

# *The effect of long-term care insurance on the utilization of medical services among middle-aged and elderly people in China*

Xiu Luo<sup>1</sup>, Yibing Li<sup>1,\*</sup>, Panpan Yang<sup>1</sup>

<sup>1</sup>*School of International Pharmaceutical Business, China Pharmaceutical University, Nanjing, China*

*\*Corresponding author*

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**Abstract:** In order to investigate the policy effect of China's long-term care insurance pilot policy and enrich the relevant research results of long-term care insurance evaluation. In this paper, DID model and PSM-DID model are used for empirical analysis, and CHARLS mixed panel data is used. Baseline regression shows that the implementation of long-term care insurance significantly reduces the out-of-pocket medical expenses and the number of inpatient visits of the middle-aged and elderly insured group, while has no significant impact on the number of outpatient visits. The PSM-DID model and counterfactual estimation are used to enhance the reliability of the results. In addition, the heterogeneity test is conducted by household registration and gender group, and the results show that long-term care insurance only has a significant positive effect on the number of inpatient visits in rural population, but not in urban population. The implementation of the policy has a significant effect on the utilization of medical services for men, but not for women.

## 1. Introduction

Statistics from the China's National Bureau of Statistics show that by the end of 2022, there are 209 million people over the age of 65, accounting for 14.85% of the total population, further deepening the degree of population aging. At the same time, the number of disabled elderly and their need for long-term care is rising. Under the influence of many factors, such as family planning policy, urbanization process, family role change, government financial pressure and so on, the traditional family nursing is difficult to continue to play an important role. The demand for socialized nursing surges<sup>[1]</sup>, and the nursing problem of disabled elderly has become a hot social issue should to be solved urgently. In this context, China has promulgated two pilot guidelines on long-term care insurance in 2016 and 2020, setting up national pilot cities. In addition, there are also some cities under the guidance of 2016 national policy documents carrying out long-term care insurance pilot, before 2018 alone (including the cities issued policy in 2017 but implemented on January 1, 2018), there are totally 33 first batch of national pilot cities and self-built pilot cities (hereinafter referred to as the "first batch of pilot cities"). It is necessary to analyze the effect of policies in pilot cities to provide a basis for the formal introduction of long-term care insurance.

Some foreign scholars have studied the effect of long-term care insurance policy implementation, but no consistent conclusion has been reached on the effect. Hughes et al. <sup>[2]</sup> find that a long-term home care program significantly reduces the risk of long-term hospitalization. Umegaki H et al. <sup>[3]</sup> find that the long-term care insurance system can effectively reduce the family burden and is conducive to home care in the investigation of the care needs of the elderly in Japanese cities. At the same time, some scholars hold the views that long-term care insurance increases the use of hospital resources. Deraas et al. <sup>[4]</sup> using Norway national data find that there is a statistically significant positive correlation between the care rate and hospitalization rate for women and all men aged 67 to 79. As for the release effect and substitution effect of long-term care insurance, studies by foreign scholars <sup>[5-8]</sup> show that in major developed countries, the total cost of long-term care insurance is constantly rising no matter what kind of long-term care insurance policy is adopted.

The impact of long-term care insurance on medical burden must be combined with national conditions. Domestic scholars <sup>[9-12]</sup> have studied the implementation effect of long-term care insurance, but the sample selection has not yet included the self-pilot cities in the experimental group. For this reason, using the data of CHARLS database in 2011, 2013, 2015 and 2018, this paper selects the population covered by long-term care insurance in 15 cities with data available in the first batch of pilot cities as the control group to consider the impact of long-term care insurance on the utilization of medical services. Because the financing channel of long-term care insurance in our pilot cities mainly depends on the basic medical insurance system, the effect of the policy can be evaluated reasonably and effectively by considering the impact of long-term care insurance on the utilization of medical services, and by comparing the impact difference between men and women and between urban and rural areas, which can provide the basis for the establishment and sustainable development of the long-term care insurance system to enhance the sense of gain, happiness and security of the elderly.

## 2. Materials and methods

### 2.1. Data source

The China Health and Retirement Longitudinal Study (CHARLS) is a database of high-quality micro-data, which mainly carries out on the families and individuals of middle-aged and elderly people over the age of 45. The national baseline survey was officially launched in 2011. The survey covered 28 provinces, municipalities and autonomous regions, and was conducted nationwide in 2013, 2015 and 2018. The questionnaire covers basic information, health status and function, cognition and depression, medical care and insurance, family income and other contents, and publishes individual city information, which can meet the research requirements of this paper.

### 2.2. Sample selection

The implementation plan of the pilot cities is as shown in Table 1. In order to improve the reliability of the research conclusions, the samples of the treatment group are screened as follows: First, nine samples of Changchun, Rizhao, Nantong and other cities with missing relevant data are excluded; Then, based on 2016 as the time node, Qingdao, Weifang and Liaocheng, which start the pilot earlier than 2016, are excluded. For the samples of cities, which launched less than half a year away from the CHARLS 2018 data survey, it is considered that they had not been affected by the policy, so this paper also eliminates them. A total of 15 cities are included in the treatment group. The respondents who are insured by the long-term care insurance in that city are finally included in the treatment group, and the non-insured people are automatically classified as the control group along with other cities.

Table 1 Classification of pilot cities based on different coverage

Types of medical insurance	Cities
Urban workers	Weifang, Rizhao, Shangrao, Jinan, Chengde, Anqing, Chengdu, Guangzhou, Linyi, Qiqihar, Liaocheng, Taian, Chongqing, Binzhou, Dezhou and Zibo
Urban workers and urban residents	Changchun, Songyuan, Jilin City and Tonghua
Urban workers and urban and rural residents (or new rural cooperative medical insurance)	Qingdao, Nantong, Xingtai, Jingmen, Shanghai, Shihezi, Hangzhou, Xuzhou, Jiaxing, Linfen, Suzhou, Ningbo and Baishan

### 2.3. Research methods

Based on the quasi-natural experiment of policy, the National Human Resources and Social Security Administration issues the guidance on the long-term care insurance pilot in 2016, the DID model is used as the benchmark regression to investigate the overall implementation effect of the system pilot, and the PSM-DID model is used to solve the selective bias and endogeneity problem, making the experimental results more convincing.

#### 2.3.1. DID model

The DID model is used as the benchmark regression to measure the impact of the long care insurance pilot policy on the utilization of medical services among the middle-aged and elderly. The formula of the differential model is as follows:

$$Y_{it} = \alpha + \beta post_t * treat_i + \gamma X_{it} + \mu_i + \delta_t + \varepsilon$$

#### 2.3.2. PSM-DID model

Propensity score matching (PSM) is a method to calculate the propensity score of samples by using control variables, match treatment group and control group samples as similar as possible, and then calculate the average treatment effect. Through the combination of PSM and DID, the problem of selective bias and endogeneity are better handled. The formula for matching propensity scores is as follows:

$$\omega(X_i) = Pr(treat_{it} = 1|X_i) = \frac{\exp(\beta X_i)}{1 + \exp(\beta X_i)}$$

### 2.4. Variable definition

In order to investigate the impact of the implementation of long-term care insurance on the utilization of medical services for middle-aged and elderly people, out-of-pocket medical expenses, outpatient visits and inpatient visits are respectively taken as explained variables. The core explanatory variable of this paper is DID, and control variables include demographic variables and socio-economic variables and so on. Detailed definitions of variables are shown in Table 2.

Table 2 Definitions of variables

Variables	Variables' full name	Definition
self_paid	Out-of-pocket medical expenses	Out-of-pocket medical expenses consist of three indicators, which need to be annualized for out-of-pocket outpatient expenses and out-of-pocket self-medical expenses, then summed up with out-of-pocket hospitalization expenses, and finally logarithmically processed.
out_visits	Number of outpatient visits	Number of outpatient visits in the month prior to the survey.
in_visits	Number of inpatient visits	Number of inpatient visits received in the previous year.
DID	Interaction term	The core explanatory variable that indicates whether the respondents participate in long-term care insurance.
gender	Gender	Female =1, Male =0.
age	Age	Current age (age $\geq$ 45 years old)
marriage	Marital status	Married and living with spouse =1, Married but temporarily separated for reasons such as work =2, Separation =3, Divorced =4, Bereavement =5, Unmarried =6, Cohabitation =7.
education	Educational level	Illiteracy or semi-illiteracy =1, Primary school =4, Middle school =6, High school =8, University =11, Master's =13, Doctor's and above =16.
lninc	Household income	Household income = household income + transfer income + agricultural income + self-employment income, and then logarithmically treated.
children	The number of children	The number of children still alive.
ADL	Activity of Daily Living	The higher the score, the more independent and less dependent.
chr_diseases	Chronic diseases	Having chronic diseases or not, yes=1, no=0.
dep	Depression score	Subtract 10 points from the total score of 10 questions.

### 3. Results

#### 3.1. Descriptive Statistics

Table 3 Descriptive statistics

Variables	All samples					2018		2015	
	N	mean	min	max	sd	mean	sd	mean	sd
self_paid	11628	4.666	0	14.09	3.846	4.874	3.824	4.479	3.856
out_visits	11628	0.502	0	37	1.560	0.462	1.515	0.539	1.599
in_visits	11628	0.314	0	24	0.822	0.351	0.913	0.280	0.728
gender	11628	0.562	0	1	0.496	0.566	0.496	0.559	0.497
age	11628	61.04	45	99	9.737	60.538	9.395	61.494	10.014
marriage	11628	2.183	1	7	1.767	2.241	1.793	2.130	1.741
education	11628	3.431	1	16	2.644	3.376	2.615	3.482	2.668
lninc	11628	6.903	0	14.60	3.911	8.702	2.458	5.282	4.254
children	11628	3.179	0	14	1.731	3.080	1.686	3.267	1.766
ADL	11628	0.134	0	6	0.544	0.137	0.543	0.131	0.545
chr_diseases	11628	0.852	0	1	0.355	1	0.000	0.718	0.450
dep	11628	9.613	0	30	6.387	9.951	6.481	9.308	6.286

Table 3 reports descriptive statistical results of 11628 valid samples. On the whole, the logarithmic mean of out-of-pocket medical expenses is about 126.27 yuan. The number of outpatient visits of respondents in the past month is about 0.5, and the number of inpatient visits in the past year is about 0.31.

In addition, in order to visually observe the changes of variables before and after the implementation of long-term care insurance policies, the samples are divided into 2018 and 2015 two

periods. It can be seen from the Table 3, compared with 2015, the number of outpatient visits in the past month in 2018 decreases, and the number of out-of-pocket medical expenses and inpatient visits in the past year increase. The average age of the samples in 2015 is 61.49 years old. Since the data of the two periods are unbalanced panel data and there are new respondents in 2018, the average age even decreases instead of increasing in 2018. All of the respondents retained in 2018 has chronic diseases.

### 3.2. The impact on the utilization of medical services

#### 3.2.1. Results of DID baseline regression

Table 4 Results of DID baseline regression

	self paid	out visits	in visits
DID	-1.002**	-0.054	-0.225**
	(0.433)	(0.121)	(0.103)
gender	1.085	0.017	0.225
	(1.855)	(0.158)	(0.438)
age	-0.027	-0.000	0.000
	(0.057)	(0.013)	(0.009)
marriage	-0.071	-0.056	0.041**
	(0.079)	(0.041)	(0.018)
education	0.230**	0.038	0.010
	(0.091)	(0.025)	(0.019)
lninc	0.021	0.015**	0.002
	(0.017)	(0.007)	(0.004)
children	-0.234	0.008	-0.183
	(0.388)	(0.093)	(0.157)
ADL	0.155	0.104	0.091**
	(0.115)	(0.082)	(0.039)
chr_diseases	-0.106	0.113	-0.078**
	(0.180)	(0.070)	(0.035)
dep	0.038***	0.015***	0.009***
	(0.012)	(0.005)	(0.003)
Individual fixed	YES	YES	YES
Time fixed	YES	YES	YES
N	11628	11628	11628
r-squared	0.015	0.007	0.023

Standard errors in parentheses \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

The regression results after accounting for the time fixed effect and individual fixed effect and adding control variables are shown in Table 4. The regression coefficients corresponding to out-of-pocket medical expenses and inpatient visits are significantly positive ( $p < 0.05$ ), indicating that long-term care insurance significantly reduces the out-of-pocket medical expenses, and the proportion of out-of-pocket medical expenses is reduced to 100.2%. At the same time, long-term care insurance also significantly improves the number of inpatient visits hospitalizations of middle-aged and elderly people, the number of hospitalizations is decreases by about 0.225. However, the interaction term coefficient of outpatient visits does not have a significant impact, indicating that long-term care insurance does not have a significant impact on outpatient visits.

#### 3.2.2. Regression results of PSM-DID

PSM method is often used to test the effectiveness of policies. In this paper, the Logit model is used to regression the above control variables and the caliper distance is limited to 0.01 to predict the

probability of individuals participating in long-term care insurance. Only individuals within the common value range are matched. The result test of propensity score passes the co-supporting hypothesis test and the balance test.

The variables and effects controlled from model (1) to model (3) are the same as those treated in baseline regression. We can see from Table 5 that the dummy variable coefficient of out-of-pocket medical expenses and hospitalization frequency show a negative value, which proves that long-term care insurance could indeed reduce the out-of-pocket medical expenses and hospitalization frequency of middle-aged and elderly people, while the outpatient frequency does not have a significant negative impact. The regression results of PSM-DID in out-of-pocket medical expenses, outpatient expenses and hospitalization expenses are consistent with the baseline regression results, which confirm the reliability of the baseline regression results.

Table 5 Regression results of PSM-DID

	self paid	out visits	in visits
DID	-1.163***	-0.054	-0.229**
	(0.429)	(0.122)	(0.105)
Control variables	YES	YES	YES
Individual fixed	YES	YES	YES
Time fixed	YES	YES	YES
N	11484	11484	11484
r-squared	0.016	0.006	0.023

Standard errors in parentheses \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 3.3. Robustness test

Table 6 Robustness test

	self paid		out visits		in visits	
	One period in advance	Two periods in advance	One period in advance	Two periods in advance	One period in advance	Two periods in advance
DID	-0.726*	-0.085	-0.13	0.545	-0.117	-0.096
	(0.374)	(0.446)	(0.165)	(0.394)	(0.076)	(0.087)
Control variables	YES	YES	YES	YES	YES	YES
Individual fixed	YES	YES	YES	YES	YES	YES
Time fixed	YES	YES	YES	YES	YES	YES
N	17437	18153	17437	18153	17437	18152
r-squared	0.014	0.012	0.006	0.007	0.02	0.009

Standard errors in parentheses \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

The premise of the use of DID is that if there is no policy impact, the explained variables of the treatment group and the control group should develop along the established trend. In other words, the effect of policy implementation is not significant. This paper draws on the method of Ma Chao et al. [13] to artificially advance the policy occurrence time by one period (2013) and two periods (2011). If the coefficient of the core explanatory variable is not significant, the policy impact has brought about changes in the explained variable, otherwise, the change of explanatory variable is caused by other factors. As shown in Table 6, out-of-pocket medical expenses are significant ( $p < 0.1$ ) in 2013, indicating that other factors such as medical insurance reform may have caused the decline of out-of-pocket medical expenses during this period. This significance does not appear in 2011. The non-significant results of the number of inpatient visits and outpatient visits in 2011 and 2013 periods. It is consistent with the results of DID and PSM-DID, which enhances the credibility of the empirical results.

### 3.4. Heterogeneity analysis

#### 3.4.1. Gender heterogeneity analysis

As shown in Table 7, the out-of-pocket medical expenses and outpatient of males are significantly negative, indicating that compared with middle-aged and elderly females, middle-aged and elderly males significantly reduce their own medical expenses and outpatient frequency of hospitals after being obviously affected by the long-term care insurance policy. This may be because the female social security system needs to be further improved. There is no significant difference in the number of inpatient visits between two sex groups, and long-term care insurance is not statistically equally affected between men and women.

Table 7 Gender heterogeneity analysis

	self paid		out visits		in visits	
	Female	Male	Female	Male	Female	Male
DID	-0.296	-2.202**	-0.159	-0.791**	-0.224	-0.272
	(0.786)	(0.868)	(0.229)	(0.371)	(0.165)	(0.195)
Control variables	YES	YES	YES	YES	YES	YES
Individual fixed	YES	YES	YES	YES	YES	YES
Time fixed	YES	YES	YES	YES	YES	YES
N	4788	3748	4788	3748	4788	3748
r-squared	0.012	0.031	0.013	0.015	0.036	0.021

Standard errors in parentheses \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

#### 3.4.2. Urban-rural heterogeneity analysis

Table 8 shows the regression results of urban-rural heterogeneity test. Long-term care insurance has no significant effect on the out-of-pocket medical expenses of middle-aged and elderly people in two household registration groups. In terms of the number of outpatient visits, the interaction term of the urban population is significantly negative, indicating that the long-term care insurance can effectively reduce the number of outpatient visits of the urban population by 0.948 times ( $p < 0.05$ ), while the effect on the rural population is not significant. Contrary to the number of outpatient visits, long-term care insurance has a negative effect on hospitalization costs of rural population ( $p < 0.05$ ), reducing their inpatient visits, but the impact on urban population is not significant.

Table 8 Urban-rural heterogeneity analysis

	self_paid		out_visits		in_visits	
	Rural	Urban	Rural	Urban	Rural	Urban
DID	-0.685	0.316	-0.465	-0.948**	-0.504**	0.040
	(0.873)	(1.225)	(0.383)	(0.434)	(0.244)	(0.227)
Control variables	YES	YES	YES	YES	YES	YES
Individual fixed	YES	YES	YES	YES	YES	YES
Time fixed	YES	YES	YES	YES	YES	YES
N	4947	1371	4947	1371	4947	1371
r-squared	0.021	0.043	0.017	0.049	0.032	0.023

Standard errors in parentheses \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 4. Conclusions

Long-term care insurance system is an important measure to deal with the aging population. Using the data of CHARLS database in 2011, 2013, 2015 and 2018, this paper selects the population covered by long-term care insurance in 15 cities with data available in the first batch of pilot cities as the

control group to consider the impact on the utilization of medical services. The conclusions are as follow: The implementation of long-term care insurance significantly reduces the out-of-pocket medical expenses and inpatient visits in middle-aged and elderly insured groups, while has no significant impact on outpatient visits. Subsequent PSM-DID model and counterfactual test demonstrate the validity of the results. Furthermore, the results of heterogeneity test show that the long-term care insurance only has a significant positive effect on the number of inpatient visits of the rural population, but not the urban population; The implementation of the policy has a significant effect on the utilization of medical services for men, but not for women.

The conclusions drawn make the following recommendations for subsequent policy top-level design: It can be predicted that the long-term care insurance system will effectively reduce the medical costs of families, reduce “social hospitalization” phenomenon, and alleviate the shortage of social medical resources. So, firstly the long-term care insurance law with mandatory binding force and corresponding supporting regulations should be established as soon as possible to promote the standardization of long-term care insurance. It is important to make detailed regulations and clarify the responsibility attribution and rights enjoyment of all relevant subjects. In addition, in order to ensure relative fairness, we should gradually establish a unified national coverage covering urban and rural residents, expanding the coverage. And it is necessary to gradually include the moderately disabled and severely mentally retarded elderly people in the coverage. We should also pay attention to the different needs between men and women.

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