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ORIGINAL RESEARCH

# Impact of Enhanced Outpatient Pooling Level on Healthcare Utilization, Costs and Fund Expenditures in China: An Interrupted Time Series Analysis

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**Background:** China introduced the outpatient pooling fund model into Urban Employee Basic Medical Insurance (UEBMI) to increase the compensation level for outpatient costs, but the empirical evidence is extremely limited. As an early adopter of China's healthcare reform, Sanming City increased the reimbursement rate of general outpatient visits for UEBMI enrollee in August 2016. The reimbursement rate for UEBMI enrollees seeking general outpatient care at primary hospitals increased from 40% to 90%, and for secondary and above hospitals from 30% to 70%. This study aimed to assess the changes in medical service utilization, medical costs, and medical insurance fund expenditures among UEBMI enrollees after the improvement of outpatient pooling level for employees.

**Methods:** A retrospective analysis was conducted using monthly monitoring data on public hospitals from August 2015 to August 2017 in Sanming City, China. An interrupted time-series analysis was performed to evaluate the level and trend changes in medical services utilization, medical costs, and UEBMI fund expenditures before and after the improvement of outpatient pooling level.

**Results:** After the intervention, the number of monthly outpatient visits per capita for UEBMI enrollees increased by 0.047 immediately ($P<0.05$), while the change in inpatient demand was insignificant ($P>0.05$). The medical cost per outpatient visit increased by 0.6% per month ($P<0.001$). The out-of-pocket (OOP) cost per outpatient visit decreased by 23.66% immediately ($P<0.001$), with a monthly increase of 1.61% afterward ($P<0.001$). The outpatient fund expenditures increased by 151.68% immediately ($P<0.001$), but decreased by 2.37% per month in the long term ($P<0.01$). The total and inpatient fund expenditures varied insignificantly ($P>0.05$).

**Conclusion:** The improvement of outpatient pooling level for urban employees had positive effects on stimulating the demand for outpatient medical services, reducing OOP costs, and maintaining the sustainability of UEBMI funds, while the long-term effect was weakened, and the substitution effect between inpatient and outpatient healthcare was insignificant. There is an urgent need to improve the outpatient benefits, establish a value-based outpatient payment method and an intelligent medical insurance fund monitoring system.

**Keywords:** outpatient pooling, medical services utilization, out-of-pocket expenditures, medical insurance fund, interrupted time series, China

## Introduction

Health insurance is a crucial policy tool for sharing the risk of disease, promoting health equity and protecting individuals and families from the financial risks inherent in healthcare costs.[1] In recent decades, developing countries have introduced social health insurance models to cope with the trends of health inequality and the higher risk of poverty due to disease.[2] In 2010, China established a government-led basic medical insurance system nationwide and remained

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committed to realizing its social and welfare functions. By the end of 2023, the number of people covered by China's basic medical insurance reached 1.334 billion, with the coverage rate stabilizing at over 95%.[3]

As an essential part of the binary basic medical insurance system, the Urban Employee Basic Medical Insurance (UEBMI) is the largest social medical insurance program in China in terms of fund revenues and surplus, providing basic medical protection for a large population of employees.[4] UEBMI is funded primarily by the average paychecks of employers (6%) and employees (2%), with 70% of employer contributions going to the Social Pool of Account (SPA), performing the role of redistributing resources and advancing health equity, and the remaining 30% flowing to the individual Medical Savings Accounts (MSAs). Employee contributions flow entirely to MSAs, enabling individuals to take direct control of their healthcare finances. The SPA and MSAs show independent operation pattern, which is mainly reflected in the fact that the SPA is only used to pay for medical costs related to inpatient care, while the MSAs are used to pay for outpatient costs, the personal burden of inpatient medical costs, and the drug costs from designated pharmacies.[5] It is worth noting that while MSAs are only used to pay for a specific range of medical costs, their principal and interest are owned by the individuals and can be carried forward for use and inheritance, thus assuming the attributes of private property.

Within this framework, a series of problems have emerged. First, the main incentive for the demand side is moral hazard. Cost-sharing reduces patients' out-of-pocket (OOP) costs while increasing the quantity of healthcare services consumed.[6] Low-cost, high-frequency diseases have a higher elasticity of demand and are more prone to moral hazard than diseases with high medical costs.[7] Compared with outpatient medical services, patients prefer to receive inpatient medical services to obtain higher reimbursement from the SPA, even if the clinical symptoms appear to be mild.[8] Thus, a large amount of inpatient medical resources were allocated in an irrational manner, and the hospitalization rate and medical costs of UEBMI enrollees rose rapidly. According to a publicly available data, the hospitalization rate of UEBMI enrollees in China had risen from 5.5% in 2005 to 17.7% in 2021.[5] Moreover, the inequitable distribution of UEBMI benefits should not be overlooked. Previous studies have demonstrated that high-income groups benefited more from health insurance as they receive more healthcare services compared to low-income groups.[9,10] With the government's positioning of prioritizing compensation for inpatient costs, the compensation for outpatient costs has been neglected to a certain extent.[11] Due to the lower level of outpatient reimbursement, the low-income groups may reduce the utilization of outpatient medical services, even if they are necessary, and this may lead to deterioration of the disease.[12]

By contrast, some developed countries have accumulated viable experience in improving outpatient health insurance benefits. A common feature is that the detail level of the outpatient health insurance benefit catalog is closely associated with the compensation method on the provider side. Most welfare states have formulated detailed outpatient treatment catalogs to specify the healthcare services covered by outpatient health insurance, which are adjusted according to different compensation methods. For instance, the General Medical Service contract of the United Kingdom has detailed provisions on the outpatient healthcare services provided by outpatient general practitioners.[13] However, the outpatient health insurance coverage in majority of countries only includes routine medical care, while some special services, such as cosmetic surgery, dental treatment, preventive surgery and acupuncture treatment are not covered by outpatient health insurance. In the area of drug cost coverage, the outpatient health insurance covers outpatient prescription drugs in most developed countries and regions, as evidenced by the fact that the reimbursement rate of prescription drugs in the outpatient drug list is over 75%.[14,15] Additionally, it is worth noting that the US government reformed the Traditional Fee-For-Service (FFS) Medicare payment structure to reward value rather than the volume of care by means of bundled payments, accountable care organizations, and incentives for alternative payment models. In particular, Medicare Advantage (MA) is leading this way from a model of volume-based care to a framework of incentives aimed at improving health outcomes. MA is designed to identify health problems early, enable beneficiaries to live with chronic conditions, and support providers who offer comprehensive and coordinated services.[16] In addition, Accountable Care Organizations (ACOs) are groups of health care providers who voluntarily assume the total cost and quality of care for their most frequent patients (primary care), which incentivize cost containment by allowing participating health care organizations to share in savings to the Medicare program.[17] With their shared savings incentives and other features of each model, ACOs can enhance a wide range of care delivery processes, influenced by their markets and their own structural factors. These processes may make care more accessible to patients, enhance primary care services and health-

promoting treatment programs. As ACO models continue to evolve and ACOs grow in experience, ACOs have demonstrated the ability to reduce Medicare expenditures by millions of dollars with no indication of hampering healthcare quality.[18]

To address these problems and take into account international practical experience, the Chinese government proposed a plan to gradually establish an outpatient pooling mechanism. Through the establishment of an outpatient pooling fund, the SPA was separated into inpatient pooling fund and the outpatient pooling fund. The payment scope of SPA has extended from inpatient medical services to inpatient and outpatient medical services, elevating the compensation level for outpatient costs. Since 2011, certain eligible regions in China have initiated pilot reforms of UEBMI-based outpatient pooling scheme, most of which only included costs related to chronic diseases in the payment scope of the outpatient pooling fund, and a few regions implemented the general outpatient pooling scheme without limiting the types of diseases, such as Sanming City in eastern China. However, less than 30% of cities in China had implemented the UEBMI-based outpatient pooling scheme as of 2018.[3] In 2021, the Chinese government launched a program to establish an outpatient mutual assistance security mechanism, aiming to enhance the level of medical welfare and strengthen outpatient risk-sharing capacity. Consequently, China's national-level UEBMI-based outpatient mutual assistance security policy has been officially established, and it has become an inevitable trend for more regions to implement outpatient pooling reforms in the future.

Previous studies conducted a range of analyses of the policy's operational mechanisms and short-term effects, mostly focusing on the impact of outpatient and inpatient medical insurance policies on medical service utilization and medical costs of enrolled patients.[19,20] For instance, Freeman et al[21] found that the implementation of outpatient Medicare contributed to an increase in patient adherence, which led to a decrease in hospitalization rates. However, contrasting evidence indicated that inpatient and outpatient medical services were complementary. An increase in the level of outpatient benefits does not necessarily reduce the utilization of inpatient medical services or inpatient costs.[22,23] A study by Zhang et al[24] also reached similar results. However, a study conducted in Korea found that outpatient co-payment policies failed to effectively control the growth in hospitalization rates and total medical costs.[25] Thus, the conclusions of existing studies remain controversial, and there is a relative lack of effectiveness evaluation of the UEBMI-based outpatient pooling policy. Previous studies were conducted at lower levels of health insurance financing and compensation, and may be inapplicable to the current situation. Simultaneously, there is still a gap in the studies analyzing the impact of outpatient pooling policy from the perspective of the sustainability of medical insurance funds, and further empirical evidence is warranted. These results provided a starting point for our study.

Sanming City launched a comprehensive reform of healthcare system in 2012, focusing on comprehensive reforms of public hospitals and promoting synergistic reforms of health insurance, healthcare and medicine. The Sanming reform of healthcare system has accumulated a series of experiences, systematically changed the profit-seeking mechanism of public hospitals, and solved the problem of the healthcare insurance fund not covering expenditures, forming a replicable institutional system and attracting the attention of the Chinese government. In November 2021, the Chinese government formally requested that the Sanming model be replicated at the national level.[26] For these reasons, this study selected Sanming City, China, as the case city with the aim of evaluating the changes in medical services utilization, medical costs, and medical insurance fund expenditures of UEBMI enrollees after the improvement of outpatient pooling level. Our findings will provide empirical evidence and policy insights for the implementation of outpatient pooling policy in the remaining regions.

# Methods

## Study Setting and Design

This study was conducted in Sanming City, Fujian Province, which is located in southeastern China, with a residential population of 2.455 million and a Gross Domestic Product (GDP) per capita of 126,044 CNY in 2022. As of 2022, the number of UEBMI enrollees in Sanming City reached 448,200.[27] Sanming City is an early adopter of the medicine and healthcare system reforms, and its accumulated practical experience and remarkable performance provide an effective guideline for the implementation of related reforms in all parts of China.

In August 2016, Sanming City improved the UEBMI-based reimbursement rate for general outpatient medical services. The reimbursement rate for UEBMI enrollees seeking general outpatient care at primary hospitals increased from 40% to 90%, and for secondary and above hospitals from 30% to 70%. The annual deductible and annual payment limits were 1000 CNY and 3000 CNY, respectively. This policy aimed to narrow the gap between inpatient and outpatient reimbursement rates, reduce patients' OOP payments for general outpatient care, guide patients to rationally utilize healthcare services, and reduce the abuse of inpatient services. Based on this, this study retrospectively analyzed the changes in medical services utilization, medical costs, and medical insurance fund expenditures of UEBMI enrollees in Sanming City between August 2015 and August 2017, using August 2016 as the intervention time point.

## Data Sources

Data were obtained from the monthly monitoring reports of public hospitals published by the Sanming government. The monthly monitoring data of public hospitals strictly implement the national and local statutory health statistics survey system and work norms. The index definitions, calculation methods, classification catalogs and statistical codes applied in the health statistics investigations are all processed in a standardized manner. In addition, a system of random data quality checks has been established in the government to regularly assess the quality of statistical data, which includes the timeliness, completeness, and accuracy of data reporting, and regular data comparisons are conducted between operational and comprehensive statistical data involving the same indicators to verify the accuracy and consistency of the data. The reports aggregated monthly data on medical insurance fund revenues and expenditures, patient healthcare service utilization and flow situations, and healthcare costs. Data were collected from 22 public hospitals from August 2015 to August 2017.

## Outcome Variables

Based on the intended objectives, this study assessed the effects of the policy from three aspects. One focused on the imbalance between the distribution of outpatient and inpatient medical resources. The policy aimed to narrow the gap between inpatient and outpatient reimbursement rates and guide patients to make rational choices regarding medical services. Therefore, the number of outpatient and inpatient visits for UEBMI enrollees was selected as an indicator of medical service utilization. The other was to reduce the financial burden on general outpatient visits. Thus, this study also analyzed the changes in the medical and OOP costs of outpatient and inpatient visits. Considering the potential impact of enhancing the outpatient pooling level on the sustainability and distribution of the medical insurance fund, this study evaluated the expenditure changes of the UEBMI fund at the overall, outpatient, and inpatient levels.

## Statistical Analysis

We performed per-capita standardization on the healthcare utilization variables as the data used in this study were obtained from the official reports of the Sanming government and were all aggregated. Based on the impact of inflation, the costs for 2015–2017 were adjusted based on the Consumer Price Index (CPI) for healthcare, using 2017 as the base year. Non-normally distributed data were natural log (Ln) transformed to reduce the skewness.

An interrupted time series (ITS) analysis based on the segmented regression model was used to assess the short-term level changes and long-term trend changes in medical services utilization, medical costs, and medical insurance fund expenditures of UEBMI enrollees before and after the improvement of outpatient pooling level.[28] We considered August 1, 2016 as the time of intervention implementation, and divided the time series into pre-reform (August 1, 2015 to July 31, 2016) and post-reform (August 1, 2016 to August 31, 2017), and selected the time variable as the independent variable in terms of the number of months. The model is specified as follows:

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_t + \beta_3 X_t T_t + \varepsilon_t$$

The $Y_t$ is the dependent variable representing the outcome variable at month t. $T_t$ is the time-series variable representing the time in months from the start of the observation to month t. $X_t$ is a binary dummy variable representing the point of intervention. Thus, $\beta_0$ represents the baseline level. $\beta_1$ represents the trend change in the outcome variables before intervention. $\beta_2$ represents the instantaneous level of change in the outcome variable at the time of the intervention

implementation. $\beta_3$ represents the change in the trend of outcome variables after the intervention. $\beta_1+\beta_3$ represents the trends of outcome variables after the intervention. $\varepsilon_t$ is the random error.[29] The Durbin–Watson (D–W) method was used to test the autocorrelation of errors, and we set the D–W value between 1.5 and 2.5 as no first-order autocorrelation. Generalized least squares estimation (GLSE) based on the Paris-Winsten method was used to cope with the autocorrelation.[30] To directly reflect the percentage changes in the independent and dependent variables after Ln transformation, log-line transformations were used to adjust for cost variables.[31] As the time series data reflecting healthcare utilization and health insurance fund expenditures usually exhibit seasonal fluctuations, which in turn may affect the assessment results of the policy. A moving average method is used for seasonal adjustment.[32] The statistical significance level was set at 0.05. All analyses were performed using Stata 17.0 software.

# Results

## Description Statistics

Table 1 presents the descriptive statistics of the indicators. After improvement in the level of outpatient pooling, the average number of monthly outpatient visits per capita increased significantly, whereas the average number of monthly inpatient visits per capita varied insignificantly. The average outpatient OOP cost of UEBMI enrollees decreased from 136.47 CNY to 111.67 CNY, while the average inpatient OOP cost increased from 2,079.35 CNY to 2,262.78 CNY. The average medical cost per outpatient visit and average medical cost per inpatient visit remained almost unchanged. The total pooling fund expenditure increased, with the outpatient fund expenditure making the largest contribution, rising from 2,964,706.12 CNY to 7,134,540.74 CNY, while the inpatient fund expenditure increased slightly.

## The ITS Analysis on Medical Services Utilization

Table 2 and Figure 1 depict the ITS analysis of medical service utilization for UEBMI enrollees. In the pre-intervention period, the number of monthly outpatient visits per capita increased by 0.005 per month ($P<0.001$), and the number of monthly inpatient visits per capita showed a positive change, while the trend remained insignificant ($\beta_1=0.00007$, $P>0.05$). At the time of the intervention, the number of monthly outpatient visits per capita increased by 0.047 immediately ($P<0.05$). While the number of monthly inpatient visits showed a negative change, the level change was insignificant ($\beta_2=-0.005$, $P>0.05$). The number of monthly outpatient visits per capita decreased by 0.008 compared with the pre-intervention trend after the intervention ($P<0.001$), but the long-term trend remained insignificant ($\beta_1+\beta_3=-0.003$, $P>0.05$).

**Table 1** Descriptive Statistics of Indicators Before and After the Policy

| Variables | | Pre-Intervention (2015.8–2016.7) | | Post-Intervention (2016.8–2017.8) | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| Medical services utilization (n) | Number of monthly outpatient visits per capita | 0.30 | 0.03 | 0.36 | 0.03 |
| | Number of monthly inpatient visits per capita | 0.01 | 0.002 | 0.01 | 0.001 |
| Medical costs (CNY) | Medical costs per outpatient visit | 161.40 | 3.83 | 161.01 | 3.98 |
| | Medical costs per inpatient visit | 7193.68 | 393.61 | 7139.65 | 455.50 |
| | OOP costs per outpatient visit | 136.47 | 5.12 | 111.67 | 8.77 |
| | OOP costs per inpatient visit | 2079.35 | 177.22 | 2262.78 | 230.21 |
| UEBMI pooling fund payments (CNY) | Total fund expenditure | 48,738,528.04 | 8,295,760.10 | 54,162,256.80 | 9,606,559.87 |
| | Outpatient fund expenditure | 2,964,706.12 | 778,107.77 | 7,134,540.74 | 1,429,119.74 |
| | Inpatient fund expenditure | 23,746,747.87 | 3,992,317.54 | 24,113,888.68 | 4,245,431.74 |

**Abbreviations**: SD, standard deviation; UEBMI, Urban Employee Basic Medical Insurance; OOP, out-of-pocket.


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**Table 2** The ITS Regression Results of Medical Services Utilization, Medical Costs, and Medical Insurance Fund Payments of UEBMI Enrollees Before and After the Policy

| Variables | Constant ($\beta_0$) | | Baseline Slope ($\beta_1$) | | Level Change ($\beta_2$) | | Slope Change ($\beta_3$) | | Trend ($\beta_1+\beta_3$) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coefficient | 95% CI | Coefficient | 95% CI | Coefficient | 95% CI | Coefficient | 95% CI | Coefficient | 95% CI |
| Medical services utilization | | | | | | | | | | |
| Number of outpatient visits per capita | 0.270*** | 0.250 to 0.289 | 0.005*** | 0.002 to 0.008 | 0.047* | 0.008 to 0.085 | −0.008*** | −0.012 to −0.004 | −0.003 | −0.006 to 0.0004 |
| Number of inpatient visits per capita | 0.011*** | 0.010 to 0.012 | 0.00007 | −0.0006 to 0.0002 | −0.0005 | −0.002 to 0.001 | −0.00002 | −0.0002 to 0.0002 | 0.00005 | −0.00007 to 0.0002 |
| Medical costs | | | | | | | | | | |
| Ln (Medical cost per outpatient visit) | 5.099*** | 5.079 to 5.119 | −0.003 | −0.006 to 0.0002 | −0.019 | −0.049 to 0.010 | 0.009*** | 0.005 to 0.013 | 0.006*** | 0.003 to 0.009 |
| Ln (Medical cost per inpatient visit) | 8.911*** | 8.863 to 8.958 | −0.006 | −0.013 to 0.002 | 0.013 | −0.059 to 0.086 | 0.008 | −0.002 to 0.017 | 0.002 | −0.004 to 0.009 |
| Ln (OOP cost per outpatient visit) | 4.937*** | 4.909 to 4.965 | −0.004 | −0.011 to 0.004 | −0.270*** | −0.380 to −0.165 | 0.020*** | 0.011 to 0.028 | 0.016*** | 0.008 to 0.023 |
| Ln (OOP cost per inpatient visit) | 7.597*** | 7.485 to 7.708 | 0.007 | −0.007 to 0.022 | 0.057 | −0.070 to 0.183 | −0.011 | −0.026 to 0.006 | −0.003 | −0.011 to 0.004 |
| Medical insurance fund payments | | | | | | | | | | |
| Ln (Total fund expenditure) | 17.691*** | 17.552 to 17.830 | −0.0006 | −0.013 to 0.011 | 0.098 | −0.106 to 0.302 | 0.003 | −0.015 to 0.020 | 0.002 | −0.010 to 0.014 |
| Ln (Outpatient fund expenditure) | 14.777*** | 14.467 to 15.088 | 0.017 | −0.032 to 0.066 | 0.923*** | 0.498 to 1.348 | −0.042 | −0.091 to 0.008 | −0.024** | −0.041 to −0.007 |
| Ln (Inpatient fund expenditure) | 16.994*** | 16.867 to 17.121 | −0.004 | −0.021 to 0.012 | −0.005 | −0.234 to 0.225 | 0.012 | −0.008 to 0.033 | 0.008 | −0.004 to 0.020 |

**Note**: *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

**Abbreviations**: 95% CI, 95% confidence interval; Ln, natural log; OOP, out-of-pocket; UEBMI, Urban Employee Basic Medical Insurance.


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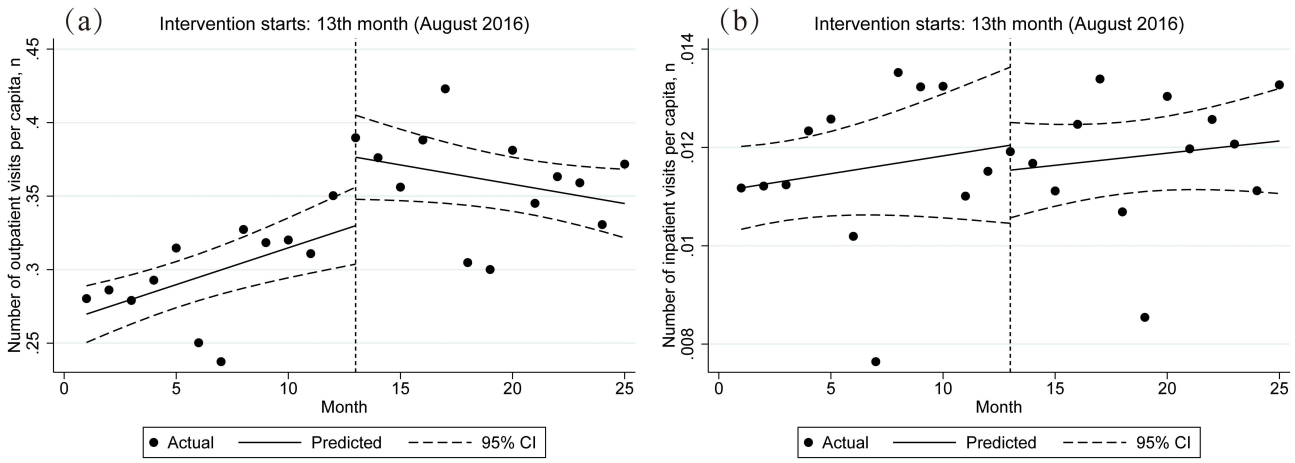


**Figure 1** Monthly trends in medical service utilization for UEBMI enrollees across different visit types in 22 public hospitals.
**Notes**: (**a**) the number of outpatient visits per capita; (**b**) the number of inpatient visits per capita.

## The ITS Analysis on Medical Costs

Table 2 and Figure 2 show the ITS analysis of the medical costs for UEBMI enrollees. In the pre-intervention period, the medical cost per outpatient visit and medical cost per inpatient visit showed negative changes, whereas the monthly

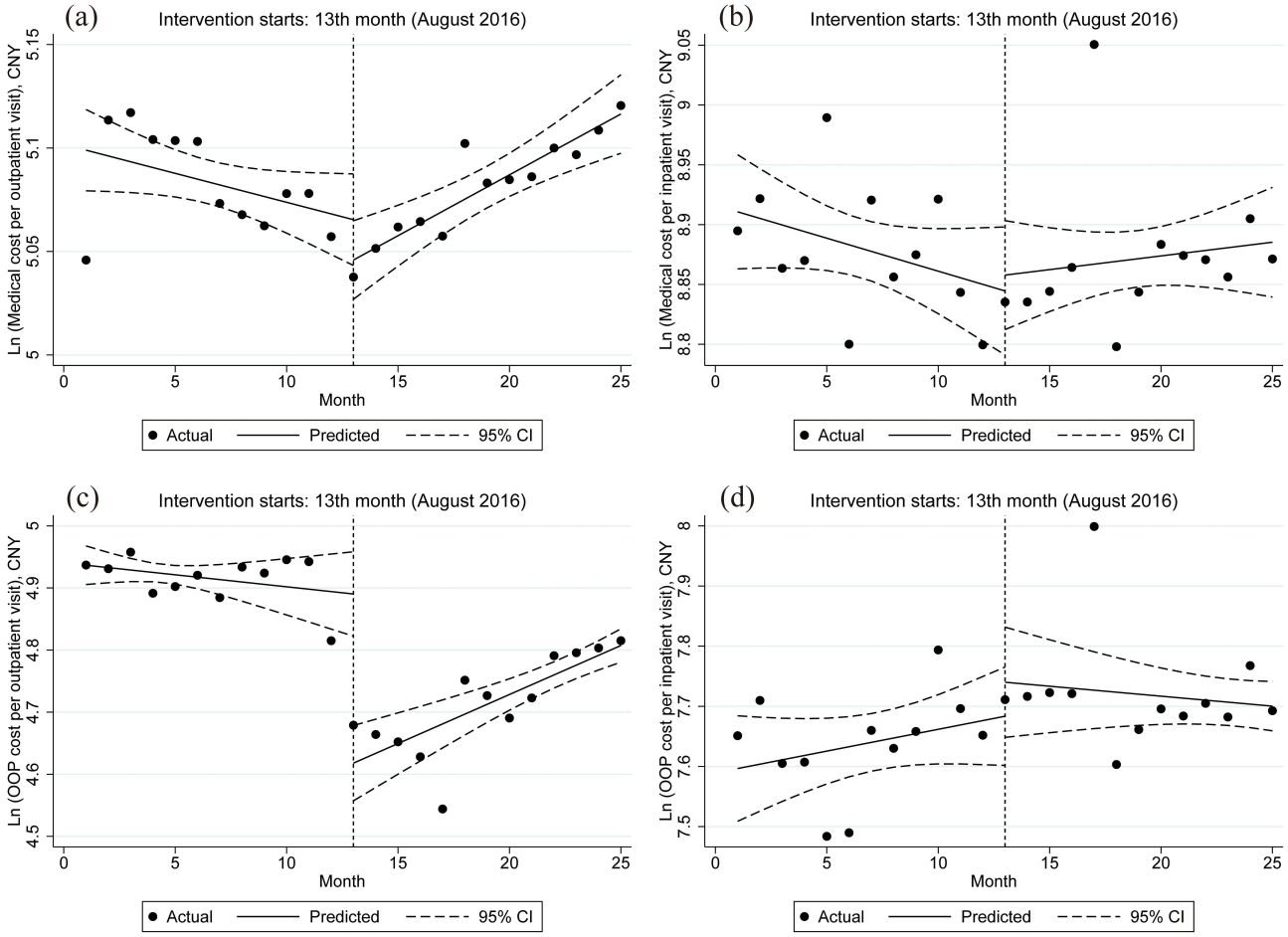


**Figure 2** Monthly trends in medical cost per visit (in log form) and OOP cost per visit (in log form) for UEBMI enrollees across different visit types in 22 public hospitals.
**Notes**: (**a**) medical cost per outpatient visit; (**b**) medical cost per inpatient visit; (**c**) OOP cost per outpatient visit; (**d**) OOP cost per inpatient visit.


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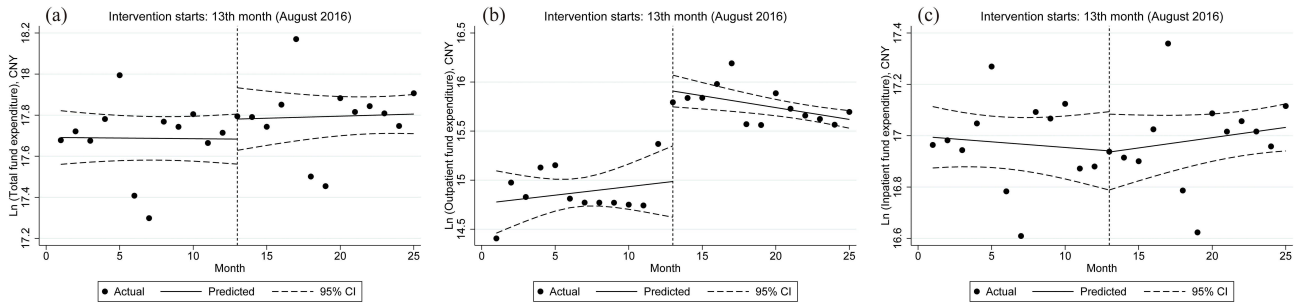


**Figure 3** Monthly trends in UEBMI fund expenditures (in log form) across different visit types in 22 public hospitals.
**Notes**: (**a**) total fund expenditure; (**b**) outpatient fund expenditure; (**c**) inpatient fund expenditure.

trends remained insignificant ($\beta_1$=−*0*.003, $P$>0.05; $\beta_1$=−*0*.006, $P$>0.05). Compared to the pre-intervention trend, the medical cost per outpatient visit increased by 0.9% after the intervention ($P$<0.001), with a significant increase of 0.6% per month ($P$<0.001). The medical cost per inpatient visit showed a positive change, whereas long-term trend changes remained insignificant ($\beta_1+\beta_3$=0.002, $P$>0.05). In terms of OOP costs, at the time of intervention implementation, the OOP cost per outpatient visit decreased by 23.66% immediately ($P$<0.001), while the level trend of OOP cost per inpatient visit remained insignificant ($\beta_2$=0.057, $P$>0.05). Compared to the pre-intervention trend, the OOP cost per outpatient visit increased by 2.02% after the intervention ($P$<0.001), with a monthly increase of 1.61% ($P$<0.001). However, the OOP cost per inpatient visit showed a negative change in the post-intervention period, while the long-term trend change was insignificant ($\beta_1+\beta_3$=−0.003, $P$>0.05).

## The ITS Analysis on Medical Insurance Fund Expenditures

Table 2 and Figure 3 show the ITS analysis of the UEBMI fund expenditures. Prior to the intervention, there were no significant differences in the baseline trends of total fund expenditures, outpatient fund expenditures and inpatient fund expenditures ($\beta_1$=−*0*.0006, $P$>0.05; $\beta_1$=0.017, $P$>0.05; $\beta_1$=−*0*.004, $P$>0.05). At the time of intervention implementation, outpatient fund expenditures immediately increased by 151.68% ($P$<0.001), while the changes in the level trend of total fund expenditures and inpatient fund expenditures remained insignificant ($\beta_2$=0.098, $P$>0.05; $\beta_2$=−*0*.005, $P$>0.05). Although the trend change in outpatient fund expenditures was insignificant compared to the pre-intervention trend after the intervention ($\beta_3$=−*0*.042, $P$>0.05), a significant decrease of 2.37% per month was observed afterward ($P$<0.01). The trends in total fund expenditures and inpatient fund expenditures were insignificant after the intervention ($\beta_1+\beta_3$=0.002, $P$>0.05; $\beta_1+\beta_3$=0.008, $P$>0.05).

# Discussion

To the best of our knowledge, this is the first study to assess the changes in medical services utilization, medical costs, and medical insurance fund expenditures after the improvement of outpatient pooling level for employees in China, and innovatively analyzes the intended and unintended effects of the policy from the perspective of different visit types.

The results of the empirical study showed that the demand of outpatient medical services for UEBMI enrollees increased significantly after the improvement of outpatient pooling level. The immediate level of the intervention effect varied significantly, but showed a monthly downward trend over a long period, indicating that the long-term effect of the policy was weakening. The short-term increase in demand for outpatient care may stem from the substitution of some unreasonable inpatient hospitalization needs and previously suppressed demand for reasonable outpatient medical services. However, no substantial change was observed in inpatient medical services utilization among the UEBMI enrollees, indicating that the long-term effect of substituting inpatient care with outpatient care remained inconclusive. This result was not entirely consistent with the findings reported by He et al.[19] While the improvement of outpatient pooling level has alleviated the financial burden of insured patients to a certain extent, the more conservative approach was adopted at the initial stage of the policy. The range of outpatient medical services eligible for reimbursement was considerably narrower compared to inpatient medical services, and the reimbursement of outpatient costs only became

effective upon reaching the minimum payment threshold or remaining below the maximum payment limitation.[33] In the sample area set in this study, the minimum payment threshold was 1000 CNY and the annual payment limit was 3000 CNY, significantly lower than the set standards for inpatient medical services in the same period (with an annual payment limit of 100,000 CNY), indicating that the level of UEBMI benefits remained relatively low. Consequently, the annual payment limit for individuals may be swiftly exhausted within a short period, rendering subsequent outpatient costs ineligible for additional insurance coverage and patients may assume full financial responsibility for outpatient medical costs. Thus, patients may turn to inpatient medical services to obtain reimbursement from the SPA, especially at the end of one year.[19]

The medical cost per outpatient visit showed a monthly upward trend after the intervention, but the changes varied slightly. However, there was no significant change in medical cost per inpatient visit, consistent with the findings of Kaestner et al.[34] For one thing, patients preferred to receive multilevel outpatient examinations and treatments after the further release of outpatient medical needs, and some patients with mild clinical symptoms substituted unnecessary inpatient demands for outpatient demands, which led to an increase in outpatient medical costs.[4,35] Moreover, compared with the working population, the retired population has a greater demand for outpatient medical services. With the aging of China's population structure and the rapidly increasing incidence of chronic diseases, the outpatient healthcare system will encounter more complex medical needs, and the associated medical costs will increase.[36,37] Additionally, in contrast to the case-based payment model adopted in the inpatient healthcare system, outpatient healthcare system in China is still mainly based on the FFS model, which may lead to moral hazard for healthcare providers. Part of excessive medical behaviors and extra inpatient medical costs may be transferred to the outpatient medical system, thus triggering an unreasonable increase in outpatient medical costs.[38,39] It is worth noting that the outpatient cost per visit was far lower than the inpatient cost per visit, which may be due to the inequality in the level of outpatient and inpatient medical insurance benefits, as well as to patients' long-standing and inherent health awareness and medical preferences.

The OOP cost per outpatient visit decreased by 23.66% immediately after the intervention, which was consistent with previous studies and the intended objectives.[19,22] Although the reimbursement rate for general outpatient services increased substantially, the short-term reduction in OOP cost per outpatient visit was somewhat constrained by the limited number of reimbursable medical items and lower payment limits. Unexpectedly, the OOP cost per outpatient visit showed a long-term upward trend after the intervention. An explanation for this may be related to an increase in ex-post moral hazard for UEBMI enrollees.[40] The main incentive for the demand side of this is moral hazard. Cost-sharing reduces patients' OOP costs while increasing the quantity of healthcare services consumed. Low-cost, high-frequency diseases have a higher elasticity of demand and are more prone to moral hazard than diseases with high medical costs.[7,41] Therefore, the outpatient medical services have a relatively high price elasticity of demand, which may induce some patients to incur unnecessary outpatient medical service costs with the improvement of outpatient pooling level.[42,43] Furthermore, the irrational outpatient payment method would exacerbate the tendency of medical institutions to shift part of the medical services that should be hospitalized to the outpatient medical system, and the general reliance on expensive medical examinations and drugs would further lead to an increase in outpatient OOP costs.[5] In the long-term, the initial effectiveness of the policy in reducing the financial burden on patients would be gradually weakened.

Previous studies have found that an increase in the level of outpatient pooling can improve the chances of early diagnosis of disease, reduce the risk of disease deterioration, save additional inpatient medical expenditure, and thus diminish the total medical insurance fund expenditure.[44,45] The initial purpose of the policy was to consider the outpatient pooling scheme as a long-term health investment to contain the unreasonable growth in inpatient fund expenditures and realize the sustainability of the UEBMI fund. The other side of the coin involved reducing the burden of disease on patients, slowing disease progression, controlling the incidence of chronic diseases, and ultimately reducing total healthcare expenditures. This study found that outpatient fund expenditures increased by 151.68% immediately after the intervention, but appeared to show a monthly downward trend in the long term. Outpatient medical services had a higher frequency and demand elasticity.[22] The release of outpatient demand in the short term triggered a significant increase in outpatient fund expenditure. Additionally, the outpatient pooling system has a substitution effect. Although a certain degree of substitution between the outpatient pooling fund and the inpatient pooling fund occurred in the short term, and the savings of the inpatient fund expenditures may be less than the increase of the outpatient fund expenditures,

the UEBMI fund utilization efficiency and risk-resistant ability would be effectively improved in the long term. Notably, the total UEBMI fund expenditures and inpatient fund expenditures remained unchanged after the intervention, indicating that the expenditure pressure on the UEBMI fund was not significantly elevated and that the long-term substitution effect between the outpatient and inpatient funds was insignificant. While the potential impact of public policy generally requires a certain incubation period, the diminished long-term change trend weakened the intended effects of the policy.

Compared to China, some developed countries and regions have already accumulated mature experiences in outpatient health insurance systems in terms of social financing, health service delivery models, health insurance regulation, payment methods, definition of benefits, and individual payments. China's outpatient medical insurance system had a relatively late start and has made gradual adjustments on the basis of actual national conditions and a certain accumulation of practical experience. It has achieved staged results in such areas as the individual account reform, the improvement of the general outpatient coverage level and the definition of entitlements, and the system's convergence with hierarchical diagnosis and treatment. However, China's basic medical insurance system for urban employees faces problems such as the lack of unified outpatient payment methods, large regional variations in policy, low levels of equality in care, and imperfections in the internal regulatory mechanism.[3] The realization of the expected policy goals may be affected to some extent.

The study has several policy implications. Preventing and mitigating the economic risks of diseases is the main purpose of health insurance system, and it is also necessary to take into account the benign operation of medical institutions and the sustainable growth of the health insurance fund in order to achieve the greatest policy effect. China needs to learn from the mature experience of developed countries, continue to optimize relevant supporting policies, and achieve synergistic promotion of different policies. First, it is necessary to further improve the outpatient pooling level of UEBMI, so as to equalize the levels of outpatient and inpatient benefits and reduce the occurrence of moral hazard. This approach is conducive to the establishment of a more orderly medical care structure and improves the efficiency of medical services, which in turn reduces the burden of disease and improves overall health. Second, a value-based outpatient payment system needs to be urgently established, centering on patient health outcomes and pursuing the optimal balance between medical quality and cost-effectiveness. As medical service providers, medical institutions may generate profit-seeking behaviors in the FFS-based payment system, and outpatient medical services may be affected by moral risks on the supply side, leading to the transfer of inpatient medical services to the outpatient system. The health insurance sector should promote the establishment of a multifaceted and composite payment system reform under total budget management, with the implementation of Ambulatory Patient Groups (APG) payment method and per capita payment, develop various outpatient payment methods for different levels of medical institutions, and improve the incentive mechanism for multiple stakeholders. Third, the supervision of medical insurance fund expenditures and the use of individual accounts must be improved. The demand for outpatient medical services is more elastic, and the level of medical institutions is complex and scattered, making it more difficult to supervise the outpatient pooling fund. The adoption of information technology and big data monitoring technology to issue real-time warnings on unreasonable medical behaviors has been widely recognized in enhancing the regulatory efficiency of medical insurance funds. The government should establish a national-level unified public service platform of medical insurance as soon as possible, using the national medical insurance information system as the carrier and big data monitoring technology as the support, to realize the smooth flow of e-prescription and effectively enhance the regulatory capacity of the medical insurance fund and individual accounts. Once the threshold value of intelligent audit and monitoring rules embedded in the data center is triggered in advance, unreasonable diagnosis and treatment, medication, false hospitalization and other medical insurance violations can be automatically intercepted, thus realizing the goal of intelligent monitoring in the whole process, such as reminding the fixed-point medical institutions beforehand, auditing during the process, and supervising the medical insurance administrative department after the fact. It is also necessary to improve the multi-departmental medical insurance anti-fraud law enforcement coordination mechanism and strengthen the punishment of fraudulent insurance behaviors. Fourth, individual account responsibility system is the direction of future reforms, which should stipulate the responsibility of participants in the use of individual accounts at the legal level and reduce the abuse of individual accounts.[5]

There are some limitations in this study. First, the omission of an analysis of the outcome indicators at different levels of medical institutions may lead to an incomplete assessment of policy effects, given the fact that the outpatient pooling policy setting stipulates the promotion of hierarchical diagnosis and treatment and the disparity in medical insurance benefits across various facility tiers in China. This limitation arises from the partial absence of public-government data. Second, the sample of this study was limited to a pilot city in eastern China, which may affect the generalizability of the results. Similarly, the Sanming model may not be entirely applicable to other Chinese cities or regions implementing similar policies in the future. The lack of comparisons across cities or regions may reduce the interpretability and extrapolation of the effects. Third, although the number of UEBMI enrollees within the timeframe set for the study remained essentially stable and no major adjustments were made to the reimbursement rates and range of reimbursable diseases under the outpatient pooling system, the potential confounding factors such as aging demographics, changes in the disease spectrum, and the rising prevalence of chronic diseases over the years remain, which may lead to an underestimation of policy effects. Fourth, due to data availability limitations, the monthly monitoring data of public hospitals published by the Sanming government does not cover indicators on population characteristics and the quality of medical services, which may lead to an insufficient assessment of the comprehensive policy effects of the health system. Fifth, continuous public policy interventions may have a lag and frequently require a period of time from implementation to effect.[31] Although the time points selected for this study ensure that the ITS model is statistically sufficiently robust, some of the insignificant policy effects may be affected by the limited number of time points, leading to a deviation in the estimated policy effects.

## Conclusion

After the improvement of the outpatient pooling level of UEBMI, the demand for outpatient medical services of UEBMI enrollees was released in the short term, while the long-term effect was weakened. The substitution effect between inpatient and outpatient medical services was insignificant due to the lower outpatient payment limit. While OOP cost per outpatient visit declined significantly in the short term and the financial burden of patients was effectively alleviated, the medical cost per outpatient visit showed a long-term upward trend constrained by the higher moral hazard and inadequate outpatient payment methods. In addition, the expenditure pressure on the UEBMI fund showed no obvious increase and the operation of the fund remained stable Improving the level of outpatient benefits, establishing a value-based outpatient payment method, and developing an intelligent medical insurance fund supervision system are crucial for maintaining the long-term effectiveness of the UEBMI-based outpatient pooling policy.

## Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

## Ethics Approval and Informed Consent

The study was approved by the Ethics Committee of Chongqing Medical University (No. 2024023). This study utilized retrospective data from the Healthcare Security Bureau of Sanming City for evaluation, without involving individual human participants or identifiable personal information, and was exempted by the ethics committee to obtain informed consent from patients. The study was conducted in compliance with the principles of the Declaration of Helsinki. The dataset was provided by the Healthcare Security Bureau of Sanming City.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest in this work.

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