



# Influences of Public Medical Insurance System on Labor Health Status and Supply

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## Abstract

**Background:** The emergence of COVID-19 in 2020 has brought dramatic impacts to the global economy. The resulting health crisis and widespread fear have triggered labor shortage problems such as high job vacancy rate and low labor participation rate. Thus, how to increase the labor supply has become a hotspot among scholars. We aimed to analyze the influences of public medical insurance system on labor health status and supply.

**Method:** Using the China Health and Nutrition Survey five-phase panel data, the new rural cooperative medical system was taken as an example to empirically analyze the influences of public medical insurance system on the individual health status and labor supply via the panel Tobit model and panel binary Logit model. The analysis revealed the mediating effect of health status.

**Results:** First, Public medical insurance system could significantly improve individual health status. Second, public medical insurance system will lengthen the labor supply time and elevate the labor supply rate by improving individual health status. Third, the influences of public medical insurance system on labor health status and supply vary with gender and age.

**Conclusion:** Public medical insurance system will generate positive influences on labor health status and labor supply. Hence, perfecting the public medical insurance system is able to mitigate the negative impacts of population aging and pandemic on the labor supply.

**Keywords:** Public medical insurance; Health effect; Labor supply; Mediating effect

## Introduction

The COVID-19 outbreak in 2020 has become a major global public health event, which imposes dramatic impacts to the global economy (1). Unlike influences brought about by general economic recession, the pandemic not only lowers labor demands but also impacts labor supply (2). After this pandemic is alleviated in economies like America and China, the labor demand will rise at a low rate, job vacancy will rebound significantly, and the labor participation rate will remain at a

low level, all of which are manifested by “labor shortage”(3).

The labor shortage problem resulting from the pandemic is the result of multiple factors like health status, infection or fear of infection, quarantine or treatment, and flow limitation. Nonetheless, perfecting the public medical insurance is an effective measure of improving the labor health status and increasing labor supply (3, 4). Laborers with medical insurance can usually take



better advantages of medical care services, to reduce the occurrence of diseases and improve their health conditions (5). As a result, their labor participation will be motivated and labor time will be increased (6). However, labor supply is negatively affected by public medical insurance programs. The State Children's Health Insurance Programme would lower the labor participation rate of nonwhite poorly educated women (7). After the implementation of American Affordable Care Act, the participation probability of the population it covered in full-time jobs was reduced by 2.2%, and the probability of exiting from the labor market was increased by 1.4% (8). The public medical insurance equivalently intensified the budget constraint to non-wage labor income, which was to the disadvantage of labor supply; consequently, people would prefer leisure time than labor (9).

Given the disputes in the existing literature, the influences of public medical insurance system on labor health status and labor supply were discussed again in this study, and whether the public medical insurance system could improve the labor health status and increase the labor supply was empirically analyzed. With the new rural cooperative medical care system (NRCMCS) in China taken as an example, the influences of this medical insurance system on labor health status and labor supply were analyzed on the basis of the China Health and Nutrition Survey (CHNS) five-phase panel data. Additionally, the differences in laborers of different genders and ages in their health status and labor supply under the NRCMCS were explored. As a representative of China rural public medical insurance system; the new rural cooperative medical care system (NRCMCS) is a medical mutual aid system for peasants. It is organized, guided, and supported by the government, participated by peasants voluntarily, funded by individuals, collectives and government, and centers on the comprehensive arrangement for serious diseases. In 2009, the Chinese government made an important strategic deployment of deepening the reform of medical and health sectors, and established the status of NRCMCS as the rural basic medical insurance

system (10). Since its implementation, the NRCMCS has aroused extensive attention in academic circles. The existing literature regarding the NRCMCS has concentrated on the health effect it generates.

### *Literature Review*

Theoretically, the public medical insurance system facilitates peasants to utilize medical services and improves their health status (6). The NRCMCS contributes to the improvement of the health level of peasant participants, mitigates participants' "unwillingness to seek for medical treatment of their diseases," and especially improves the health level of high-income participants (10). The elevated utilization rate of medical services is an important channel for the NRCMCS to influence the health level of participants (11). However, although the NRCMCS can facilitate the daily life, actions, and cognitive functions of the aged, the self-assessment of their health level is not promoted accordingly (12).

Rural labor supply can be promoted by improving the quality of healthy human capital (13, 14). Given that public medical insurance system is a key factor that improves health status, the elevated health level of peasants is the catalyst for labor supply (15, 16).

However, it exerted a positive influence on agricultural labor participation probability and agricultural labor supply time of rural old people. This effect was stronger on old men than on old women (16). Whether the public medical insurance system influences individual labor supply via its health effect remains unfounded. Liao and Taylor investigated the influence of universal health insurance on female participation in non-agricultural labor in Taiwan, and the results showed that compared with those not participating in the insurance system, the nonagricultural labor participation probability of female participants was reduced by 10% (17). Although medical insurance decreased the nonagricultural labor participation probability and nonagricultural labor time of peasants, it remarkably increased their agricultural labor participation and agricultural labor time. This public medical insurance

system stipulates that peasant participants must satisfy a certain agricultural labor time and cultivated area and shall not participate in full-time nonagricultural labor, thus discouraging peasants from participating in nonagricultural labor largely (9, 15, 18).

The influence of public medical insurance system on individual labor supply decisions ultimately depends on the leisure value and labor income. If the marginal value of leisure is greater than the marginal income of labor, then leisure will be preferred, which reduces labor supply. By contrast, if the marginal value of leisure is smaller than the marginal income of labor, then labor supply can be increased (15,18).

The health effect generated by public medical insurance system and its influence on labor supply have been a key focus in the existing literature, but the conclusions are not consistent, thus needing new empirical evidence. Directing at the disputes in the literature, the influence of NRCMCS on labor supply and its action path were empirically analyzed by using panel Tobit model and panel binary Logit model based on the CHNS five-phase panel data from 2004–2015. Furthermore, the differences in the labor supply among different genders and ages under the NRCMCS were explored.

## **Methods**

### ***Data sources and features***

The CHNS data were used in this study. The data were used to investigate the implementation of related national and governmental policies regarding nutrition, health, and birth control. The nationwide tracing investigation was carried out every two years since 1989, and now 10 periods have been completed (10). As the NRCMCS was experimentally implemented in 2003, the five-phase (2004, 2006, 2009, 2011, and 2015) panel data were chosen in this study.

### ***Research Variables***

#### ***1) Dependent variables***

***Health:*** Chronic disease was used as a quantitative index of health capital. If the respondent was diagnosed by a doctor with one or multiple diseases among hypertension, diabetes, myocardial infarction, stroke or fracture, the variable value was 1; otherwise it was 0 (19).

***Labor supply:*** Labor supply was investigated from two aspects: logarithm of labor supply time and labor supply rate. Labor supply time was measured by the annual total labor supply time of individual samples. It was the annual total number of agricultural labor hours of peasants, and the labor time of peasants occupied in four agricultural activities was summed. Nonagricultural labor supply time was the sum of annual total labor time of individual samples. The four agricultural activities in the CHNS data include kitchen garden and orchard; collective and family agriculture; collective and family livestock and poultry rearing; collective and family fishery. The three questions related to labor time in the CHNS data are “how many months did you spend in doing this job in the last year?,” “how many days averagely per week did you spend in doing this job over the several months?,” and “how many hours averagely per day did you spend in doing this job over the several months?” Labor supply rate: Over 104 hours of participation in agricultural labor throughout one year was defined as participation in agricultural labor, whereas over 53 hours of participation in nonagricultural labor throughout one year was defined as participation in nonagricultural labor (16).

#### ***2) Independent variables***

***NRCMCS:*** The variable value was 1 for NRCMCS participants and 0 for non-NRCMCS participants.

***Household income:*** Household per capita net income was selected to measure household income, which was converted into the present value in 2015 using the resident consumer price index in each year, and the logarithmic value was taken.

#### ***3) Control variables***

Other control variables included age, gender, educational level, marital status, whether the participant was smoking or drinking, whether parents were diagnosed with any chronic disease or ge-

netic disease, family population, family-cultivated area, year, and region.

Descriptive analysis of the variables was presented below in Table 1.

**Table 1:** Descriptive analysis of the variables

<i>Name</i>	<i>Mean value</i>	<i>Standard deviation</i>	<i>Minimum value</i>	<i>Maximum value</i>	<i>Sample size</i>
<b>Dependent variables</b>					
Agricultural labor supply time	784.73	867.72	0	4368	11,890
Nonagricultural labor supply time	411.69	976.73	0	4368	11,890
Logarithm of agricultural labor supply time	5.28	2.59	0	8.38	11,890
Logarithm of nonagricultural labor supply time	1.36	2.92	0	8.38	11,890
Agricultural labor supply rate	0.75	0.43	0	1	11,890
Nonagricultural labor supply rate	0.18	0.38	0	1	11,890
Health	0.17	0.37	0	1	11,890
<b>Independent variables</b>					
NRCMCS	0.70	0.46	0	1	11,890
Household per capita net income	8.74	1.06	5.37	11.17	11,890
<b>Control variables</b>					
Age	53.50	12.31	18	100	11,890
Gender	0.44	0.50	0	1	11,890
Family population	3.88	1.73	1	15	11,890
Educational level	1.54	0.73	1	4	11,890
Whether smoking or drinking	0.23	0.37	0	1	11,890
Whether parents are diagnosed with any chronic disease or genetic disease	0.56	0.28	0	1	11,890
Marital status	0.90	0.30	0	1	11,890
Family-cultivated area	6.15	12.07	0	210	11,890
Year	2009	3.85	2004	2015	11,890
Region	0.58	0.49	0	1	11,890

Note: The data were derived from CHNS

**Empirical model**

**1) Panel binary Logit model**

An explained variable was health status (value: 0 or 1), which was estimated by using panel binary Logit model, with the following form: Concrete model is shown as follows:

$$Logit(P_{it}) = \ln\left(\frac{P_{it}}{1-P_{it}}\right) = \alpha_0 + \beta_0 M_{it} + \beta_1 X_{it} + \varepsilon_i$$

$$P_{it} = E[y_{it} | X_{it}, M_{it}] = \Pr(y_{it} = 1 | X_{it}, M_{it})$$

where  $y_{it}$  is the health status of individual  $i$  in year  $t$ ;  $M_{it}$  is the NRCMCS participation of indi-

vidual  $i$  in year  $t$ ;  $X_{it}$  represents the other control variables for individual  $i$ ;  $P_{it}$  denotes the probability that the explained variable of individual  $i$  will be 1 under certain explanatory variables;  $\alpha_0$  is the intercept term;  $\beta_0$  and  $\beta_1$  are the coefficients; and  $\varepsilon_i$  is the random disturbance term.

**2) Tobit model**

In consideration that labor time and labor supply rate were typical merging data, labor supply was analyzed by using the panel Tobit model. With

labor supply time as an example, the specific form is as follows:

$$Y_{it} = \alpha + \beta_0 M_{it} + \beta_1 X_{it} + \varepsilon_i \quad \varepsilon_i \sim N(0, \sigma^2)$$

$$Y_{it} = \begin{cases} \alpha + \beta_0 M_{it} + \beta_1 X_{it} + \varepsilon_i & (Y_i > 0) \\ 0 & (Y_i \leq 0) \end{cases}$$

Where  $Y_{it}$  is the annual total labor supply time of individual  $i$  in year  $t$ , which is specifically divided into agricultural labor supply time and nonagricultural labor supply time. No unnecessary details will be given to the meaning of other symbols.

Model estimation was conducted using Stata15.0.

## Results

**Table 2:** Influences of NRCMCS on health and labor supply

<i>Variables</i>	<i>Health</i>	<i>Labor supply time</i>	<i>Labor supply rate</i>
NRCMCS	-0.274*** (0.025)	1.050*** (0.102)	0.783*** (0.135)
Household per capita net income	0.012 (0.038)	-0.008 (0.034)	-0.046 (0.044)
Age	0.080*** (0.006)	-0.010** (0.005)	-0.004 (0.008)
Gender	0.147 (0.118)	0.001 (0.094)	-0.263 (0.172)
Family population	-0.073*** (0.025)	-0.056** (0.023)	-0.055* (0.030)
Educational level	-0.031 (0.069)	-0.585*** (0.064)	-0.332*** (0.082)
Whether smoking or drinking	0.208*** (0.055)	0.160 (0.002)	0.389 (0.269)
Whether parents are diagnosed with any chronic disease or genetic disease	0.170*** (0.028)	-0.850** (0.362)	-0.598*** (0.185)
Marital status	-0.126 (0.150)	0.821*** (0.157)	0.737*** (0.189)
Family-cultivated area	-0.004 (0.004)	0.033*** (0.004)	0.029*** (0.006)
Year	Y	Y	Y
Region	Y	Y	Y
Constant term	-6.610*** (0.535)	5.359*** (0.474)	3.219*** (0.633)

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\*  $P < 0.001$ ; Standard errors are shown in parentheses

By dividing labor supply into agricultural labor supply and nonagricultural labor supply, according to the empirical results in Table 3, the

### Result of basic regression

According to the empirical results in Table 2, the NRCMCS had a significant effect on health status with a negative correlation, indicating that the NRCMCS would improve individual health status. Labor supply time and labor supply rate were significantly influenced by the NRCMCS ( $P < 0.001$ ), with positive coefficients, manifesting that this system would increase labor supply. As a representative of China rural public medical insurance system, the NRCMCS can effectively increase rural medical service supply in China, reduce individual medical costs, further improve their health status, and elevate labor supply.

NRCMCS was revealed to lengthen agricultural labor supply time and enhance agricultural labor participation. However, it had no significant in-

fluence on nonagricultural labor supply time or supply rate, which may be ascribed to the following aspects.

**Table 3:** Influences of NRCMCS on agricultural and nonagricultural labor supplies

<i>Variable name</i>	<i>Agricultural labor supply time</i>	<i>Nonagricultural labor supply time</i>	<i>Agricultural labor supply rate</i>	<i>Nonagricultural labor supply rate</i>
NRCMCS	0.160*** (0.051)	-0.041 (0.369)	0.770*** (0.135)	-0.035 (0.117)
Household per capita net income	0.011 (0.017)	2.415*** (0.149)	-0.046 (0.044)	0.736*** (0.046)
Educational level	-0.094*** (0.035)	1.584*** (0.206)	-0.332*** (0.082)	0.481*** (0.061)
Other control variables	Y	Y	Y	Y
Region	Y	Y	Y	Y
Year	Y	Y	Y	Y
Constant term	5.535*** (0.348)	-19.513*** (1.833)	3.180*** (0.632)	-5.928*** (0.550)

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\*  $P < 0.001$ ; Standard errors are shown in parentheses

**Mediating effect test**

In this section, the high-dimensional fixed effect and panel binary Logit model were used to verify whether health status played a mediating role in the influence of NRCMCS on labor supply. According to the basic principle of mediating effect model, the influence of NRCMCS on labor supply, that of NRCMCS on health status and that of NRCMCS and health status on labor supply should be tested. Table 3 presents the influences

of NRCMCS on health status and labor supply. The NRCMCS and health status were taken as the independent variables to estimate supplementary the influences of NRCMCS and health status on labor supply.

As seen in Table 4, the NRCMCS and health status exerted significant effects on labor supply time and labor supply rate ( $P < 0.001$ ).

**Table 4:** Estimated influences of NRCMCS and health status on labor supply

<i>Variable name</i>	<i>Labor supply time</i>	<i>Labor supply rate</i>
NRCMCS	1.042*** (0.102)	0.770*** (0.135)
Health status	-0.437*** (0.094)	-0.370*** (0.119)
Household per capita net income	-0.007 (0.034)	-0.046 (0.044)
Educational level	-0.585*** (0.063)	-0.332*** (0.082)
Other control variables	Y	Y
Year	Y	Y
Region	Y	Y
Constant term	5.299*** (0.474)	3.180*** (0.632)

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\*  $P < 0.001$ ; Standard errors are shown in parentheses

By combining the results in Table 4 with that in Table 3, the NRCMCS remarkably influenced labor supply time and labor supply rate. Health status was significantly influenced by the NRCMCS ( $P < 0.001$ ). After the mediating variable—health status—was introduced, the NRCMCS still generated evident influences on labor supply time and labor supply rate ( $P < 0.001$ ). Labor supply was also affected by health status at a certain significance level ( $P < 0.001$ ). Therefore, according to the basic principle of mediating effect model, health status played a partial mediating role, that is, the NRCMCS exerted a health effect on labor supply, and it would

facilitate labor supply by improving individual health status.

#### **Robustness test**

Regression of samples with different genders and ages was further conducted in this section. In Table 5, relative to female samples, the NRCMCS exerted a more significant effect on agricultural labor supply time and agricultural labor supply rate among male samples, but its influence on nonagricultural labor supply time among male and female samples was insignificant. In general, the regression results accorded with the empirical results obtained through the benchmark model.

**Table 5:** Estimated influences of NRCMCS on labor supply with different genders

<b>Variable name</b>	<b>Male sample</b>				<b>Female sample</b>			
	Agricultural labor supply time	Nonagricultural labor supply time	Agricultural labor supply rate	Nonagricultural labor supply rate	Agricultural labor supply time	Nonagricultural labor supply time	Agricultural labor supply rate	Nonagricultural labor supply rate
NRCMCS	0.229***	0.438	0.818***	0.112	0.102	-0.869	0.748***	-0.242
CS	(0.081)	(0.425)	(0.191)	(0.152)	(0.065)	(0.698)	(0.192)	(0.185)
Health status	-0.095	0.529	-0.339**	0.152	-0.094	-0.227	-0.370**	-0.068
	(0.074)	(0.426)	(0.172)	(0.148)	(0.061)	(0.728)	(0.165)	(0.190)
Control variable	Y	Y	Y	Y	Y	Y	Y	Y
Constant term	4.329***	-12.948***	2.261**	-4.681***	6.513***	-21.198***	4.160***	-5.156***
	(0.539)	(2.147)	(0.917)	(0.716)	(0.449)	(3.399)	(0.886)	(0.863)

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\*  $P < 0.001$ ; Standard errors are shown in parentheses

The total samples were divided into two groups—young and middle-aged peasants (18–65 yr old) and old peasants (65 or over 65 years

old)—for the regression. The results in Table 6 accorded with the basic regression results.

**Table 6:** Estimated influences of NRCMCS on labor supply with different ages

Variable name	Young and middle-aged sample				Old sample			
	Agricultural labor supply time	Nonagricultural labor supply time	Agricultural labor supply rate	Nonagricultural labor supply rate	Agricultural labor supply time	Nonagricultural labor supply time	Agricultural labor supply rate	Nonagricultural labor supply rate
NRCMCS	0.174*** (0.053)	-0.011 (0.371)	0.825*** (0.146)	-0.055 (0.121)	0.288 (0.182)	0.873 (2.643)	0.846** (0.411)	0.379 (0.558)
Health status	-0.094* (0.054)	0.125 (0.392)	-0.456** * (0.140)	0.047 (0.123)	-0.135 (0.116)	2.246 (1.660)	-0.307 (0.261)	0.385 (0.354)
Other control variables	Y	Y	Y	Y	Y	Y	Y	Y
Constant term	4.502*** (0.373)	-20.242*** (1.898)	2.101*** (0.704)	-6.238*** (0.576)	15.487** * (1.555)	-22.353 (17.855)	21.409** * (2.948)	-4.441 (3.867)

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\*  $P < 0.001$ ; Standard errors are shown in parentheses

## Discussion

This study verified that the public medical insurance system can significantly improve individual health level and further facilitated labor supply by improving individual health status. This finding coincided with the research findings in the existing literature (10, 11). Belonging to the category of social insurance redistribution, the public medical insurance policy reaches the secondary allocation effect by compensating medical costs for people with medical expenditures. For individuals, the public medical insurance system lowers medical costs, mitigates their “unwillingness to seek for medical treatment of their diseases,” increases the probability of sick people seeing doctors and accepting treatment in formal medical institutions, elevates the utilization rate of medical services, and helps patients recover from injury or disease rapidly. In addition, the preventive health care services offered by the public medical insurance system such as physical examination and health education can improve the individual awareness of health and fitness, with significant

effects on disease prevention and timely treatment (6). The elevated utilization rate of medical services is an important channel for the NRCMCS to influence the health level of participants (11, 16).

As an important human capital, health level has a profound influence on labor supply (13,14). When the public medical insurance system is incomplete, some fragile people prone to health risks will experience significant reduction of their labor supply time and production efficiency once they are impacted by diseases. The public medical insurance system can improve their individual health status, reduce the time loss caused by diseases, and further enhance labor supply. Theoretically, the public medical insurance system influences labor supply possibly from two aspects: positive influence, that is, the “health effect” of NRCMCS improves peasants’ health status and increases agricultural labor efficiency to some extent (15); negative influence, that is, the public medical insurance system, which is a government transfer payment, equivalently increases the non-wage income of laborers and is not good for



stimulating their labor supply (9,18). The existing literature believe that the influence of public medical insurance system on individual labor supply decisions ultimately depends on the leisure value and labor income (16, 18). The empirical analysis results show that the public medical insurance system generally exerts a positive effect on labor supply.

The policy enlightenments of this study are as follows. First, the government should continue to expand the input of basic public services and social insurance, strengthen the basic medical facility construction, perfect the public medical insurance system, enhance the supply capacity of medical and health services, give full play to the health effect and economic effect of public medical insurance system, strengthen individual human capitals, and improve their labor productivity (11). Second, to realize the reasonable allocation of limited financial funds, medical insurance at different levels can be provided to different people, and the emphasis can be laid on elevating medical subsidies and compensation proportion of major diseases for disadvantaged groups, such as rural middle-aged and aged people and low-income people (16).

## Conclusion

Based on the CHNS five-phase panel data during 2004–2015, the influences of NRCMCS on rural labor health status and labor supply were empirically analyzed. The public medical insurance system is capable of improving peasants' health status significantly. The public medical insurance system can lengthen agricultural labor supply time and elevate the agricultural labor supply rate by improving individuals' health status. The influences of public medical insurance system on agricultural labor health status and labor supply vary with gender and age. Furthermore, the public medical insurance system will generate positive influences on agricultural labor health status and labor supply. Hence, the reduction of labor supply brought about by the pandemic can be remit-

ted by further perfecting the public medical insurance system.

## Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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## Conflict of interest

The authors declare that there is no conflict of interest.

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