Analysis on the Efficiency of Health Care Service Delivery and Influencing Factors in China: A Study Based on DEA-Malmquist Index and Tobit Model

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Research Article

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Analysis on the Efficiency of Health Care Service Delivery and Influencing Factors in China: A Study Based on DEA-Malmquist Index and Tobit Model[1]

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Abstract

Objective: To evaluate the changeing trend and influencing factors of medical and health service supply efficiency in 31 provinces of China.

Methods: According to the input-output relevant index data of medical and health service in China from 2009 to 2018, data envelopment analysis- Malmquist(DEA-Malmquist) was used to calculate the total factor productivity, technical efficiency, and technical change. Meanwhile, Tobit model to analyzed the main effective factors of medical and health service supply efficiency in China

Results: In 2018, 21 provinces including Beijing, Shanghai, Zhejiang and Guangdong were effective in DEA of China's medical and health supply efficiency. Jilin, Heilongjiang, Jiangsu and Shandong were weak DEA effective, while Shanxi, Inner Mongolia, Liaoning, Anhui, Fujian and Xinjiang were not DEA effective. From 2009 to 2018, the total factor productivity of China's medical and health service supply has been decreased steadily, which was mainly affected by technological changes. From the perspective of regions, the technical efficiency and pure technical efficiency of medical and health service supply was the highest in the east, followed by the central and the western region. Associate’s degree or above, gross regional domestic product, and health care expenditure were significantly associated with the increasing of medical and health service supply efficiency.

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Conclusions: According to their own conditions and constraints, all localities should take targeted measures to strengthen the allocation and management level of medical and health resources, promote technological progress, give full play to the role of education and economic development, increase the expenditure on medical and health care, improve the utilization rate of beds, shorten the average hospitalization days, effectively improve the efficiency of medical and health services supply, and better provide health care for people.

Key words: Health care services; data envelopment analysis; Malmquist index; Tobit model; supply; efficiency

Background

Health care is a fundamental human right and the basis for the formation of a country's human capital. [1] A high-quality and efficient delivery system for health care services, as a guarantee to meet people's health needs, plays an important role in economic development and social progress. With the continuous improvement of China's health care system, the medical needs of the population are continuously being released both in quantity and quality, showing a diversified trend with increased pressure on the supply of medical services. [2] However, health care service delivery reform is lagging behind, the allocation of health care resources is unreasonable, the supply capacity of health care services is insufficient, and the contradiction of medical services between supply and demand is very prominent. [3] From the perspective of service supply, insufficient medical and health resources coexist with structural imbalance. In terms of efficiency, the shortage and waste of health care resources exist simultaneously. [4] The key to solving this problem is figuring out how to improve the efficiency and performance of health care service delivery under the situation of limited medical resources.

Improving the quality of the health care delivery system in China is inseparable from the two basic issues. One is how to invest more resources into health care and increase the supply, [5] and the other is how to measure the delivery of health care services and improve the efficiency of health care resource allocation. Data envelopment analysis (DEA) is a linear optimization performance analysis method that integrates multidimensional data into a comprehensive index and suggests directions for system improvement, [6] which can evaluate the relative efficiency values of decision-making units based on actual input and output data.

[7] The Malmquist index model, commonly used in DEA, is mainly used to measure total factor productivity (TFP) across decision-making units over different periods. [8] TFP represents the ratio of the total output of a decision-making unit to the input of all factors. The TFP change index can be represented by the product of technical change (TC) and (technical) efficiency change (EC). Efficiency change can be broken down further into the product of pure technical ECs and the extent of ECs. [9-10] Compared to static analytical models, the Malmquist index model has the advantage of analyzing the dynamic efficiency of a decision-making unit (DMU), and can also analyze changes in efficiency over time, along with their causes.

This study uses the DEA-Malmquist index model to evaluate the dynamic changes in health care service delivery, and introducesthe Tobit model to analyze the influencing factors of the efficiency of health care service delivery in China based on the panel data of input-output related health care service indicators in each provinces in Chinese from 2009 to 2018. Additionally, put forward countermeasures to further improve its efficiency, meet public health needs, and provide references for enriching and developing theoretical research, and improving the practical foundation of health care services efficiency in China.

Data sources and research methods

Research methods

DEA-BCC model

This study uses the DEA method to evaluate the efficiency of health care service delivery. Suppose that the Banker-Charnes-Cooper (BCC) model has multiple DMUs, where xij is the amount invested in health care in a certain province and $xij \geq 0$, yij is the health care output in a certain province and $yij \geq 0$, θ is the target planning value, λj is the planning decision variable, ε is the non-Archimedes infinitesimal, and $s-$ and $s+$ are the slack variable vectors. If $\theta=1$, $s-=0$, and $s+=0$, then the DEA of the DMU is valid. If $\theta < 1$, then the DMU is the same as the DEA; thus, the DEA is invalid. If $\theta=1$ and $s- \neq 0$ or $s+ \neq 0$, then the DMU is weak and the DEA is valid.

$$\begin{cases} min[\theta - \varepsilon(\sum_{i=1}^{m} si^{-} + \sum_{r=1}^{n} sr^{+})] \\ \sum_{j=1}^{l} xij\lambda j + si^{-} = \theta xik \\ \sum_{j=1}^{l} yrj\lambda j - sr^{+} = yrk \\ \sum_{j=1}^{l} \lambda j = 1 \\ \lambda j, si^{-}, sr^{+} \geq 0, j = 1,2,\cdots,n \end{cases} \quad (1)$$

2.1.2 DEA-Malmquist model

The Malmquist index was developed by the Swedish scholar Malmquist in 1953 to analyze trends in dynamic ECs. In 1982, Caves et al. applied the index to measuring productivity changes and named it the Malmquist productivity index. [11] In 1994, Fare combined the Malmquist index with DEA, resulting in a Malmquist productivity index based on periods t and t+1,[12] which is expressed as:

$$M(x^{t+1}, y^{t+1}, x^{t}, y^{t}) = \left[\frac{D^{t}(x^{t+1}, y^{t+1})}{D^{t}(x^{t}, y^{t})} \times \frac{D^{t+1}(x^{t+1}, y^{t+1})}{D^{t+1}(x^{t}, y^{t})}\right]^{\frac{1}{2}} \quad (2)$$

Where (x^{t},y^{t}) and (x^{t+1},y^{t+1}) denote the input-output vector of China's health care in period t and t+1, respectively. If the Malmquist index is greater than 1, it indicates increased efficiency; if the Malmquist index is less than 1, it indicates reduced efficiency.

Tobit model

The Tobit model is a model in which the dependent variable satisfies certain constraints and was formally proposed by famed American economist Tobin in 1958. [13] If the independent variable Y_i is censored between 0 and 1, and Y_i is related to the independent variable X_i, then there exists the following linear regression model:

$$Y_i=\beta_0+\beta^T X_i+u_i \quad (3)$$

Where Y_i is the restricted dependent variable, X_i is the explanatory variable, β^T is the unknown parameter vector, and u_i—N $(0,\sigma^2)$.

Index selection and data sources

This study is based on the current state of China's health care service delivery. [14-15] Taking into account the rationality and validity of the data, this study measures the efficiency of health care service delivery in the 31 Chinese provinces and municipalities from 2009 to 2018. After considering the significance of health care services, the number of beds in medical institutions, the number of medical and technical personnel, and the total health care expenditure of medical institutions were selected as input indicators. Selected as output indicators were the number of medical institution visits, hospital discharges, patient admissions and surgeries, perinatal mortality, maternal mortality, and incidence of category A and B infectious diseases. The input and output levels of China's health care services were measured separately, as shown in Table 1.

Pure technical efficiency reflects the ability of health care investments to meet overall requirements and maximize their effectiveness. When the pure technical efficiency value is equal to 1, the technology is efficient, which indicates that the output of health services has been maximized. When the pure technical efficiency value is less than 1, it is not technically efficient, which indicates that the output of health services has not been maximized. Scale efficiency refers to the magnitude of the effect that optimal allocation of health care resources has on its output. When scale efficiency is equal to 1, the scale is efficient, and the returns to scale for health care resource inputs are at the optimal point between increasing and decreasing returns to scale. When scale efficiency is less than 1, the scale is not efficient and health care resources are at increasing or decreasing returns to scale.[16] Overall efficiency is equal to pure technical efficiency multiplied by scale efficiency. When pure technical efficiency is equal to 1 and scale efficiency is equal to 1, both technical and scale efficiency are achieved, and local health care service delivery is said to be DEA efficient. When pure technical efficiency is equal to 1 or scale efficiency is equal to 1, either technical or scale efficiency has been achieved, and local health care service delivery is said to have weak DEA efficiency. When pure technical efficiency is less than 1 and scale efficiency is less than 1, both technical and scale efficiency have not been achieved, and local health care service delivery is said to be not DEA efficient. The Malmquist index reflects the changes in the efficiency of health care service delivery in each province and analyzes the efficiency changes in TFP.

Statistical analysis

This study uses the Tobit model to analyze the factors influencing the efficiency of health care service delivery to avoid biased and inconsistent errors when using the ordinary least squares (OLS) method.[17] The Tobit model is used to analyze the factors influencing the efficiency of health care service delivery in China. STATA 15.1 software was used to perform Tobit analysis, and the DEAP 2.1 software was used for the efficiency analysis of health care service input and output indicators. DEAP 2.1 was also used to explore changes in TFP.

Results

Static analysis of the efficiency of health care service delivery

Pure technical efficiency

In 2009 and 2018, the pure technical efficiency value of China's health care service delivery increased to 0.983 from 0.959, which is an improvement of 2.50% and a difference of 0.017 from the production frontier. The 25 provinces that achieved pure technical efficiency in 2018 include Beijing, Tianjin, Shanghai, and Jiangsu, indicating that these provinces' health care investments met the overall requirements and achieved maximum efficiency. Six provinces, namely Shanxi, Inner Mongolia, Liaoning, Anhui, Fujian, and Shandong, had a net pure technical efficiency value of less than 1, with Inner Mongolia having only 0.813.

Scale efficiency

Overall, the scale efficiency value of China’s health care service delivery increased slightly to 0.982 in 2018 from 0.973 in 2009. The scale efficiency value was 1 for two years in 15 provinces, including Tianjin, Hebei, Shanghai and Zhejiang, accounting for 48.39% of China’s overall scale efficiency value. The nine provinces of Shanxi, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Jiangsu, Anhui, Shandong, and Xinjiang had low scale efficiency values of less than 1 in both years. They accounted for 29.03% of China's overall scale efficiency value. According to the data from 2018, there were 21 provinces with a scale efficiency value of 1, all of which had unchanged scale gains, accounting for 67.74% of overall scale efficiency values. Ten provinces had scale efficiency values of less than 1: Shanxi, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Jiangsu, Anhui, Fujian, Shandong, and Xinjiang. These provinces all showed a trend of decreasing returns to scale except for Xinjiang, which had increasing returns to scale.

Overall efficiency

In 2018, China's health care delivery efficiency was considered DEA efficient in 21 provinces: Beijing, Tianjin, Hebei, Shanghai, Zhejiang, Jiangxi, Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, and Ningxia. Weak DEA efficiency was found in Jilin, Heilongjiang, Jiangsu, and Shandong, while DEA was not efficient in Shanxi, Inner Mongolia, Liaoning, Anhui, Fujian and Xinjiang. (Table 1)

Dynamic analysis of health care service delivery efficiency

Changes in China's health care service delivery efficiency between 2009 and 2018

The TFP change index of health care service delivery from 2009 to 2018 was 0.998, in other words, there was an average annual decrease of 0.2%, as shown in Table 3. When broken down, the efficiency change index was 1.004, an average annual increase in technical efficiency of 0.4%. This contributed significantly to the increase in TFP efficiency. The technology change index showed a slight decline at 0.994, which is a decrease of 0.6% and plays a major role in reducing TFP efficiency. The pure technical efficiency change index value was 1.003, indicating an average annual growth of 0.3%. The scale efficiency change index was 1.001, indicating an average annual growth of 0.1%. On an annual basis, only in the periods of 2010 to 2012, 2014 to 2015, and 2016 to 2017 did the TFP of China's health care services increase, while all other years showed a decline in TFP. From 2010 to 2011, technical efficiency increased by 1%, TC by 0.8%, pure technical efficiency by 0.2%, and scale efficiency by 0.8%, with technical EC being the main reason for increased TFP (Table 2).

Changes in health care service delivery efficiency across various regions

From 2009 to 2018, TFP showed an upward trend in 12 provinces: Beijing, Tianjin, Shanxi, Liaoning, Jilin, Shanghai, Jiangsu, Zhejiang, Hubei, Guangdong, Shaanxi, Xinjiang, and Tianjin. Among these provinces, Shanghai, Beijing, and Tianjin showed the fastest increase in TFP. At their peak, they achieved increases of 7%, 4.2%, and 3.8%, respectively. Shandong's TFP remained unchanged at a value of 1. Simultaneously, the TFP in 18 provinces showed a downward trend, with Ningxia, Shaanxi, Qinghai, and Sichuan showing the largest decreases, reaching 2.5%, 2.4%, and 2.1%, respectively. Overall, the efficiency of health care delivery in most parts of the country had declined, but not by much. From 2009 to 2018, the technical efficiency, pure technical efficiency, and scale efficiency of health service delivery values in Chinese provinces were greater than 1; however, their technical progress values were less than 1. Specifically, from 2009 to 2018, only seven Chinese provinces had a technical progress value of 1 for their health care service delivery. These seven provinces are Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, Guangdong, and Hubei. The other 24 provinces achieved a score of less than 1. China's efforts to improve provincial health care service delivery efficiency mainly arise from the fact that the promotion of technical progress is necessary for maintaining an appropriate scale of health care investment and improving its management (Table 3).

Comparison of regional efficiency differences

Between 2009 and 2018, the average TFP for health care service delivery was 1.006 in East China, 0.997 in Central China, and 0.989 in Western China. Overall, East China ranked at the top, followed by Central China, then Western China. Health care service delivery efficiency in East China has been rising despite year to year fluctuations, mainly due to the rapid increase in technical progress. In contrast, Western China needs to strengthen its ability to manage health care service delivery and improve pure technical efficiency. Central China has seen a slower growth of technical scale efficiency; they should further develop health care service delivery, improve the allocation of health care resources, and improve their scale efficiency through technological and management improvements. Meanwhile, technical progress in East, Central, and Western China all show a declining trend, indicating that technical progress is the main constraint on improving health care service delivery efficiency, as shown in Table 4. The data also reveals that these regions should improve their efficiency and development capacity through technological and management improvements (Table 3).

Analysis of the factors influencing China's health care service delivery efficiency

There is a positive correlation between the efficiency of health care service delivery and bed occupancy rate, the percentage of people with tertiary education attainment, gross regional domestic product (GRDP), the percentage of health care expenditure, and the percentage of primary care visits. There is a negative correlation between the efficiency of health care service delivery and the average length of hospital stays, as shown in Table 4.

Discussion

Based on the panel data of 31 provinces and cities in China from 2009 to 2018, the DEA-BCC model and the Malmquist index method were used to measure the efficiency of health care service delivery in each locality. The Tobit regression model was used to analyze the factors influencing efficiency improvements, and draws the following conclusions.

From the static efficiency calculation of medical and health service supply, the overall efficiency of health care service delivery in China's 31 provinces and municipalities was relatively high, with an average combined efficiency of 0.965. Twenty-one provinces, including Beijing, Tianjin, Shanghai, and Zhejiang, had a combined efficiency value of 1, which was at the production frontier. The other ten provinces were in a state of varying degrees of inefficiency, mainly due to their low pure technical efficiency and scale efficiency values. For regions where scale efficiency values were less than 1 and had diminishing returns to scale, careful regional health planning should be carried out to optimize the allocation of health care resources and prevented the overexpansion of various components of the health care service system. With overexpansion, it becomes difficult to achieve effective coordination, thus reducing delivery efficiency. Meanwhile, the government should fully implement its supervisory and management responsibilities to reasonably control the scale of health care resource investments, and avoid undesirable outcomes such as the waste of health care resources due to blind expansion of health care institutions, declining resource allocation efficiency, and a decline in the quality of health care service delivery. If the government carries out these responsibilities, it would effectively improve the overall efficiency of China's health care service delivery system.

The Malmquist index of China’s health care service delivery efficiency from 2009 to 2018 was 0.998, of which the Malmquist index of TFP efficiency in 13 provinces, including Beijing, Tianjin, Shanghai and Jiangsu, was greater than 1. The Malmquist index of TFP efficiency in 18 other provinces, including Ningxia, Shaanxi, Qinghai, and Sichuan, was less than 1. At the regional level, the efficiency of health care service delivery in East China increased, while the TFP efficiency of health care services in Central and Western China decreased. To address the imbalance of regional health care service delivery efficiency, the government should formulate health development plans suitable for each region based on their actual conditions, optimize the health care resource allocation structure, and gradually resolve the conflict between shortage and waste of health care resources so as to improve such resource allocation in a targeted manner.

Simultaneously, the government should integrate various high-quality management models, improve the management and operational decision-making efficiency of medical institutions, strictly control unreasonable expansion of bed space and personnel, optimize resource allocation, improve the operational efficiency of health care service delivery, and build a high-quality and efficient health care service delivery system. The Tobit regression analysis revealed that the tertiary education attainment factor was significant, passed the 0.01 level test. GRDP and health care expenditures are also significant, passed the 0.05 level test, which were important factors in improving the TFP efficiency of health care services. The correlation coefficient between the average length of hospital stays and TFP efficiency is negative; thus, they were negatively correlated, meaning they hinder the improvement of TFP efficiency. Additionally, the bed occupancy rate, the average length of hospital stays, and the percentage of primary care visits have an impact on improving efficiency, albeit not significantly. Therefore, to further improve the efficiency of health care service delivery, it is necessary to increase regional economic development and educational attainment, increase health care expenditure, further reduce the average length of hospital stays, and increase bed occupancy rates.

Conclusions

This study found disparities in health care service delivery efficiency among various provinces, and that most provinces could still improve in terms of pure technical efficiency and scale efficiency to varying degrees. A dynamic analysis based on the Malmquist index reveals that the TFP efficiency of health care service delivery among Chinese provinces is in decline. From the spatial distribution perspective, changes in health care service delivery efficiency across regions vary greatly. From the efficiency growth perspective, East China shows the largest amount of growth, followed by Central China then Western China. In addition, the factors of tertiary education attainment, GRDP, and health care expenditures show a significant influence on improving health care service delivery efficiency.

Abbreviations

BCC: Banker-Charnes-Cooper; DEA: Data envelopment analysis; DMU: Decision-making unit; EC: Efficiency change; GRDP: Gross regional domestic product; OLS: Ordinary least squares; TC: Technical change; TFP: Total factor productivity

Declarations

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.E-mail: yjwz87@163.com.

Ethics approval and consent to participate

The study protocol was approved by the ethical review committee of The First Affiliated Hospital of Anhui Medical University.

Consent for publication

Not applicable.

Availability of data and materials

Please contact the corresponding author for data requests.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors have contributed to the conception and formulation of this article. Kui Chen drafted the first version of the manuscript, Jun Ye regarding the methodological and statistical examination.

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Table 1.Efficiency value of health care service delivery in 31 provinces in 2009 and 2018

Provinces	2009				2018			
	Overall efficiency	Pure technical efficiency	Scale efficiency	Returns to scale	Overall efficiency	Pure technical efficiency	Scale efficiency	Returns to scale
Beijing	0.912	0.915	0.996	irs	1	1	1	-
Tianjin	1	1	1	-	1	1	1	-
Hebei	1	1	1	-	1	1	1	-
Shanxi	0.643	0.734	0.876	drs	0.847	0.85	0.996	drs
Inner Mongolia	0.767	0.778	0.986	drs	0.808	0.813	0.993	drs
Liaoning	0.71	0.923	0.769	drs	0.822	0.876	0.939	drs
Jilin	0.721	0.806	0.894	drs	0.764	1	0.764	drs
Heilongjiang	0.921	0.949	0.971	drs	0.916	1	0.916	drs
Shanghai	1	1	1	-	1	1	1	-
Jiangsu	0.923	1	0.923	drs	0.901	1	0.901	drs
Zhejiang	1	1	1	-	1	1	1	-
Anhui	0.96	1	0.96	drs	0.96	0.965	0.994	drs
Fujian	1	1	1	-	0.974	0.976	0.998	drs
Jiangxi	1	1	1	-	1	1	1	-
Shandong	0.907	1	0.907	drs	0.97	1	0.97	drs
Henan	1	1	1	-	1	1	1	-
Hubei	0.911	0.941	0.969	drs	1	1	1	-
Hunan	0.968	0.997	0.97	drs	1	1	1	-
Guangdong	1	1	1	-	1	1	1	-
Guangxi	1	1	1	-	1	1	1	-
Hainan	1	1	1	-	1	1	1	-
Chongqing	1	1	1	-	1	1	1	-
Sichuan	1	1	1	-	1	1	1	-
Guizhou	1	1	1	-	1	1	1	-
Yunnan	0.997	1	0.997	drs	1	1	1	-
Tibet	1	1	1	-	1	1	1	-
Shaanxi	0.927	0.953	0.973	drs	1	1	1	-
Gansu	0.891	0.922	0.967	drs	1	1	1	-
Qinghai	1	1	1	-	1	1	1	-
Ningxia	1	1	1	-	1	1	1	-
Xinjiang	0.824	0.826	0.998	drs	0.967	0.981	0.986	irs
Mean	0.935	0.959	0.973		0.965	0.983	0.982	

Notes: DRS: Decreasing returns to scale; IRS: Increasing returns to scale

Table 2.Malmquist index of health care service delivery between 2009 and 2019 in China

Year	Technical efficiency	Technical progress	Pure technical efficiency	Scale efficiency	Total factor productivity
2009-2010	0.995	0.988	0.99	1.004	0.982
2010-2011	1.01	1.008	1.002	1.008	1.019
2011-2012	1.005	1.005	1.012	0.993	1.011
2012-2013	0.995	0.986	1.003	0.993	0.981
2013-2014	1.005	0.981	1.002	1.003	0.986
2014-2015	1.005	1	1.007	0.998	1.005
2015-2016	1.012	0.977	1.008	1.004	0.989
2016-2017	1.001	1.016	0.998	1.003	1.017
2017-2018	1.007	0.988	1.005	1.003	0.995
Mean	1.004	0.994	1.003	1.001	0.998

Table 3.Malmquist index of health care service delivery between 2009 and 2019 in 31 provinces of China

Provinces	Technical efficiency	Technical progress	Pure technical efficiency	Scale efficiency	Total factor productivity
Beijing	1.01	1.031	1.01	1	1.042
Tianjin	1	1.038	1	1	1.038
Hebei	1	0.991	1	1	0.991
Shanxi	1.031	0.988	1.016	1.014	1.019
Inner Mongolia	1.006	0.991	1.005	1.001	0.997
Liaoning	1.016	0.99	0.994	1.022	1.006
Jilin	1.006	0.995	1.024	0.983	1.001
Heilongjiang	0.999	0.993	1.006	0.994	0.992
Shanghai	1	1.07	1	1	1.07
Jiangsu	0.997	1.01	1	0.997	1.007
Zhejiang	1	1.019	1	1	1.019
Anhui	1	0.999	0.996	1.004	0.999
Fujian	0.997	0.991	0.997	1	0.988
Jiangxi	1	0.986	1	1	0.986
Shandong	1.008	0.993	1	1.008	1
Henan	1	0.987	1	1	0.987
Hubei	1.01	1	1.007	1.004	1.01
Hunan	1.004	0.987	1	1.003	0.991
Guangdong	1	1.001	1	1	1.001
Guangxi	1	0.983	1	1	0.983
Hainan	1	0.986	1	1	0.986
Chongqing	1	0.985	1	1	0.985
Sichuan	1	0.979	1	1	0.979
Guizhou	1	0.976	1	1	0.976
Yunan	1	0.996	1	1	0.996
Tibei	1	0.948	1	1	0.948
Shaanxi	1.008	0.998	1.005	1.003	1.007
Gansu	1.013	0.985	1.009	1.004	0.997
Qinghai	1	0.979	1	1	0.979
Ningxia	1	0.975	1	1	0.975
Xinjiang	1.018	0.986	1.019	0.999	1.004
Eastern China	1.005	1.001	1.004	1.001	1.006
Central China	1.002	0.994	1.003	0.999	0.997
Western China	1.003	0.987	1.003	1	0.989
National mean	1.004	0.994	1.003	1.001	0.998

Table 4.Tobit regression analysis of the factors associated with health care service delivery

Variables	*β*	*SE*	*t*	*P value*
Bed occupancy rate	0.0006143	0.0004025	1.53	0.140
Average length of hospital stays	-0.003986	0.0034255	-1.16	0.256
Associate's degree or above	0.002656	0.0007571	3.51	0.002
Gross regional domestic product	3.30e-07	1.48e-07	2.23	0.035
The percentage of health care expenditure	0.002869	0.0010623	2.70	0.012
The percentage of primary care visits	0.0264599	0.0534739	0.67	0.509

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- TobitData.xls
- DEAData.xls