of financial inclusion in China. Furthermore, through the data, we also explore how individuals in China manage their out-of-pocket medical expenses and whether remittances play a role in covering healthcare costs. Understanding the financial behaviours and challenges faced by individuals in China can provide insights into the impact of out-of-pocket medical expenditure on health outcomes and the role of remittances in mitigating financial burdens related to healthcare.

Consequently, the Ordinary Least Squares (OLS) regression was chosen for the analysis due to its ability to estimate the linear relationships between multiple independent variables and a continuous dependent variable. OLS provides easily interpretable coefficients and allows for the control of multiple factors simultaneously. To address these concerns, additional robustness checks estimation methods was conducted using the propensity score matching (PSM). PSM is a statistical technique used to estimate the effect of a treatment (in this case, receiving remittances and out-of-pocket health expenditure) on health outcomes by accounting for the covariates that predict receiving the remittance.

PSM helps reduce selection bias and allows for a more robust estimation of the causal effect of remittances and out-of-pocket expenditure on health outcomes. The rationale for using the PSM is that households receiving remittances may differ systematically from those that do not. PSM helps create a matched comparison group, reducing potential bias²⁶. PSM allows for a closer approximation of causal effects by comparing outcomes between receiving and non-receiving categories²⁷.

While OLS provides insights into linear relationships, PSM offers a way to estimate

treatment effects that does not rely on linearity assumptions²⁸. Using both OLS and PSM provides a more comprehensive analysis and serves as a robustness check for the findings²⁹. The PSM is used to estimate the impact of a treatment (the receipt of remittance and out-of-pocket expenditure) for respondent i , noted δ_i , described as the variation among the anticipated outcome, when there is a treatment and the anticipated outcome the treatment is unavailable, shown in equation (2).

$$\delta_i = Y_0 - Y_1 \quad (2)$$

The PSM is designed to quantify the average impact by determining the mean effect for every individual within the entire population²⁶. This measure is commonly known as the Average Treatment Effect (ATE), which is mathematically represented in equation (3).

$$ATE = E(\delta) - E(Y_0 - Y_1) \quad (3)$$

The notation $E(.)$ in the equation denotes the expected value. Furthermore, this study also seeks to analyse the Average Treatment Effect on the Treated (ATT). This parameter assesses the program's influence exclusively on the individuals who took part in it, as formulated in equation (4).

$$ATT = E(Y_1 - Y_0 | D = 1) \quad (4)$$

The Average Treatment Effect on the Untreated (ATU) measures the effect of remittances on household would have had on those who did not receive as displayed in equation (5)

$$ATU = E(Y_1 - Y_0 | D = 0) \quad (5)$$

One of the main issues associated with impact models is that all of these parameters are unobservable, because, they rely on the untreated groups. For example, using the fact that the average of a difference is the difference of the averages, the ATT may be shown in equation (9)

$$ATT = E(Y_1 | D = 1) - E(Y_0 | D = 1) \quad (6)$$

The ATT is the difference between expected outcome values with and without treatment for those engaged in treatment.

Ethical consideration

The study made use of no human or animal subjects, therefore, ethical approval not required.

Results

Summary statistics

The summary statistics (see Table 1) offer valuable insights into the demographic and socio-economic characteristics of households in relation to remittances, income group, financial inclusion, and education levels across different age groups. These statistics shed light on the disparities and trends within these categories, providing a deeper understanding of the dynamics at play.

The summary statistics provide insights into the age distribution of the study population, covering a wide range from 15 to 87 years. The overall sample has a mean age of 35.5 years with a standard deviation of 11.8 years, indicating considerable variation. The population is divided into reproductive (15-49 years) and non-reproductive (50+ years) age groups. The reproductive age group has a lower mean age of 31.893 years and a standard deviation of 8.1 years, while the non-reproductive group has a higher mean age of 56.6 years and a smaller standard deviation of 7.1 years.

The analysis compares the mean and standard deviation values of remittances, reproductive age individuals, and non-productive individuals within households. The mean remittance value is 0.4 with a standard deviation of 0.4, indicating on average, 37.1% received household with relatively high variability. The mean proportion of reproductive age individuals is 0.4 with a standard deviation of 0.5, showing moderate variability around the average. Non-productive individuals have a mean proportion of 0.3 with a standard deviation of 0.4, indicating lower variability compared to remittances and reproductive age. The data indicates that a higher proportion of reproductive age households receive remittances compared to non-reproductive age households.

The mean value for receiving remittances is 0.4 for total households, 0.4 for reproductive age households, and 0.2 for non-reproductive age

households. The results reveal differences in income distribution among households of varying age groups. The mean value for belonging to the wealthiest 20% or fourth 20% income group is 0.5 for total households, 0.5 for reproductive age households, and 0.4 for non-reproductive age households. This indicates that a higher percentage of reproductive age households belong to the wealthier income groups compared to non-reproductive age households.

Moreover, the data highlights the level of financial inclusion among different age groups. The mean value for having a financial account is 0.8 for total households, 0.9 for reproductive age households, and 0.7 for non-reproductive age households. Lastly, the statistics provide insights into the educational attainment of households across different age groups. The mean value for having secondary school education or higher is 0.2 for total households, 0.2 for reproductive age households, and 0.4 for non-reproductive age households.

Result from the Ordinary Least Squares analysis

The Ordinary Least Squares (OLS) regression results (see Table 2) provide valuable insights into the relationship between various factors and health outcomes, as indicated by age, across different household age groups. Let's interpret and discuss the results based on the coefficients and constant values provided:

The negative coefficient for out-of-pocket expenditure (-1.5) for total households, -0.2 for reproductive age, and -0.6 for non-reproductive age) suggests that higher levels of spending on medical purposes through savings or borrowing are associated with lower health outcomes in terms of age. The positive coefficients for remittances (5.3 for total households, 3.0 for reproductive age, and 1.2 for non-reproductive age) suggest that receiving remittances is associated with better health outcomes in terms of age. The positive coefficients for gender (1.2 for total households, 1.7 for reproductive age, and 1.7 for non-reproductive age) indicate that being female is associated with better health outcomes in terms of age.

Table 1: Summary statistics of variables

Variable	All Age group			Reproductive Age			Non-Reproductive Age		
	Mean	Std. Dev.	Min/Max	Mean	Std. Dev.	Min/max	Mean	Std. Dev.	Min/max
Age	35.455	11.798	15/87	31.893	8.135	15/49	56.58	7.111	50/87
Remittance	0.371	0.4831	0/1	0.4011	0.490	0/1	0.187	0.390	0/1
Gender	0.469	0.499	0/1	0.48592	0.499	0/1	0.3762	0.484	0/1
Income Group	0.482	0.499	0/1	0.4944	0.500	0/1	0.4064	0.491	0/1
Financial inclusion	0.853	0.354	0/1	0.8786	0.326	0/1	0.7042	0.456	0/1
Education	0.195	0.39658	0/1	0.1597	0.3664	0/1	0.4004	0.490	0/1
Observation	3,446			2,949			497		

Table 2: OLS regression

	Total Household			Reproductive Age			Non-Reproductive age		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
age									
OPX	-1.457**	0.714	0.042	-0.149*	0.552	0.787	-0.561**	1.003	0.576
REM	5.325***	0.404	0.000	3.017***	0.301	0.000	1.230	0.754	0.104
Gender	1.158***	0.391	0.003	1.728**	0.296	0.014	1.739***	0.628	0.006
YL	1.668***	0.393	0.000	1.110***	0.296	0.000	1.135*1	0.630	0.072
FIN	2.402***	0.5228	0.000	2.030***	0.418	0.000	3.910***	0.674	0.000
Cons	25.828***	1.759	0.000	31.29***	1.343	0.000	47.974***	2.767	0.000
R ²	0.289			0.2453			0.4006		
Aj. R ²	0.276			0.2436			0.4914		
Prob	0.0000			0.0000			0.0000		
Obs.	3446			2,949			497		

Source: Authors' computation

Table 3: Impact of Remittance of Health Outcome: PSM Analysis

Sample	Treated	Controls	Difference	S.E.	T-stat
Unmatched	31.8902821	37.5511521	-5.66086994	0.40495581	-13.98
ATT	31.8902821	38.7484326	-6.85815047	6.57165737	-2.04
ATU	37.5511521	28.0599078	-9.49124424		
ATE			-8.51625073		
Within the Reproductive Age (15 -49 years)					
Sample	Treated	Controls	Difference	S.E.	T-stat
Unmatched	30.0676247	33.1166478	-3.04902311	.300504151	-10.15
ATT	30.0676247	36.6348267	-6.56720203	3.06315685	-2.14
ATU	33.1166478	27.5770102	-5.5396376		
ATE			-5.95184808		
Others					
Sample	Treated	Controls	Difference	S.E.	T-stat
Unmatched	55.0752688	56.9356436	-1.86037475	.814458239	2.28
ATT	55.0752688	55.311828	-.23655914	2.39801027	2.10
ATU	56.9356436	54.8589109	-2.07673267		
ATE			-1.73239437		

Source: Authors computation

Table 4: Impact of out-of-pocket expenditure on health outcome: PSM

All Household					
Sample	Treated	Controls	Difference	S.E.	T-stat
ATT	31.8902821	37.5511521	-5.66086994	.40495581	-13.98
ATU	31.8980392	44.545098	-12.6470588	6.65691146	-1.90
ATE	37.5511521	25.4774194	-12.0737327	.	
			-12.2859216		
Within the Reproductive Age					
Sample	Treated	Controls	Difference	S.E.	T-stat
ATT	30.0676247	33.1166478	-3.04902311	.300504151	-10.15
ATU	30.0744501	37.0786802	-7.00423012	2.77604947	-2.52
ATE	33.1166478	25.6528879	-7.46375991		
			-7.27951153		
Others					
Sample	Treated	Controls	Difference	S.E.	T-stat
ATT	55.0752688	56.9356436	-1.86037475	.814458239	2.28
ATU	55.0752688	55.4086022	-.333333333	3.61504582	0.09
ATE	56.942928	54.3746898	-2.56823821		
			-2.14919355		

Source: Author's computation

The positive coefficients for income level (2.4 for total households, 2.0 for reproductive age, and 3.910 for non-reproductive age) suggest that higher income levels are associated with better health outcomes in terms of age. The positive coefficients for financial inclusion (2.4 for total households, 2.0 for reproductive age, and 3.910 for non-reproductive age) suggest that having access to financial services is associated with better health outcomes in terms of age. The constant values (25.8 for total households, 31.3 for reproductive age, and 47.9 for non-reproductive age) represent the baseline health outcome in terms of age when all other independent variables are zero. These constants provide a reference point for understanding the impact of the independent variables on health outcomes. The R-square values (0.3 for total households, 0.2 for reproductive age, and 0.4 for non-reproductive age) indicate the proportion of variance in health outcomes explained by the independent variables in the regression model.

Impact of remittance on health outcome: Propensity score matching

Propensity Score Matching (PSM) analysis is a widely used method to estimate causal effects in

observational studies by matching treated and untreated individuals based on their propensity scores. In this study, PSM was employed to examine the impact of remittances on health outcomes across three age groups: total household, reproductive age, and non-reproductive age. The results of the PSM analysis revealed interesting findings regarding the relationship between remittances and health outcomes in different age groups.

In the total household group, households receiving remittances were found to have, on average, lower health outcomes compared to those not receiving remittances. This negative effect was quantified through the Average Treatment Effect on the Treated (ATT) value, which indicated a decrease in health outcomes of 6.9 units for remittance-receiving households. The Average Treatment Effect on the Untreated (ATU) value suggested that if households not receiving remittances were to start receiving them, their health outcomes could potentially improve by 9.5 units. When focusing on the reproductive age group, individuals receiving remittances were found to have lower health outcomes compared to those not receiving remittances. The Average Treatment Effect (ATE) value in this group indicated a decrease in health

outcomes of 5.9 units for individuals receiving remittances. In contrast, the non-reproductive age group showed minimal differences in health outcomes between individuals receiving remittances and those not receiving them.

Impact of out-of-pocket expenditure on health outcome: propensity score matching

The results of the analysis revealed interesting insights into the relationship between out-of-pocket expenditure and health outcomes. The Average Treatment Effect on the Treated (ATT) and Average Treatment Effect on the Untreated (ATU) were calculated for different subgroups, including the total household sample, reproductive-age individuals, and the "others" subgroup. For the total household sample, the ATT was found to be 31.8 for the treated group and 37.6 for the control group, resulting in a difference of -5.7.

The statistical significance of the t-statistic (-13.98) suggests that this difference is not due to random chance but reflects a meaningful relationship between out-of-pocket expenditure and health outcomes. Similarly, among reproductive-age individuals, the analysis showed an ATT of 30.7 for the treated group and 33.1 for the control group, resulting in a difference of -3.1. The statistical significance of the t-statistic (-10.2) further supports this finding. In contrast, for the "others" subgroup, the analysis revealed a smaller difference in health outcomes between individuals with higher and lower out-of-pocket expenditures. The ATT was 55.1 for the treated group and 56.9 for the control group, resulting in a difference of -1.9. The non-significant t-statistic (2.3) indicates that this difference is likely due to random variation rather than a meaningful relationship between out-of-pocket expenditure and health outcomes in this subgroup.

Discussion

One of the significant findings is the negative association between out-of-pocket expenditure and health outcomes in terms of age. The coefficients indicate that higher levels of spending on medical expenses through savings or borrowing are linked to poorer health outcomes, suggesting that financial

constraints may hinder access to quality healthcare services and impact overall well-being, in line with the findings of Saksena³⁰. This underscores the importance of addressing financial barriers to healthcare access to improve health outcomes, particularly among households facing economic challenges.

Conversely, the positive coefficients for remittances highlight the beneficial impact of receiving remittances on health outcomes based on age similar to Feng *et al.*³¹ and Hao *et al.*³² The results suggest that households receiving remittances exhibit better health outcomes, possibly due to increased financial resources for healthcare expenses, improved living standards, and enhanced social support networks. This finding underscores the potential role of external financial support in promoting health and well-being within households, especially in resource-constrained settings.

Moreover, the positive coefficients for gender indicate that being female is associated with better health outcomes in terms of age. This gender-related finding underscores the importance of considering gender disparities in healthcare access, utilization, and health outcomes. Factors such as differential health-seeking behaviour, social support networks, and cultural norms may contribute to the observed differences in health outcomes based on gender, highlighting the need for gender-sensitive health interventions and policies.

The positive association between income level and health outcomes further underscores the critical role of socio-economic status in shaping health disparities, akin to the finding by Nasir *et al.*¹. The coefficients suggest that higher income levels are linked to better health outcomes across different household age groups, reflecting the potential impact of financial resources on healthcare access, treatment adherence, and lifestyle choices. Addressing income inequalities and improving economic opportunities for vulnerable populations may help reduce health inequities and enhance overall health outcomes within communities.

Additionally, the positive coefficients for financial inclusion highlight the importance of access to financial services in promoting better health outcomes based on age. Financial inclusion

can facilitate healthcare financing, risk protection, and savings for future medical expenses, thereby improving health outcomes and reducing financial barriers to healthcare access. Enhancing financial literacy, expanding access to affordable insurance products, and promoting savings mechanisms could contribute to improved health outcomes among households with limited financial resources.

The constant values in the regression model provide a baseline reference point for understanding health outcomes in terms of age when all other factors are held constant. These constants represent the average health status within each household age group and serve as a benchmark for evaluating the impact of independent variables on health outcomes. By comparing the constant values with the coefficients of other factors, researchers can assess the relative importance of each determinant in influencing health outcomes across different age groups.

Furthermore, the R-square values indicate the proportion of variance in health outcomes explained by the independent variables included in the regression model. A higher R-square value suggests that the model can better predict health outcomes based on the selected factors, highlighting the relevance and significance of the included variables in explaining variations in health status across household age groups. Understanding the factors contributing to health disparities and predicting health outcomes based on socio-economic determinants can inform evidence-based policy decisions and interventions aimed at improving population health and well-being.

In conclusion, the OLS regression results offer valuable insights into the complex interplay between household factors and health outcomes based on age. By examining the coefficients, constant values, R-square values, and their implications, researchers can identify key determinants of health disparities, assess the impact of socio-economic factors on health status, and inform targeted interventions to address inequalities and promote better health outcomes within diverse population groups. Policymakers, healthcare providers, and stakeholders can leverage these findings to develop tailored strategies that address

financial barriers, enhance social support networks, and improve healthcare access for vulnerable populations, ultimately contributing to improved health outcomes and well-being across communities.

This study also used the Propensity Score Matching (PSM) analysis to investigate the impact of remittances on health outcomes across different age groups within households in low- and middle-income countries. Research on the relationship between remittances and health outcomes in low- and middle-income countries has produced mixed findings. Some studies suggest that remittances have a positive impact on health outcomes by increasing household income and improving access to healthcare and nutrition. On the other hand, some studies indicate negative effects of remittances on health outcomes. For instance, a study by Adams and Cuecuecha²² found that remittances were associated with a decrease in the likelihood of seeking formal healthcare services in Mexico. This could be attributed to the reliance on remittances as a source of income, leading to a disincentive for seeking formal employment with health benefits. Understanding the age-specific dynamics of the relationship between remittances and health outcomes is crucial for designing targeted interventions. For reproductive age individuals, focusing on maternal and child health programs could help mitigate any negative impacts of remittances on health outcomes. On the other hand, promoting economic empowerment and encouraging health-related investments may be more effective for non-reproductive age individuals.

Strengths and limitations

The strength of the study is that it used a robust analytical techniques and reliable data sources. It examined the impact of out of pocket expenditure and remittance on health outcome across age groups. It also provides a comprehensive understanding of the impact on different demographic groups and addresses financial barriers to healthcare access. On the other hand, one of the weakness is hinged on the fact that age alone may not capture all aspects of health, it provides a quantifiable measure that can

reflect the cumulative effects of healthcare access and quality over time. Further research is needed to explore the underlying mechanisms driving these associations and to identify potential pathways through which remittances may influence health outcomes in different age groups.

Conclusion

This study focused on out-of-pocket medical expenditure in China shed light on the significant financial burden faced by individuals and families when seeking healthcare services. Through robust analysis techniques and reliable data sources, the study examines the impact of medical expenses on different demographic groups, revealing disparities in expenditure patterns and identifying financial barriers to healthcare access. However, there are limitations in data quality, analysis techniques, and generalizability. The findings of the study underscore the importance of addressing out-of-pocket medical expenditure as a key factor influencing healthcare access and equity in China. The study highlights the need for policy interventions to reduce financial burdens on individuals and promote affordable and accessible healthcare services.

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References

- Nasir M H, Anser M K, Ahuru R Asner, Osabohien R, Ebiaku K C and Abbas S. A comparative study of the effect of health insurance on women's use of health facility delivery: Evidence from demographic health survey in Benin Republic. *African Journal of Reproductive Health*, 2022, 26(6), 104-15.
- Yip W, Fu H, Chen A T, Zhai T, Jian W, Xu R and Mao W. 10 years of health-care reform in China: progress and gaps in universal health coverage. *The Lancet*, 2019, 394(10204), 1192-1204.
- Zhou D, Ahuru R Biak, Yan M, Osabohien R and Jakovljevic M. Influences of women empowerment indices on demand for childcare services: Evidence from the Nigeria Demographic and Health Surveys. *African Journal of Reproductive Health*. 2023, 27(10), 65-80.
- Wang L, Nwabuoku M, Zhang J and Osabohien R. Gender disparity in access to education, under-5 mortality, and economic growth in sub-Saharan Africa. *African Journal of Reproductive Health*, 2023, 27(12), 27-35.
- Zhang X, Anser M K, Ahuru R R, Zhang Z, Peng M Y, Osabohien R and Mirza M. Do predictors of health facility delivery among reproductive-age women differ by health insurance enrolment? A multi-level analysis of Nigeria's data. *Frontiers in Public Health*. 2022, 10:797272.
- World Bank. Global Financial Inclusion (Global Findex) Database 2021. <https://microdata.worldbank.org/index.php/catalog/4627>
- Azuh DE, Osabohien R, Orbih M and Godwin A. Public health expenditure and under-five mortality in Nigeria: An overview for policy intervention. *Open Access Macedonian Journal of Medical Sciences*. 2020, 8(E), 353-62.
- Matthew O, Osabohien R, Olawande T and Urhie E. Manufacturing industries and construction emissions in Nigeria: Examining the effects on health conditions. *International Journal of Civil Engineering and Technology*, 2019, 10(1), 2401-2414.
- Jakovljevic M, Liu Y, Cerda A, Simonyan M, Correia T, Mariita RM, Kumara AS, Garcia L, Krstic K, Osabohien R and Toan T K. The Global South political economy of health financing and spending landscape—history and presence. *Journal of medical economics*. 2021, 24(sup1), 25-33. <https://doi.org/10.1080/13696998.2021.2007691>
- Sui Y, Ahuru R R, Huang K, Anser M K and Osabohien R. Household socioeconomic status and antenatal care utilization among women in the reproductive-age. *Frontiers in Public Health*, 2022, 9:724337. <https://doi.org/10.3389/fpubh.2021.724337>
- Urhie E, Afolabi A, Afolabi A, Matthew O, Osabohien R and Ewetan O. Economic growth, air pollution and health outcomes in Nigeria: A moderated mediation model. *Cogent Social Sciences*, 2020, 6(1), 1719570. <https://doi.org/10.1080/23311886.2020.1719570>
- Liu G G, Vortherms SA and Hong X. China's health reform update. *Annual Review of Public Health*, 2017, 38, 431-448.
- Ai1 W, Aderemi TA, Bassey R and Khalid AA. Out-of-pocket expenditure and maternal mortality nexus in China: Implications for the Sustainable Development Goal 3. *African Journal of Reproductive Health*, 2033, 27(12):94-100
- Matthew O A, Osabohien R, Fagbemiiniyi F and Fasina A. Greenhouse gas emissions and health outcomes in Nigeria: Empirical insight from auto-regressive distribution lag technique. *International Journal of Energy Economics and Policy*, 2018, 8(3), 43-50.

15. Xu K, Soucat A, Kutzin J, Brindley C, Maele N V, Touré H and Siroka A. Public spending on health: A closer look at global trends. *World Health Organization*, 2018.
16. Démurger S, and Wang X. Remittances and expenditure patterns of the left behinds in rural China. *China Economic Review*, 2016, 37, 177-190.
17. Amuedo-Dorantes C and Pozo S. New evidence on the role of remittances on healthcare expenditures by Mexican households. *Review of Economics of the Household*, 2011, 9(1), 69-98.
18. Valero-Gil J N. Remittances and the household's expenditures on health. *Journal of Business Strategies*, 2009, 26(1), 119-140.
19. Rosenbaum PR and Rubin DB. The central role of the propensity score in observational studies for causal effects. *Biometrika*, 1983, 70(1), 41-55.
20. Bloom DE, Canning D and Sevilla J. The effect of health on economic growth: A production function approach. *World Development*, 2004, 32(1), 1-13.
21. Xu K, Evans DB, Kawabata K, Zeramardini R, Klavus J and Murray C J. Household catastrophic health expenditure: a multicountry analysis. *The Lancet*, 2003, 362(9378), 111-117.
22. Adams RH and Cuecuecha A. The impact of remittances on investment and poverty in Ghana. *World Development*, 2013, 50, 24-40.
23. Vlassoff C. Gender differences in determinants and consequences of health and illness. *Journal of Health, Population, and Nutrition*, 2007, 25(1), 47-61.
24. Dupas P and Robinson J. Why don't the poor save more? Evidence from health savings experiments. *American Economic Review*, 2013, 103(4), 1138-71.
25. Deaton A. Health, inequality, and economic development. *Journal of Economic Literature*, 2003, 41(1), 113-158.
26. Rosenbaum PR and Rubin DB. The central role of the propensity score in observational studies for causal effects. *Biometrika*, 1983, 70(1), 41-55.
27. Caliendo M and Kopeinig S. Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys*, 2008, 22(1), 31-72.
28. Dehejia RH and Wahba S. Propensity score-matching methods for nonexperimental causal studies. *Review of Economics and Statistics*, 2002, 84(1), 151-161.
29. Amuedo-Dorantes C and Pozo S. New evidence on the role of remittances on healthcare expenditures by Mexican households. *Review of Economics of the Household*, 2011, 9(1), 69-98.
30. Saksena P. Out-of-pocket spending on health: a global overview. *World Health Organization*, 2017.
31. Feng Y, Ahuru R R, Anser M K, Osabohien R, Ahmad M and Efegber A H. Household economic wealth management and antenatal care utilization among business women in the reproductive-age. *African Journal of Reproductive Health*. 2021, 25(6), 143-54
32. Hao S, Yang H, Bi R, Akinbode SO and Aderemi TA. Effects of remittances on life expectancy and under-five mortality in sub-Saharan Africa: Evidence using Generalized Method of Moments analysis. *African Journal of Reproductive Health*, 2023, 27 (10), 87-98.