Innovation Humanities and Social Sciences Research, Volume 21, Issue 7, 2025. ISSN: 2949-1282
Proceedings of The 6th International Conference on Culture, Education and Economic Development of Modern Society (ICCESE 2025)

Measurement and Assessment of the Efficiency of Government Health Expenditure in the Chengdu-Chongqing Economic Circle

Yujie Peng[1] Haidong Yu[2]

[1,2] *School of Public Health, Chongqing Medical University, Chongqing 400016, China*
[2]*Corresponding author. Email: haidongyu@cqmu.edu.cn*

ABSTRACT

Objective: By evaluating the efficiency level of government health expenditure within the Chengdu-Chongqing Economic Circle, this study aims to analyze the spatial heterogeneity of health expenditure efficiency and its driving factors, providing a basis for improving the efficiency of health resource allocation and policy optimization within the region. Methods: Based on the panel data of 44 districts and counties in Sichuan Province and Chongqing Municipality from 2015 to 2020, the DEA-Malmquist index model was used to calculate the changes in total factor productivity (TFP) of regional government health expenditure, revealing the characteristics of regional differences and annual fluctuations. Results: The overall efficiency of government health expenditure within the Chengdu-Chongqing Economic Circle is relatively low and shows significant fluctuations. The efficiency reached its peak in 2018 and then dropped sharply in 2020. The overall fluctuations in the Chongqing Metropolitan Area were greater than those in the Chengdu Metropolitan Area, and the internal regional differences were also significant. Conclusion: The efficiency level of government health expenditure is mainly affected by policy shocks and public health emergencies. At the same time, insufficient regional coordination and an incomplete information sharing mechanism have also become essential reasons restricting the improvement of efficiency. Therefore, the government can optimize the allocation of health resources, enhance the capacity of primary medical care, and promote regional coordination and information sharing to improve the efficiency of regional health expenditure and promote the sustainable development of the regional public health system.

Keywords*: Chengdu-Chongqing Economic Circle, Government health expenditure efficiency, DEA-Malmquist Index Model, Regional collaborative governance.*

1. INTRODUCTION

The construction of the Chengdu-Chongqing Economic Circle is a major strategic deployment by the country to promote regional coordinated development, aiming to create an important growth pole that drives the high-quality development of the entire country [1]. Against this backdrop, the integration of health services has become the core issue of regional coordinated development. Government health expenditure, as a key means to ensure the fairness and accessibility of public health services and optimize the allocation of regional health resources, is directly related to the realization of the strategic goal of "major diseases not being treated in Chengdu and Chongqing" [2]. However, existing studies primarily focus on the national or provincial macro level and lack detailed analysis of the hierarchical differences within urban circles of the Chengdu-Chongqing Economic Circle and other national economic circles. Therefore, this study intends to adopt the DEA-Malmquist index model, using the panel data of health resources in Sichuan Province and Chongqing Municipality from 2015 to 2020 as samples, to analyze the measurement and differences in the efficiency of government health expenditure among different urban circles within the Chengdu-Chongqing Economic Circle, to provide a basis for improving the efficiency of health resource allocation within the region and optimizing policies.

2. LITERATURE REVIEW

The DEA-Malmquist model, due to its non-parametric nature, has become a core tool for evaluating the efficiency of health expenditures. Sherman (1984) was the first to apply DEA to the evaluation of hospital efficiency, confirming that it outperforms traditional ratio analysis and econometric regression methods in identifying inefficient units, laying the methodological foundation for subsequent research [3]. Lan Ying (2023) used a three-stage DEA model to calculate the efficiency of government health expenditures in 12 provinces in the western region of China. After eliminating environmental factors and random disturbances, it was found that technological progress was the main driving force for efficiency improvement, while insufficient scale efficiency constrained the overall performance [4]. Zhong et al. (2020) used this model to analyze the efficiency of primary medical institutions in 86 counties in Hunan Province. After excluding environmental variables such as population density and economic level, the actual gap in pure technical efficiency was reduced by 12.3% compared to the initial value [5].

With the advancement of the regional coordinated development strategy, the efficiency evaluation based on urban agglomerations and economic circles has become a new research direction. Spatial heterogeneity has a significant impact on the efficiency of government health expenditure. Gou Xingchao (2024) found that there is a significant spatial positive correlation in the efficiency of health expenditure in the Chengdu-Chongqing region. The technological spillover from the central city can enhance the efficiency of surrounding areas [6]. Guo et al. studied the regional heterogeneity and influencing factors of health expenditure efficiency in 31 provincial units in China and found that there is significant spatial heterogeneity in the efficiency of health expenditure in the eastern, central, and western regions. The health output in the eastern and central regions is higher than that in the western region [7]. Boduroglu et al. (2023) evaluated the efficiency of health expenditure during the pandemic in 5 OECD countries. They found that due to differences in geographical conditions, population density, and health resource bases among different regions, the efficiency of health expenditure shows significant spatial heterogeneity, mainly reflected in the efficiency differences in the input-output of health resources [8]. In addition, Carroll (2024) estimated the efficiency of health expenditure in various countries and found that there is a significant efficiency difference between emerging and developing countries and developed countries, and spatial factors such as regional economic development levels and policy systems have a significant impact on efficiency [9]. This further confirms that spatial heterogeneity is an essential factor affecting the efficiency of government health expenditure, and it is necessary to consider this factor when formulating regional health policies fully.

The existing domestic research mainly focuses on mature economic regions such as the Yangtze River Delta and the Pearl River Delta as the research objects. Jiang Chenglei (2024) found that the government health expenditure efficiency in the Yangtze River Delta region shows a pattern of "higher in the south and lower in the north, and higher in the east and lower in the west", and the global Moran index is significantly positive, indicating a positive spatial correlation [10]. At the same time, Zang Mengliu et al. (2024) used a three-stage DEA model to analyze the Yangtze River Delta urban agglomeration, pointing out that Shanghai has a suction effect on surrounding cities. Still, the resource synergy among Jiangsu, Zhejiang, and Anhui provinces is insufficient [11]. For the central and western regions, Yu Lan et al. (2022) found that there is significant spatial clustering of health expenditure efficiency at the municipal level in the western region, and pure technical efficiency is the main factor restricting the comprehensive efficiency [12]. The Chengdu-Chongqing Economic Circle, as the first national economic circle in the west, has a balanced and differentiated distribution of health resources. Specifically, the main urban areas of Chengdu and Chongqing concentrate high-quality medical resources, while the counties in Sichuan and Chongqing have problems of service capacity deficiencies. Compared with the eastern economic circles, such as the Yangtze River Delta, its efficiency characteristics can better reflect the institutional constraints and development potential of the central and western regions. Therefore, this study selects the Chengdu-Chongqing Economic Circle as the research object, which can provide new empirical evidence for regional coordinated development.

3. METHODS

3.1 Data Sources

This article selects the relevant basic data of 44 districts and counties in the Chengdu-Chongqing Economic Circle, including 15 prefectures and cities in Sichuan Province and 29 districts (counties) in Chongqing City, from 2015 to 2020 as the sample. The data are sourced from "Sichuan Statistical Yearbook", "Chongqing Statistical Yearbook", "Sichuan Health Statistical Yearbook", and "Chongqing Health Statistical Yearbook".

3.2 Selection of Input-Output Indicators

This paper selects the total government health expenditure as the sole input indicator. This indicator directly reflects the scale of fiscal resources invested by the government in the field of healthcare. It is a fundamental variable for measuring the supply capacity of public health services. Three indicators are selected from the hardware and human resources dimensions of healthcare service supply capacity as output indicators, namely the number of healthcare institutions, the number of beds in healthcare institutions, and the number of staff in healthcare institutions. These three indicators form a complete chain of healthcare service supply from the "institution-bed-personnel" three dimensions, comprehensively reflecting the effect of the government's health expenditure being transformed into actual service capacity, avoiding the one-sidedness of a single output indicator.

3.3 Research Methods and Model Setup

This paper selects the DEA-Malmquist index model as the research method. The DEA model assesses the relative efficiency of decision-making units (DMU) by constructing the production frontier and does not require a preset form of the production function. It is suitable for complex systems with multiple inputs and outputs [13]. The Malmquist index is used to measure the inter-period total factor productivity (TFP) change, which can be decomposed into technical efficiency change (EC) and technological progress (TC), that is, TFP = EC × TC [14]. Therefore, this study adopts the output-oriented Malmquist index to study the dynamic evolution of government health expenditure efficiency in the Chengdu-Chongqing Economic Circle from 2015 to 2020, and calculates the change in total factor productivity (tfpch), and the specific expression is as follows:

For periods t and t+1, the Malmquist index (i.e., tfpch) of the kth DMU is:

$$tfpch = M(x_t, y_t, x_{t+1}, y_{t+1}) = \left[\frac{D^t(x_{t+1}, y_{t+1})}{D^t(x_t, y_t)} \times \frac{D^{t+1}(x_{t+1}, y_{t+1})}{D^{t+1}(x_t, y_t)}\right]^{1/2}$$

Among them, $D^t(x_t,y_t)$ represents the distance function at period t, which measures the production efficiency of the DMU at the technical level in period t; $D^t(x_{t+1},y_{t+1})$ represents the distance function of input-output at period t under the technical level of period t+1; and $D^{t+1}(x_t, y_t)$ represents the distance function of input-output at period t+1 under the technical level of period t.

4. RESULTS

4.1 Efficiency Calculation Results of the Chengdu-Chongqing Economic Circle

The total factor productivity (TFP) of government health expenditure in the Chengdu-Chongqing Economic Circle from 2015 to 2020 exhibited a non-linear characteristic of "fluctuation - increase - adjustment" (see “Table 1” and “Figure 1”). The average TFP of government health expenditure in the Chengdu-Chongqing Economic Circle from 2015 to 2020 was 0.9428, which was lower than 1, indicating an overall decline in total factor productivity. Specifically, in 2015, the TFP was 0.8608, at a relatively low level. After experiencing adjustment periods in 2016 (0.9621) and 2017 (0.9449), it reached a peak of 1.0026 in 2018, marking a "turning point year" of efficiency improvement, indicating that the input-output of health resources reached a relatively optimal state that year. However, in 2019, it dropped to 0.9878, and in 2020, it significantly decreased to 0.8985, the lowest value within the period from 2015 to 2020. This fluctuation trajectory is coupled with the regional economic cycle, possibly because 2018 was the first year of the implementation of the "Action Plan for Deepening Sichuan-Chongqing Cooperation and Promoting the Development of the Yangtze River Economic Belt", which significantly promoted the economic development of both Sichuan and Chongqing, while in 2020, the TFP value of government health expenditure dropped sharply, which was caused by the impact of the sudden public health event, resulting in a rigid

increase in public health expenditure and restricted routine medical services.

Table 1. The measurement results of the regional TFP

Year	TFP of Chengdu-Chongqing Economic Circle	TFP of Chongqing Metropolitan Area	TFP of Chengdu Metropolitan Area
2015	0.8608	0.8746	0.8691
2016	0.9621	1.0807	0.9182
2017	0.9449	0.9458	0.9547
2018	1.0026	1.0381	1.0092
2019	0.9878	0.9772	0.9944
2020	0.8985	0.8847	0.9301
Mean value	0.9428	0.9669	0.9459

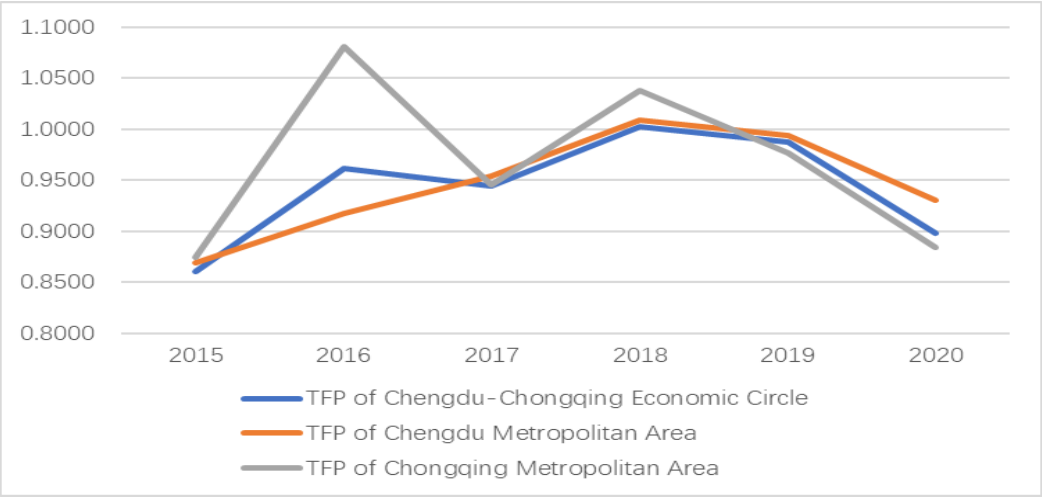

Figure 1 The comparison results of the regional TFP.

4.2 Regional Efficiency Calculation Results

The TFP of government health expenditure in the Chongqing metropolitan area fluctuated significantly from 2015 to 2020, with a peak but insufficient resilience (see “Table 1” and “Figure 1”). Specifically, the average TFP of government health expenditure in the Chongqing metropolitan area from 2015 to 2020 was 0.9669, which was higher than the overall level of the Chengdu-Chongqing Economic Circle but still below 1. This indicates that there is still considerable room for improving the efficiency of government health expenditure in the Chongqing metropolitan area. Chongqing achieved an extremely high efficiency value of 1.0807 in 2016, significantly exceeding the efficiency value in 2015. Under the influence of relevant policies, the two regions of Sichuan and Chongqing have developed collaboratively, leading to a significant increase in the TFP of government health expenditure in the Chongqing metropolitan area compared to the previous year in 2018. However, the amplitude of its efficiency fluctuations was much higher than that of the Chengdu metropolitan area. In 2020, it dropped sharply to 0.8847, a significant decline of 18.1% compared to the peak in 2016, indicating that the health system in Chongqing is less stable in responding to external shocks and the sustainability of resource allocation needs to be further improved and enhanced.

4.3 Spatial Distribution Characteristics of Efficient and Inefficient Zones

Based on the micro-data of the Chongqing Metropolitan Area and the Chengdu Metropolitan Area (“Table 2” and “Table 3”), it can be observed that the efficiency spatial distribution of the two metropolitan areas exhibits a common feature of "core concentration and edge dispersion". The efficient zones in the Chongqing Metropolitan Area are mainly concentrated in the main urban area, with the mean TFP values of Shapingba District

and Nan'an District ranging from 1.018 to 1.1703 from 2015 to 2020, and Yuzhong District reached 1.114 in 2018. In the Chengdu Metropolitan Area, the efficient zones are distributed in a "core + satellite city" pattern. During the period when the TFP of government health expenditure in the Chengdu Metropolitan Area reached its peak, the core city Chengdu achieved a TFP value of 1.013 in 2018, while the satellite cities, including Meishan City, Deyang City, and Mianyang City, had TFP values of 1.142, 1.001, and 1.003, respectively.

The distribution characteristics of the inefficient areas are mainly located in the peripheral edge areas of the two major metropolitan areas and the underdeveloped counties (“Table 2” and “Table 3”). The inefficient areas in the Chongqing metropolitan area are mainly distributed in the southeastern and northeastern parts of Chongqing. Among them, Qianjiang District had a TFP value of only 0.243 in 2015, which might be caused by various factors such as terrain and economy, resulting in low efficiency. The inefficient areas in the Chengdu metropolitan area are mainly concentrated in the western Sichuan Plateau and the northeastern hills of Sichuan. For example, Ya'an City had a TFP of 0.832 in 2020. This might be due to terrain limitations and poor accessibility of medical resources, thereby leading to low efficiency in government health expenditure.

Table 2. The TFP measurement results of the Chongqing Metropolitan Area

Area	TFP					
	2015	2016	2017	2018	2019	2020
Banan	0.946	0.942	0.93	1.056	0.935	0.815
Beibei	0.831	0.96	0.933	0.946	1.009	0.917
Bishan	1.074	1.111	1.043	1.07	0.856	0.941
Dudukou	1	0.899	0.941	1.064	0.95	0.867
Dazu	0.877	0.88	0.995	1.087	0.959	0.974
Dianjiang	0.978	0.809	0.805	1.247	1.02	0.971
Fengdu	0.57	2.012	0.415	1.304	0.995	1.032
Fuling	0.633	0.868	1.352	1.036	1.034	1.016
Hechuan	0.823	0.989	0.946	0.988	0.849	0.908
Jiangbei	0.926	0.756	1.163	0.983	1.221	0.863
Jiangjin	0.994	1.046	0.986	0.781	0.979	0.516
Jiulongpo	1.073	1.021	1.06	0.963	0.924	0.786
Kaizhou	0.747	1.796	0.601	0.89	1.001	0.91
Liangping	0.797	3.561	0.248	0.983	0.837	1.034
Nan’an	1.121	1.042	0.947	2.05	0.901	0.961
Nanchuan	0.956	1.072	0.931	1.136	0.868	1.004
Qijiang	0.903	0.937	0.902	0.974	1.062	0.952
Qianjiang	0.243	0.959	0.92	1.074	0.899	0.969
Rongchang	0.832	1.008	0.904	0.833	0.765	0.896
Shapingba	1.019	0.88	1.26	1.041	1.187	0.719
Tongliang	0.94	0.975	0.733	0.955	0.875	0.924
Tongnan	0.881	1.003	0.907	0.872	1.151	1.024
Wanzhou	0.847	0.946	0.765	0.997	0.947	0.739
Yongchuan	0.952	0.971	1.293	0.985	0.916	0.926
Yubei	0.77	1.107	0.861	0.82	1.096	0.901
Yuzhong	0.996	1.021	0.934	1.114	1.023	0.921
Yunyang	0.864	0.917	0.965	1.086	1.065	0.886
Changshou	0.923	0.839	0.718	1.256	0.964	0.856
Zhongxian	0.575	0.693	1.458	0.956	0.655	1.113

Table 3. The TFP measurement results of the Chengdu Metropolitan Area

Area	TFP					
	2015	2016	2017	2018	2019	2020
Chengdu	0.89	0.951	0.898	1.013	1.054	0.868
Dazhou	0.848	0.848	1.038	1.031	0.983	1.091
Deyang	0.84	0.872	1.044	1.001	0.968	0.896
Guang'an	0.891	0.883	0.973	1.019	1.013	0.911
Leshan	0.827	0.963	0.975	0.894	1.125	0.949
Luzhou	0.814	0.774	1.094	1.058	0.924	1.002
Meishan	0.836	0.959	0.841	1.142	0.977	0.9
Mianyang	0.849	0.964	0.98	1.003	0.979	0.936
Nanchong	0.843	0.889	0.891	1.022	0.898	0.903
Neijiang	0.978	0.907	1.018	0.971	0.938	1.064
Suining	0.886	0.896	0.931	0.952	0.9	1.003
Ya'an	0.832	0.953	1.078	0.96	0.989	0.832
Yibin	0.923	0.987	0.93	0.999	0.93	0.925
Ziyang	0.878	0.899	0.989	1.021	1.047	0.851
Zigong	0.82	0.969	0.92	0.973	1.019	1.003

5. DISCUSSION AND RECOMMENDATIONS

5.1 Discussion

5.1.1 Driving Mechanism of Efficiency Fluctuations

By analyzing the calculation results of TFP in the Chengdu-Chongqing Economic Circle, it was found that exogenous factors, including short-term incentives from policy shocks and negative impacts of sudden public health events, significantly influence the annual fluctuations of TFP in this economic circle. In 2017, the 19th National Congress of the Communist Party of China proposed to implement the strategy of regional coordinated development firmly. In 2018, the "Action Plan for Deepening Sichuan-Chongqing Cooperation and Promoting the Development of the Yangtze River Economic Belt" was implemented. The economic development level of the Chengdu-Chongqing region was effectively improved. Therefore, the TFP value of government health expenditure in the Chengdu-Chongqing Economic Circle reached its peak in 2018. However, in 2020, the sudden public health event of COVID-19 also led to temporary fluctuations in the input structure and efficiency of the health system. The fiscal resources were tilted towards emergency prevention and control, resulting in a general decline in the efficiency of health expenditure [15]. This is consistent with the phenomenon observed by Boduroglu of "increased efficiency loss due to the misallocation of medical resources under the impact of the epidemic" [8].

5.1.2 Deep Causes of Regional Differences

From the specific TFP results of health expenditures in each region from 2015 to 2020, it can be seen that both Chongqing and the Chengdu metropolitan area have obvious efficient and inefficient zones within. The main reasons for the regional differences are as follows. Firstly, economic foundation and industrial structure are important factors determining regional TFP. The efficient zones represented by the main urban areas of Chengdu and Chongqing have long been concentrating on high-end manufacturing, modern services, and innovative resources, possessing strong financial strength and a high degree of knowledge concentration, which provides a solid foundation for the modernization of the public health system's investment and management. Secondly, the efficient zones are often located in transportation hubs and areas with information interconnection, facilitating the timely flow of talents, technologies, and materials. However, the low-efficiency zones, such as Qianjiang District in Chongqing and Ya'an City in Sichuan, are constrained by objective factors, including terrain and transportation, which result in restricted

technological diffusion and input-output efficiency, thereby affecting the efficiency of government health expenditures. Moreover, the core areas of the metropolitan region generally have stronger information infrastructure and public governance capabilities, which facilitate the interconnection of health information and regional collaboration in resisting risks. In contrast, the low-efficiency zones have problems such as information barriers and high collaboration costs, making it challenging to achieve coordinated responses in the event of public health emergencies.

5.1.3 Analysis of Constraints on Regional Collaboration and Information Sharing

The calculation results show that the TFP of government health expenditure in the Chengdu-Chongqing metropolitan area remains relatively low overall, and there are significant fluctuations in some years and regions. This reflects that there are obvious constraints on regional health collaboration and information sharing in the Chengdu-Chongqing region. The possible reason might be the limited level of regional collaborative governance. Specifically, inter-governmental cooperation within the Chengdu-Chongqing economic circle mainly focuses on infrastructure and economic development, while the collaboration agreements, policy integration, and fiscal linkage mechanisms in the medical field are lagging. The mechanism for sharing medical resources is not yet perfect, resulting in the long-term existence of structural problems such as difficulty in accessing medical care and referrals[16]. The mobility of medical personnel, technology, and equipment is restricted by administrative divisions or policy barriers, making it impossible to fully and efficiently integrate across regions. The internal policy innovation in the region is lagging due to a lack of collective governance and incentive and restraint mechanisms, which makes it challenging to promote and replicate advanced management experiences and high-efficiency practices[17]. The Chengdu-Chongqing economic circle involves two provincial administrative entities, dozens of counties and cities, and a large number of medical institutions. The interdepartmental collaboration takes a long time, and the responsibility allocation and incentives for cross-regional sharing platform construction are insufficient, leading to prominent governance fragmentation issues.

5.2 Recommendations

5.2.1 Optimizing the Allocation of Health Resources Based on Local Conditions

Considering the diverse economic development levels and health demands within the Chengdu-Chongqing Economic Circle, a "one-size-fits-all" resource allocation model is not suitable. Instead, differentiated fiscal health expenditure strategies should be employed based on urban-rural and regional differences. For regions with rapid economic growth and high population density (such as Chengdu and the main urban area of Chongqing), the allocation should focus on meeting residents' demands for high-quality medical services and increasing the supply of specialized medical care and innovative medical technologies. For economically underdeveloped areas (such as Qianjiang District and Ya'an City), efforts should be made to strengthen the construction of grassroots medical capabilities, improve the accessibility and equity of public health services, and thereby enhance the efficiency of health resource investment. Additionally, the expenditure structure should be optimized. Based on ensuring basic medical services, increased investment should be made in preventive health services to strengthen public health functions such as disease prevention, control and health education. This ensures that in the event of a public health emergency, the health expenditure structure can be adjusted promptly and effectively to ensure the stable operation of the health system and minimize efficiency losses.

5.2.2 Strengthening the Establishment and Improvement of the Cross-regional Medical Resource Sharing Mechanism

To address the issue of restricted medical resource collaboration across administrative regions, a unified medical resource sharing platform can be established to enhance the mutual assistance and sharing of medical facilities, equipment, and professional talents within the region. At the same time, the government needs to introduce more supportive policies to eliminate administrative barriers and promote cooperation among medical institutions, effectively improving the level of medical and health services. Moreover, in policy design, introducing clear incentive and restraint mechanisms ensures that each region can obtain practical benefits and increases the enthusiasm to implement policies, thereby promoting resource sharing across different regions.

5.2.3 Enhancing Information Infrastructure and Regional Cooperative Governance Capacity

The improvement of information technology levels is crucial for optimizing regional medical collaboration. By increasing investment in regional information infrastructure, especially by promoting the interconnection of medical information systems, the efficiency of public health information flow and sharing can be enhanced, thereby strengthening regional collaboration capabilities [18]. Moreover, technological progress can effectively improve the efficiency of government health expenditures. Therefore, measures such as cultivating high-tech talents and increasing funding for technical research can be taken to enhance pure technical efficiency [19]. Finally, unified regional health policy standards can be established to promote the interconnection of medical services, drug procurement, and medical insurance payment, break down administrative barriers between regions, and enhance the governance capacity of regional medical cooperation, thereby improving the efficiency of government health expenditures.

6. CONCLUSION

This study used the DEA-Malmquist index model to calculate the government health expenditure efficiency of the Chengdu-Chongqing Economic Circle, revealing the temporal and spatial variation characteristics of efficiency within the region and the influencing factors. The research indicates that there is still room for optimization in the public health resource allocation of the Chengdu-Chongqing Economic Circle. Multiple factors, including economic foundation, industrial structure, transportation and informatization level, and governance capacity constrain the improvement of efficiency. At the policy level, it is necessary to adopt regionally tailored resource allocation strategies, strengthen the basic health service capabilities at the grassroots level, and reduce the gap in resources and capabilities among regions. At the same time, establish an efficient mechanism for collaborative governance and information sharing among regions to eliminate administrative barriers and promote the flow of medical resources and information exchange. In addition, strengthening regional health cooperation and promoting technology spillover and complementary advantages are necessary to achieve an overall improvement in the level of public health services. This will effectively improve the health expenditure efficiency of the Chengdu-Chongqing Economic Circle and provide a solid health guarantee for the high-quality development of the regional economy.

ACKNOWLEDGEMENTS

We acknowledge funding support from the Science and Technology Research Program of Chongqing Municipal Education Commission (Grant No. KJQN202200409); and supported from the Chongqing Social Science Planning Project(Grant No: 2023NDYB106).

REFERENCES

[1] The central committee of the communist party of China and the state council. The "Outline for the construction of the Chengdu-Chongqing economic circle"[J]. Gazette of the state council of the people's republic of China, 2021(31): 13-33.

[2] Wang Ruonan, et al. Study on the direct impact and spatial spillover effect of new urbanization on the efficiency of public health expenditure in China[J]. Medicine and society, 2023, 36(05): 26-31. DOI: 10.13723/j.yxysh.2023.05.005.

[3] Sherman H D. Hospital efficiency measurement and evaluation: empirical test of a new technique[J]. Medical care, 1984, 22(10): 922-938.DOI: 10.1097/00005650-198410000-00005.

[4] Lan Ying. Evaluation of public health fiscal expenditure efficiency - an empirical study based on 12 provinces in western regions [J]. Statistics and decision, 2023, 39(15): 147-151. DOI: 10.13546/j.cnki.tjyjc.2023.15.027.

[5] Zhong K, Chen L, Cheng S, et al. The efficiency of primary health care institutions in the counties of Hunan Province, China: data from 2009 to 2017[J]. International journal of environmental research and public health, 2020, 17(5): 1781.DOI: 10.3390/ijerph17051781.

[6] Gou Xingchao, Yang Jirui. High-quality development of Chengdu-Chongqing economic circle: Level measurement, influencing factors and its trend prediction[J]. Journal of Xihua normal university (philosophy and social sciences edition),

2024(02): 57-69.DOI: 10.16246/j.cnki.51-1674/c.20230524.001.

[7] Guo Y, Hong X, Li D, et al. The economic effect of financial compensation in China's healthcare system: comprehensive insights regarding supply and demand factors[J]. Health Economics Review, 2024, 14(1): 21. DOI: 10.1186/s13561-024-00496-5.

[8] Boduroglu E, Atici K B, Omay T. Phase and wave dependent analysis of health expenditure efficiency: A sample of OECD evidence[J]. Frontiers in Public Health, 2023, 11: 1125975.DOI: 10.3389/fpubh.2023.1125975.

[9] Carroll N, Bloch C, GonzÁLez-Pier e, et al. Jordan: Health spending efficiency: Issues and reform directions[J]. High-level summary technical assistance reports, 2024,2024(001): A1.DOI: 10.5089/9798400264610.029.A001.

[10] Jiang Chenglei, et al. Evaluation and influencing factors of government health expenditure efficiency in the Yangtze river delta region[J]. Medicine and society, 2024, 37(12): 32-38.DOI: 10.13723/j.yxysh.2024.12.005.

[11] Zang Mengliu, et al. Research on the equity and efficiency of health resource allocation in the Yangtze river delta region [J]. Medicine and society, 2024, 37(04): 68-73.DOI: 10.13723/j.yxysh.2024.04.011.

[12] Yu Lan, et al. Study on characteristics of spatio-temporal distribution of health expenditure of municipal governments in western China[J]. Medicine and society, 2022, 35(03): 11-14.DOI: 10.13723/j.yxysh.2022.03.003.

[13] Charnes A, Cooper W W, Rhodes E. Measuring the efficiency of decision-making units[J]. European journal of operational research, 1978, 2(6): 429-444. DOI: https://doi.org/10.1016/0377-2217(78)90138-8.

[14] F X, Re R, Grosskopf S, et al. Productivity growth, technical progress, and efficiency change in industrialized countries[J]. The American economic review, 1994,84(1): 66-83.

[15] Haldane v, de foo c, Abdalla s m, et al. Health systems resilience in managing the covid-19 pandemic: Lessons from 28 countries[J]. Nat med, 2021,27(6): 964-980.DOI: 10.1038/s41591-021-01381-y.

[16] Li H, Wang R, Wang H. Regional disparities and influencing factors of health production efficiency: evidence from China[J]. BMC Public Health, 2025, 25(1): 2406. DOI: 10.1186/s12889-025-23537-y.

[17] Xi Yi, Liu Ke. "Embedded coordination": An explanatory framework for cooperative governance of regional health resources: Based on a case study of the Chengdu-Chongqing twin-city economic circle[J]. China health policy research, 2021, 14(10): 8-16.

[18] Shi Jingjin, et al. A study on the current status of medical information sharing in the tertiary public hospitals in shanghai[J]. China hospital management, 2023, 43(08): 52-55.

[19] Huang R, Li W, Shi B, et al. Evaluating China's primary healthcare services' efficiency and spatial correlation: a three-stage DEA-Malmquist model[J]. Frontiers in Public Health, 2024, 12: 1366327..DOI: 10.3389/fpubh.2024.1366327.