

ICT Adoption, Health Literacy and Health Human Capital of Rural Residents—Based on the Health Survey Data of 4829 Farmers in Jiangxi Province

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Abstract

The key to rural revitalization lies in the revitalization of talents, and the key to the revitalization of talents lies in the promotion of human capital. As an important component of human capital, health is the cornerstone of national prosperity and prosperity. As a large agricultural country, China has a large gap in health literacy levels between urban and rural areas, and the health inequality is still quite serious. Therefore, based on the survey data of “hundreds of villages and thousands of households” in Jiangxi Province in 2018, with 4829 rural household health survey data as the sample, this paper uses the ordered Probit model to study the impact of ICT adoption on rural residents’ health human capital, and explores the mediating role of health literacy between ICT adoption and rural residents’ health human capital. Finally, the robustness test was carried out. The baseline regression results show that ICT adoption has a significant positive impact on the health human capital of rural residents. Considering the possible endogeneity problems, the results are still robust after the selection of appropriate instrumental variables. The results of heterogeneity analysis show that the impact of ICT adoption is more significant in women and middle-aged and elderly population than in men and non-middle-aged and elderly population. The mediating effect test results show that health literacy plays a partial mediating role between ICT adoption and rural residents’ health human capital. Based on this, the paper proposes to strengthen the construction of communication infrastructure in rural areas. To encourage rural women and middle-aged and elderly people to use the Internet by providing subsidies and other means; the aim is to provide empirical basis and decision-making reference for the government to promote the health of rural residents.

Keywords: *Health human capita, ict adoption, health literacy, mediating effect, ordered probit modle*

I. Introduction

Health, as an important part of human capital, is not only the necessary foundation and important guarantee for human beings to enjoy a better life, but also the cornerstone of national prosperity and national prosperity. China is a large agricultural country, with the health problems of rural residents, which has always been the focus of the state. In 2016, in the “Healthy China 2030” Program issued by the State Council, it is pointed out that “the construction of healthy cities and healthy villages and towns should be taken as an important starting point to promote the construction of a healthy China”. In the rural revitalization strategy deployed in the report of the 19th National Congress, it is pointed out that it is necessary to promote healthy rural construction, strengthen rural public health services, and improve the level of rural people’s livelihood security. According to the monitoring results of health literacy in 2020, the health literacy level of urban residents is up to 28.08%, while that of rural residents is only 20.02%, indicating a big difference in health literacy level between urban and rural areas, and the still serious health inequality. The health problems of rural residents gradually pose severe challenges to the implementation of healthy China and rural revitalization strategy. The rapid development of information and communication technology (ICT) has promoted the continuous growth of China’s Internet penetration rate and the scale of netizens. According to the 46th Statistical Report on the Development of Internet in China, as of June 2020, the number of Internet users in China had reached 940 million, with a penetration rate of 52.3% in rural areas. In 2015, the Guiding Opinions on Actively Promoting the “Internet Plus” issued by the State Council pointed out that it is necessary to accelerate the development of the “internet plus”, give full play to the advantages

of Internet in efficiency and convenience, and accelerate the development of Internet-based emerging services such as medical care and health. In the same year, the Opinions on Promoting the Development of “Internet+ Medical Health” issued by the State Council emphasized the promotion of Internet use on residents’ health. The global COVID-19 outbreak has not only highlighted the importance and urgency of health as a core theme of human development, but also demonstrated the importance of Internet use for rural residents to maintain their health. Existing researches in academic circles have not reached a consistent conclusion about the relationship between ICT adoption and healthy human capital, and mainly formed several viewpoints such as health promotion theory and technostress theory. From the perspective of health promotion theory, the Internet can directly or indirectly promote residents’ health. For example, Wangberg (2008) studied the relationship between Internet use, socio-economic status, social support and self-rated health, and found that Internet indirectly affects residents’ health by influencing socio-economic status and other factors ^[1]. Shapira et al. (2007) believed that the use of the Internet is conducive to the communication between the elderly and the society, making them feel stronger social connection, thus reducing loneliness and improving their health ^[2]. Szabo (2018) found that the Internet will make individuals more extroverted, thus significantly improving their happiness and promoting their mental health ^[3]. Technostress refers to the negative impact of Internet use on residents’ health. For example, Billari et al. (2018) believed that the Internet provides a variety of entertainment ways to make people addicted and lead to health deterioration ^[4], and this kind of negative impact is more obvious among teenagers with immature values and relatively weak self-control ^[5]. At present, domestic scholars generally focus their research objects on special groups such as teenagers and middle-aged and elderly people, which results in too limited research objects and insufficient consideration of the importance of research in the field of health for the large group of rural residents. In combination with China’s national conditions, it is an urgent problem to be solved in theory and practice to no longer limit the research object to the minority groups, so further in-depth research is needed.

On this basis, in this paper, with health literacy as the breakthrough point and ICT adoption as the foothold, the relationship between ICT adoption and rural residents’ health human capital is further clarified, which theoretically enriches the research contents of domestic Internet economy and healthy economy, and provides a new idea for the research in this field. Practically, it is not only conducive to strengthening the construction of communication infrastructure in rural areas, but also conducive to the relevant government departments to enhance their understanding of the overall health literacy level of rural residents, providing empirical basis and decision-making reference for improving farmers’ healthy human capital and promoting the implementation of the strategies of “rural revitalization” and “healthy China” in rural areas.

II. Literature Review and Research Hypotheses

2.1 ICT adoption and health human capital

Information Communications Technology (ICT), originated in 1980s, is a new concept and new technical field formed by the integration of information technology (IT) and communication technology (CT). The OECD (Organization for Economic Cooperation and Development), which has been leading the definition and data collection of ICT-related concepts, defines ICT as those products that are designed to satisfy or achieve information processing and communication functions through electronic means. Therefore, ICT is defined in this paper as an electronic product that can realize communication function, obtain information and exchange information, so ICT adoption is the process of using the Internet through this kind of electronic product.

According to Grossman’s (1972) theory of healthy capital demand, healthy investment depends on the return and cost of investment. The return consists of two parts: consumer goods directly entering the utility function to increase the utility of investors and capital goods determining the total time available for market and non-market activities. Cost consists of the cost of inputs such as medical services, exercise, entertainment and housing, and is influenced by environmental variables. When the returns outweigh the costs, it is beneficial to invest more in health, and vice versa ^[6]. Internet use can improve the efficiency of health investment in many ways, Baker Laurence et al. (2003) thought that the Internet has brought a lot of information resources, and people use ICT to

learn knowledge about preventive health care, obtain health information and medical services, etc ^[7,8]. Bliuc (2019) studied the influence of online support network on abstaining from addiction to tobacco and alcohol, and believed that Internet use enriches people's social networks, thus helping them to quit tobacco and alcohol addiction ^[9]. Lu Jiehua (2020) found, based on the household survey data of China in 2016, that Internet use had a significant positive impact on its self-rated health, and one of the main pathways was the information access mechanism ^[10]. Mathers (2009) concluded from the Internet use frequency that it is appropriate to use the Internet several times a week, and the total time of surfing the Internet every day should be controlled within 4 hours, which is beneficial to the health of residents^[11]. In the information society, the Internet provides rural residents with access to health information, thus satisfying the health needs of the disadvantaged rural groups. At the same time, because the social network in rural areas is smaller than that in urban areas, the adoption of ICT has greatly changed the communication methods of rural residents, reduced the phenomenon of face-to-face communication, and expanded the interpersonal range of rural residents as a whole. Thus, the following hypothesis is made:

H1a: The adoption of ICT has a significant positive impact on the health human capital of rural residents.

However, residents with different characteristics may have heterogeneity in the degree of using the Internet to improve their health. Judging from the existing research objects, the majority of them are teenagers and the elderly, because the rich entertainment functions on the Internet will make young people with poor self-control more likely to become addicted than the middle-aged and the elderly. Ning Ke et al. (2019) conducted a study using 1,954 youth samples from CHNS and found that the impact of increased Internet use on their life time allocation and physical health depended on the sum of the substitution effect and complementary effect, and this impact on women was particularly significant^[12].The stock of health capital is decreasing with the increase of age, so the health problems of the elderly are widely concerned by scholars. Cohall et al. (2016) found that Internet use can obviously improve the physical and mental health of the elderly, mainly by improving their learning frequency, and the improvement effect on mental health is higher than that on physical health ^[13]. In addition, services such as smart and healthy old-age care based on internet plus are also important factors affecting the health of the elderly ^[14]. Therefore, the gender and age of rural residents may have some heterogeneous influences. Thus, the following hypothesis is made:

H1b: The health promotion effects by ICT adoption are more significant in the female and middle-aged and elderly groups compared with those in the male and non-middle-aged and elderly groups.

2.2 ICT adoption and Health literacy

The concept of health literacy is so different when defined from different angles that there is no uniform standard in the international community. Health literacy in this paper mainly refers to the ability of rural residents to form a health knowledge reserve by getting health information and reflect it in the healthy behavior of daily life, including health knowledge and health behavior.

At present, there are relatively few studies on the relationship between ICT adoption and health literacy. Heidi et al. (2017) found that there is a certain correlation between health literacy and mobile information technology ^[15]. Song shi jie(2018)found that access to health information through information and communication technology has the greatest effect on promoting health literacy of urban and rural residents, and ICT has a greater effect on promoting health literacy of rural residents than urban residents ^[16]. Most scholars still focus their research on teenagers and the elderly, and thought that the impact is mainly achieved through the combination of Internet and multi-fields. A scholar, Venkata(2014)searched the literature reports from 2004 to 2014, systematically evaluated the health literacy of the elderly, and concluded that the number of elderly people searching for health information through the Internet increased year by year^[17].The "new medical model based on internet plus" is expected to solve the difficult management problem of chronic diseases in the elderly, thus promoting the health literacy of chronic diseases in the elderly ^[18]. At the same time, smart services such as "Internet + Medical service" and "Internet + Interactive health education" can carry out comprehensive health education in a timely and effective manner,

promote the development of healthy lifestyle for teenagers, and have obvious effects on improving the overall health literacy of residents ^[19]. Thus, the following hypothesis is made:

H2: The adoption of ICT has a significant positive impact on the health literacy of rural residents.

2.3 Health literacy and Health human capital

Health literacy is a more effective predictor of health status than demographic factors (such as income, age, etc.) ^[20] and a comprehensive reflection of the level of economic and social development but is influenced and restricted by political and economic factors. The research on health literacy by ChoiN et al. (2011) has drawn close attention from scholars and governments of various countries to health information literacy. They found that the level of individual health literacy is not only of great significance to improving health conditions, but also of great influence to reducing medical expenses ^[22]. KaphingstKA et al. (2014) pointed out that there is a reverse correlation between health literacy and age, which is mainly due to the cognitive impairment of the elderly ^[23]. Bas et al. (2016) conducted a research on the correlation between health literacy and self-management ability for 1,052 elderly people over 75 years old, and the results showed that the low level of health literacy would lead to the decline of health level and affect the happiness of the elderly ^[24]. Individuals with low health literacy mean lack of health awareness and corresponding health knowledge, less active participation in health activities, and thus no lasting motivation to maintain and promote health ^[25]. In addition, some scholars mainly discuss the influence of health literacy and health human capital by region. Huang Ruiqin (2018) investigated the rural residents in Enshi Tujia and Miao Autonomous Prefecture, and thought that health literacy is a powerful tool to maintain and improve the national health level, and improving health literacy has become an important path to improve the health status of residents and achieve the strategic goal of national health ^[26]. Zhou Liang et al. (2019) investigated the residents in 6 rural monitoring points in Hubei Province, and found that the low level of health literacy will not only affect their own health, but also increase the disease burden of rural residents ^[27]. Wang Zhifan et al. (2020) conducted a questionnaire survey on 16,349 farmers aged 18-69 in Gansu Province by multi-stage sampling method, and found that farmers' health literacy had a significant impact on their self-rated health, and their income level played an intermediary role^[28]. Rural residents with high health literacy pay attention to health and hygiene in their daily life and keep good living habits, so as to maintain or improve their own health level. Thus, the following hypothesis is made:

H3: Rural residents' health literacy level has a significant positive impact on their health human capital.

2.4 Mediating effect of health literacy

ICT, as an information and communication technology, cannot directly affect health itself, but must have an effect on health through some mechanism, among which the main mechanism is the information acquisition and interpretation mechanism. As a media, the Internet is an important source of health information. Internet users can find health knowledge, search information about disease characteristics and improve lifestyle through the Internet to improve their health literacy. From the above analysis, rural residents can access health information through the process of using the Internet to improve health literacy level, and thus improve their health human capital. Thus, the following hypothesis is made:

H4: Health literacy plays a mediating role in ICT adoption and rural residents' health human capital.

III. Research Design

3.1 Data sources

The data in this paper are from the survey of "100 villages and 1,000 households" in Jiangxi Province, which was jointly carried out by the School of Modern Agriculture of Peking University and the Jiangxi Institute of Rural Revitalization Strategy of Jiangxi Agricultural University, and was officially implemented in 2018, covering 12

counties in Jiangxi Province, using random sampling method. Finally, the actual household survey reached 1,080 households with large sample size and strong representativeness. This survey covered multi-disciplinary information, such as demographic, economic and social information, and the questionnaire included information on individual health status and Internet use, which met the data requirements of this paper. Data from 1,080 households were cleaned and analyzed using data from 4,829 valid individual questionnaires.

3.2 Variable selection

1. Explained variable. Rural residents' health human capital is an important explained variable in this paper, which is measured by the commonly used self-rated health status in the study by referring to the methods of domestic and foreign scholars [29, 30]. Assign the self-rated health status to the numbers 1-5, and very unhealthy=1; Unhealthy=2; Average=3; Comparative healthy=4; Very healthy=5.

2. Explanatory variable. ICT adoption is the core explanatory variable in this paper. Using the research experience of Leng et al. (2020) for reference, whether rural residents have mobile phone network can be judged by whether they adopt ICT [31]. If they use mobile phone network, it is 1, and if not, it is 0.

3. Mediating variable. Health literacy is an intermediary variable in this paper, which is mainly composed of health knowledge and health behavior of rural residents. In the questionnaire, health knowledge is reflected by the answers to 9 questions such as "Do you think eating too salty can easily lead to high blood pressure?" "Do you think drinking alcohol is one of the causes of high blood pressure?" "Can some health products cure high blood pressure?", health behavior is reflected by the answers to 10 questions such as "Do you share a face towel with your family?" "Do you only brush your teeth after getting up in the morning?" Based on the answers to each question, a score of 1 is accumulated for each item met, and 0 for the opposite item. The level of health literacy is calculated, and the level of health literacy is between 0 and 19.

4. Control variable. In addition, according to the existing research, individual characteristics and living environment characteristics are selected as control variables in this paper. Individual characteristics include gender, age, income and education level [32]. Since with the construction of a new socialist countryside and the continuous improvement of rural public facilities, the living environment such as the public fitness facilities in the villages where rural residents are located and the distance to the township health rooms may also affect their health [33], variables such as "whether the main source of drinking water is tap water", "whether there are public fitness facilities in the village", "whether there is a toilet for independent household use", and "the distance from home to the nearest township health center" are added for control. The description and assignment of specific variables in this paper are shown in TABLE 1.

Table 1. Selections and definitions of variables

Types	Variables	Definitions	Expected directions Of Influence
Explained variable	Health	1 =Very unhealthy, 2 = Healthy, 3 =Average, 4=Comparative healthy, 5=Very healthy	
Explanatory Variable	Int	1 if mobile network use in 2018, 0 otherwise	+
Mediating variable	H-liter	Health knowledge questions (9) and health behavior questions (10), for each one of them, the cumulative score is 1, otherwise, the score is 0, health literacy The level is between 0 and 19	+
Control Variables	Gender	1=male, 0=famale	+
	Age	Age =2018-year of birth (years)	-
	Education	Years of education (years)	+
	Marriage	1 if married, 0 otherwise	-

	Nation	1 if ethnic minority, 0 otherwise	+
	Family	Family Size (persons)	+
	Income	Annual Per capita income in 2018(Ten thousand Yuan)	+
	Toilet	1 if people have their own toilet, 0 otherwise	+
	Facilities	1 if there are fitness facilities in the village, 0 otherwise	+
	Water	1 if the main source of drinking water is tap water, 0 otherwise	+
	Distance	Distance from home to the nearest township health center(miles)	+
IV	Percentage of cell phone networks in village	The number of mobile phone users in the village/ The total number of village	

3.3 Modeling

As the index of health human capital–self-rated health is an orderly classified variable, the ordered Probit model is adopted for analysis and the benchmark regression model is constructed as follows:

$$Health_i = \alpha + \beta_1 Int_i + \theta X_i + \varepsilon_i \quad (1)$$

Where,

i =the individual respondent;

$Health_i$ =the explained variable, indicating the self-rated health status;

Int_i =the explanatory variable, indicating whether the respondent uses mobile phone network;

X_i =the control variables, including individual characteristics, whether the village has fitness facilities, whether the source of domestic water is tap water, and the distance from home to township township health centers;

ε_i =the error term.

However, the existing research shows that farmers' ICT adoption decisions vary from person to person, and are often influenced by observable and unobservable factors, so it is an endogenous variable [34]. Therefore, in this paper, "the proportion of mobile phone network in the village where the respondent is located" was selected as the instrumental variable (IV), and the ordered Probit regression model (EOP) with endogenous covariates was selected for further analysis. Referring to the method of Judit (2011) [35], it is found that the instrumental variable is significant for ICT adoption, but not significant for the health status of rural residents, indicating that the instrumental variable in this paper is effective.

Then, referring to the mediating effect test method proposed by Wen Zhonglin et al. (2004)[36], the following regression models were constructed for independent variables, dependent variables and mediating variables, and the regression coefficients were tested sequentially, as follows:

$$Health_i = \alpha_1 + \beta_2 Int_i + \theta_1 X_i + \varepsilon_i \quad (2)$$

$$H - liter_i = \alpha_2 + \beta_3 Int_i + \theta_2 X_i + \varepsilon_i \quad (3)$$

$$Health_i = \alpha_3 + \beta_4 Int_i + \lambda H - liter_i + \theta_3 X_i + \varepsilon_i \quad (4)$$

Where,

$Health_i$ =the self-rated health of rural residents;

Int_i =ICT adoption;

$H - liter_i$ =the level of health literacy;

X_i =the control variables, including whether the village has fitness facilities, whether the source of domestic water is tap water, and the distance from home to township township health centers;

ε_i =the stochastic disturbance item.

The first step in testing the mediating effect is to test the impact coefficient β_2 of ICT on the health human capital of rural residents in equation (2), if it is significant, continue to test, otherwise stop; the second step is to test the impact coefficient β_3 of ICT adoption on health literacy in equation (3), and continue if it is significant; the third step is to test the significance of β_4 in equation (4). If it passes the significance test and is less than β_2 , it shows that health literacy plays a partial mediating role between ICT adoption and the health status of rural residents. If it is not significant, it shows that health literacy plays a complete mediating role.

IV. Empirical Result and Analysis

4.1 Descriptive statistical analysis

The specific results of descriptive statistical analysis in this study are shown in Table 2. According to individual characteristics, rural male residents accounted for 50.9% and female residents accounted for 49.1% in the sample, and the ratio of male to female was relatively balanced. The largest age group was residents over 55 years old (excluding 55 years old), accounting for 25.68%, followed by those under 19 years old (excluding 19 years old), accounting for 25.02%, indicating that the rural residents in the sample were mainly elderly and children, which reflects the current phenomenon of left-behind children and elderly people in the rural areas. The average number of years of education of the surveyed rural residents was about 6.39, and the education level was mainly concentrated in primary school education, indicating that the rural residents in the sample had relatively low educational level. In terms of health status, the maximum value of self-rated health status of rural residents was 5, with the average value of 3.99, and the maximum value of health literacy level was 18, with the average value of 12.12, indicating that the overall health status was good. As for ICT adoption, 86.5% of the residents used mobile phones to access the Internet, indicating that the Internet did not reach all rural residents, or a small percentage of residents did not use mobile phone networks. As for family size, 47.53% of the households had more than 5 people, with an average of 5.36, indicating that the rural residents in the sample were mainly "big families". In terms of annual income, the average per capita annual income of rural residents was 17,500 yuan, which was generally low and needed to be improved. Regarding the living environment of the respondents, 55.31% of the total samples were rural residents who had public fitness facilities in their villages, and nearly half of the residents were not equipped with fitness facilities in their villages, indicating that the current construction of rural infrastructure is not perfect. Only 37.92% of the rural residents had main drinking water source of tap water, most of them had well

water, which has a certain impact on the health of the residents. 93% of rural residents had their own toilets, which shows that the “toilet revolution” has really and effectively improved the use of toilets by rural residents. Finally, from the point of view of the distance to the township health center, the average value of the nearest township health center is 4.93km, which is relatively moderate and provides farmers with more convenient conditions to see a doctor than before.

Table 2 Descriptive statistics of variables

Variables	Sample	Mean	Std.Dev.	Smallest	Largest
Health	4829	3.99	1.10	1	5
Int	4829	0.86	0.34	0	1
H-Liter	4829	12.12	2.41	4	18
Gender	4829	0.51	0.50	0	1
Age	4829	37.94	22.34	0	108
Education	4829	6.39	4.61	0	23
Marriage	4829	0.63	0.48	0	1
Nation	4829	0.01	0.08	0	1
Family	4829	5.36	2.07	1	13
Income	4829	1.75	1.95	-9.75	21.71
Toilet	4829	0.93	0.25	0	1
Facilities	4829	0.55	0.50	0	1
Water	4829	0.38	0.49	0	1
Distance	4829	9.86	11.01	0	140
Iv	4829	0.84	0.15	0.4	1

4.2 Correlation analysis

Table 3 shows Pearson correlation coefficient analysis results of main variables. Except for ethnicity, the correlation coefficients between other independent variables and health human capital were significant. At the same time, the correlation coefficients of other main independent variables were mostly less than 0.5, indicating that there was no significant multicollinearity problem, which guaranteed the reliability of the results of subsequent multiple regression analysis.

Table 3. Pearson correlation coefficients of key variables

	1	2	3	4	5	6	7	8	9
Health	1								
Int	0.136*	1							
Gender	0.045*	-0.009	1						
Age	-0.541*	-0.142*	0.000	1					
Education	0.194*	0.086*	0.149*	-0.086*	1				
Marriage	-0.323*	0.045*	-0.040*	0.690*	0.079*	1			
Nation	-0.006	0.033	-0.004	0.011	0.008	0.006	1		
Family	0.219*	0.143*	-0.032*	-0.303*	-0.030*	-0.093*	-0.057*	1	
Income	0.148*	0.068*	0.011	-0.059*	0.133*	0.017	-0.013	0.031*	1

4.3 Benchmark regression: ICT adoption and health human capital

Table 4 is the benchmark regression results of the impact of ICT adoption on rural residents’ health human capital. The model (1) was not added with the control variables, and the model (2) and the model (3) were respectively and gradually added with the individual characteristics, the living environment characteristics and other control variables. According to the results of the ordered probit regression model, after gradually adding all the control variables, the impact coefficient of ICT adoption on the health human capital is significantly positive, indicating that ICT adoption significantly positively affects the health human capital of rural residents. Thus, H1a is verified. In addition to the core explanatory variables, other control variables will also have an impact on residents’ health.

From the individual characteristics of the respondents, gender, education level, family size and annual per capita income have significant positive impact on health human capital. Farmers with higher education level are usually better at using mobile phones and can obtain health information through various channels, so they are healthier. The larger the family size, the larger the social network is, which is more beneficial to both physical and mental health. The higher the income of rural residents, the greater the chance of obtaining medical services. However, age has a significant negative impact on health, because the physical function of farmers is gradually decreasing with age, so the older they are, the unhealthier they are, which is consistent with previous research conclusions. From the point of view of living environment, whether to use independent toilets at home, the source of drinking water and the distance from home to township health centers have significantly promoted the healthy human capital of rural residents. It is noteworthy that whether the village has public fitness facilities has no impact on health, probably because although the new rural areas have installed public fitness facilities according to the policy requirements, but most rural residents busy with their livelihood during the day, the use of fitness facilities is low. The source of drinking water, the type of toilets and the distance from the township health centers all reflect the improvement of the living environment of the current rural residents. The better the living environment, the higher the probability of residents' health.

Table 4 Impact of ICT adoption on health human capital of rural residents

Variables	Oprobit Model			Eoprobit Model	
	Model (1)	Model (2)	Model (3)		Model (4)
Int	0.4042*** (0.0452)	0.1140** (0.0477)	0.0909* (0.0480)		0.3327** (0.1322)
Gender	—	0.0702** (0.0333)	0.0735** (0.0333)	—	0.0740** (0.0332)
Age	—	-0.0295*** (0.0011)	-0.0294*** (0.0011)	—	-0.0293*** (0.0011)
Education	—	0.0290*** (0.0039)	0.0281*** (0.0039)	—	0.0281*** (0.0039)
Marriage	—	-0.0049 (0.0484)	-0.0114 (0.0485)	—	-0.0133 (0.0483)
Nation	—	0.0607 (0.1941)	0.0422 (0.1949)	—	0.0568 (0.1941)
Family	—	0.0404*** (0.0085)	0.0410*** (0.0085)	—	0.0394*** (0.0086)
Income	—	0.0632*** (0.0087)	0.0581*** (0.0089)	—	0.0583*** (0.0087)
Toilet	—	—	0.2026*** (0.0647)	—	0.2081*** (0.0645)
Facilities	—	—	0.0174 (0.0331)	—	0.0207 (0.0331)
Water	—	—	0.1217*** (0.0345)	—	0.1132*** (0.0347)
Distance	—	—	0.0003* (0.0002)	—	0.0003* (0.0002)
Iv	—	—	—	3.4402** (0.1528)	
Corr	—	—	—	—	-0.1509** (0.0766)

After the benchmark regression, in order to deal with the sample selection deviation, the instrumental variable IV was added to select the Eoprobit model for further regression, and the coefficient was still significantly positive and larger than the coefficient when the instrumental variable was not added, so the error problem of the ordered probit model is proved.

4.4 Heterogeneity analysis: gender and age

As different rural residents may have different understandings of ICT adoption, its impact on healthy human capital may also be heterogeneous among different people. In this part, the respondents in the sample are divided by gender and age to further explore the heterogeneous impact of rural residents' adoption of ICT on their health. The gender is divided into male and female, and the age is divided into middle-aged and non-middle-aged groups according to the age over 50 (including 50) and under 50 years, with the results shown in Table 5. The adoption of ICT has no significant impact on the improvement of male health, but has a significant positive impact on female health. Compared with men, rural women have less access to the Internet, and their educational level is generally lower than that of men, so they are not very good at using mobile phones to obtain health information. The adoption of ICT has a significant positive impact on both middle-aged and non-middle-aged people, but it has a greater impact on middle-aged and elderly people. Thus, H1b is verified.

Table 5 Heterogeneous impact of ICT adoption on health human capital by Gender and age

Variables	GENDER		AGE	
	Male	Female	Middle-aged and elderly people	Non-middle-aged and elderly people
Int	0.0569 (0.0667)	0.1407** (0.0685)	0.1932*** (0.0668)	0.1465** (0.0702)
Control Variables	yes	yes	yes	yes
Observation	2458	2371	1736	3093

The above research results prove that ICT adoption has a significant positive impact on rural residents' health human capital, so whether ICT adoption can affect rural residents' health literacy level, and whether health literacy level can affect their health human capital? Whether there is a mediating effect between the two, and if so, is it a complete or a partial mediating effect? In view of the above series of problems, step tests were carried out according to the mediating effect model, and the regression results of each equation are shown in Table 6.

Table 6 Test of mediating effects of health literacy

Variables	First step (health)	Second step (H-Liter)	Third step (health)
Int	0.1024*** (0.0387)	0.5271*** (0.1020)	0.0944** (0.0388)
H-Liter			0.0150*** (0.0055)
Gender	0.0648** (0.0262)	-0.1215* (0.0690)	0.0667** (0.0262)
Age	-0.0258*** (0.0009)	0.0000 (0.0023)	-0.0258*** (0.0009)
Education	0.0297*** (0.0029)	0.0407*** (0.0078)	0.0291*** (0.0029)
Marriage	-0.0840 (0.0835)	-0.0693 (0.1015)	-0.0851** (0.0385)
Nation	0.0404 (0.1569)	-0.6491 (0.4134)	0.0502 (0.1569)
Family	0.0317*** (0.0067)	-0.0270 (0.0177)	0.0321*** (0.0067)
Income	0.0495*** (0.0068)	0.0319* (0.0178)	0.0490*** (0.0067)
Toilet Facilities	0.1852*** (0.0525)	0.9629*** (0.1381)	0.1707*** (0.0527)
	0.0037	0.2271	0.0003

	(0.0262)	(0.0690)	(0.0262)
Water	0.0920*** (0.0271)	0.4123*** (0.0714)	0.0858*** (0.0272)
Distance	0.0002 (0.0001)	-0.0011*** (0.0003)	0.0002 0.0001

According to the regression results in Table 6, ICT adoption has a significant positive impact on health literacy and health human capital. The adoption of ICT in the first step of mediating effect test significantly promoted the healthy human capital of rural residents ($\beta_2=0.1024$, $p<0.1$), so the second step was continued. According to the results of the second test, ICT adoption significantly promoted the residents' health literacy level ($\beta_3=0.5271$, $p<0.01$). Finally, the third step was carried out. The result shows that ICT adoption and health literacy have a significant positive impact on health human capital ($\beta_4=0.0787$, $\lambda=0.0150$) after addition of the mediating variable of health literacy, indicating that health literacy plays a partial mediating role between ICT adoption and the positive impact of rural residents' health human capital, with the mediating effect being 0.0079, that is, the product of β_3 and λ , with the mediating effect accounting for 7.71%.

4.5 Robustness test

In this paper, the explanatory variable, whether the mobile phone network is used or not, was replaced by whether there is broadband network at home, to test the robustness of the impact of ICT on health human capital of rural residents, which is also verified by Oprobit regression model. Similarly, the control variables were added in turn, and the results showed that the adoption of the core variable ICT still had a significant positive impact on rural residents' health human capital, indicating that the robustness is better.

V. Conclusions and Suggestions

5.1 Conclusions

The popularization of information and communication technology in rural areas has brought great changes to rural residents' communication methods and access to medical information, thus affecting their health level. China, as a big agricultural country, has the primary task of improving the health level of rural residents to realize a healthy China and the rural revitalization strategy. On the basis of summarizing the existing studies, this paper holds that ICT adoption may affect the health status of rural residents, and health literacy may play a mediating role between them. Therefore, in this paper, 4,829 rural residents' health survey data of "one hundred villages and one thousand households" in Jiangxi Province are used to verify the above hypotheses. The results show that the adoption of ICT by rural residents has a significant positive impact on their health human capital through benchmark regression, and the regression results with instrumental variables further confirm this conclusion. In addition, individual characteristics such as gender, education level, family size and per capita annual income have a significant positive impact on residents' health human capital, while age has a significant negative impact. Independent toilets, drinking water sources and the distance from home to township health centers can significantly promote health human capital, while whether the village has fitness facilities has no effect on health. Heterogeneity analysis reveals that compared with rural male residents, ICT has a more significant impact on female residents. Compared with non-middle-aged and elderly people, ICT has a greater impact on middle-aged and elderly people, mainly because women and middle-aged and elderly people have less access to the Internet and limited skills in using electronic products. Mediating effect test shows that health literacy plays a partial mediating role in the impact of ICT adoption on health human capital, and the adoption of ICT can improve the health literacy level of rural residents, and then improve their health human capital.

5.2 Suggestions

Based on the above research conclusions, in order to give full play to the health effects of ICT adoption and improve the health human capital of rural residents, the following policy recommendations are put forward in this paper:

First, the construction of communication infrastructure in rural areas should be strengthened to increase the penetration rate of mobile Internet. According to the latest data, there is still a large gap in Internet penetration between urban and rural areas, and the digital divide is widening. Moreover, there are also differences in Internet penetration rate in different rural areas due to resources, traditional concepts and other factors, between the developed central rural areas and the relatively backward western rural areas. Under the background of a series of national policies to promote the development of “internet plus”, the government should continuously strengthen the construction of communication infrastructure in rural areas, increase the penetration rate of mobile Internet, eliminate the deviation of policies and resources to the maximum extent, and fill the shortcomings of Internet infrastructure and bridge the digital divide.

Second, the policy of benefiting the people should be introduced, and the coverage of mobile internet among rural women and middle-aged and elderly people should be expanded. Internet usage in rural areas is mainly concentrated among men and non-middle-aged and elderly groups due to factors such as educational level, so the government should strengthen the inclusive construction of Internet-related public services, improve the accessibility of Internet use by rural women, middle-aged and elderly people, narrow the gap between gender and age, and promote rural residents to share network resources more evenly. At the same time, ordinary people should actively provide necessary help and encouragement for women and middle-aged and elderly people around them to meet their needs for social interaction and leisure entertainment by using electronic products, so that they can fully understand the benefits of using the Internet and expand the positive effects of using the Internet.

Thirdly, training on internet use skills, especially health information search skills, should be carried out through public welfare training lectures, because it is very important to train rural residents in skills such as searching for health information, which will improve their health literacy level. It is necessary to help farmers improve their basic ability to operate electronic products such as smart phones and computers, understand the ways to get health information, improve their health literacy level, and embody health information in their daily life by conducting public welfare training lectures on Internet use skills and one-to-one guidance by volunteers. At the same time, rural residents should be guided to use the Internet rationally, give full play to the positive role of the Internet, and reduce the negative impact of the Internet on the health of residents, especially minors with poor self-control.

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