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Protecting Poor Rural Households from Health Shocks: Poverty Alleviation Practices in Chongqing, China

Qianqian Zhang [1], Tao Li [2], Xiongwei Tan [3] and Jianzhong Yan [1,*]

[1] College of Resources and Environment, Southwest University, Chongqing 400715, China; qian8422@email.swu.edu.cn
[2] School of Geographical Sciences, Southwest University, Chongqing 400715, China; litao28332@swu.edu.cn
[3] College of Economics and Management, Southwest University, Chongqing 400715, China
* Correspondence: yanjzswu@126.com; Tel.: +86-150-8668-6708

Abstract: In certain low- and middle-income countries, information asymmetry, human capital damage and long-term economic decline are longstanding problems in health-related poverty alleviation. Notably, China's Targeted Poverty Alleviation program sheds new light on resolving these problems. Based on existing paradigms in the poverty research area, the purpose of this paper is to summarize and explore the roles of Chinese support policies in poor rural households coping with health shocks. Using a questionnaire survey of 4635 poor rural households in a municipality in Southwest China conducted from December 2018 to January 2019, this study examines the relationships between health shocks, human capital, support policies, and per capita household income. The results show that (1) apart from safety nets and cargo nets, monitoring nets are formed in China's poverty alleviation practice, which could resolve the problem of information asymmetry. (2) Health shocks do not cause poor rural households to fall back into poverty. The reason for this is that safety net and cargo net policies are provided to relevant poor rural households by considering household human capital endowments and the information received from cargo nets. Through this method, patients can obtain effective support and caregivers can obtain off-farm employment opportunities. Thus, the ability of poor rural household human capital to resist health shocks is enhanced. (3) With the support of these policies, the negative effects of dependent family members and agricultural laborers on per capita household income are reversed. Thus, the long-term increase in poor rural household income is also ensured. These findings hold great value for other developing countries coping with health shocks and formulating anti-poverty policies.

Keywords: human capital; policy intervention; health shocks; long-term income increase; targeted policy support

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1. Introduction

Eradicating poverty is not only the first of the United Nations Sustainable Development Goals [1], but also a paramount objective for pursuing equitable and sustainable development worldwide [2]. Poverty and health are intertwined. Before the COVID-19 pandemic, each year close to 100 million people were pushed into extreme poverty because they had to pay for health expenses out of their own pockets [3]. The fallout from the pandemic threatens to push over 70 million people into extreme poverty [4]. Meanwhile, the social insurance system is inadequate, especially in low- and middle-income countries [5]. The World Health Organization noted that the government covers nearly 70% of health care spending in high-income countries, while the value is approximately 30% in low-income countries [6]. At the current rates of progress, up to 5 billion people will lack health care in 2030 [7]. The inefficient social insurance system is difficult to improve in the short term. Therefore, enhancing the ability of poor rural households to cope with health shocks may be a plausible path to accelerating progress towards world poverty reduction.

Differing from the poverty criterion of the World Bank, according to which people are poor when they live on less than 1.9 USD per day, in China, the Two Assurances and Three Guarantees (the Two Assurances and Three Guarantees refer to assurances of adequate food and clothing and guarantees of access to compulsory education, basic medical services and safe housing for impoverished rural residents) are utilized to identify poor rural households. If rural households fall below the level of acceptability on any of these indicators, they are identified as poor rural households and their household members are considered as poor population. Moreover, to accurately assist poor rural households, the government set up the Chinese Poor Population Tracking Dataset [8,9], which records the poverty causes, support policies and other basic information of registered poor rural households. Hence, poor rural households are also called registered poor rural households because they are contained in the Chinese Poor Population Tracking Dataset. Health shocks affect both poor rural households and non-poor rural households. The difference lies in that the adverse effects are more likely to be fatal for the former than for the latter. Thus, this paper analyses the ability of poor rural households to cope with health shocks and the deficiency of existing intervention policies from the general rural household perspective.

The ability of rural households to cope with health shocks is affected by their own characteristics and by external intervention policies. For rural households, these factors have been well documented and include the household labor supply [10], educational level and family members engaged in non-agricultural work [11], the endowment of household wealth [12], household size, the gender and age of the household head and housing characteristics [13]. Moreover, in most cases, rural households cannot successfully cope with health shocks by themselves. In fact, the adverse effects of health shocks have two causes. Firstly, health shocks to household members may directly incur a sizable out-of-pocket medical expense. Secondly, health shocks often lead to a loss of labor days or lowered productivity for affected household members and their caregivers [14], which directly reduces their household income [15]. To respond to these adverse effects and the catastrophic economic expenditures brought about by health shocks, rural households in most low- and middle-income countries have to resort to income, savings, borrowing, spending reduction, loans or mortgages and engage in livestock and natural product sales [16]. To compensate for lost labor days and income, a household may reallocate family members and reduce investment in human capital, such as substituting intra-household labor, hiring external labor and withdrawing children from schools [17]. The coping strategies of rural households not only fail to effectively cope with health shocks but also aggregate the adverse impact of health shocks on their livelihoods. Therefore, some studies have called for more intervention policies to enhance the ability of rural households to cope with health shocks [5,18–23].

The successful implementation of external intervention policies is lacking for rural households coping with health shocks. The current intervention policies have various problems that need to be resolved. Firstly, how can groups suffering from health shocks be accurately identified? The loss of targeting efficiency due to information asymmetry is a longstanding problem in aid programs, which is also unsolved in several developing countries. This problem causes a mismatch between relief resources and the needs of rural households, and it lowers the effectiveness of external intervention policies [8,24]. How, then, can the human capital of rural households suffering from health shocks be improved? Health shocks often lead to a loss of labor days or lowered productivity both for patients and their caregivers. Moreover, health shocks may lead certain laborers to permanently quit the labor market [14]. Thus, it is crucial to improve the level of human capital and enhance the resilience of household laborers. To achieve this aim, most existing studies have noted that it is necessary for the government to build a formal social protection system [18,19,25] to cushion rural households from health shocks. However, the social protection system can only reduce the economic burden of health shocks and has limited effects on improving the human capital of rural households. It cannot truly enhance the ability of rural households to cope with health shocks [26]. Finally, how can sustainability

increase the long-term household income of those suffering from health shocks? Health shocks directly incur not only a sizable out-of-pocket medical expense but also a long-term economic loss [12,27,28]. Some studies have reported the positive long-term effects of credit and insurance on rural households coping with health shocks [12,16,17,28]. However, a high mortgage threshold limits credit availability [29]. Meanwhile, social insurance is also inaccessible in many developing countries [27,30]. Therefore, effective, universal and inclusive policies are still needed to improve the household income of groups suffering from health shocks in the long term. In other words, to actually enhance the resilience of rural households in the face of health shocks, these three problems need to be resolved through external intervention policies.

China has long been plagued by poverty at a scale and level of severity that has rarely been seen anywhere else in the world [31]. According to data released by the World Bank, until 2012 there were 897 million people living on less than 1.9 USD per day in the world, among whom 87 million people were living in China. Meanwhile, poverty caused by health shocks has always been the greatest problem for China's poverty alleviation efforts. The Poverty Alleviation Office of the State Council of China claimed that illness caused 42.3% of poor rural households in the registered poor rural household database to slip into poverty or slip back into poverty in 2017 [11]. To accelerate progress towards extreme poverty reduction, China launched the Targeted Poverty Alleviation program in 2013, which contained a series of policies and made China the first developing country to eradicate extreme poverty [9,31,32]. The policy package of the Chinese government is an integrated system that contains more than three types of external intervention policies, namely, monitoring nets, safety nets and cargo nets, which may provide insights into solving the longstanding problem of health-related poverty alleviation. Concretely, monitoring nets are composed of village-based assistance systems and poverty alleviation coordinator systems, which may address the problem of information asymmetry in aid programs [8]. Safety nets include subsistence allowances, transfer income, the renovation of rural dilapidated houses and other measures, which may improve the economic performance of poor rural households in a short period of time. Additionally, cargo nets include vocational training, microcredit, relocation, etc., which may effectively enhance the ability of poor rural households' human capital to cope with health shocks and increase their household income in the long run. However, although China's Targeted Poverty Alleviation program has made progress in mitigating the adverse effects of health shocks on the livelihoods of poor rural households, few studies have comprehensively explored the underlying mechanisms. In practice, existing studies have considered only the relationships between health poverty alleviation projects and the economic vulnerability of poor families [33,34], failing to fully reflect the efforts made by the Chinese government to address poverty-related health shocks. Therefore, to explore a successful case of external intervention policies, it is necessary to research the topic in China.

To fill the gap in research noted above, based on China's Targeted Poverty Alleviation program, this paper attempts to empirically explore whether the monitoring nets, safety nets and cargo nets mentioned above play roles in poor rural households coping with health shocks. The specific objectives of this paper are as follows: (1) to summarize the policy roles of China's Targeted Poverty Alleviation program in the ability of poor rural households to cope with health shocks; (2) to examine how monitoring nets accurately identify poor rural households suffering from health shocks; and (3) to reveal the mechanisms through which government support policies enhance the human capital of poor rural households coping with health shocks. If the effects of Chinese government support policies on mitigating the health shocks of poor rural households are verified, then these findings can shed light on the design and implementation of policies that aim to eradicate poverty related to disease in low- and middle-income countries.

The paper is structured as follows: Section 2 outlines the Chinese policy context and elaborates on the relationships between human capital, the Targeted Poverty Alleviation program, and health shocks. Section 3 lays out the choice of the field sites and methods

of data collection. Sections 4 and 5 present the research design and the results, respectively. Section 6 discusses the main core results. Finally, Section 7 concludes with policy implications.

2. The Policy Context

2.1. Human Capital and the Targeted Poverty Alleviation Program

Human capital represents the skills, knowledge, ability to labor and good health that, together, enable people to pursue different livelihood strategies using different forms of assets and to attain their livelihood goals [35]. In other words, human capital can be considered an important invisible asset that can increase individuals' productivity and wages [36,37]. Rural households that suffer from extreme poverty often possess a low level of human capital [38]. Moreover, as a factor that is slow to change, human capital, such as education [39,40] and experience [41], is difficult to improve in a short period of time. However, with the improvement in infrastructure in rural areas [42] and rapid economic growth nationwide [43], the output efficiency of human capital has risen, and even those who hold low levels of human capital can also benefit. Thus, for poor rural households, it is unreasonable to measure human capital from a qualitative perspective. In contrast, considering the improving agricultural production environment and non-agricultural employment environment, calculating the human capital of poor rural households from a quantitative perspective that reflects the ability of households to obtain productivity and wages is plausible. In the literature, migrant workers, the labor force and dependent family members [44–46] are typically utilized to measure the quantitative aspect of human capital.

Additionally, human capital is the bridge between rural household poverty and poverty alleviation policies in China's Targeted Poverty Alleviation program. According to the Poverty Alleviation Office of the State Council of China, there are 12 main causes of poverty, among which six causes are related to the human capital of rural households, namely, poverty induced by illness, disability, school, skill, laborers and positive attitude. In an empirical study, Jiao pointed out that the presence of dependent family members, elderly people and children in rural households places households at greater risk of falling into poverty, while a rising number of household laborers increases household income [47]. Nevertheless, as implied in China's Targeted Poverty Alleviation program, government support policies are given to impoverished rural households based on the characteristics of their human capital. For example, public welfare jobs and microcredit are used to support poor rural households that have laborers to carry out related work, and land transfer is applied more often to poor rural households with fewer laborers. In related studies, Tang opined that China's Targeted Poverty Alleviation program is positively associated with gender, illness and farmland size [48]. Likewise, Liu stated that industrial development can significantly enhance farmers' human capital [49]. Thus, improving the human capital of poor rural households can accelerate the process of poverty alleviation.

2.2. Targeted Poverty Alleviation Program and Health Shocks

In 2013, China launched the Targeted Poverty Alleviation program, transitioning from a relief-oriented poverty reduction strategy to a development-oriented poverty reduction strategy. The core feature of the program is to precisely identify poor rural households and provide targeted assistance on the basis of the cause of poverty [9,50]. In the meantime, a policy package including various policies was formed. According to Barrett's research, government support policies can be divided into two types, namely, safety nets and cargo nets [51,52], which are examined in this paper. Additionally, distinctive monitoring nets consisting of grassroots officials are established under China's Targeted Poverty Alleviation program. Representative support policies are described below.

Monitoring nets: a village-based assistance and grid supervision system. In this system, local government officials, called poverty alleviation coordinators, are assigned to individual impoverished households to solve the problem of anti-poverty efficiency loss due to information asymmetry [18]. In the Targeted Poverty Alleviation program,

poverty alleviation coordinators are required to pay frequent home visits to the assigned households and to deploy policy resources for poverty reduction. As a link between poor rural households and the government, dynamic monitoring nets are formed by these poverty alleviation coordinators. Through the monitoring nets, poor rural households and the causes of poverty can be accurately identified in a timely manner, which is conducive to offering targeted support policies.

Safety nets: mainly medical insurance, subsistence allowances (Dibao) and the renovation of rural dilapidated houses, which play a safety net role when rural households suffer from contingencies. Regarding the short-term economic burden on health shocks, all rural households on the edge of poverty are covered by China's new rural cooperative medical insurance, which is a universal safety net that has special and preferential principles for poor rural households. For rural households identified by monitoring nets as being in poverty or on the edge of poverty, their hospitalization expense in local public county hospitals is less than 30% of the actual expense. In some regions, the value is even less than 10%, and the remaining expense is covered by government finance. Through this method, the sudden out-of-pocket medical expense associated with health shocks is greatly mitigated [34]. Additionally, subsistence allowances (Dibao) refers to providing poor rural households with funds and therefore helping them to maintain a minimum living standard. The renovation of dilapidated rural houses means that the government helps poor rural households to improve the quality of their dwellings. In regards to these policies, the implementers are the government, and the beneficiaries are poor rural households. Through the support of safety nets, poor rural households have basic living security and can live above the poverty line when they suffer from health shocks.

Cargo nets: mainly public welfare jobs, land transfer, industry-based poverty alleviation programs, relocation and microcredit, which play a cargo net role when a rural household is on the edge of poverty. In the Targeted Poverty Alleviation program, various methods are designed to enhance the human capital of poor rural households. The main measures include boosting the economy to provide more job opportunities, relocating poor rural households from inhospitable areas, improving education in impoverished areas, etc. These policies are similar to incentives or a conditional cash transfer mechanism that provides finances, opportunities and skills to help poor rural households improve the economic performance of their human capital. In addition, most of these policies are implemented in rural areas. Cargo nets can ensure that groups left behind in rural areas obtain consistent revenue, which is crucial for poor rural households suffering from health shocks or not participating in off-farm employment.

If external intervention is lacking, health shocks will have aggravating adverse effects on the human capital and household income of poor rural households [3,22]. Nevertheless, in China's Targeted Poverty Alleviation practice, effective government intervention behaviors eliminate the negative effects of health shocks on household income. Specifically, once a poor rural household suffers from a health shock, it can be quickly recognized by the monitoring nets. Then, this information is transmitted to the actors responsible for the safety nets and cargo nets. Subsequently, based on the human capital of the poor rural household, corresponding support policies cover this household to enhance its ability to cope with the health shock. This process is shown in Figure 1.

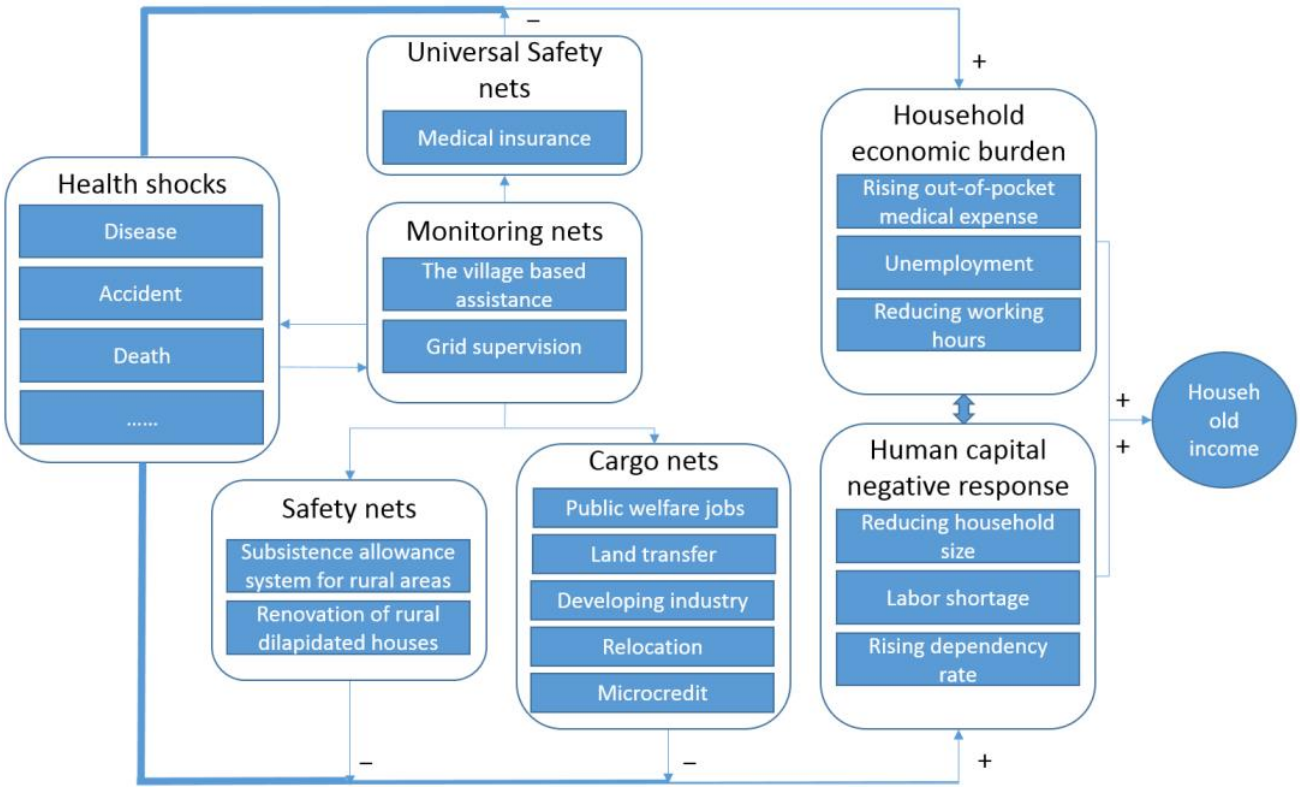

Figure 1. The process of China's support policies in response to health shocks. Note: "+" indicates the positive effects between different modules, while "−" implies the negative effects. Additionally, the thickness of the lines indicates the magnitude of the effects.

3. Study Area and Data

3.1. Study Area

Chongqing municipality is located in Southwest China. It is divided into 38 county-level divisions, including 26 districts and 12 counties, and it covers an area of 82,300 km^2. Chongqing municipality is characterized by an obvious urban–rural dual structure, in which 14 counties/districts are national-level, poverty-stricken counties and four are municipality-level, poverty-stricken counties. Chongqing's socioeconomic development level is unbalanced. Although the counties/districts with good economic performance are located in the western area, two out of 14 national-level contiguous areas in extreme poverty, the Qinba Mountains and Wuling Mountains, are distributed in northeast Chongqing and southeast Chongqing, respectively [53]. In fact, this regional difference is a microcosm of the situation across all of China.

As a western municipality, the official task of the Targeted Poverty Alleviation program is arduous. In 2014, 0.47 million poor rural households, a poor rural population of 1.66 million and 1919 poor villages were identified in Chongqing. The poverty headcount was 7.1%, which is nearly equal to the national poverty headcount ratio (7.2%). In these poor rural households, approximately 1/3 of them fell into poverty due to illness. Faced with the enormous task of poverty reduction, the Chongqing government has made great efforts to carry out the Targeted Poverty Alleviation program. Specifically, all county-level grassroots officials were assigned to the so-called front lines of the Targeted Poverty Alleviation program. Based on the officials' rank, each official provided assistance to 1–5 poor rural households, and some of them were assigned as first secretaries and resident officials to poor villages (The materials came from a symposium attended by the leader of the responsible government department and the authors.). Through these measures, Chongqing made great progress in identifying poor rural households, allocating supporting funds and guiding village development. Additionally, medical, financial,

employment, industry, educational and other types of support have been synchronously implemented to help poor rural households achieve sustainable development. Since the implementation of these effective measures, the number of poor rural households affected by illness has decreased by 96.6% when compared to 2014. By the end of June 2020, only 4946 poor rural households remained in poverty due to illness. At the same time, the National Health Commission of China claimed that China had completed the task of health-related poverty alleviation and that poverty caused by illness had been effectively resolved (http://www.forestry.gov.cn/main/72/20201121/233807421435666.html, accessed on 20 April 2023.). From this perspective, the pace of Chongqing in controlling poverty induced by illness is consistent with that nationwide, and the Targeted Poverty Alleviation practice is a reflection of that across China [38]. Therefore, Chongqing can be selected as a research area to explore the role of external intervention policies in poor rural households coping with health shocks.

3.2. Data

The data used in this paper were collected from a registered poor rural household survey conducted from December 2018 to January 2019. Semi-structured interviews in participatory rural appraisals were utilized in the household survey [52,54]. Two investigators took part in every household survey. The respondents were householders, and other household members could participate as a supplement. Each rural household interview lasted for approximately 1–2 h. The survey was conducted in three steps. Firstly, the questionnaire was modified based on feedback from respondents in a presurvey conducted over seven days. Secondly, 3–4 towns in each county and 1–2 villages in each town were selected based on the local population, poverty level, and level of infrastructure construction. Thirdly, to ensure that the survey data covered at least 30% of the registered poor rural households in each surveyed village, 20–50 registered poor rural households were selected in each of the selected villages through a random sampling method. Ultimately, 4635 questionnaires were obtained from 33 counties, 117 towns and 195 villages (Figure 2).

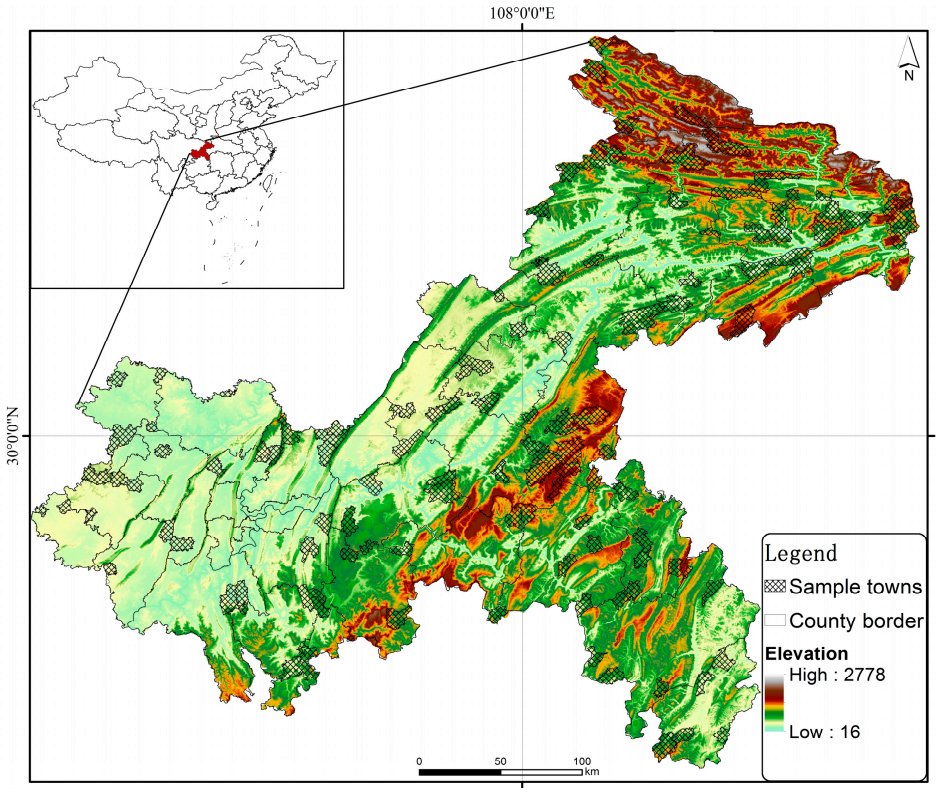

Figure 2. Location of Chongqing municipality and the sample towns.

The questionnaires contained five parts: (1) basic information about the poor rural household's family members, such as the household size and education, health and employment characteristics; (2) the policy support that the households obtained and the effect; (3) the characteristics of their household income; (4) the household's perception of the effect of support policies and their income increase; and (5) the recommendations of poor rural households regarding support policies.

As shown in Table 1, male household heads constituted approximately 83.28% of the sample household respondents, and 20.71% of household heads were minorities. There is an imbalanced age distribution of household heads, with more than 70% of household heads being above 50 years old, which means that the sample household heads in this study were relatively experienced. Regarding household size, rural households with 1–3 persons and 4–6 persons accounted for 44.94% and 49.77% of the sample, respectively. This finding suggests that most of the poor rural households had a relatively small number of household members. Household income was concentrated in the categories 0–18,000 CNY and 18,000–36,000 CNY, accounting for 29.92% and 33.07% of the sample households, respectively. The income data show that the household income of poor rural households is at the bottom of the pyramid.

Table 1. Description of the sample (n = 4635).

Variable		Observations	Percentage	Variable		Observations	Percentage
Gender of the Householder	Male	3860	83.28	Household Size (persons)	[1, 3]	2083	44.94
	Female	775	16.72		[4, 6]	2307	49.77
Nationality of the Householder	Han	3675	79.29		[7, +∞)	245	5.29
	Minority	960	20.71	Household Income (CNY)	[0, 18,000)	1387	29.92
Age of the Householder	(0, 40)	233	5.03		[18,000, 36,000)	1533	33.07
	[40, 50)	1131	24.40		[36,000, 50,000)	776	16.74
	[50, 60)	1091	23.54		[50,000, 70,000)	496	10.70
	[60, 70)	1129	24.36		[70,000, +∞)	443	9.56
	[70, +∞)	1051	22.68				

4. Econometric Methodology

To examine the relationships between health shocks and poor rural households' income, human capital and policy support and the effectiveness of support policies in prompting an income increase for poor rural households, multiple regression analysis and hierarchical regression are employed. In these regression analyses, dependent variables and independent variables are needed, and they are explained in detail in the next section.

4.1. Dependent Variables

Three dependent variables are selected, namely, income, identification of the poor and duration of poverty.

Income is the first dependent variable. When rural households suffer from health shocks, the number of their household laborers and their effective working time decrease, which will affect their household income [15]. Rural household income is sensitive to health shocks. Given that poverty alleviation means that the welfare of the entire population is protected, per capita household income [55] is chosen to represent the state of household income.

Identification of the poor refers to the year that a rural household is identified by the government as a poor rural household. As mentioned in Section 2, monitoring nets are formed by village-based assistance and grid supervision in rural China. Once rural households suffer from health shocks, the monitoring nets identify them in a timely manner to prevent them from slipping too far into poverty and to keep them above the poverty line. Thus, identification of the poor is employed to examine the effectiveness of the monitoring nets.

Duration of poverty refers to the length of the period during which rural households are identified as poor. The duration of poverty among poor households varies by the

different causes of poverty. This variable is selected to measure whether health shocks extend the duration of poverty among poor rural households. It is expected that the Targeted Poverty Alleviation policies are effective when the duration of poverty is not prolonged by health shocks.

4.2. Independent Variables

The independent variables are selected to describe the health shocks, human capital and policy aspects.

Health shocks are the first independent variable. In China, if a family member suffers from a chronic disease but is not hospitalized, the adverse effects are considerably smaller than those due to hospitalization [56]. Thus, hospitalization is selected as a core variable to represent health shocks.

Human capital is the second independent variable. Human capital is not only the main source of household income but also the target of health shocks and the basis of obtaining support policies. The numbers of older people, off-farm laborers, farmers, disabled people and children in a poor rural household are selected to describe the quantity of human capital in relation to health shocks.

Policy is the third independent variable. Policies with a high penetration rate are chosen to measure the effects of policies on health shocks. All samples were covered by medical insurance, which effectively reduced short-term medical expenses. Therefore, such insurance is not considered a representation of the effects of safety nets on eliminating long-term economic loss. Thus, safety net policies mainly include the subsistence allowance system for rural areas (SA) and the renovation of rural dilapidated houses (RH). Cargo net policies include public welfare jobs (WJ), relocation (RL), industry share (IS), land transfer (LT) and microcredit (CR).

Control variables are also taken into account. Given rural infrastructure [42], household size and housing characteristics [13] affect the ability of rural households to cope with health shocks. In this paper, members, water and the housing structure are selected as control variables.

The details of variables mentioned above is shown in Table 2.

Table 2. Definitions and summary statistics of the variables (n = 4635).

Variable	Definitions	Mean	SD
Dependent Variables			
Income	Ln(PCHI), PCHI = per capita household income = household income/household members	1.76	0.79
Identification of the Poor	The year in which a rural household is identified as a poor rural household	2014.78	1.29
Duration of Poverty	The duration a rural household is identified as a poor rural household	2.09	1.28
Independent Variables Health Shocks			
Hospitalization	Whether poor rural household members are hospitalized; yes = 1; no = 0	0.12	0.32
Human Capital			
Older	The number of members whose age is above 64 years old in a poor rural household	0.86	0.84
Off-Farm Laborers	The number of off-farm laborers in a poor rural household	0.92	0.95
Farmers	The number of agricultural laborers in a poor rural household	1.06	0.88
Disabled	The number of disabled members whose age is 16–64 years old in a poor rural household	0.58	0.76
Children	The number of children whose age is below 16 years old in a poor rural household	0.51	0.81

Table 2. *Cont.*

Variable	Definitions	Mean	SD
Policy			
Safety Nets			
Subsistence Allowances (SA)	Ln(SA), SA = income came from the subsistence allowance system for rural area	1.69	2.84
Renovation of Rural Dilapidated Houses (RH)	Whether a poor rural household obtains an RH; yes = 1; no = 0	3.10	4.61
Cargo Nets			
Public Welfare Jobs (WJ)	Whether a poor rural household obtains WJ; yes = 1; no = 0	0.11	0.33
Relocation (RL)	Whether a poor rural household obtains RL; yes = 1; no = 0	0.14	0.35
Industry Share (IS)	Ln(IS), IS = income came from the industry share	0.33	1.54
Land Transfer (LT)	Ln(LT), LT = income came from land transfer	1.21	2.63
Microcredit (CR)	Whether a poor rural household obtains CR; yes = 1; no = 0	0.29	0.45
Control Variables			
Members	The number of members in a poor rural household	3.75	1.66
Water	Whether a poor rural household has access to safe tap water; yes = 0; no = 1	0.11	0.32
Housing Structure	Housing structure: civil structure = 3; brick concrete = 2; reinforced concrete = 1	1.81	0.41

4.3. Model Selection

Income, identification of the poor and duration of poverty are the main independent variables, which are multivariate variables. Based on this characteristic, multiple regression analysis is used to test the effects of health shocks on income, identification of the poor, duration of poverty and the relationship between human capital and support policy acquisition [8,57]. The model is presented as Equation (1). When examining the effect of health shocks on income, identification of the poor and duration of poverty, y_{Ti} is the dependent variable shown in Table 2, and X_i is the core independent variable hospitalization. β_{Ti}, α_{Ti} and ε_{Ti} are the corresponding coefficient, constant term and random disturbance term with normal distribution characteristics, respectively. When examining the relationship between human capital and support policy acquisition, y_{Ti} is the variable included in human capital, and X_i is the independent variables from the Policy section in Table 2.

$$y_{Ti} = \alpha_{Ti} + \beta_{Ti}(X_i) + \varepsilon_{Ti} \quad (1)$$

The mitigating role of human capital in health shocks is examined by Equation (2), which adds $\gamma_i(Z_i)$ to Equation (1). Z_i is the independent variable describing human capital in Table 2, and γ_i is the corresponding coefficient. Comparing β_{Ti} in Equations (1) and (2), when the value and significance increase in Equation (2), human capital increases the negative effect of health shocks on poor rural households, and vice versa.

$$y_{Ti} = \alpha_{Ti} + \beta_{Ti}(X_i) + \gamma_i(Z_i) + \varepsilon_{Ti}. \quad (2)$$

The role of support policies in per capita household income is examined by the interaction between human capital and support policies [55,58], which is shown in Equation (3), where y is per capita household income and X_i is a variable of human capital, only one of which is included in Equation (3) at a time. $X_i * P_j$ is the interactive variable between support policies and human capital. β_i and δ_{ij} are the corresponding coefficients, and α_i and ε_i are the constant term and random disturbance term with normal distribution characteristics, respectively.

$$y = \alpha_i + \beta_i(X_i) + \delta_{ij}(X_i * P_j) + \varepsilon_i. \quad (3)$$

5. Results

5.1. Impacts of a Health Shock and the Positive Response of Identification of the Poor

Health shocks affect patients and their caregivers in a rural household, resulting in considerable medical expenditure in the short term and economic losses in the long term. Meanwhile, as monitoring nets exist in China's Targeted Poverty Alleviation program, when members suffer from serious health shocks, their household can be identified in a timely manner. Consequently, various policies will be offered to help them to escape the crisis. Hence, it is believed that when a health shock takes place, it will not cause a decline in household income and, thus, will not prolong the duration of household poverty. By applying the data to Equation (1), with the assistance of STATA 12.0 software, the impacts of hospitalization on income, identification of the poor and duration of poverty are examined. The results are shown in Table 3.

Table 3. The relationship between health shocks and household income, the identification of poor rural households and the duration of poverty.

Variable	Income	Identification of the Poor	Duration of Poverty
Hospitalization	−0.1297 ***	0.3458 ***	0.0816
Cons	8.8947 ***	2014.7363 ***	2.0844 ***

Note: 1. "Hospitalization" is a proxy variable for health shocks. 2. *** $p < 0.01$.

Hospitalization negatively affects income with a coefficient of −0.1297 and is statistically significant ($p < 0.01$), which indicates that health shocks negatively affect household income increase. Furthermore, hospitalization positively correlates with identification of the poor with a coefficient of 0.3458 and is statistically significant ($p < 0.01$), indicating that once poor rural households suffer from health shocks, they can be identified by monitoring nets in a timely manner. The positive relationship between hospitalization and the duration of poverty is not significant, which indicates that hospitalization is not related to the duration of poverty of poor rural households.

5.2. The Roles of Support Policies in Enhancing the Ability of Poor Rural Households to Cope with Health Shocks

5.2.1. The Mitigating Role of Human Capital in Health Shocks

As mentioned in Section 5.1, hospitalization negatively affects income without considering the human capital of poor rural households. Next, employing Equation (2), variables from human capital will be added to examine the mitigating role of human capital in health shocks.

As shown in Table 4, when the variables representing human capital are entered into Equation (2), both the value and significance of the coefficient between hospitalization and income decrease or disappear. These results mean that household human capital buffers the adverse effects of health shocks. Concretely, the value of the coefficient is −0.1297 in Table 3, while the value is −0.0630 in Table 4. The significance of the coefficient is below 0.01 in Table 3, while the coefficient is not significant in Table 4. The results explain the mitigating role of human capital in smoothing the negative effect of health shocks on poor rural household income. Similarly, the estimated coefficient of identification of the poor shows a downward trend, from 0.3458 to 0.2882, and is statistically significant ($p < 0.01$). Finally, both the coefficient and significance of the duration of poverty remain stable but are still indistinct. The underlying reason may be the complex causes of poverty, such as harsh living conditions, poor transportation and distance from the market, which weaken the role of human capital in reducing the duration of poverty [59].

Table 4. The mitigating role of human capital in health shocks.

Variable	Income	Identification of the Poor	Duration of Poverty
Hospitalization	−0.0630	0.2882 ***	0.0813
Older	−0.0725 ***	0.0537 *	−0.0107
Off-Farm	0.2785 ***	−0.1622 ***	−0.0815 ***
Farm	0.0485 ***	−0.0604 ***	−0.0729 ***
Disabled	−0.0180	0.0503 *	−0.0034
Kids	−0.0371 *	0.0631 **	−0.0017
Control Variable	Control	Control	Control
Cons	9.1027 ***	2014.9034 ***	1.9040 ***

Note: 1. "Hospitalization" is a proxy variable for health shocks; 2. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$; 3. The multicollinearity test is shown in Table A1.

5.2.2. Support Policies Improve Human Capital

As mentioned in Section 5.2.1, human capital buffers the adverse effects of health shocks. The underlying reason is perhaps that the human capital of poor rural households is complemented by poverty reduction policies. Specifically, external intervention policies support poor rural households by considering their household human capital. For example, when the dependency rate is high and labor is limited in poor rural households, subsistence allowances will be likely to support them in safety nets. However, if poor rural households have ample laborers but they are constrained by household patients and have to remain at home, it is possible to provide them with public welfare jobs in cargo nets. Through the precise support of related external intervention policies, the human capital of poor rural households is enhanced, at least in terms of economic performance. Thus, the relationship between human capital and support policies is tested below.

By examining the complementary effects of support policies on human capital [60], the results in Table 5 show that safety net policies are related to the dependent family members in a household. Specifically, subsistence allowances (SA) have a positive effect on older and disabled people, and the estimated coefficients are statistically significant ($p < 0.01$). However, as a safety net policy, the renovation of rural dilapidated houses (RH) has no significantly positive effect on human capital. One plausible explanation is that the quality of housing is dependent on the age and structure of the housing, rather than household human capital.

Table 5. The complementary effects of support policies on human capital.

Variable		Older	Off-Farm Laborers	Farmers	Disabled	Children
Safety Nets	SA	0.0137 ***			0.0192 ***	
	RH					
Cargo Nets	WJ			0.1804 ***	0.0687 **	0.0794 **
	RL		0.0927 **			
	IS			0.0217 ***		
	LT	0.0106 **		0.0135 ***	0.0083 *	
	CR		0.0711 **	0.3086 ***		0.1367 ***

Note: 1. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$; 2. The multicollinearity test is shown in Table A2.

Regarding cargo net policies, all five policies have positive effects on the number of off-farm laborers and farmers, especially in households with dependent family members. For example, public welfare jobs (WJ), land transfer (LT) and microcredit (CR) have positive effects on the number of household farmers, disabled people and children, and the estimated coefficients are statistically significant ($p < 0.05$). Specifically, the estimated coefficients between public welfare jobs (WJ) and farmers, disabled people and children are 0.1804, 0.0687 and 0.0794, respectively. Similarly, the estimated coefficients between land transfer (LT) and older people, farmers and disabled people are 0.0106, 0.0135 and

0.0083, respectively, and all of them are significant. Additionally, the estimated coefficients between microcredit (CR) and off-farm laborers, farmers and children are 0.0711, 0.3086 and 0.1367, respectively, and are statistically significant.

Apart from the cargo net policy mentioned above, only relocation (RL) and industry share (IS) have positive effects on rural household labor. The estimated coefficient between relocation (RL) and off-farm laborers is 0.0927 and is statistically significant ($p < 0.05$). Similarly, the estimated coefficient between industry share (IS) and farmers is 0.0217 and is statistically significant ($p < 0.01$).

5.3. The Role of Support Policies in the Income Increase of Rural Households

As mentioned in Section 2.2, sudden out-of-pocket medical expenses for poor rural households are mitigated by the special and preferential principles of China's new rural cooperative medical insurance. To compensate for the long-run economic loss, it is plausible to reverse the negative effects of dependent family members and amplify the positive effects of labor on the income increase of poor rural households. In general, dependent members decrease rural household income. However, in China's Targeted Poverty Alleviation program, external intervention policies are more likely to support poor rural households with more dependent family members. In this situation, the negative effects of dependent family members on the income increase of poor rural households will be reversed. Additionally, with the support of cargo nets, the efficiency loss of labor in poor rural households may be reversed. For example, public welfare jobs and relocation can help rural laborers to take part in off-farm employment in their community. Therefore, the positive effects of labor on the income of poor rural households may be improved.

To examine the role of support policies in affecting the income of poor rural households, four groups of interactive variables are set between household laborers, dependent family members and support policies. As reported in Table 6, both the older and the disabled have significantly negative effects on income, with estimated coefficients of -0.1376 and -0.0560, respectively, and are statistically significant ($p < 0.01$ and $p < 0.05$, respectively). Similarly, the number of farmers negatively affects income, but the effect is not significant. However, the interactive variables between the older, the disabled, farmers and support policies show that some of these interactive variables have a significantly positive effect on income, especially in the case of cargo net policies. Specifically, two interactive variables in the older group are significant, namely, relocation and older people, and land transfer and older people. This phenomenon means that relocation and land transfer can reverse the negative effects of the older people on income increase. One interactive variable in the disabled group, which is land transfer and disabled people, is significant. This result means that land transfer reverses the negative effects of the disabled people on income increase. The policy effects are most obvious in the farmers group, where three interactive variables are significant: public welfare jobs and farmers, land transfer and farmers and microcredit and farmers. The results imply that farmers are easily supported by cargo nets, which reverse the negative effects of farmers on income.

In contrast to the negative effect associated with dependent family members and farmers in a household, the number of off-farm laborers has a positive effect on income, with an estimated coefficient of 0.2688, and is statistically significant ($p < 0.01$). However, there are few interactive variables in the off-farm laborers group that are significant (Table 6). One plausible explanation may be that most off-farm laborers take part in work outside their hometown. Nevertheless, most support policies are executed in their hometown. Therefore, it is difficult to link support policies and off-farm laborers.

Table 6. The relationship between human capital and support policies in regard to household income increase.

Interacted Variables	Interaction between the Older and Policy Variables	Interaction between the Disabled and Policy Variables	Interaction between the Farmers and Policy Variables	Interaction between the Off-Farm Laborers and Policy Variables
Single Human Capital	−0.1376 ***	−0.0560 **	−0.0005	0.2688 ***
SA * Human Capital	−0.0008	0.0021	0.0018	−0.0025
RH * Human Capital	0.0035	−0.0020	0.0008	0.0007
WJ * Human Capital	0.0546	0.0648	0.0621 **	0.0415
RL * Human Capital	0.0991 ***	0.0526	0.0348	0.0170
IS * Human Capital	−0.0058	0.0012	0.0079	−0.0001
LT * Human Capital	0.0105 **	0.0107 *	0.0074 **	0.0067
CR * Human Capital	0.0363	0.0025	0.0512 **	−0.0156
Other Human Capital	Controlled	Controlled	Controlled	Controlled
Control Variables	Controlled	Controlled	Controlled	Controlled
Cons	8.9656 ***	8.9713 ***	8.9710 ***	8.9689 ***

Note: 1. The dependent variable is "income", which is the same as in Tables 3 and 4; 2. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$; 3. The multicollinearity test is shown in Table A3.

5.4. The Effects of Health Shocks on Household Income in Different Income Groups

To test the effects of health shocks on household income in different income groups, the sample households are divided into four equally proportioned groups based on their income. Hospitalization has a nonsignificant effect on household income in all four income groups (Table 7). Thus, the results firmly support the conclusion that health shocks do not make poor rural households fall back into poverty under China's Targeted Poverty Alleviation policies.

Table 7. The effects of health shocks on household income increase in different income groups.

Variable	Income	Income	Income	Income
Income Groups	(0, 0.25)	(0.25, 0.50)	(0.50, 0.75)	(0.75, 1)
Hospitalization	−0.1896	0.0144	0.0077	−0.0213
Older	−0.0204	0.0146 **	0.0183 ***	−0.0146
Off-Farm Laborers	−0.3643 ***	0.0489 ***	0.0012	0.0454 ***
Farmers	0.0206	0.0052	−0.0044	0.0110
Disabled	0.0322	−0.0119	0.0077	0.0188
Children	0.0708	0.0120	0.0085	−0.0305 **
Members	−0.3415 ***	−0.2641 ***	−0.2387 ***	−0.0199 ***
Housing Structure	−0.0623	−0.0115	−0.0004	0.0011
Water	−0.2261 *	0.0030	−0.0062	−0.0198
Cons	9.0985 ***	9.6659 ***	10.0830 ***	10.4822 ***

Note: 1. "Hospitalization" is a proxy variable for health shocks. 2. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

6. Discussion

6.1. Monitoring Nets Are Effective in Accurately Targeting Poor Rural Households Suffering from Health Shocks

Monitoring nets can play a role in identifying poor rural households suffering from health shocks. As shown in Table 3, Section 5.1, hospitalization has a significantly positive effect on the identification of the poor, which explains the effectiveness of the monitoring nets of local government. Once rural households face poverty caused by a health shock, the monitoring nets of the local government can identify them in a timely manner, and then safety net and cargo net policies are utilized to support the rural households.

Governments have long been challenged by low poverty alleviation efficiency due to the inaccurate targeting of poor rural households [8,61]. The Chinese government has solved this puzzle by assigning poverty alleviation coordinators to households in poverty [8] and executing a tracking system for poor rural households [9], which is described as a monitoring

net in this paper. Monitoring nets are an intervention mechanism that takes effect after rural households suffer from health shocks, but before they are severely affected. The effect of monitoring nets is between ex ante intervention and ex post intervention, which is different from traditional ex ante or ex post risk intervention mechanisms.

Studies from Kenya [62] and other low- and middle-income countries [5] have highlighted ex ante interventions in rural households coping with health shocks. Nevertheless, in a limited resource context, it is almost impossible for rural households to reserve a share of their limited resources only for protection against health shocks, and this is also a challenge for the government [62]. As countries around the world signal their intentions to reduce support payments [63], making full use of limited financial resources is crucial for poor rural households. Under these conditions, the monitoring nets of the Chinese government provide a near ex ante intervention mechanism that is conducive to rationally allocating limited resources and increasing low- and middle-income countries' rate of resource utilization for poverty alleviation.

6.2. Cargo Nets Improve the Ability of the Human Capital of Poor Rural Households to Cope with Health Shocks

Human capital is crucial for poor rural households to escape from poverty traps. The results in Section 5.2.1 show that the adverse effects of health shocks on household income are largely mitigated by human capital. This result is similar to the finding of Liu, who confirmed that human capital had an effect against health shocks [10]. Cheng also proved the moderating effects of the human capital endowment on poverty alleviation projects [45]. The role of policies in improving the human capital of poor rural households is to enhance their ability to withstand unexpected risk and to make them more resilient.

For poor rural households in developing countries, not only are the individuals who suffer from health shocks shielded, but their caregivers are also equally shielded. The redistribution of labor inside households is a coping strategy in response to health shocks. When dependent family members are unable to take care of themselves, their caregiver, the main laborer of the household, has to return to the hometown to take care of them [17]. Undoubtedly, this situation decreases the number of laborers taking part in off-farm employment and increases the supply of farm laborers, which could cause long-term economic damage. Therefore, it is necessary to ensure that farm laborers obtain a stable income. In practice, safety net policies, such as unconditional cash transfer, are usually offered to rural households whose family members suffer from health shocks, but their effects on long-term economic growth are limited. For instance, a case study in Germany pointed out that welfare state instruments support the poorest segment of the population but do not succeed in neutralizing the effects of a health shock on these groups [26]. This means that financial support alone is not enough to eradicate the risk posed by health shocks in the long run. The reason for this phenomenon is that such support does not change the ability of the poorest people to cope with health shocks, and patients and their caregivers do not obtain consistent income to mitigate their expenditures.

In contrast to this stable financial support, in China's Targeted Poverty Alleviation practice, laborers of households could be supported by cargo nets when rural household family members suffer from health shocks. As presented in Table 5 of Section 5.2.2, cargo net policies are positively associated with the farmers or off-farm laborers in a household, which can ensure an increase in poor rural household income. Specifically, the positive connection between relocation (RL), the industry share (IS) and rural household labor proves the existence of pro-labor cargo net policies. Relocation (RL) means that rural households migrate from remote mountainous areas to areas with nearby markets, which helps rural household laborers to obtain off-farm employment. Similarly, the industry share (IS) is positively associated with farm labor. Here, industry refers to the agricultural industry developed in villages [64], in which only farm laborers participate. Thus, a positive relationship exists between the industry share (IS) and farm labor, which also provides a safeguard for increasing household income after households suffer from health shocks.

Through the support of these cargo net policies, even though laborers have to return to their hometowns due to health shocks to their family members, they can still obtain revenue from local economic development. Hence, the output efficiency of the laborers of poor rural households is protected, and the human capital of poor rural households is improved from the quantitative perspective of household laborers.

6.3. The Increase in Household Income Is Guaranteed by Human Capital and Cargo Nets

Cargo net policies can enhance the economic performance of dependent family members and agricultural laborers in poor rural households suffering from health shocks (Table 6). Concretely, the negative coefficient of older people, disabled people, and farmers is changed to a positive coefficient with some of their policy interaction variables. This phenomenon indicates that when health shocks take place, both dependent family members and their caregivers can contribute to increasing the income of poor rural households with the help of government support policies. Thus, even though the main laborers are forced to return to their hometowns because of health shocks, there is income from agriculture and villages to uphold their income flow. Similarly to this paper, Arouri found that the interaction variables between microcredit and disasters all had significant proactive effects on household per capita expenditure [55]. Moreover, a study from Ethiopia demonstrated that the conditional cash transfer component of public works can improve the health care-seeking behavior of vulnerable cohorts [65]. The effectiveness of external intervention policies is different from China in some developing countries. For example, Ouoba noticed that households with adaptive capacity were able to adjust to the COVID-19 shock, but social security was not a mitigating factor [66]. Arouri and Ouoba also found that safety nets are patchy and small, and have a limited effect on improving the ability of households to resist risks [55–66]. This means that external intervention policies have plenty of room for improvement in these countries. Therefore, based on the endowment of rural household human capital, tailoring effective external policies is crucial for increasing the ability of poor rural households to cope with health shocks.

None of the interaction variables of household off-farm laborers and support policies is significant (Table 6). This result may indicate that China's external intervention policies are unlikely to benefit off-farm laborers. This view is supported by Tang, who pointed out that rural migrants are less likely to receive assistance from working in urban areas and more populous villages [67]. Thus, to enhance the income of poor rural households suffering from health shocks, the feasible paths are to protect the interests of off-farm laborers in their household and improve their output efficiency.

6.4. Summary of the Mechanisms through Which the Chinese Policy Package Impacts on the Ability of Poor Rural Households to Cope with Health Shocks

The ability of poor rural households to cope with health shocks is increased by effective external intervention policies in China. The underlying mechanism is as follows (Figure 3): (1) synthetic external intervention policies are formed in the Chinese anti-poverty policy package, namely, monitoring nets, safety nets and cargo nets. (2) The monitoring nets can accurately identify those suffering from health shocks. Through this method, the information asymmetry in aid programs is resolved, which improves the effectiveness of external intervention policies. (3) Cargo nets can enhance the human capital of poor rural households suffering from health shocks. By linking cargo net policies with labor, caregivers from poor rural households suffering from health shocks can still obtain opportunities from cargo nets. Hence, the human capital of poor rural households is enhanced, in terms of economic performance, from the quantitative perspective of laborers. (4) The income increase of poor rural households is prompted by human capital and cargo net policies. Due to the effects of cargo net policies and human capital, the negative effects of human capital on income increase are reversed. Therefore, rural household income is able to increase in a sustainable way. Ultimately, with triple support, poor rural households can effectively cope with health shocks.

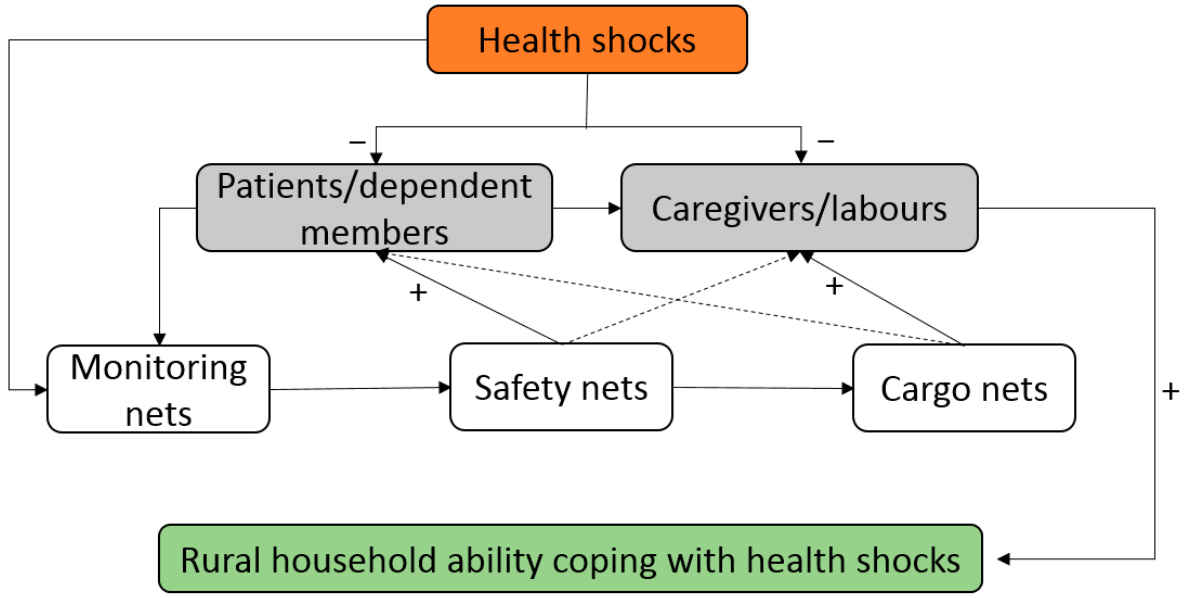

Figure 3. The mechanism of the impact of Chinese external intervention policies on the ability of poor rural households to cope with health shocks. Note: "+" indicates the positive effects between different modules, while "−" implies the negative effects.

7. Conclusions and Policy Recommendations

Addressing poverty caused by disease will accelerate the process of world poverty reduction, especially in low- and middle-income countries. However, information asymmetry, human capital damage and long-term economic decline have not been resolved in health-related poverty alleviation for a long time. In practice, safety nets are common measures in poverty alleviation, but they can only partially buffer against the short-term economic burden of poor rural households and have limited effects on enhancing the long-term ability of such households to consistently withstand health shocks. Various policies are formed in China's Targeted Poverty Alleviation program, which helps poor rural households escape from poverty traps. Thus, it is necessary to explore how China theoretically resolves the longstanding problem of health-related poverty alleviation. Based on existing paradigms in the poverty research area, this paper examines the main external intervention policies and explores how the ability of poor rural households to resist health shocks is enhanced, with the help of heterogeneous support policies and their underlying mechanisms. The data utilized in this paper were obtained from a questionnaire survey of 4635 registered poor rural households in a municipality located in Southwest China.

The results confirm that, in contrast to safety nets and cargo nets, monitoring nets formed in China's Targeted Poverty Alleviation program can accurately link external intervention policies with poor rural households suffering from health shocks and resolve the problem of information asymmetry. Moreover, the human capital of poor rural households suffering from health shocks is enhanced by cargo nets. When poor rural households suffer from health shocks, the risk can be identified by monitoring nets in a timely manner, and then effective safety net policies and cargo net policies are offered to these households by considering the characteristics of their household human capital. Through these measures, not only can patients be supported by these policies, but their caregivers can also gain opportunities to engage in off-farm employment. Thus, the human capital of poor rural households' ability to cope with health shocks is increased. Additionally, the long-term income increase of poor rural households is guaranteed by support policies and human capital. Human capital is linked with rural households' access to support policies. With the support of these policies, it is possible to reverse the negative effects of dependent family members and agricultural laborers on income increase. Owing to these effective

policies, poor rural households in China can successfully cope with the adverse effects of health shocks.

Based on this study, some policy recommendations can be proposed for developing countries. First, a near ex ante intervention mechanism is necessary to cope with health shocks. When poor rural households suffer from health shocks, effective external intervention is crucial for alleviating their risks. However, in a limited resource context, neither the government nor rural households can allocate a share of their resources to avert the risk of health shocks. Thus, building a near ex ante intervention mechanism is a feasible method that can both identify the risk of health shocks and rationally allocate limited resources to provide accurate supporting measures, thereby helping poor rural households to escape the negative effects of health shocks. The effectiveness of the near ex ante intervention mechanism is confirmed by the experience of the monitoring nets in China's Targeted Poverty Alleviation practice, which can be a reference for other developing countries.

Additionally, safety nets alone are not enough to eradicate the risks of health shocks, and cargo nets based on the human capital endowment can more effectively improve the ability of poor rural households to cope with health shocks. Thus, connecting human capital with cargo nets is vital for alleviating health shocks to poor rural households. In China's Targeted Poverty Alleviation program, by developing public welfare jobs and collective industry, public welfare jobs are provided to poor rural households that suffer from health shocks and are in danger of slipping back into poverty. Additionally, by offering microcredit, agricultural laborers receive some agricultural funding support. These cargo nets can help poor rural households to escape the adverse effects of health shocks. Therefore, building cargo net policies that can benefit vulnerable groups is an effective way to alleviate the adverse effects of health shocks.

This study has three limitations. Firstly, our survey was conducted during the implementation of China's Targeted Poverty Alleviation program, which is highly valued by local governments. It is uncertain whether poor rural households can sustain this positive policy effectiveness as the intensity of policy implementation declines. Thus, future studies should examine the long-term policy effectiveness on the ability of poor rural households to cope with health shocks. Secondly, cross-sectional data were used in this paper, which did not make it possible to describe dynamic changes in the policy effectiveness on the ability of poor rural households to cope with health shocks over time. Answering these questions could help in better understanding policy effectiveness in different poverty alleviation stages. Finally, restricted by survey data, there is still much room for improvement in the choice of control variables. Therefore, these issues need to be explored in the future.

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Appendix A

Table A1. Results of the variance inflation factors (VIFs) for the independent variables in Table 4.

Variable	VIF	1/VIF
Hospitalization	1.22	0.82
Members	2.32	0.43
Older	1.64	0.61
Off-Farm Laborers	1.63	0.61
Farm	1.19	0.84
Disabled	1.28	0.78
Children	1.42	0.70
Age	1.59	0.63
Housing Structure	1.01	0.99
Water	1.00	1.00
Mean VIF	1.43	

Note: The upper limit of the VIF is 10.00. All of the independent variables pass the multicollinearity test.

Table A2. Results of the variance inflation factors (VIFs) for the independent variables in Table 5.

Variable	VIF	1/VIF
SA	1.01	0.99
RH	1.07	0.93
WJ	1.04	0.96
RL	1.08	0.93
IS	1.02	0.98
LT	1.01	0.99
CR	1.04	0.96
Mean VIF	1.04	

Note: The upper limit of the VIF is 10.00. All of the independent variables pass the multicollinearity test.

Table A3. Results of the variance inflation factors (VIFs) for the independent variables in Table 6.

Interacted Variables	Interaction between the Older and Policy Variables		Interaction between the Disabled and Policy Variables		Interaction between the Farmers and Policy Variables		Interaction between the Off-Farm Laborers and Policy Variables	
	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF
Single Human Capital	1.85	0.54	1.98	0.51	1.95	0.51	2.26	0.44
SA × Human Capital	1.25	0.80	1.28	0.78	1.15	0.87	1.07	0.93
RH × Human Capital	1.33	0.75	1.31	0.77	1.28	0.78	1.25	0.80
WJ × Human Capital	1.08	0.92	1.12	0.90	1.13	0.88	1.07	0.93
RL × Human Capital	1.15	0.87	1.16	0.86	1.16	0.86	1.17	0.86
IS × Human Capital	1.06	0.95	1.08	0.93	1.05	0.95	1.04	0.96
LT × Human Capital	1.13	0.89	1.16	0.86	1.14	0.88	1.11	0.90
CR × Human Capital	1.19	0.84	1.31	0.76	1.43	0.70	1.29	0.77
Children	1.42	0.71	1.42	0.71	1.42	0.70	1.42	0.71
Farmers	1.20	0.84	1.20	0.83			1.20	0.83
Off-Farm Laborers	1.65	0.61	1.65	0.61	1.66	0.60		
Older			1.13	0.88	1.15	0.87	1.12	0.89
Disabled	1.06	0.94			1.06	0.95	1.06	0.94
Members	2.30	0.43	2.30	0.44	2.32	0.43	2.27	0.44
Housing Structure	1.02	0.98	1.02	0.98	1.02	0.98	1.01	0.99
Water	1.01	0.99	1.01	0.99	1.01	0.99	1.01	0.99
Mean VIF	1.31		1.34		1.33		1.29	

Note: The upper limit of the VIF is 10.00. All of the independent variables pass the multicollinearity test.

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