

The Impact of Medical Insurance Type on Healthcare Utilization among Older Adults: An Empirical Analysis Based on CHARLS Data

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Abstract: Using 2018 CHARLS data, this study examines how medical insurance types affect healthcare utilization among older adults through Logit and negative binomial regression models, along with heterogeneity and robustness tests. The results show a structural interaction between basic and commercial health insurance: commercial insurance promotes outpatient care for Urban Employee Basic Medical Insurance (UEBMI) enrollees but encourages inpatient care for Urban and Rural Resident Basic Medical Insurance (URRBMI) enrollees. Thus, better coordination between basic and commercial insurance is needed to improve the multi-tiered medical insurance system and optimize resource allocation.

Keywords: Medical Insurance; Healthcare Utilization; Older Adults; CHARLS Database

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1. Introduction

Since entering the stage of population aging at the end of the twentieth century, China has experienced a marked acceleration in the aging process. As the end of 2024, the population aged 60 and above in China has reached 310.31 million, accounting for 22.0% of the total population. Among them, 220.23 million are aged 65 and above, accounting for 15.6% of the total population, marking China's move towards deep aging^[1]. The increasing medical demand and management of chronic diseases among the elderly brought about by population aging pose unprecedented challenges to the medical insurance system. Therefore, the "Proposal of the Central Committee of the Communist Party of China on Formulating the 15th Five Year Plan for National Economic and Social Development" passed at the Fourth Plenary Session of the 20th Central Committee of the Communist Party of China clearly proposes to "actively respond to population aging" and "develop integrated medical and elderly care services"^[2].

In this context, medical insurance, as an important institutional arrangement to reduce the economic burden of elderly people seeking medical treatment and improve their well-being, urgently needs to be based on their health needs, optimize the supply structure of medical services, and balance both increment and quality improvement. Since entering the new era, China has gradually established a multi-level medical security system with basic medical insurance as the main pillar, medical assistance and catastrophic illness insurance as safeguards, and supplementary medical insurance, commercial health insurance, charitable donations, and mutual medical aid developing in coordination^[3]. Within this framework, the medical insurance system, composed mainly of basic medical insurance and commercial health insurance, undoubtedly plays a fundamental

and supportive role. Based on this background, this study uses data from the 2018 China Health and Retirement Longitudinal Study (CHARLS) and focuses on older adults aged 60 and above. It aims to empirically analyze the current utilization of medical services among older adults and examine the effects of different types of medical insurance on their outpatient and inpatient healthcare-seeking behaviors.

Existing studies have accumulated a relatively rich body of evidence on medical insurance and healthcare service utilization among older adults. Most studies classify medical insurance according to differences in protection functions, coverage scope, and responsible entities, and further analyze its mechanisms of influence on healthcare service utilization. One type of view-point focuses on the essential attributes of insurance, categorizing basic medical insurance for employees and residents, large-scale medical subsidies for employees, and major illness insurance for residents as basic guarantees, medical assistance and charitable medical care as bottom line guarantees, and supplementary guarantees as market insurance and mutual assistance between communities or certain groups of people; Another perspective is based on the division of responsibility subjects, deconstructing the security system into three types of security: government led, market led, and social force supported. Some scholars believe that basic medical insurance should be based on the positioning of “basic insurance” and play its core basic role, while commercial health insurance should be positioned as supplementary protection, focusing on meeting the differentiated needs of residents, in order to achieve effective connection between the two. Although scholars have different perspectives on the classification of medical insurance, they all emphasize the need for China to develop a multi-level medical insurance system with multiple subjects and mechanisms to collaborate and share, in order to maintain the health of the elderly and promote healthy aging.

There are many factors that affect the utilization of medical services for the elderly, and scholars generally use the Anderson Health Service Utilization Model as an analytical framework to explore the influencing factors of medical service utilization for different populations. At both individual and societal levels, the medical behavior of elderly people is driven by both medical needs and the constraints and tendencies of enabling resources. On this basis, scholars further identified the key influencing factors of specific groups and found that the level of health status, accessibility of medical services, and frequency of child care have a significant impact on the medical decision-making of empty nest elderly ^[8]. Recent research has expanded to the dimension of psychological experience and found that negative experiences during the medical process are an important factor leading to delayed medical treatment for elderly people ^[9]. At the macro level of medical resource supply, research has found that an increase in the number of beds and technical personnel per thousand population in medical and health institutions is not conducive to improving the outpatient visit rate of middle-aged and elderly people ^[10]. These studies collectively indicate that the medical behavior of elderly people is a complex process influenced by multidimensional factors such as individual, social, psychological, and macro supply.

Medical insurance is one of the key factors influencing healthcare service utilization among older adults, and most studies have found that different types of medical insurance have heterogeneous effects on medical service use. With the gradual improvement of China’s medical insurance system, medical insurance has been found to have a positive effect on inpatient service utilization among older adults while reducing their use of outpatient services ^[11]. Some scholars have found that after the Urban and Rural Resident Basic Medical Insurance system achieved broad coverage, both inpatient and outpatient healthcare-seeking behaviors among older adults improved significantly ^[12]. Other studies have shown that, compared with individuals participating in the New Rural Cooperative Medical Scheme, those enrolled in Urban and Rural Resident Basic Medical Insurance tend to reduce outpatient service use, while those enrolled in Urban Employee Basic Medical Insurance are more likely to use inpatient services ^[13]. Urban and Rural Resident Basic Medical Insurance has been found to increase both the probability and frequency of hospitalization among middle-aged and older adults ^[14]. The integration of Urban and Rural Resident Basic Medical Insurance reduced outpatient service utilization but increased the number of hospitalizations ^[15]. The employee outpatient pooling policy has increased the frequency of outpatient visits among middle-aged and older employees ^{[16][17]}. Some scholars have also pointed out that compared with urban residents’ medical insurance participants without commercial health insurance, urban residents’ medical insurance participants with commercial health insurance have a higher probability of outpatient and inpatient treatment ^[18].

Overall, existing literature still focuses on the single effect of basic medical insurance, with insufficient attention paid to the synergistic or substitutive relationship between basic medical insurance and commercial health insurance; Meanwhile, there is still limited comparative research from the perspective of the elderly population nationwide. Therefore, based on the existing literature mentioned above, this article studies the differences in the utilization of medical services for the elderly between basic medical insurance and commercial health insurance. Using the interaction term research method, it attempts to answer the protection role of participating in multiple medical insurances for the elderly. Based on this, suggestions for the construction of a medical security system are proposed.

2. Research hypothesis

Previous studies have shown that basic medical insurance is an important factor affecting the utilization of medical services for the elderly. However, due to various objective factors such as the level of overall planning and the nature of the unit, the medical insurance benefits enjoyed by elderly people participating in urban employee medical insurance and urban and rural resident medical insurance (hereinafter referred to as “employee medical insurance” and “resident medical insurance”) are also different^[19]. In this context, commercial health insurance, as an important extension of the multi-level medical security system, effectively bridges the gap in basic medical insurance coverage. Through the linkage of cost space and coverage population, it effectively fills the gap in basic medical insurance coverage. Therefore, whether or not to participate in commercial health insurance may result in differences in the medical expenses paid by individuals, thereby affecting patients’ medical decisions^[20].

In summary, this article proposes the following hypothesis:

H1. Compared to elderly people who participate in resident medical insurance, elderly people who participate in employee medical insurance are more likely to utilize outpatient and inpatient medical services, and their frequency of medical service utilization is higher.

Compared to resident medical insurance, employee medical insurance has a higher level of funding and better reimbursement policies. Therefore, elderly people who participate in employee medical insurance have a lower economic burden for medical treatment and a greater impact on their utilization of outpatient and inpatient services. It can be inferred that there are differences in the impact of different types of basic medical insurance on the utilization of outpatient and inpatient services for the elderly.

H2. There is a significant correlation between participation in commercial health insurance and the frequency of medical service utilization for the elderly. There may be a positive correlation between commercial health insurance and the frequency of outpatient service utilization, while there may be a negative correlation with the frequency of inpatient service utilization. Commercial health insurance can to some extent share patients’ medical expenses and alleviate payment pressure. For older adults, commercial health insurance may affect healthcare service utilization by improving their ability to pay for outpatient examinations, follow-up visits for chronic diseases, and inpatient treatment. Since commercial health insurance functions as supplementary protection, its effect is more likely to be reflected in the frequency and structure of healthcare service utilization. Therefore, it can be inferred that commercial health insurance influences the frequency of healthcare service utilization among older adults.

H3. The effect of commercial health insurance on healthcare service utilization among older adults is moderated by the type of basic medical insurance; that is, its supplementary protection effect differs significantly between older adults enrolled in employee medical insurance and those enrolled in resident medical insurance.

A multi-level medical security system is an organic integration of various medical security arrangements. Basic medical insurance and commercial health insurance may have both substitutive and complementary relationships. The two may interact in terms of medical expense sharing, coordination of coverage content, and choices of medical services. Therefore, their effects on healthcare service utilization among older adults are not merely additive, but may involve interactive effects.

3. Research Design

3.1 Data Source

Based on the availability of variables in the CHARLS database, this study defines the types of medical insurance that have a direct economic impact on healthcare service utilization among older adults. Specifically, the types of medical insurance discussed in this article include basic medical insurance (employee medical insurance, resident medical insurance) and commercial health insurance. This study focuses on analyzing the utilization behavior of elderly medical services from the perspective of coordinated development of medical insurance, and selects data from the China Health and Retirement Longitudinal Study (CHARLS) database in 2018 to remove invalid samples such as “don’t know” and “refuse to answer”, as well as outliers and missing values in the data. Finally, 9500 observations were obtained as valid samples for this study.

3.2 Variable settings

The variable settings of this study are based on the Anderson Health Service Utilization Model ^[21], which provides a comprehensive framework that categorizes factors that affect individual healthcare service utilization into three types: propensity factors, enabling resources, and demand factors. Based on this theoretical framework and the characteristics of the CHARLS database, the variables are defined and operationalized as shown in Table 1.

3.2.1 Dependent Variables

The indicators of healthcare service utilization include outpatient service utilization and inpatient service utilization. Outpatient service utilization is measured by whether the respondent visited a medical institution for outpatient care in the past month and the number of outpatient visits received at medical institutions in the past month. Inpatient service utilization is measured by whether the respondent received inpatient care in the past year and the number of hospitalizations in the past year.

3.2.2 Independent Variables

The core independent variables in this study are the type of basic medical insurance selected by older adults and their participation in commercial health insurance. Basic medical insurance is mainly divided into two categories: participation in employee medical insurance and participation in resident medical insurance. Commercial health insurance is divided into “insured” and “uninsured”. Systematically analyze the roles of different types of insurance and their impact on the utilization of medical services.

3.2.3 Control variables

This study incorporates the propensity factors, enabling factors, and demand factors from the Anderson model as control variables into the model. Tendency factors reflect the demographic characteristics of the research subjects, mainly including age, gender, education level, and marital status. Enabling resources represent the ability to access healthcare service resources, covering both residential areas and family doctors. The demand factor is the most directly related factor affecting medical behavior, reflecting the needs of elderly people for medical services based on their actual health conditions, including chronic diseases and self-assessment of health status.

Table 1 Variable Definitions and Coding

Dimension	Variable Definition	Coding
Dependent variables	Whether the respondent visited an outpatient department in the past month	Yes = 1, No = 0
Dependent variables	Number of outpatient visits in the past month	Count variable
Dependent variables	Whether the respondent was hospitalized in the past year	Yes = 1, No = 0
Dependent variables	Number of hospitalizations in the past year	Count variable
Independent variables	Type of basic medical insurance participation	Resident medical insurance = 1, employee medical insurance = 0
Independent variables	Commercial health insurance	Insured = 1, uninsured = 0
Control variables: predisposing factors	Age	Continuous variable

Dimension	Variable Definition	Coding
Control variables: predisposing factors	Gender	Male = 1, Female = 0
Control variables: predisposing factors	Educational attainment	Primary school or below = 1, junior high school or senior high school = 2, college degree or above = 3
Control variables: predisposing factors	Marital status	Married = 1, unmarried = 0
Control variables: enabling resources	Current place of residence	Urban = 1, rural = 0
Control variables: enabling resources	Whether the respondent has signed a contract with a family doctor	Yes = 1, No = 0
Control variables: need factors	Chronic disease	Yes = 1, No = 0
Control variables: need factors	Self-rated health status	Good = 1, poor = 0

3.3 Model Specification

This study employs the Logit model and the negative binomial regression model to examine the effects of participation in different types of medical insurance on healthcare service utilization among older adults and conducts empirical analysis accordingly.

3.3.1 Logit Model

Given that the dependent variable Y_i is a binary choice variable indicating whether an individual has utilized medical services, this study adopts the Logit model for estimation. To provide a more intuitive interpretation of the coefficients, average marginal effects are reported.

The model is specified as follows:

$$P(Y_i=1)=\frac{\exp(\beta_0+\beta_1Insurance_i+\gamma X_i)}{1+\exp(\beta_0+\beta_1Insurance_i+\gamma X_i)}$$

where Y_i represents individual healthcare service utilization. Specifically, $Y_i=1$ if the respondent visited an outpatient department in the past month or was hospitalized in the past year, and $Y_i=0$ otherwise. $Insurance_i$ is the core explanatory variable, representing the type of medical insurance in which the individual participates. X_i denotes a set of control variables, including age, gender, marital status, and other covariates. β_0 is the constant term, β_1 is the regression coefficient of different insurance participation types, and γ denotes the coefficient vector corresponding to the control variables.

3.3.2 Negative Binomial Regression Model

The variables “number of outpatient visits” and “number of hospitalizations” are both non-negative count variables. Moreover, the sample shows obvious overdispersion. Therefore, this study adopts the negative binomial regression model. The model is specified as follows:

$$\ln(E(Y_i|Z_i))=\alpha_0+\alpha_1Insurance_i+\delta X_i$$

Y_i represents the number of times elderly people have utilized medical services, including outpatient visits in the past month and hospitalizations in the past year; The meanings of $Insurance_i$ and X_i are consistent with the previous text; α_0 is a constant term, α_1 is the regression coefficient of the core explanatory variable, and δ is the coefficient vector corresponding to the control variable.

Table 2 shows the descriptive statistics of the variables. From the dependent variable, it can be seen that the probability of going to the outpatient department for medical treatment in the past month is 16%, and there are more occasional outpatient visits in the sample. The probability of hospitalization in the past year is 17%. The average number of outpatient visits is 0.37, indicating significant differences in medical needs among the elderly, with a small number of people seeking medical treatment multiple times increasing volatility. The average number of hospitalizations is 0.29. In terms of the core explanatory

variables, the participation rate in commercial health insurance is only 4%, indicating that the coverage level of commercial health insurance among older adults in China remains relatively low and that its supplementary role in the medical security system for older adults is still limited. The mean value of the type of basic medical insurance is 0.84, suggesting that the vast majority of older adults are enrolled in resident medical insurance, while the proportion of older adults enrolled in employee medical insurance is relatively low. This reflects that the medical security structure of older adults in China is mainly based on resident medical insurance.

Among the control variables, nearly half of the older adults suffer from chronic diseases, and about 4% have signed a contract for family doctor services. Older adults with good self-rated health account for 25% of the total sample. In addition, 86% of the respondents are married, and 29% live in urban areas. The mean value of educational attainment is 1.37, indicating that the overall educational level of older adults is relatively low. The average age of the sample is 69 years, and males account for 47%.

Table 2 Descriptive Statistics of Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Outpatient visit	0.16	0.37	0	1
Number of outpatient visits	0.37	1.40	0	32
Hospitalization	0.17	0.38	0	1
Number of hospitalizations	0.29	1.36	0	150
Type of basic medical insurance	0.84	0.37	0	1
Commercial health insurance	0.04	0.19	0	1
Age	69.17	7.10	60	118
Gender	0.47	0.50	0	1
Place of residence	0.29	0.45	0	1
Educational attainment	1.37	0.52	1	3
Marital status	0.86	0.35	0	1
Self-rated health status	0.25	0.43	0	1
Chronic disease	0.45	0.50	0	1
Family doctor service	0.04	0.20	0	1

4. Empirical Tests and Results Analysis

4.1 Analysis of Benchmark Regression Results

The benchmark regression results in Table 3 show the effects of different types of medical insurance on healthcare service utilization among older adults, after controlling for other relevant factors. Compared to elderly people who participate in employee medical insurance, those who participate in resident medical insurance have a 2.7% lower probability of using outpatient services and a 2.3% lower probability of using inpatient services, indicating that the overall utilization rate of medical services for elderly people with employee medical insurance is higher. Therefore, this article assumes that H1 is validated.

From the control variables, it can be seen that the probability of women using outpatient services is on average 1.9 percentage points higher in terms of propensity factors. The probability of utilizing outpatient services for elderly people with a college degree or above is high. As age increases, the probability of hospitalization increases by 0.6%. There is a significant positive correlation between age and hospitalization behavior, indicating that older adults may reduce their daily outpatient visits due to mobility issues and neglect of deteriorating physical conditions. However, when health problems accumulate and require

higher-level treatment, their hospitalization needs significantly increase.

In terms of enabling resources, elderly people living in urban areas have a 2.8% higher probability of hospitalization compared to those living in rural areas. The accessibility of medical resources is high in urban areas, and elderly people in rural areas tend to prefer conservative treatment due to health cognitive biases and other reasons. In terms of accessibility of medical services, the probability of elderly people receiving outpatient treatment from contracted family doctors has increased by 5.1%. Family doctors may plan medical strategies and guide appropriate graded diagnosis and treatment based on the actual situation of patients.

In the Anderson model framework, demand factors are the core variables that drive individuals to seek medical treatment. The regression results show that older adults with one or more chronic diseases have a 6.9 percentage point higher probability of using outpatient services and a 12.4 percentage point higher probability of using inpatient services than those without chronic diseases. As objective and persistent health conditions, chronic diseases generate medical needs for both outpatient and inpatient services among older adults. Older adults with good self-rated health have an 8.7 percentage point lower probability of using outpatient services and a 12.5 percentage point lower probability of using inpatient services. Overall, whether measured by objective chronic disease status, subjective health perception, or potential behavioral risks, health-related need factors directly and significantly drive healthcare-seeking decisions among older adults.

Table 3 Effects of Medical Insurance Type on Outpatient and Inpatient Service Utilization

Variable	Outpatient Service Utilization	Inpatient Service Utilization
Type of basic medical insurance	-0.027**	-0.023*
	(0.013)	(0.013)
Age	0.001	0.006***
	(0.001)	(0.001)
Gender	-0.019**	0.013
	(0.008)	(0.008)
Place of residence	-0.011	0.028**
	(0.010)	(0.011)
Educational attainment: junior/senior high school	0.008	-0.010
	(0.010)	(0.011)
Educational attainment: college degree or above	0.095**	-0.037
	(0.038)	(0.029)
Marital status	-0.013	-0.006
	(0.010)	(0.010)
Self-rated health status	-0.087***	-0.125***
	(0.008)	(0.009)
Chronic disease	0.069***	0.124***
	(0.008)	(0.008)
Contracted family doctor service	0.051***	0.013
	(0.020)	(0.019)
Observations	9500	9500

Note: Standard errors are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The results in Table 4 show that, according to the negative binomial regression results, older adults enrolled in employee medical insurance generally have higher frequencies of outpatient visits and hospitalizations than those enrolled in resident medical insurance. Taking the employee medical insurance group as the reference group, commercial health insurance is positively associated with the number of outpatient visits and negatively associated with the number of hospitalizations. The results of the interaction term indicate that this effect changes in the resident medical insurance group. Specifically, the promoting effect of commercial health insurance on outpatient service utilization is significantly weakened, while its inhibitory effect on inpatient service utilization is also weakened and may even turn positive. Therefore, Hypotheses H2 and H3 are supported.

Table 4 Effects of Medical Insurance Type on Outpatient Visits and Hospitalizations

Variable	Number of Outpatient Visits	Number of Hospitalizations
Type of basic medical insurance	-0.313**	-0.168**
	(0.133)	(0.085)
Commercial health insurance	1.593*	-0.877**
	(0.853)	(0.414)
Basic medical insurance × commercial health insurance	-1.511*	0.945*
	(0.894)	(0.494)
Control variables	Controlled	Controlled
Observations	9500	9500

Note: Standard errors are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.2 Heterogeneity Analysis

In order to deeply analyze the complexity of the impact of medical insurance on the utilization of medical services for the elderly, and considering that urban-rural differences largely reflect differences in the accessibility of medical resources, the level of medical service supply, and chronic diseases are the core characteristics for measuring the rigid medical needs of the elderly. This article selected two key dimensions, urban and rural areas and whether the elderly have chronic diseases, to estimate the impact of participating in medical insurance on the utilization of medical services for the elderly. The results are shown in Tables 5 and 6. The results show that there are significant differences in the impact of medical insurance on the frequency of medical service utilization among the elderly.

In the heterogeneity analysis of inpatient services (see Table 5), the variables of basic medical insurance were significantly negative in the urban group and chronic disease group, indicating that compared to elderly people who participated in employee medical insurance, those who participated in resident medical insurance and lived in urban areas and had chronic diseases had lower hospitalization times. Commercial health insurance also showed a negative impact in the urban group and chronic disease group. This indicates that the basic medical facilities and medical resources in urban areas are more accessible, and the medical needs of elderly people with chronic diseases are stronger. Elderly people who participate in employee medical insurance will seek timely medical treatment with the support of medical insurance after falling ill. Commercial health insurance may play a role in sharing medical expenses and actively managing diseases among elderly people in urban areas and those with chronic diseases. Furthermore, the interaction term has a positive impact in both urban and chronic disease groups, indicating that the dual protection of basic medical insurance and commercial health insurance will promote the utilization rate of medical services for some elderly people.

In the heterogeneity analysis of outpatient services (see Table 6), the impact of basic medical insurance is negative in rural areas and chronic disease groups, indicating that elderly people who participate in employee medical insurance have a higher frequency of outpatient visits. The impact of participating in commercial health insurance is positive in urban areas and non chronic disease groups, indicating that the promoting effect of commercial health insurance on outpatient visits is

more reflected in areas with abundant medical resources and non chronic disease groups. The interaction term has a negative impact only in the non chronic disease group, indicating that in the non chronic disease elderly population, the impact of commercial health insurance on outpatient frequency varies significantly depending on the type of basic medical insurance. The positive impact on outpatient frequency mainly exists in the employee medical insurance group, and its promoting effect is weakened in the resident medical insurance group. For non chronic disease elderly people, the supplementary protection role of commercial health insurance depends on the institutional foundation provided by basic medical insurance.

Table 5 Heterogeneity Analysis of the Number of Hospitalizations

Variable	Urban Group	Rural Group	Chronic Disease Group	Non-chronic Disease Group
Type of basic medical insurance	-0.223**	-0.064	-0.207**	-0.084
	(0.099)	(0.153)	(0.104)	(0.144)
Commercial health insurance	-0.787*	-1.215	-1.480***	-0.031
	(0.450)	(0.880)	(0.536)	(0.577)
Basic medical insurance × commercial health insurance	1.298**	1.146	1.367**	0.335
	(0.608)	(0.942)	(0.615)	(0.725)
Control variables	Controlled	Controlled	Controlled	Controlled
Observations	2537	6963	4503	4997

Note: Standard errors are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6 Heterogeneity Analysis of the Number of Outpatient Visits

Variable	Urban Group	Rural Group	Chronic Disease Group	Non-chronic Disease Group
Type of basic medical insurance	-0.139	0.501**	-0.310*	-0.278
	(0.169)	(0.203)	(0.163)	(0.218)
Commercial health insurance	1.745**	-0.163	-0.949	2.331***
	(0.874)	(1.013)	(0.610)	(0.855)
Basic medical insurance × commercial health insurance	-1.620	0.223	1.074	-2.277**
	(1.193)	(1.046)	(0.672)	(0.982)
Control variables	Controlled	Controlled	Controlled	Controlled
Observations	2537	6963	4503	4997

Note: Standard errors are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Robustness Tests

This study conducts robustness tests from two aspects: replacing the estimation method and narrowing the sample range. The benchmark regression examines whether participation in basic medical insurance affects healthcare service utilization among older adults aged 60 and above. Considering that older adults in different age groups may differ in health status, medical needs, and healthcare service utilization, this study further restricts the sample to older adults aged 70 and above, as shown in Table 7. The results are consistent with those of the benchmark regression. After the regression is conducted using the sample of older adults aged 70 and above, the direction of the effect of basic medical insurance on outpatient and inpatient service utilization among older adults remains unchanged.

In the benchmark regression, the Logit model is used to estimate whether older adults use medical services. In the robustness test, the Probit model is used for re-estimation. The results show that the estimated directions are consistent with those of the benchmark regression, although the significance of the inpatient service utilization result is weakened, as shown in Table 8. For the frequency of healthcare service utilization, the negative binomial model is used in the benchmark regression. Considering that the number of outpatient visits and the number of hospitalizations are non-negative count variables and that there are many zero values in the sample, this study further adopts the zero-inflated negative binomial model for re-estimation in the robustness test. The results show that the estimated directions of basic medical insurance, commercial health insurance, and their interaction term are generally consistent with the benchmark regression results, indicating that the benchmark regression results reported above are robust, as shown in Table 9.

Table 7 Effects of Medical Insurance Type on Healthcare Service Utilization among Older Adults Aged 70 and Above

Dependent Variable	Outpatient Service Utilization	Inpatient Service Utilization
Type of basic medical insurance	-0.016*	-0.048***
	(0.009)	(0.010)
Control variables	Controlled	Controlled
Observations	3545	3545

Note: Standard errors are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8 Probit Regression Results for Healthcare Service Utilization among Older Adults

Dependent Variable	Outpatient Service Utilization	Inpatient Service Utilization
Type of basic medical insurance	-0.028**	-0.022
	(0.013)	(0.014)
Control variables	Controlled	Controlled
Observations	9500	9500

Note: Standard errors are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9 Zero-Inflated Negative Binomial Regression Results for the Frequency of Healthcare Service Utilization

Dependent Variable	Number of Outpatient Visits	Number of Hospitalizations
Type of basic medical insurance	-0.297***	-0.166**
	(0.107)	(0.0843)
Commercial health insurance	1.015**	-0.923**
	(0.439)	(0.401)
Basic medical insurance $\times$ commercial health insurance	-0.959*	0.963**
	(0.549)	(0.476)
Control variables	Controlled	Controlled
Observations	9500	9500

Note: Standard errors are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5. Conclusions and Policy Recommendations

5.1 Conclusions

Based on CHARLS 2018 data, this study analyzes the effects of different types of medical insurance on healthcare service utilization among older adults. The findings are as follows.

First, compared with resident medical insurance, employee medical insurance is more effective in increasing both the

probability and frequency of outpatient and inpatient service utilization among older adults. Second, the role of commercial health insurance shows structural differences. Among older adults covered by employee medical insurance, commercial health insurance mainly promotes outpatient service utilization and suppresses inpatient service utilization. Among those covered by resident medical insurance, its promoting effect on outpatient service utilization is significantly weakened, while its inhibitory effect on inpatient service utilization is also weakened and may even turn into a promoting effect. Thirdly, there is significant heterogeneity in the impact of medical insurance, with different mechanisms of action among urban, rural, and elderly populations with chronic diseases.

5.2 Policy recommendations

Therefore, as mentioned earlier, policy makers can optimize existing policies from the following four aspects:

Firstly, priority should be given to addressing the shortcomings in the level of medical insurance benefits and payment conditions for residents, and narrowing the actual gap in protection between different types of medical insurance. This study found that compared to elderly people with employee medical insurance, the outpatient and inpatient frequency of elderly people with resident medical insurance is generally lower. Therefore, policy makers should focus on optimizing the adjustment mechanism of residents' medical insurance benefits, gradually increasing the outpatient reimbursement ratio and ceiling line of residents' medical insurance, and reducing the difference in protection level between residents' medical insurance and employee medical insurance. By enhancing the actual coverage depth of residents' medical insurance, narrowing the treatment gap with employees' medical insurance, and alleviating the unfair utilization of medical services caused by the type of medical insurance for the elderly.

Secondly, promote the development of commercial health insurance to provide precise protection for elderly outpatient services, and develop targeted insurance types. Research has shown that the impact of commercial health insurance on the utilization of medical services for the elderly shows certain differentiation in different dimensions and among different medical insurance groups. Government departments should encourage insurance institutions to develop targeted supplementary medical insurance products: for the employee medical insurance group, strengthen the outpatient support of commercial health insurance for chronic disease management, and play the cost control role of "outpatient instead of hospitalization"; for the resident medical insurance group, emphasis should be placed on the economic compensation function of commercial health insurance for major illness hospitalization, reduce the pressure of large medical expenses on the elderly, and achieve the connection of multi-level protection in terms of cost space.

Third, the interaction effect between basic medical insurance and commercial health insurance indicates that healthcare service utilization among older adults is jointly affected by different levels of medical protection. Therefore, the two types of insurance should form a clearer division of roles and a more complementary relationship from the perspective of institutional coordination. On the one hand, given the role of basic medical insurance in "ensuring basic needs," commercial health insurance should be guided to focus on covering out-of-pocket expenses outside the basic medical insurance catalogue, such as self-paid medicines, high-value consumables, and expensive medical equipment. Through institutional design, the role of commercial health insurance should be clarified as providing "secondary compensation" above the payment ceiling of basic medical insurance, rather than repeatedly reimbursing expenses already covered within the basic insurance catalogue. On the other hand, in response to the finding that the combination of employee medical insurance and commercial health insurance may induce hospitalization, claims data from commercial health insurance should be incorporated into the supervision system of medical insurance funds. A joint inspection mechanism involving both basic medical insurance and commercial health insurance should be established, and AI algorithms should be used to monitor hospitalization cases with high frequency and high expenditure.

Fourth, attention should be paid to group heterogeneity in healthcare service utilization, and differentiated health intervention mechanisms should be established. The heterogeneity analysis confirms that, among older adults with chronic diseases, the interaction between basic medical insurance and commercial health insurance has not been transformed into effective outpatient service utilization. Therefore, government departments should guide commercial health insurance toward a "health management-oriented medical insurance" model and encourage the development of more inclusive products for people with

chronic diseases, so as to make up for the insufficient depth of protection under basic medical insurance.

For rural older adults, a bundled protection model combining “basic medical insurance + medical assistance + commercial insurance” should be explored. Premium subsidies can be used to encourage low-income rural older adults to participate in commercial insurance, thereby preventing them from being excluded from the multi-level medical security system. At the same time, policies related to long-term prescriptions, regular follow-up visits, and health monitoring should be improved to prevent the risk of disease deterioration caused by interrupted medical care.

This study also has several limitations. First, because the 2020 data may have been affected by the COVID-19 pandemic, both healthcare service utilization among older adults and the survey implementation process may have been disturbed to some extent, making the sample characteristics relatively special. Therefore, this study mainly uses CHARLS 2018 survey data for analysis. The conclusions reflect the relationship between healthcare service utilization and insurance variables among older adults during the sample period. Future studies may use data with a longer time span to examine the effects of different types of medical insurance on healthcare service utilization among older adults. Second, in the interaction term analysis, the sample size of participants in commercial health insurance is relatively limited. Future research may expand the sample size to further examine the mechanisms through which the multi-level medical security system affects healthcare service utilization among older adults.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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