Can Government Health Expenditure Influence Patients' Choice of Medical Care? — An Empirical Study Based on Beijing Suburbs (Postprint)

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Abstract

Background: High-quality medical resources in China are concentrated in urban areas of large cities, and patients tend to seek treatment in large hospitals, leading to irrational healthcare-seeking behavior. To address this, in recent years the government has increased fiscal expenditure to strengthen the construction of primary-level medical and health institutions, aiming to promote rational healthcare-seeking behavior among patients and achieve tiered diagnosis and treatment.

Objective: To analyze the impact of government health expenditure in suburban districts on the healthcare choices of suburban patients, and to provide a reference basis for advancing the reform of the tiered diagnosis and treatment system.

Methods: On February 10, 2022, data from 2015 to 2017 were selected for 10 suburban districts of Beijing. The number of outpatient and emergency visits and inpatient admissions by patients from these suburban districts to Beijing municipal hospitals, suburban district hospitals, and suburban primary-level medical and health institutions were used as dependent variables, per capita government health expenditure was used as the independent variable, and permanent population size, per capita gross domestic product (GDP), and number of health technicians per thousand population in each suburban district were used as control variables. Chow test and Hausman test were employed to select appropriate data analysis models (pooled regression model, fixed effects model, and random effects model) to explore the influencing factors of suburban patients' healthcare-seeking behavior in municipal hospitals, suburban district hospitals, and suburban primary-level medical and health institutions.

Results: The fixed effects model analyzing the influencing factors of suburban patients' healthcare choices in municipal and suburban district hospitals

showed that per capita government health expenditure, number of health technicians per thousand population, per capita GDP, and permanent population size were not influencing factors for suburban patients' outpatient, emergency, and inpatient visits to municipal hospitals (P>0.05), while per capita government health expenditure and per capita GDP were influencing factors for suburban patients' outpatient and emergency visits to suburban district hospitals (P<0.05). The random effects model analyzing the influencing factors of suburban patients' healthcare choices in suburban primary-level medical and health institutions showed that permanent population size, per capita GDP, and per capita government health expenditure were influencing factors for suburban patients' outpatient and emergency visits to suburban primary-level medical and health institutions (P<0.05).

Conclusion: Currently, the "siphon" phenomenon of large hospitals attracting patients still exists, and government health expenditure has not had a significant impact on suburban patients seeking treatment in municipal hospitals. However, increasing government health expenditure can promote suburban patients to seek medical care within their own region, which helps to achieve tiered diagnosis and treatment. The number of health technicians per thousand population has not had a significant impact on patients' healthcare choices. It is recommended to further increase government health expenditure in suburban districts, enhance the medical service capacity of suburban healthcare personnel, and promote patients to seek medical care within the region.

Full Text

Can Government Health Expenditures Influence Patients' Choice of Medical Care?—An Empirical Study Based on the Suburbs of Beijing

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Abstract

Background: China's high-quality medical resources are concentrated in the urban areas of large cities, and patients tend to go to large hospitals, resulting in irrational access to medical care. For this reason, in recent years, the government has increased its financial expenditure to strengthen the construction of primary healthcare institutions, with the aim of promoting rational access to medical care by patients and realizing hierarchical diagnosis and treatment. **Objective:** To analyze the influence of suburban government health expenditure

on suburban patients' choice of medical care and provide a reference basis for promoting the reform of hierarchical diagnosis and treatment system. **Methods:** On February 10, 2022, the number of outpatient visits (outpatient and emergency visits) and inpatient admissions to Beijing municipal hospitals, suburban hospitals, and suburban primary healthcare institutions in 10 suburbs of Beijing from 2015 to 2017 were collected as the explained variables. Per capita government health expenditure was selected as the explanatory variable, and the number of permanent residents, gross domestic product (GDP) per capita, and the number of health technicians per 1,000 population were selected as the control variables. Chow's test and Hausman's test were used to select appropriate data analysis models (mixed regression model, fixed-effects model, and random-effects model) in order to explore the influencing factors of patients' visits to municipal hospitals, suburban hospitals, and suburban primary healthcare institutions in suburban Beijing. **Results:** The results of the fixed-effects model to analyze the factors influencing the choice of suburban patients' visits to municipal hospitals and suburban hospitals in Beijing showed that per capita governmental health expenditure, the number of health technicians per 1,000 population, GDP per capita, and the number of permanent residents were not the influencing factors for suburban patients' visits to municipal hospitals for outpatient and inpatient care ($P>0.05$), while per capita government health expenditure and GDP per capita were influencing factors for suburban patients' outpatient and emergency care visits to suburban hospitals ($P<0.05$). The results of the random effects model to analyze the factors influencing the choice of patients from suburban areas of Beijing to seek medical care in suburban primary health care institutions showed that the permanent residents, GDP per capita, and per capita government health expenditure were influential factors for suburban patients' outpatient and emergency care visits to suburban primary healthcare institutions ($P<0.05$). **Conclusions:** At present, the phenomenon of "siphoning" patients in large hospitals still exists, and government health expenditure has not had a significant impact on suburban patients' access to municipal hospitals. However, increased government health expenditure can promote suburban patients to seek care in the region, which helps to achieve hierarchical diagnosis and treatment. The number of health technicians per 1,000 population has no significant effect on patients' choice of medical care. It is recommended to further increase the suburban government health expenditure, improve the medical service capacity of suburban medical staff, and encourage patients to seek medical care in the region.

Keywords: Health expenditures; Hierarchical medical system; Government health expenditure; Choice of medical institution; Root cause analysis

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1. Data and Methods

1.1 Data Sources and Variable Description Beijing has 16 districts. The *Beijing Urban Master Plan (2016–2035)* [20] defines 6 districts as central urban

areas, and this study defines the remaining 10 districts as suburbs, including M District, F District, T District, S District, C District, D District, H District, P District, Y District, and Q District. On February 10, 2022, data on the number of patients from these 10 suburban districts who visited Beijing municipal hospitals, suburban hospitals, and suburban primary healthcare institutions from 2015 to 2017 were collected. Data sources included the Beijing Municipal Hospital Management Center and the *Beijing Health and Health Work Statistical Data Compilation* for 2015–2017.

Explained Variables: Suburban residents have three main choices for medical care: seeking treatment at urban tertiary hospitals, at suburban secondary or tertiary hospitals, or at suburban primary healthcare institutions. Since the proportion of suburban residents seeking care at other suburban hospitals or primary healthcare institutions is very small, these options were not included in the analysis. Beijing municipal hospitals have distinct specialties and relatively high medical technology levels, such as Beijing Children's Hospital, Beijing Obstetrics and Gynecology Hospital, and Beijing Tiantan Hospital, which have strong appeal to suburban residents. Following Yang et al. [21], who used outpatient and emergency visit volumes and inpatient volumes to represent patient flow and illustrate patient choice, this study selected six variables as explained variables to reflect patient choice: the number of outpatient and emergency visits by suburban patients to Beijing municipal hospitals, the number of inpatient admissions to Beijing municipal hospitals, the number of outpatient and emergency visits to suburban hospitals, the number of inpatient admissions to suburban hospitals, the number of outpatient and emergency visits to suburban primary healthcare institutions, and the number of inpatient admissions to suburban primary healthcare institutions.

Explanatory Variables: Government health expenditure includes medical and health service expenditure, medical security expenditure, administrative management expenditure, and population and family planning affairs expenditure. Among these, medical and health service expenditure and medical insurance fund subsidies account for a relatively high proportion [22], reflecting the government's emphasis on health affairs. This study did not subdivide the specific content of government health expenditure. To reduce the impact of different population bases and population growth, and referring to variable selection in related studies, this study selected per capita government health expenditure as the explanatory variable [23-24].

Control Variables: Since regional population size, economic conditions, and health human resources may affect residents' medical choices, this study selected the number of permanent residents, per capita gross domestic product (GDP), and the number of health technicians per 1,000 population in each suburban district as control variables [25-26]. The data sources for each selected variable are detailed in Table 1 [27].

1.2 Model Specification The data used in this study are panel data on patient choice in 10 suburban districts from 2015 to 2017. To reduce the impact of heteroscedasticity, this study applied logarithmic transformation to both explanatory and explained variables [28-29]. The absolute values of skewness for permanent residents, per capita GDP, health technicians per 1,000 population, and per capita government health expenditure are close to 0, and the absolute values of kurtosis are close to 3, indicating that the sample data follow a normal distribution [30]. The basic form of the constructed model is as follows:

$$lny_{it} = \beta_0 + \beta_{1lnx} p + \beta_{2lnx} q + c_i + v_t + u_{it}$$

where β_1 and β_2 represent regression coefficients, β_0 represents the intercept, c_i represents individual effects, v_t represents time effects, and u_{it} represents the error term. y_{it} represents the number of outpatient and emergency visits by suburban residents to municipal hospitals, the number of inpatient admissions to municipal hospitals, the number of outpatient and emergency visits to suburban hospitals, the number of inpatient admissions to suburban hospitals, the number of outpatient and emergency visits to suburban primary healthcare institutions, and the number of inpatient admissions to suburban primary healthcare institutions. x_p represents per capita government health expenditure in each district, and x_q represents control variables including health technicians per 1,000 population, permanent residents, and per capita GDP in each district.

1.3 Statistical Methods Stata17 MP was used for data analysis. This study's data are panel data, which can be processed using pooled regression models, fixed-effects models, and random-effects models to analyze the influencing factors of patient visits to municipal hospitals, suburban hospitals, and suburban primary healthcare institutions in Beijing's suburbs. Before data analysis, Chow's test and Hausman's test were used to select appropriate data analysis models. Chow's test is typically used to determine whether a pooled regression model is suitable; if Chow's test shows $P<0.05$, it indicates that the pooled regression model is not appropriate. Hausman's test is used to determine whether to use a fixed-effects model or a random-effects model; if Hausman's test shows $P<0.05$, it indicates that the fixed-effects model is appropriate, while $P>0.05$ indicates that the random-effects model is appropriate.

2. Results

2.1 Basic Situation of Patient Choice in Beijing's Suburbs The average number of patient visits from each suburban district to municipal hospitals, suburban hospitals, and suburban primary healthcare institutions from 2015 to 2017 is shown in Table 2 . The district with the highest average number of outpatient and emergency visits to municipal hospitals was C District (707,314 visits), followed by T District and D District with 399,823 and 373,852 visits, respectively. The top three districts for average inpatient admissions to municipal

hospitals were T District, D District, and C District, with 21,929, 18,575, and 15,165 admissions, respectively. C District had the highest average number of outpatient and emergency visits to suburban hospitals (7,251,759 visits), while D District had the highest average number of inpatient admissions to suburban hospitals (150,272 admissions). D District also had the highest average number of outpatient and emergency visits (4,045,720 visits) and inpatient admissions (7,510 admissions) to primary healthcare institutions (Table 2). This indicates that C District and D District had relatively high numbers of patients visiting both municipal hospitals and suburban medical institutions, suggesting strong demand for medical services.

2.2 Analysis of Influencing Factors for Suburban Patients' Choice of Municipal Hospitals Chow's test showed P<0.05, and Hausman's test showed P<0.05, indicating that the fixed-effects model was appropriate for exploring influencing factors for suburban patients' visits to municipal hospitals. Using logarithmically transformed numbers of outpatient and emergency visits and inpatient admissions to municipal hospitals as explained variables, and controlling for individual and time effects, the final results showed that per capita government health expenditure, health technicians per 1,000 population, per capita GDP, and permanent residents were not influencing factors for suburban patients' outpatient, emergency, or inpatient visits to municipal hospitals (P>0.05) (Table 3).

2.3 Analysis of Influencing Factors for Suburban Patients' Choice of Suburban Hospitals Chow's test showed P<0.05, and Hausman's test showed P<0.05, indicating that the fixed-effects model was appropriate for exploring influencing factors for suburban patients' visits to suburban hospitals. Using logarithmically transformed numbers of outpatient and emergency visits and inpatient admissions to suburban hospitals as explained variables, and controlling for individual and time effects, the final results showed that per capita government health expenditure and per capita GDP were influencing factors for suburban patients' outpatient and emergency visits to suburban hospitals (P<0.05). However, per capita government health expenditure, health technicians per 1,000 population, per capita GDP, and permanent residents were not influencing factors for suburban patients' inpatient admissions to suburban hospitals (P>0.05) (Table 4).

2.4 Analysis of Influencing Factors for Suburban Patients' Choice of Suburban Primary Healthcare Institutions Chow's test showed P<0.05, and Hausman's test showed P>0.05, indicating that the random-effects model was appropriate for exploring influencing factors for suburban patients' visits to suburban primary healthcare institutions. Using logarithmically transformed numbers of outpatient and emergency visits and inpatient admissions to primary healthcare institutions as explained variables, and controlling for individual and time effects, the final results showed that per capita government health expen-

diture, per capita GDP, and permanent residents were influencing factors for patients' outpatient and emergency visits to suburban primary healthcare institutions ($P<0.05$). However, per capita government health expenditure, health technicians per 1,000 population, per capita GDP, and permanent residents were not influencing factors for suburban patients' inpatient admissions to primary healthcare institutions ($P>0.05$) (Table 5).

3. Discussion

3.1 Government Health Expenditure Influences Suburban Patients' Choice of Suburban Hospitals This study found that increasing suburban government health expenditure can increase the number of outpatient and emergency visits to suburban hospitals but has no effect on local inpatient admissions, which rules out the possibility that the increase in outpatient and emergency visits is due to an increase in the total number of patients. Government health investment, as a means of social redistribution, plays a crucial role in the development of medical institutions. As hospitals develop, they improve medical service quality and standards, enhance the patient care environment, and meet the needs of more patients [31]. Suburban government health expenditure is mostly used for medical services, health care, and other aspects. Related studies have shown that increasing government health expenditure can improve residents' overall health level and life expectancy [32-33]. As residents' health levels improve and disease severity decreases, suburban hospitals can meet the medical needs of more patients, and suburban residents find it more convenient to seek care in suburban hospitals, leading them to choose suburban hospitals for outpatient and emergency care. Additionally, increased government health expenditure helps improve the fairness and efficiency of medical and health service utilization, reduces patient waiting times during visits, and enhances the patient experience [34].

Second, outpatient and emergency patients have lower trust in doctors and a less satisfactory care experience than inpatients. Therefore, increased government health expenditure, which enhances the medical service capacity of suburban institutions, gradually meets patient needs and first affects the choice of outpatient and emergency patients, while temporarily not affecting the choice of inpatients [35-36]. Patients requiring hospitalization generally have more severe conditions than outpatient and emergency patients and may prefer to seek care at tertiary hospitals in urban Beijing with higher medical technology levels. The goal of China's hierarchical diagnosis and treatment system is to have outpatients and inpatients with common and frequent diseases seek care within their own region. This study found that government health expenditure had no significant effect on inpatient volume, indicating that there is still a distance to achieving the goal of hierarchical diagnosis and treatment. Government health expenditure has begun to show effects on residents' medical choices, and it is recommended that the government continue to increase health expenditure, improve the diagnosis and treatment capacity of suburban hospitals, narrow the service capacity

gap between urban and suburban medical institutions, and promote residents to seek appropriate care in suburban medical institutions.

3.2 Government Health Expenditure Promotes Residents' Visits to Primary Healthcare Institutions Unlike He et al. [37], who pointed out that increasing the proportion of government health expenditure in total health expenses does not affect the choice of primary healthcare institutions by the floating population, this study shows that increasing government health expenditure promotes residents' outpatient visits to primary healthcare institutions. To "strengthen primary care, ensure basic services, and establish mechanisms" and further promote the implementation of the hierarchical diagnosis and treatment system, Beijing has intensified its publicity for hierarchical diagnosis and treatment policies, which has better raised residents' awareness of primary care as the first point of contact. At the same time, as Beijing's continuous investment in primary healthcare institutions has increased, these institutions have received more support for development, and their medical technology levels, facilities, equipment, and service content have significantly improved, making residents willing to choose primary healthcare institutions for outpatient care [38].

3.3 Number of Health Technicians in Suburbs Does Not Affect Residents' Medical Choices The number of health technicians per 1,000 population is an important indicator reflecting the level of health human resource allocation in a region. Beijing's health human resource allocation tends to favor economically developed areas, and the level of health human resource allocation in suburbs is lower than in urban areas [39]. Increasing the quantity and quality of health technicians in suburbs can enable medical staff to provide higher-quality services to patients and narrow the gap with urban areas. However, this study shows that the number of health technicians per 1,000 population does not affect patients' medical choices, and the effect of suburban health human resource investment has not yet been realized.

The number of health technicians may affect the service capacity of primary healthcare institutions. The fact that the number of health technicians per 1,000 population did not promote residents' visits to primary care may be because primary care staff devote more energy to completing public health indicators and insufficient energy to treating patients' diseases [40-41]. It is recommended that suburban governments increase investment in health human resources while also paying attention to the rational allocation of health human resources between hospitals and primary healthcare institutions, guide health technicians to flow to suburban primary healthcare institutions, enable primary care staff to devote more energy to diagnosis and treatment work, improve their professional skills, provide higher-quality services, and promote residents to seek care in communities for common and frequent diseases.

3.4 Limitations of This Study There are many tertiary hospitals in urban Beijing. Due to current data availability, this study only used the number of outpatient and emergency visits and inpatient admissions by suburban patients to municipal hospitals as two explained variables, which may introduce some bias. However, Beijing municipal hospitals are relatively evenly distributed in urban areas and are well-known tertiary hospitals in Beijing, so they can to some extent illustrate patients' medical choices. Additionally, the research team believes that there may be mediating variables between government health expenditure and patient choice, but it is difficult to prove mediating effects due to the lack of relevant data. Therefore, future studies will collect more patient choice data to identify mediating variables and verify mediating effects.

4. Conclusion

Achieving hierarchical diagnosis and treatment is an important goal of China's deepening medical and health system reform. The government can optimize resource allocation, improve medical service capacity, and promote rational medical seeking by increasing health expenditure. This study shows that per capita government health expenditure is an influencing factor for suburban patients' outpatient and emergency visits to suburban hospitals and suburban primary healthcare institutions. However, per capita government health expenditure has no effect on suburban patients' outpatient, emergency, or inpatient visits to municipal hospitals, nor on inpatient visits to suburban hospitals and primary healthcare institutions, indicating that suburban government health expenditure has a positive effect on suburban patients seeking care within their own region. The results of this study provide a scientific basis for the government to increase health expenditure and promote rational medical seeking by residents. At the same time, this study found that the number of health technicians per 1,000 population has not yet had a significant effect on patients' medical choices. It is recommended to further optimize the allocation of health technicians, improve their medical service capacity, and promote rational medical seeking by patients. In future research, more data on patient visits across years and regions can be added to verify the robustness of this study's results and promote further generalization of the findings.

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