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Original Paper

The Impact of Outpatient Pooling Reform on Patients' Out-of-Pocket Burden: Evidence from China

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Abstract

Objective: *This study systematically evaluates the financial burden on outpatient visits following implementation of the outpatient pooling reform among Urban Employee Basic Medical Insurance enrollees in Chongqing. The research focuses on the evaluation of the degree to which the policy reduces the burden of outpatient expenses. In addition, through the analysis of the heterogeneity of chronic diseases and the elderly group, the institutional effectiveness of the policy in accurately guaranteeing the newly-needed population is further explored.*

Methods: *This study is based on comprehensive outpatient claims data from a large tertiary hospital in Chongqing, covering the period from January 2023 to December 2024. The dataset comprises approximately 600,000 insured individuals and 1.67 million outpatient visit records, forming a high-frequency micro-level panel dataset. First, an interrupted time series (ITS) model is employed to identify macro-level trends and immediate structural breaks at the time of policy implementation, with Newey–West heteroskedasticity and autocorrelation consistent standard errors applied to correct for serial correlation. Second, a two-way fixed effects (TWFE) model is constructed to track within-individual behavioral changes before and after policy implementation, controlling for individual heterogeneity and seasonal effects to identify the net micro-level impact of the policy. Finally, robustness checks are conducted through placebo tests using pseudo-policy implementation dates and by replacing the age threshold used to define elderly status.*

Results: *The empirical analysis yields the following core findings. In the cost burden dimension, the policy showed a significant and robust burden reduction effect, and the ITS showed that the proportion of out-of-pocket payment decreased by 12.5 percentage points (95% CI: -0.169, -0.080); the TWFE model showed that the proportion of out-of-pocket expenses of the same patient decreased by 24.2 percentage*

points on average, and the total amount of absolute out-of-pocket expenses decreased by more than 58%. Heterogeneity analysis confirmed that the policy had significant skewed protection characteristics for high-need populations, and the decrease of absolute total out-of-pocket payments for patients with chronic diseases and the elderly was 5.3% and 5.1% more than that of the baseline group, respectively.
Conclusion: *This study shows that the outpatient pooling reform of medical insurance for workers in Chongqing significantly reduced patients' cost burden. Through the intervention of the pooling fund, the policy has reduced the outpatient out-of-pocket expenses of the insured, especially the burden reduction effect of the elderly and the chronic disease group.*
Keywords
Urban Employee Basic Medical Insurance, outpatient pooling, policy evaluation

1. Introduction

China's social medical security system is undergoing a structural transformation from "heavy hospitalization, light outpatient service" to "both hospitalization and outpatient service". For a long time, the basic medical insurance for urban workers has centered on the guarantee of hospitalization expenses. The general outpatient expenses mainly rely on personal accounts or self-payment of insured persons, and there is no unified overall fund payment arrangement. The system design shows obvious characteristics of hospitalization tilt. With the development of economy, the acceleration of population aging and the increasing burden of chronic diseases, the demand for high-frequency and continuous outpatient services of insured persons is increasing rapidly, and the limitations of personal accounts in terms of support capacity are becoming more and more obvious, which has become an important institutional obstacle to the transformation of reasonable medical needs into practical utilization. At the same time, a large number of personal account funds have been deposited for a long time due to limited scope of use, which not only reduces the overall efficiency of the fund, but also challenges the fairness and sustainability of the system.

In order to solve the above problems, China launched a nationwide outpatient pooling reform in 2021. Through the establishment of an independent general outpatient pooling fund, it is used to pay the general outpatient expenses of the insured persons in the designated medical institutions within the scope of the medical insurance policy, and to provide co-guarantee for common diseases and frequently-occurring diseases by clarifying the parameters such as the starting line, reimbursement ratio and annual ceiling line [1,2]. However, the reform still faces many practical challenges in the actual implementation process. The long-term implementation of the "unified account combination" mode of employee medical insurance, the personal account funds have strong private attributes and psychological sense of belonging, and the system adjustment may lead to the difficulty of the insured's behavior adaptation and the problem of policy identity; at the same time, affected by factors such as the level of economic development, population structure, and fund affordability, the parameters such as the scope of outpatient coverage, reimbursement ratio, deductible and ceiling lines vary greatly across regions, and the phenomenon of

policy fragmentation is more prominent. It is urgent to establish a comprehensive provincial co-ordination. In addition, outpatient services have the characteristics of high frequency, small single amount, and relatively weak controllability, which put forward higher requirements for medical insurance management capabilities and post-event supervision capabilities.

The existing literature has increasingly studied the impact of outpatient pooling reform. Overall, the available evidence shows that increased outpatient coverage increases financial protection and reduces OOP expenditures [2,3]. In addition, these reforms may help to reduce inequality in the use of medical services, and greater benefits are observed among low-income people [4]. For specific populations, studies based on administrative data have shown that outpatient coverage has significantly improved the level of service utilization and reimbursement for patients with chronic and special diseases [5]. Relevant research also shows that chronic diseases significantly increase the risk of catastrophic medical expenses, especially in the elderly and low-income people, and improving outpatient care can reduce this burden [6,7]. For the elderly, evidence from the China Health and Retirement Longitudinal Study (CHARLS) shows that medical insurance promotes the use of outpatient services, especially for elderly people living alone or with comorbidities, highlighting the importance of outpatient care to reduce their financial risks [8–11].

The existing research has fully revealed the heterogeneous guarantee effect of outpatient pooling reform on chronic diseases and elderly groups, but there are still the following deficiencies : First, most studies focus on a single disease or a single group, and lack of systematic comparison of the differences in policy effects between chronic diseases and elderly groups ; second, the research relies more on questionnaires or macro-statistical data, and the accurate measurement of heterogeneity effects based on real settlement data is still scarce. Thirdly, there is insufficient follow-up research on the dynamic evolution of policy effects. Whether the effect of policy burden reduction tends to be stable over time still lacks sufficient empirical basis.

Based on the above background, the purpose of this paper is to study the utilization effect of patients after the implementation of the medical insurance policy for employees in Chongqing, and to take the policy' improving the efficiency of the use of medical insurance funds, gradually reducing the burden of medical expenses of insured persons, and achieving a more fair and sustainable system as the core evaluation orientation. Using the outpatient settlement micro-data of a large tertiary general hospital in Chongqing, the impact of the policy on the patient's cost burden was systematically evaluated, and the precise guarantee function of the policy was tested through the heterogeneity of chronic diseases and the elderly population, providing evidence-based reference for deepening the reform of the outpatient pooling reform.

2. Materials and Methods

2.1 Study Setting and Sample Source

Chongqing is the only municipality directly under the central government in the western region of China.

It has a large population, a complex urban and rural structure, a rapid aging process, a large number of patients with chronic diseases, and a certain practical basis for outpatient service demand. In recent years, Chongqing has promoted the reform of the basic medical insurance outpatient aid system for employees. The policy implementation time is relatively clear, the system design is more standardized, and it provides an identifiable system node for observing the changes before and after the policy. From the perspective of system, the scale of employee medical insurance participation in Chongqing is large, the fund operation is relatively stable, and the adjustment of outpatient security system is representative. Choosing Chongqing as the research area is helpful to analyze the utilization effect of patients under the premise of clarifying the background of policy implementation.

In this study, a large tertiary general hospital in Chongqing was selected as the sample source. The hospital's annual outpatient volume ranks among the top in the city. The patient population covers different age structures, occupational types and disease spectrum, which can better represent the outpatient utilization characteristics of the insured population of Chongqing employee medical insurance. The hospital is located in the core area of Chongqing's main city, radiating the main urban area and surrounding districts and counties. The patient sources include local residents, migrant workers and patients in the surrounding radiation areas. The samples are representative in geographical coverage and population composition. As a designated medical institution for medical insurance in Chongqing, the hospital's medical insurance settlement system is mature, the policy implementation is standardized, the hospital information system record is standardized and highly standardized, and the data structure before and after the policy implementation is consistent. The settlement data is directly derived from the real-time reimbursement link of medical insurance, covering the core indicators such as self-paid proportion, cost composition, and frequency of visits. It can accurately reflect the impact of the policy on the burden of outpatient expenses and structural adjustment, and avoid the common recall bias and aggregation error in questionnaire survey or macro statistical data.

2.2 Data Screening and Processing

The reason for selecting January 2023 to December 2024 is to avoid the interference of epidemic data in 2022 and maintain the symmetry of the data in order to construct panel data.

The collation and cleaning of the original outpatient settlement data is completed in three stages. The first stage is sample screening. According to the purpose of the study and the scope of application of the policy, the outpatient settlement records of the insured patients with basic medical insurance for urban employees are retained, and the data of urban and rural residents' medical insurance, supplementary insurance and mixed insurance are excluded. The consultation date is limited to January 2023 to December 2024, and records beyond this range are deleted. Within the scope of insurance, the relevant settlement information of general outpatient and outpatient chronic special disease was retained, and the emergency records were deleted to form the basic samples. The second stage is data collation. The unique identification is generated with the patient as the unit, and the outpatient records are summarized according to the patient-month dimension, and the panel data of the individual monthly level is

constructed. On this basis, the monthly number of visits, the total monthly cost, the total out-of-pocket expenses and the proportion of various expenses are calculated. The third stage is variable processing. The absolute value of medical expenses usually shows a right-skewed distribution. The natural logarithm of the amount variables such as the average cost and the total monthly out-of-pocket expenses is added to 1 to reduce the impact of extreme values on the model estimation results. The proportion of out-of-pocket expenses and the proportion of various expenses are calculated under the premise that the total outpatient expenses are greater than 0 to ensure the validity and comparability of the indicators.

2.3 Methods

To systematically evaluate the effects of the outpatient pooling reform under the UEBMI on patient utilization, this study adopts a multi-method empirical strategy that accounts for policy characteristics, data structure, and potential identification biases. Specifically, an interrupted time series (ITS) model and a two-way fixed effects (TWFE) model are employed. These two approaches are complementary in their identification logic: the ITS model captures aggregate-level changes in patient utilization before and after the policy intervention, while the TWFE model enables within-individual comparisons over time. By triangulating evidence across different analytical frameworks, this study seeks to enhance the credibility of policy effect estimation.

2.3.1 Interrupted Time Series Model

In the case of unified policy implementation and lack of unaffected control groups, the traditional DID method is difficult to apply directly. The ITS model takes the policy implementation time point as an exogenous shock, and uses the continuous monthly data before and after the policy to identify the horizontal breakpoints and trend changes of the result variables. It can capture the structural changes at the overall level without the control group. It is suitable for the evaluation situation with clear policy time points and continuous data. It is a more commonly used policy evaluation strategy under the condition of no control group [12,13].

Combined with the situation of this paper: the policy time point is clear, the data is a continuous monthly series, and the indicators have seasonal characteristics. Through the control of monthly fixed effects, the ITS model has strong applicability. The specification is as follows:

$$Y_t = \beta_0 + \beta_1 Time_t + \beta_2 Post_t + \beta_3 (Time_t \times Post_t) + \sum_{m=1}^{11} \gamma_m Month_{m,t} + \varepsilon_t$$

where Y_t denotes the outcome variable in month t; $Time_t$ is a continuous time trend; $Post_t$ is a policy dummy equal to 1 for t≥ January 2024 and 0 otherwise; the interaction term $Time_t \times Post_t$t captures post-policy trend changes; $Month_{m,t}$ represents month dummies controlling for seasonality; and ε_t is the error term. The coefficient β_2 reflects the immediate (level) effect of the policy, while β_3 captures the change in trend following implementation.

Considering that the observation period of monthly discontinuous time series is 24, the inclusion of dummy variables in the complete month will take up more degrees of freedom. In this paper, the results of discontinuous time series model are mainly used as evidence of overall structural changes, and cross-

validated with the results of TWFE.

2.3.2 Two-way Fixed Effects Model

The ITS model focuses on the time change at the overall level, and it is difficult to fully control the unobservable differences in patients' health status, medical preference and risk attitude. This paper constructs a fixed effect model at the individual-month level, and realizes the internal comparison of changes before and after the same patient policy by absorbing the characteristics of individuals that do not change with time. By controlling the individual fixed effect and the time fixed effect at the same time, the internal comparison of the behavior changes of the same patient before and after the policy is realized, the interference of the unobservable heterogeneity of the individual and the common time trend is effectively stripped, and the micro net effect of the policy is identified.

The baseline specification is:

$$Y_{it} = \alpha_i + \delta_t + \beta\, post_t + \varepsilon_{it}$$

where Y_{it} denotes the outcome variable for individual *i* in month *t*; α_i represents individual fixed effects; δ_t denotes month fixed effects; $post_t$ is the policy implementation dummy; and ε_{it} is the error term. The coefficient β captures the average within-individual change in the outcome variable following policy implementation.

To further investigate heterogeneous effects, interaction terms between the policy variable and time-varying group indicators are introduced. It is important to note that both chronic disease status and elderly status are defined at the individual–month level (i.e., whether an individual is in a given state in month *t*), making them time-varying variables. As such, both their main effects and their interactions with the policy variable can be identified within the fixed effects framework.

The extended model is specified as:

$$Y_{it} = \alpha_i + \delta_t + \beta_1 post_t + \beta_2 Group_{it} + \beta_3(post_t \times Group_{it}) + \varepsilon_{it}$$

where $Group_{it}$ denotes the time-varying status variable (e.g., chronic disease status or elderly status). The coefficient β_3 captures the differential effect of the policy across population subgroups.

2.4 Variable selection

In order to analyze the utilization effect of patients after the implementation of the outpatient pooling reform, the explanatory variable selects the cost burden related variable, the core explanatory variable is whether the outpatient pooling reform is implemented, and the heterogeneity variable selects the chronic disease state and the elderly state. The specific variables are explained as follows. The definition and assignment of core variables are shown in Table 1.

2.4.1 Dependent Variables

In order to comprehensively evaluate the burden reduction effect of the outpatient pooling reform, this paper constructs an index system from the dual dimensions of relative burden and absolute burden. Among them, the self-paid proportion capture policy has a direct impact on the reimbursement structure; since the total monthly out-of-pocket expenses will be affected by the frequency of visits at the same time, this paper further introduces the average out-of-pocket expenses to remove the interference of

changes in medical utilization behavior, so as to accurately identify the net change of the absolute burden of patients in a single medical treatment.

The out-of-pocket ratio is defined as the proportion of out-of-pocket payment to total outpatient expenses in the current month. It is a core indicator to measure the level of medical insurance system guarantee and the economic burden of patients. It is widely used in the literature of outpatient pooling reform evaluation [3,14]. According to the theory of risk sharing, the intervention of the pooling fund in the outpatient expenses directly reduces the proportion of the insured's out-of-pocket payment; according to the health demand theory, the decline in the proportion of out-of-pocket means that the effective price faced by patients is reduced, which may in turn affect their willingness to seek medical treatment and utilization intensity. One of the core objectives of the outpatient pooling reform is to systematically reduce the out-of-pocket burden of insured patients by expanding the payment scope of the pooling fund. Therefore, the out-of-pocket ratio is the most direct outcome variable to test the policy burden reduction effect.

The total out-of-pocket payment is the amount of out-of-pocket payment of individual outpatient in the current month, which is used to reflect the change range of patients' cost burden before and after the implementation of the policy from the absolute value dimension, and complements the proportion of out-of-pocket payment [15]. Considering that the distribution of outpatient out-of-pocket amount is usually significantly right-skewed, logarithmic processing is helpful to alleviate the interference of extreme values on regression estimation, and the coefficient can also be directly explained as a relative change. For the observation that the monthly out-of-pocket amount is zero, the method of ln (out-of-pocket amount + 1) is used to convert, so as to reduce the skewed effect while retaining the integrity of the sample.

The average out-of-pocket expenses per visit is defined as the amount of out-of-pocket expenses in the month divided by the number of outpatient settlements in the month, reflecting the average economic burden of a single visit. It can separately identify the impact of the policy on the intensity of a single visit under the condition of controlling the change in the frequency of visits, and also uses logarithmic processing.

2.4.2 Key Independent Variable

The core explanatory variable of this paper is the dummy variable of policy implementation. Coded as 1 for January 2024 onward, and 0 otherwise, which is used to identify the institutional changes brought about by the outpatient pooling reform. Due to the unified implementation of the policy in the whole city, there is no natural control group that is not affected, and the time point of policy implementation is the main basis for identifying the policy effect. By combining this variable with time trend, individual fixed effect and monthly fixed effect, the average change and dynamic path of the outcome variables before and after the implementation of the policy are identified under the premise of controlling other factors.

2.4.3 Heterogeneity Variables

There are differences in the level of health needs and medical insurance benefits among the insured

population, and the effect of the outpatient pooling reform may vary due to different population characteristics. This paper constructs heterogeneous variables from the two dimensions of chronic disease status and elderly status, and examines the differentiated utilization effects of policies by different groups of people [16].

The state of chronic disease based on medical insurance management, which refers to the insured person who is included in the management of chronic disease and has the outpatient settlement related to chronic disease in the same month. Compared with the clinical diagnosis caliber, the medical insurance management caliber directly corresponds to the scope of treatment implementation, which helps to accurately distinguish the population covered by the policy from the system operation level. This variable is defined at the individual-month level. The value of outpatient settlement related to chronic special disease in the month is 1, otherwise it is 0, which belongs to the state variable changing with time.

The definition of the state of old age stems from the following considerations: The hospital settlement data used in this study do not contain direct retirement status fields, and flexible retirement arrangements are common in reality, making it difficult to accurately identify retirement or not. In view of the fact that Chongqing's outpatient pooling reform has a higher reimbursement ratio for retirees, the elderly group may show structural differences in the two dimensions of medical needs and treatment guarantees. In this paper, age 60 is used as the proxy threshold of the elderly state. This variable is also defined at the individual-month level. It is coded as 1 if the individual's age reaches 60 in that month, and 0 otherwise, which belongs to the state variable changing with time. In order to test the sensitivity of threshold selection, 55 years old will be used as an alternative threshold for repeated estimation in the robustness analysis.

Table 1. Definition of Core Variables

Variable Type	Variable Name	Measurement	Definition
Dependent Variables	Outpatient Self-Payment Ratio	Continuous	The proportion of outpatient out-of-pocket expenditure to total outpatient costs within a given month
	Total Out-of-Pocket Expenditure	Continuous	Total monthly out-of-pocket expenditure, log-transformed; observations with zero expenditure are converted using ln(self-payment + 1)
	Average Out-of-Pocket Expenditure per Visit	Continuous	Natural logarithm of monthly out-of-pocket expenditure divided by the number of outpatient visits
Key Independent Variable	Policy Implementation Indicator	Dummy	Equals 1 for the post-policy period and 0 otherwise

Heterogeneity Variables	Chronic Disease Status	Dummy	Indicates whether the individual had a chronic disease-related outpatient claim in the given month (1 = yes, 0 = no)
	Elderly Status	Dummy	Indicates whether the individual is aged 60 years or above in the given month (1 = yes, 0 = no)

3. Results

3.1 Descriptive Statistics

Based on the data of outpatient medical insurance settlement from January 2023 to December 2024 in a large tertiary hospital in Chongqing, this section makes descriptive statistics on the basic characteristics of the samples before and after the implementation of the outpatient pooling reform. Descriptive statistics were analyzed by independent sample t test, and the difference was reported by p value. The results of regression analysis were presented by coefficient and 95% confidence interval, and the statistical significance was judged by whether the confidence interval contained 0.

After data cleaning, a total of 1667847 medical records were finally included in the analysis sample, including 781730 before the policy and 886117 after the policy, involving 607004 insured people. The average age of the sample was aged 51.1 years (SD = 16.95); 51.2 and 50.1 years before and after the policy, respectively. The difference was statistically significant ($t = 7.658$, $p < 0.001$), but a difference of only 0.202 years, and the clinical significance was limited. Among them, women accounted for 64.197%, and there was no significant difference before and after the policy ($p = 0.053$). The proportion of elderly patients was 32.972% before the policy and 33.310% after the policy. The proportion of patients with chronic diseases decreased from 24.806% before the policy to 23.455% after the policy, and the overall sample population composition was basically stable.

Table 2. Basic Characteristics of the Study Sample

Variable	Pre-reform (n = 781,730)	Post-reform (n = 886,117)	χ^2	*p*-value
Female	501,869 (64.197%)	570,158 (64.343%)	3.731	0.053
Elderly Patients	257,751 (32.972%)	295,167 (33.310%)	21.448	<0.001
Chronic Disease Patients	193,913 (24.806%)	207,837 (23.455%)	414.454	<0.001

Table 3 uses the monthly aggregate level (n = 24 natural months) to describe the monthly average changes of key indicators at the hospital level from the cost burden, and to test the statistical significance of the differences before and after the reform through the independent sample t test. Descriptive statistics reflect the simple mean difference before and after the policy, and have not yet controlled the time trend, seasonal fluctuations and sample composition changes. The relevant results are used to present the overall picture. The correlation of policy effects will be completed in the subsequent ITS model and TWFE model.

Table 3. Overall Descriptive Statistics

Variable	Mean (Pre-reform)	SD (Pre-reform)	Mean (Post-reform)	SD (Post-reform)	t-value	*p*-value
Self-Payment Ratio	0.62	0.019	0.465	0.019	20.194	<0.001***
Monthly Out-of-Pocket Expenditure (RMB)	482.691	31.474	371.403	8.254	11.848	<0.001***
Average Out-of-Pocket Expenditure per Visit (RMB)	364.56	24.912	281.215	8.428	10.978	<0.001***

The proportion of out-of-pocket expenses decreased from 0.620 to 0.465 per month before the reform, with a decrease of about 15.5%. The t-test results showed that the difference was highly significant ($p < 0.001$), indicating that the relative burden of outpatient expenses of patients decreased significantly at the overall level after the implementation of the policy. The average monthly out-of-pocket expenses decreased from 482.69 to 371.40, and the average out-of-pocket expenses decreased from 364.56 to 281.22. The two absolute burden indicators also decreased significantly (both $p < 0.001$), which was consistent with the change direction of the out-of-pocket proportion, reflecting the actual effect of the policy in reducing the economic burden of patients.

3.2 Regression Results

3.2.1 Interrupted Time Series Analysis

In this section, the ITS model is used to identify the overall structural changes of the policy implementation point at the monthly aggregate level. Table 4 shows the ITS estimation results of the outcome variables of each dimension. The models incorporate monthly fixed effects to control seasonal fluctuations, and use Newey-West robust standard error correction sequence-related issues.

After the implementation of the policy, the core indicators showed a significant immediate decline. The proportion of outpatient out-of-pocket payment decreased by 12.5 percentage points (95% CI: -0.169, -0.080) after the implementation of the policy, indicating that the implementation of the policy had a substantial reduction in the burden of patients. At the same time, the logarithmic policy coefficients of the total out-of-pocket and the average out-of-pocket expenses are-0.084 and-0.070, respectively, with a significant decrease and the upper limit of the confidence interval is far from zero. In the long-term trend evolution after the implementation of the policy, the change in the proportion of out-of-pocket payments was not significant (95% CI: -0.002,0.004), indicating that its burden reduction effect has good continuity. Although the absolute amount index showed an extremely weak upward trend in the later period, it did not offset the significant decline in the initial stage of the policy during the overall observation period.

Table 4. Results of Interrupted Time Series

Variables	Self-Payment Ratio	ln(Total OOP Expenditure)	ln(OOP per Visit)
Time Trend (Pre-policy)	-0.003	-0.021***	-0.023***
	(-0.007, 0.001)	(-0.023, -0.019)	(-0.026, -0.020)
Immediate Policy Effect	-0.125*	-0.084*	-0.070*
	(-0.169, -0.080)	(-0.106, -0.062)	(-0.108, -0.031)
Post-policy Trend Change	0.001	0.015***	0.013***
	(-0.002, 0.004)	(0.012, 0.017)	(0.010, 0.016)
Constant	0.649***	6.378***	6.051***
	(0.605, 0.693)	(6.358, 6.398)	(6.020, 6.082)
Month Fixed Effects	Yes	Yes	Yes
Observations	24	24	24

3.2.2 Two-Way Fixed Effects Model

Although ITS analysis provides evidence of structural changes at the overall level, the monthly summary results may still be affected by changes in the composition of the patient population and individual heterogeneity. In order to identify the net intra-group changes of the same patient before and after the implementation of the policy, this paper estimates the regression model with individual fixed effect and monthly fixed effect on the individual-month panel data, that is, two-way fixed.

The results of the TWFE model show that the cost burden of patients has been significantly reduced at the micro level after the implementation of the policy. The proportion of outpatient out-of-pocket payment for the same patient decreased by 24.2 percentage points (95% CI: -0.246, -0.239) on average after the implementation of the policy, showing strong statistical robustness. In terms of the absolute value of expenditure, the policy coefficients of the total out-of-pocket expenses and the logarithm of the average out-of-pocket expenses are -0.879 and -0.871, respectively, and the corresponding actual out-of-pocket expenses decrease by more than 58%. The estimated value of these micro net effects strongly confirms the remarkable effect of the outpatient pooling reform in continuously reducing the pressure on insured persons to seek medical treatment.

Table 5. Results of Two-way Fixed Effects

Variables	Self-Payment Ratio	ln(Total OOP Expenditure)	ln(OOP per Visit)
Post-policy	-0.242***	-0.879***	-0.871***
	(-0.246, -0.239)	(-0.899, -0.859)	(-0.890, -0.852)
Constant	0.693***	5.576***	5.338***
	(0.690, 0.695)	(5.561, 5.591)	(5.324, 5.352)
Individual Fixed Effects	Yes	Yes	Yes

Month Fixed Effects	Yes	Yes	Yes
Observations	1,650,572	1,667,847	1,667,847
Number of Individuals	599,852	607,004	607,004
Within R^2	0.102	0.024	0.026

3.2.3 Heterogeneity Analysis Results

The overall effect reflects the average impact of the policy on the whole sample. Considering the differences in the level of medical needs and the characteristics of outpatient use among different groups of people, the policy effect may be different due to different population characteristics. In this section, heterogeneity analysis is carried out from the two dimensions of chronic disease status and age group to examine the distribution characteristics of policy impact.

3.2.3.1 Chronic Disease Patients

The outpatient expenses and frequency of visits of patients with chronic diseases are usually higher than those of the general insured population, and they have enjoyed special protection for outpatient chronic diseases. After the implementation of the outpatient pooling reform, the general outpatient pooling fund and the existing chronic disease coverage overlap, and the policy response of this group may be different from that of the general outpatient. Table 6 shows the TWFE regression results with the interaction term of chronic disease status and policy implementation as the core variable. The model controls both individual fixed effect and monthly fixed effect, and the standard error is clustered and robustly estimated at the individual level.

In terms of cost burden, after the implementation of the policy, the proportion of out-of-pocket payments for non-chronic disease patients decreased by 27.1 percentage points (95% CI: -0.275, -0.267), and the logarithm of total out-of-pocket payments and the logarithm of average out-of-pocket payments also decreased by 0.829 (95% CI: -0.850, -0.808) and 0.826 (95% CI: -0.846, -0.807), respectively. The regression results of the interaction term between chronic disease and policy showed that the interaction term coefficient of out-of-pocket proportion was 0.076 (95% CI: 0.074,0.078), which indicated that although the proportion of patients with chronic disease decreased less than that of non-chronic disease group, the net decrease of out-of-pocket proportion was still 19.5 percentage points after superposition. At the absolute cost level, the coefficients of the interaction term of chronic diseases are-0.131 (95% CI: -0.144, -0.118) and-0.116 (95% CI: -0.129, -0.104), respectively. After conversion, the total out-of-pocket expenses and the average out-of-pocket expenses of patients with chronic diseases decreased by about 61.7% and 61.0%, respectively, reflecting the policy’s stronger tilt protection for high-spending people.

Table 6. Heterogeneity Analysis: Chronic Disease Patients

Variables	Self-Payment Ratio	ln(Total OOP Expenditure)	ln(OOP per Visit)
Post-policy	-0.271***	-0.829***	-0.826***
	(-0.275, -0.267)	(-0.850, -0.808)	(-0.846, -0.807)
Chronic Disease	-0.321***	0.597***	0.482***
	(-0.324, -0.318)	(0.580, 0.615)	(0.466, 0.499)
Chronic Disease × Post-policy	0.076***	-0.131***	-0.116***
	(0.074, 0.078)	(-0.144, -0.118)	(-0.129, -0.104)
Constant	0.783***	5.411***	5.204***
	(0.780, 0.786)	(5.395, 5.427)	(5.189, 5.218)
Month Fixed Effects	Yes	Yes	Yes
Individual Fixed Effects	Yes	Yes	Yes
Observations	1,650,572	1,667,847	1,667,847
Number of Individuals	599,852	607,004	607,004
Within R^2	0.171	0.031	0.031

3.2.3.2 Elderly Patients

The outpatient pooling reform sets a relatively higher level of protection for retirees in the system design, and it is necessary to examine the differential impact of the policy on different age groups. Limited by the availability of hospital medical insurance settlement data, this paper cannot directly identify the retirement status of the insured, and uses the age of 60 or above as an approximate proxy variable for potential retirees. Table 7 shows the results of TWFE regression with age and policy interaction as the core variables.

In terms of cost burden, the regression results show that the policy has a significant burden reduction effect on non-elderly patients. The proportion of outpatient out-of-pocket expenses decreased by 23.7 percentage points (95% CI: -0.241, -0.233), and the total out-of-pocket expenses and the logarithm of average out-of-pocket expenses decreased by 0.821 (95% CI: -0.842, -0.800) and 0.817 (95% CI: -0.837, -0.797), respectively. The coefficients of the interaction term between age and policy are significantly negative in all three indicators, which are -0.008, -0.124 and -0.115, respectively, which means that elderly patients get more in-depth burden reduction protection after the implementation of the policy. After superimposing the main effect and interaction term, the self-pay proportion of elderly patients decreased by about 24.5 percentage points, the total self-pay and the average cost per time decreased by about 61.1% and 60.6% respectively, and the overall benefit degree was significantly higher than that of the non-elderly group. The main effect of the elderly is significantly negative in the proportion of out-of-pocket (95% CI: -0.031, -0.019), indicating that before the implementation of the policy, the existing institutional arrangements have formed a certain basic guarantee for the elderly.

Table 7. Heterogeneity Analysis: Elderly Patients

Variables	Self-Payment Ratio	ln(Total OOP Expenditure)	ln(OOP per Visit)
Post-policy	-0.237***	-0.821***	-0.817***
	(-0.241, -0.233)	(-0.842, -0.800)	(-0.837, -0.797)
Elderly	-0.025***	0	0.002
	(-0.031, -0.019)	(-0.033, 0.032)	(-0.029, 0.033)
Elderly × Post-policy	-0.008***	-0.124***	-0.115***
	(-0.011, -0.006)	(-0.137, -0.110)	(-0.128, -0.103)
Constant	0.699***	5.566***	5.328***
	(0.696, 0.703)	(5.548, 5.584)	(5.311, 5.345)
Month Fixed Effects	Yes	Yes	Yes
Individual Fixed Effects	Yes	Yes	Yes
Observations	1,650,572	1,667,847	1,667,847
Number of Individuals	599,852	607,004	607,004
Within R^2	0.102	0.024	0.026

3.3 Robustness Check

3.3.1 Placebo Test

In this study, the time point of false policy is set as October 2023 for placebo test, and July 2023 is also tested. The results of the two groups are consistent. Table 8 shows the test results for October 2023.

Table 8. Placebo Test Results Using a Fictitious Policy Implementation Date

Variables	Self-Payment Ratio	ln(Total OOP Expenditure)
Placebo Policy Effect	-0.012***	-0.029***
	(-0.017, -0.007)	(-0.035, -0.023)
Post-placebo Trend Change	-0.01	-0.032*
	(-0.027, 0.008)	(-0.066, 0.003)
Time Trend	0	0.015***
	(-0.006, 0.005)	(0.009, 0.021)
Constant	0.657***	6.386***
	(0.615, 0.700)	(6.363, 6.410)
Observations	24	24

3.3.2 Alternative Age Threshold

The robustness test results show that after using age 55 as the alternative age threshold, the sign and significance level of the interaction term between policy and the elderly state are consistent with the

benchmark model, indicating that the specific setting of the age threshold does not change the main conclusions of this paper on the burden reduction effect of the elderly group. The robustness test of replacing age variables further confirms the universality and stability of the research conclusions. The regression model shows that the implementation of the policy has a decrease of 0.810 (95% CI: -0.832, -0.789) in the logarithm of the total self-paid amount of the benchmark group under age 55, which is converted into an absolute amount reduction of about 55.6%. At the same time, the regression coefficient of the interaction between the policy and the age-55 threshold was -0.125 (95% CI: -0.139, -0.112), which meant that people aged 55 and over received an additional 11.8% increase in burden reduction on the basis of inclusive treatment. After the superposition of the two effects, the overall out-of-pocket burden of the group decreased by 60.8%, which is highly consistent with the benchmark regression conclusion using age 60 as the threshold in terms of effect magnitude and statistical direction, proving that the discovery of the benefit effect of the elderly group does not depend on specific age division criteria.

Table 9. Alternative Age Threshold (Age 55)

Variables	**ln(Total OOP Expenditure)**
Post-policy	-0.810***
	(-0.832, -0.789)
Age ≥ 55	0.073***
	(0.036, 0.110)
Age ≥ 55 × Post-policy	-0.125***
	(-0.139, -0.112)
Constant	5.536***
	(5.514, 5.557)
Month Fixed Effects	Yes
Individual Fixed Effects	Yes
Observations	1,667,754
Number of Individuals	607,004
Within R^2	0.025

4. Discussion

This study evaluates the utilization effect of patients after the implementation of the outpatient pooling reform from the cost burden dimension. This chapter analyzes the reasons behind it, aiming to reveal the deep operation logic of outpatient pooling reform in the medical system, and on this basis, to explore its institutional meaning and policy direction.

4.1 Outpatient Pooling Reform Reduces Patient Financial Burden

The empirical results of this study show that after the implementation of the outpatient pooling reform,

the average out-of-pocket expenses and the proportion of out-of-pocket expenses of insured patients have decreased significantly, but the decrease in the overall monthly out-of-pocket amount of individuals is relatively small. This conclusion is basically consistent with the existing research [17], indicating that the outpatient pooling reform has changed the patient's cost burden structure.

The significant decline in the proportion of out-of-pocket payments reflects the institutional effectiveness of the outpatient pooling reform at the level of risk sharing. Before the implementation of the policy, the general outpatient expenses of employee medical insurance are highly dependent on personal accounts. This vertical accumulation model is essentially self-saving in the individual life cycle and lacks the risk adjustment function between groups. As the disease spectrum shifts to chronic diseases, some high-frequency medical people often face the dilemma of running out of account funds and paying full self-payment. The outpatient pooling reform incorporates the risk of outpatient expenses originally borne by individuals into the pool of funds jointly constructed by all insured persons, so that medical expenses can form a more reasonable social sharing relationship between individuals and the overall fund, which is consistent with the core judgment in the risk sharing theory that emphasizes that horizontal co-payment is superior to vertical accumulation.

The relatively gentle decline in the total amount of out-of-pocket payments is related to the moderate release of reasonable outpatient demand after the implementation of the policy. According to the Grossman health demand model, the increase in the proportion of medical insurance reimbursement essentially reduces the effective medical price and marginal medical cost faced by patients[18–20]. When the actual payment price decreases, the liquidity constraints faced by patients are alleviated, and the willingness to use medical services is usually increased accordingly. Before the implementation of the policy, some insured persons postponed medical treatment or took the initiative to reduce the necessary follow-up and dosage due to the higher out-of-pocket cost threshold. After the implementation of the policy, the reduction of the effective price has prompted this part of the long-term suppressed reasonable demand to be transformed into actual diagnosis and treatment behavior [21,22]. The decline in the cost of a single medical treatment is superimposed on the moderate increase in the frequency of visits and the regularity of medication, which ultimately makes the overall self-paid amount decrease relatively flat. Therefore, the small decrease in the overall cost is not the failure of the burden reduction mechanism, but the objective result of the release of potential medical demand to a reasonable level under the price effect.

From the perspective of the long-term operation of medical security, this moderate release of outpatient demand has positive health output value. The improvement of outpatient cost accessibility is helpful for patients to carry out standardized medical intervention in the early stage of the disease, effectively control the progress of chronic diseases, and reduce the occurrence of complications, so as to reduce the probability of emergency or hospitalization caused by the deterioration of the disease in the long term, and realize the partial substitution effect of outpatient service on inpatient service.

While effectively reducing the individual burden, the outpatient pooling reform will inevitably be

accompanied by the release of some reasonable needs, which will directly translate into the current expenditure pressure of the pooling fund. It is suggested that the medical insurance management department should establish a high-frequency monitoring system for the frequency of outpatient visits and the average fund expenditure based on the demand release law identified in this study, and scientifically measure the fund carrying capacity under the background of aging, so as to ensure that the long-term operation risk of the fund can be prevented while maintaining the sense of burden reduction and gain of patients. Secondly, deepen the reform of outpatient medical insurance payment methods to guide reasonable diagnosis and treatment. In order to prevent the release of health needs from evolving into irrational excessive medical treatment, it is recommended to accelerate the transformation from project-based payment to capitation-based payment or outpatient payment based on disease diagnosis-related grouping on the basis of comprehensive coverage of outpatient co-payment. By transmitting the incentive mechanism of cost control to the supplier, medical institutions are encouraged to actively regulate prescription behavior to ensure that the declining out-of-pocket expenses are not swallowed up by the increase of non-essential medical services. In addition, we should speed up the connection between the first diagnosis at the grassroots level and the hierarchical diagnosis and treatment system. The sample of this study comes from large-scale tertiary general hospitals. The increase in the referral rate has increased the outpatient carrying pressure and resource congestion of high-level medical institutions to a certain extent. It is suggested to further widen the gap in the proportion of outpatient reimbursement among medical institutions at different levels, use more obvious price leverage, and use price leverage to divert the basic needs of outpatient services to primary medical and health institutions.

4.2 Stronger Financial Relief Effects of the Outpatient Pooling Reform among Chronic Disease and Elderly Populations

The results of empirical analysis show that the burden-reducing effect of the outpatient pooling reform is significantly differentiated among people with different characteristics, and patients with chronic diseases and the elderly group receive a greater reduction in costs. The decrease of out-of-pocket expenses of patients with chronic diseases was significantly higher than that of ordinary outpatients, and there was no synchronous surge in the number of visits. The elderly group aged 60 and above also showed a more obvious burden reduction than the non-elderly group. This phenomenon is consistent with the existing research conclusions. Patients with chronic diseases have strong rigidity in medical expenditure due to long-term medication and continuous treatment needs, so it is easier to directly benefit from the improvement of outpatient security level [6,21,23].

Chronic diseases and the elderly have a stronger burden reduction effect, which is closely related to the low price elasticity of medical demand. Due to the long course of disease or physiological dysfunction, the medical utilization of patients with chronic diseases and the elderly is mainly composed of long-term regular medication and continuous follow-up, which is a typical rigid demand. When the outpatient pooling reform reduces the effective medical price, such patients will not have irrational excessive medical consumption, and the policy dividend can be more accurately transformed into a substantial

reduction in the economic burden. This study observed that the frequency of visits remained relatively stable or even slightly contracted while the out-of-pocket costs of the two groups decreased significantly, indicating that the decrease in costs was mainly due to the adjustment of the payment structure, rather than the non-essential expansion of medical utilization.

From the perspective of health equity, the significant burden reduction of key populations reflects the strengthening of the redistribution function of the medical insurance system. The theory of health equity emphasizes that health care resources should be tilted towards groups with higher health risks and heavier economic burdens to reduce institutional health opportunity inequalities[24]. The outpatient pooling reform substantially reduces the medical threshold of high-risk groups by adjusting the payment scope of the pooling fund, combining with the proportion of retirees' reimbursement and the expansion of the chronic special disease insurance catalogue. The elderly usually have a higher disease burden and benefit more from the expansion of security, which is in line with the institutional logic of medical insurance to strengthen risk sharing and vertical equity. This differentiated burden reduction effect shows that the outpatient pooling reform can effectively play the role of precise security while achieving inclusive security. The key population maintains the stability of the utilization scale while enjoying stronger protection, which is also related to the comprehensive effectiveness of the medical insurance governance system in recent years. The outpatient pooling reform has a synergistic effect with policies such as centralized drug procurement, standardized management of chronic diseases, and long prescription system. These management methods reduce the patient 's round-trip costs on the demand side, and inhibit the induced demand on the supply side through the reform of payment methods, so that the policy dividend is concentrated on reducing the economic pressure of patients, rather than evolving into the disorderly expansion of fund expenditure.

In view of the fact that the response of chronic diseases and elderly groups to price signals is mainly economic burden reduction rather than utilization expansion, it is suggested to further explore the differentiated guarantee scheme for such groups within the affordable range of medical insurance fund. The reimbursement ratio of commonly used drugs for chronic diseases can be appropriately increased, or a lower starting payment standard can be set for the elderly insured, so as to better play the precise guarantee and risk sharing function of the medical insurance system, and ensure that the policy dividend is accurately tilted to the group with the highest health risk and the heaviest economic burden. Secondly, we should promote the deep integration of outpatient pooling reform with chronic disease management and long-term care insurance. The realization of the burden reduction effect provides a financial basis for improving the long-term health output of patients. It is suggested that the health department and the medical insurance department should work together to guide the elderly and chronic patients to enter the standardized management path through the contracted services of family doctors by using the financial leverage of outpatient pooling reform. Through the continuous reduction of expenses, patients are guided to form stable medical habits and medication compliance, so as to transform the short-term burden reduction dividend into long-term healthy life extension and improve the overall operation efficiency of

the system. In addition, improve the convenient service of medical insurance management for key groups. Considering the difference in the acceptance of information operation among the elderly, the direct settlement process of the hospital and the pharmacy should be optimized simultaneously in the process of implementing outpatient reimbursement. By simplifying the qualification of chronic diseases and promoting mobile payment assistance, we can reduce the institutional cost of key groups enjoying policy dividends and ensure that the fairness effect of policies can truly reach high-demand groups.

4.3 Stability and Dynamic Evolution of the Outpatient Pooling Reform Effect

Through ITS analysis, this study found that the burden reduction effect of the outpatient pooling reform on the patient's cost burden appeared immediately in the month of policy implementation, and maintained good stability during the subsequent observation period. This dynamic evolution trajectory shows that the burden reduction effect is not a short-term data fluctuation, but a continuous change brought about by the adjustment of institutional payment structure.

The immediate appearance of the policy effect is directly related to the settlement mechanism of the outpatient pooling reform. The pooling fund directly reimburses the eligible outpatient expenses in proportion. The insured can feel the decrease of out-of-pocket expenses when the medical treatment is settled. The burden reduction effect is quickly reflected in the settlement data after the policy is implemented. During the observation period, the proportion of out-of-pocket expenses continued to maintain at a low level, and there was no obvious rebound. The stability of the insurance level has a substantial impact on the insured's medical behavior. When patients regard outpatient burden reduction as a long-term institutional arrangement rather than a temporary measure, medical behavior tends to be regular, and irrational behaviors such as sudden medical treatment or drug hoarding are correspondingly reduced, which helps to maintain the stability of fund operation. The trend coefficient observed in this study shows that the policy burden reduction effect has not been significantly diluted due to the compensatory behavior of medical institutions. In the practice of medical insurance reform, there is a risk that the policy effect decreases with time, and medical institutions may offset the burden reduction space caused by the decline in the proportion of out-of-pocket payments by increasing non-reimbursable items. The results of this study show that this risk has been well controlled in the current governance environment, which is related to the coordinated promotion of reforms such as outpatient pooling reform, separation of prescribing and dispensing, and centralized volume procurement.

In the short term, the policy effect is stable, but the medical consumption behavior is lagging behind, and the long-term trend still needs to be continuously tracked. It is suggested that the medical insurance department should establish a cross-year policy effect evaluation system, focus on monitoring the cost evolution trend after 3 to 5 years of policy implementation, reserve parameter adjustment space for possible rebound or structural changes, and carry out dynamic rolling evaluation based on big data of medical insurance settlement. In addition, it is recommended to promote the synergy between outpatient pooling reform and the reform of employee personal accounts. After the continuous release of the overall security effect, the function of individual accounts in outpatient security will be further weakened. It can

be considered to appropriately expand the scope of mutual assistance of individual accounts and extend it to the use of mutual assistance among family members. While the pooling fund assumes the main security responsibility, it will play a complementary role and consolidate the existing burden reduction results.

5. Limitations

Several limitations of this study warrant acknowledgment. The universal implementation of the reform across Chongqing precluded the construction of a concurrent control group, meaning that unobserved time-varying confounders coinciding with the policy—such as concurrent drug pricing adjustments or shifts in care-seeking behavior—cannot be entirely ruled out, despite the reassurance provided by placebo testing.

The use of data from a single tertiary hospital also constrains the external validity of the findings. Given that tertiary institutions tend to serve patients with greater clinical complexity and higher baseline expenditures, the estimated effects may not be directly transferable to primary or secondary care settings, where the composition of outpatient demand differs substantially.

At the individual level, the TWFE model, while controlling for time-invariant heterogeneity, cannot fully account for time-varying confounders such as changes in health status or household income that may independently influence outpatient expenditure over the study period. Furthermore, the 24-month observation window limits inference to short- and medium-term dynamics, and whether the documented burden-reduction effects persist over a longer horizon remains to be established through extended follow-up.

Finally, the analysis is confined to financial burden outcomes and does not address downstream clinical results. Whether the observed reductions in out-of-pocket expenditure translate into measurable improvements in chronic disease control or reductions in avoidable hospitalization remains an open question for future research integrating claims data with longitudinal clinical records.

References

[1] Lin, J., Yan, C., Wang, H., Xu, C., & Fan, W. (2024). Outpatient coordination reform improves the sustainability of China’s Urban Employee Basic Medical Insurance Fund. *Front Public Health*, *12*, 1446408. https://doi.org/10.3389/fpubh.2024.1446408

[2] Zhang, T., & Chen, M. (2025). Long-term effects of establishing outpatient pooling funds on financial protection: Empirical evidence from a quasi-natural experiment in China. *The International Journal of Health Planning and Management*, *40*(1), 204-23. https://doi.org/10.1002/hpm.3859

[3] Qin, V. M., Zhang, Y., Chia, K. S., McPake, B., Zhao, Y., Hulse, E. S. G., et al. (2021). Temporal trends and variation in out-of-pocket expenditures and patient cost sharing: evidence from a Chinese national survey 2011-2015. *Int J Equity Health*, *20*(1), 143. https://doi.org/10.1186/s12939-021-01480-9

[4] Zhang, T., Liu, J., Li, B., & Yu, M. (2025). Dynamic effects of outpatient pooling scheme on socioeconomic inequality in healthcare utilization in China from 2011 to 2020. *Sci Rep.*, *16*(1), 2349. https://doi.org/10.1038/s41598-025-32168-7

[5] He, W., & Li, Y. (2025). Does chronic disease coverage for outpatient care affect healthcare utilization and expenditures in China? Evidence from an administrative claim dataset. *Eur J Health Econ*. https://doi.org/10.1007/s10198-025-01837-9

[6] Wang, Z., Li, X., & Chen, M. (2015). Catastrophic health expenditures and its inequality in elderly households with chronic disease patients in China. *Int J Equity Health*, *14*, 8. https://doi.org/10.1186/s12939-015-0134-6

[7] Jing, Z., Chu, J., Imam Syeda, Z., Zhang, X., Xu, Q., Sun, L., et al. (2019). Catastrophic health expenditure among type 2 diabetes mellitus patients: A province-wide study in Shandong, China. *J Diabetes Investig.*, *10*(2), 283-9. https://doi.org/10.1111/jdi.12901

[8] Qiu, C., & Wu, X. (2019). The Effect of Medical Insurance on Outpatient Visits by the Elderly: An Empirical Study with China Health and Retirement Longitudinal Study Data. *Appl Health Econ Health Policy*, *17*(2), 175-87. https://doi.org/10.1007/s40258-018-0443-1

[9] Wang, J., Pei, Y., Zhong, R., & Wu, B. (2020). Outpatient Visits among Older Adults Living Alone in China: Does Health Insurance and City of Residence Matter? *Int J Environ Res Public Health*, *17*(12), 4256. https://doi.org/10.3390/ijerph17124256

[10] Li, H., Chang, E., Zheng, W., Liu, B., Xu, J., Gu, W., et al. (2022). Multimorbidity and catastrophic health expenditure: Evidence from the China Health and Retirement Longitudinal Study. *Front Public Health*, *10*, 1043189. https://doi.org/10.3389/fpubh.2022.1043189

[11] Wang, J., Tan, X., Qi, X., Zhang, X., Liu, H., Wang, K., et al. (2021). Minimizing the Risk of Catastrophic Health Expenditure in China: A Multi-Dimensional Analysis of Vulnerable Groups. *Front Public Health*, *9*, 689809. https://doi.org/10.3389/fpubh.2021.689809

[12] Wagner, A. K., Soumerai, S. B., Zhang, F., & Ross-Degnan, D. (2002). Segmented regression analysis of interrupted time series studies in medication use research. *J Clin Pharm Ther.*, *27*(4), 299-309. https://doi.org/10.1046/j.1365-2710.2002.00430.x

[13] Bernal, J. L., Cummins, S., & Gasparrini, A. (2021). Corrigendum to: Interrupted time series regression for the evaluation of public health interventions: a tutorial. *International Journal of Epidemiology*, *50*(3), 1045-1045. https://doi.org/10.1093/ije/dyaa118

[14] Fu, W., Zhao, S., Zhang, Y., Chai, P., & Goss, J. (2018). Research in health policy making in China: out-of-pocket payments in Healthy China 2030. *BMJ*, *360*, k234. https://doi.org/10.1136/bmj.k234

[15] Manning, W. G., & Mullahy, J. (2001). Estimating log models: to transform or not to transform? *J Health Econ.*, *20*(4), 461-94. https://doi.org/10.1016/s0167-6296(01)00086-8

[16] Anderson, G., & Horvath, J. (2004). The Growing Burden of Chronic Disease in America. *Public Health Rep.*, *119*(3), 263-70. https://doi.org/10.1016/j.phr.2004.04.005

[17] Wu, Y., Zheng, S., & Qiu, J. (2025). Impact of Enhanced Outpatient Pooling Level on Healthcare Utilization, Costs and Fund Expenditures in China: An Interrupted Time Series Analysis. *Risk Manag Healthc Policy*, *18*, 2977-89. https://doi.org/10.2147/RMHP.S541047

[18] Grossman, M. (1972). On the Concept of Health Capital and the Demand for Health. *Journal of Political Economy*, *80*(2), 223-55. https://doi.org/10.1086/259880

[19] Liljas, B. (1998). The demand for health with uncertainty and insurance. *J Health Econ.*, *17*(2), 153-70. https://doi.org/10.1016/s0167-6296(97)00021-0

[20] Nocera, S., & Zweifel, P. (1998). The demand for health: an empirical test of the Grossman model using panel data. *Dev Health Econ Public Policy*, *6*, 35-49. https://doi.org/10.1007/978-1-4615-5681-7_2

[21] Du, W., Liu, P., & Xu, W. (2022). Effects of decreasing the out-of-pocket expenses for outpatient care on health-seeking behaviors, health outcomes and medical expenses of people with diabetes: evidence from China. *Int J Equity Health*, *21*(1), 162. https://doi.org/10.1186/s12939-022-01775-5

[22] Chandra, A., Gruber, J., & McKnight, R. (2014). The impact of patient cost-sharing on low-income populations: evidence from Massachusetts. *J Health Econ.*, *33*, 57-66. https://doi.org/10.1016/j.jhealeco.2013.10.008

[23] Chen, Y., & Liu, W. (2022). Utilization and out-of-pocket expenses of primary care among the multimorbid elderly in China: A two-part model with nationally representative data. *Front Public Health*, *10*, 1057595. https://doi.org/10.3389/fpubh.2022.1057595

[24] Marmot, M., Friel, S., Bell, R., Houweling, T. A. J., & Taylor, S. (2008). Commission on Social Determinants of Health. Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet*, *372*(9650), 1661-9. https://doi.org/10.1016/S0140-6736(08)61690-6