Utilization Lag of Medical Services in Beijing-Tianjin-Hebei Region and Holistic Governance

Yu Zhang¹,a, Yueying Liang²,b and Fang Yuan³,c
¹,²,³Tianjin University of Traditional Chinese Medicine, China

Keywords: Medical and health services; Lag; Holistic governance; TOPSIS model

Abstract. Objectives: To find the internal logic of medical and health services in Beijing-Tianjin-Hebei region, and to provide decision-making basis for medical and health services in this region by comparing the utilization of medical and health services in Beijing-Tianjin-Hebei region. Methods: TOPSIS model was used for comparative analysis. Results: The medical and health service utilization lag is very obvious in the Beijing-Tianjin-Hebei region. Beijing residents have the highest average number of visits. The average daily burden of doctors in Tianjin is the highest. Physicians in Hebei have the highest average daily hospital bed days. Conclusion: Although the average number of visits to residents in Beijing is high, the average number of doctors per day and the number of hospital beds per day are lower than those of Tianjin and Hebei. It indicates that the quantity and quality of health technicians in Beijing is better than that in Tianjin and Hebei, which is also the main manifestation of Beijing-Tianjin-Hebei medical and health service utilization lag. Therefore, it is necessary to comprehensively manage the utilization of medical and health services in the Beijing-Tianjin-Hebei region.

1 Introduction

Driven by the rapid development of Beijing-Tianjin-Hebei economic integration, the establishment of the Beijing-Tianjin-Hebei regional common market has become an necessary requirement for the free flow and in-depth integration of resource elements in the three places. In order to adapt to the development of the times and the actual demands, Beijing, Tianjin and Hebei have implemented coordinated cooperation strategies in a variety of fields. In terms of coordinated development of medical and health services, they have also made multiple efforts and realized remarkable achievements. However, the lag in the use of medical and health services is still relatively obvious, and influences the pace as well as progress of the coordinated development of medical and health services in Beijing, Tianjin, and Hebei.

The term “lag” originated from the “cultural lag” of the American sociologist W.F. Ogburn, that is, “in the process of social change, one part of the cultural cluster lags behind other parts and presents problems of delay and lag” and “the change of immaterial culture in social change is always later than the change of material culture” [1]. On this basis, domestic scholars have transplanted the concept of “cultural lag” into the field of social governance, and have put forward new concepts of “institutional lag” [2], “government function lag” [3], and “policy lag” [4] on the basis of conceptual innovation. On the basis of this understanding, lag generally refers to the imbalance or gap in the development of affairs that occurs when one part of a cluster of transactions lags behind the other in the process of social change. In other words, the two or in many parts, because of inconsistent timing or degree of change, the coordination between each other is reduced. The use of Beijing-Tianjin-Hebei medical and health services also suffers from the phenomenon of abandonment, that is, the synergy between the use of Beijing-Tianjin-Hebei medical and health services is not ideal, and the development of medical and health services also has obvious gaps, influencing the process of integrated development of Beijing, Tianjin and Hebei. This phenomenon can also be called the Beijing-Tianjin-Hebei health service utilization lag.
2 Data and Methods

2.1 Data sources

This article takes Beijing-Tianjin-Hebei as the research object and uses TOPSIS model to analyze the use of medical and health services in Beijing-Tianjin-Hebei area. It reflects the problems existing in the process of using Beijing-Tianjin-Hebei medical and health services and explore the methods and effective ways of the coordinated development of Beijing-Tianjin-Hebei medical and health services. Considering the various medical and health services utilization index and data collection is relatively difficult, this article will select several representative indicators from the 2019 China Health Statistics Yearbook as the research basis and data source, there are average number of visits by residents, residents’ annual hospitalization rate, bed utilization at medical institutions, number of patients’ daily consultations that the medical institutions’ doctors are responsible for and number of daily inpatient beds that the medical institutions’ doctors are responsible for (see Table 1).

| Region | Average number of visits by residents | Residents’ annual hospitalization rate | Bed utilization at medical institutions | Number of patients’ daily consultations that the medical institutions’ doctors are responsible for | Number of daily inpatient beds that the medical institutions’ doctors are responsible for |
|--------|--------------------------------------|----------------------------------------|----------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Beijing | 10.92                                | 16.40                                  | 83.40                                  | 9.10                                                                               | 1.40                                                                               |
| Tianjin | 7.69                                 | 10.40                                  | 77.50                                  | 9.90                                                                               | 1.50                                                                               |
| Hebei  | 5.71                                 | 16.10                                  | 82.70                                  | 5.10                                                                               | 2.10                                                                               |

Data sources: 2019 China Health Statistical Yearbook

2.2 Research Method

The TOPSIS method is an evaluation method that is widely used in multi-objective decision-making, whose main principle is to sort on the basis of the distance between the evaluation object and its ideal goal. Assume that the decision problem has n evaluation schemes and that it has m evaluation indexes. The decision matrix composed of the original evaluation values is \( X = (X_{ij})_{m \times n} \). The indicator system has forward indicators and reverse indicators, so it is necessary to conduct common trend evaluation on indicators. In general, the reciprocal method is used to conduct common trend processing to obtain the extreme value consistency matrix. The calculation formula is as follows:

\[
X^*_{ij} = \frac{1}{X_{ij}} (i = 1, 2, \ldots, m) \ldots \ldots \ldots \ldots (1)
\]

The evaluation indicators selected in this paper are all positive indicators, so it is unnecessary to common trend processing. So, it needs to enter the stage of normalization processing first and establish the corresponding matrix. The indicator conversion formula is as follows:

\[
\alpha_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}} \ldots \ldots \ldots \ldots (2)
\]

In the formula, \( x_{ij} \) means the value of the \( i \) evaluation target in the \( j \) index. The data in Table 1 is substituted into the formula (2), the formula is obtained as follows:
0.752 is the average number of visits to hospitals of Beijing residents after normalization. In a similar way, the average number of visits to hospital of Tianjin and Hebei’s residents after normalization, as well as the annual hospitalization rate of residents in Beijing, Tianjin and Hebei after normalization, Bed utilization at medical institutions, the average number of patients’ daily consultations that the medical institutions’ doctors are responsible for and the average number of daily inpatient beds that the medical institutions’ doctors are responsible for and other data can be obtained. See Table 2 for details.

Table 2. The normalized index matrix value of utilization of medical and health services in Beijing-Tianjin-Hebei region.

| Region | Average number of visits by residents of medical institutions | Residents’ annual hospitalization rate of medical institutions | Bed utilization at medical institutions | Average number of patients’ daily consultations that the medical institutions’ doctors are responsible for | Average number of daily inpatient beds that the medical institutions’ doctors are responsible for |
|--------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Beijing | 0.752                                                         | 0.650                                                         | 0.593                                 | 0.633                                                                                           | 0.477                                                                                           |
| Tianjin | 0.529                                                         | 0.412                                                         | 0.551                                 | 0.688                                                                                           | 0.511                                                                                           |
| Hebei   | 0.393                                                         | 0.638                                                         | 0.588                                 | 0.355                                                                                           | 0.715                                                                                           |

Data sources: The calculation is based on the corresponding data in the 2019 China Health and Family Planning Statistical Yearbook.

Secondly, in accordance with the data in Table 2, find the optimal value vector as well as the worst value vector, that is, the best plan as well as the worst plan in the finite plan are as follows:

The best plan: \( A^+ = (a_{i1}^+, a_{i2}^+, \ldots, a_{im}^+) \) = (0.752, 0.650, 0.593, 0.688, 0.751) \( \cdots \) (4)

The worst plan: \( A^- = (a_{i1}^-, a_{i2}^-, \ldots, a_{im}^-) \) = (0.393, 0.412, 0.551, 0.355, 0.477) \( \cdots \) (5)

Thirdly, calculate the distance and between the indicators of the Beijing-Tianjin-Hebei medical and health services and the best and worst plans, and the formulas are as follows:

\[
D_i^+ = \sqrt{\sum_{j=1}^{m} (a_{ij}^+ - a_{ij})^2} \quad \text{(Distance from the best plan)}
\]

\[
D_i^- = \sqrt{\sum_{j=1}^{m} (a_{ij}^- - a_{ij})^2} \quad \text{(Distance from the worst plan)}
\]

In the formula, \( D_i^+ \) and \( D_i^- \) represent the distance between the \( i \) evaluation object and the best plan and the worst plan respectively; and \( a_{ij} \) represents the value of an evaluation object \( i \) in the \( j \) index. In accordance with the formulas and principles mentioned above, the distances between the health care service utilization indicators and the best and worst plans in Beijing, Tianjin, and Hebei regions can be obtained, respectively. The first is the situation in Beijing:

\[
D_i^+ = \sqrt{\sum_{j=1}^{m} (a_{ij}^+ - a_{ij})^2} = \sqrt{(0.752 - 0.752)^2 + (0.650 - 0.650)^2 + (0.593 - 0.593)^2 + (0.688 - 0.630)^2 + (0.715 - 0.477)^2} = 0.2448
\]

\[
D_i^- = \sqrt{\sum_{j=1}^{m} (a_{ij}^- - a_{ij})^2} = \sqrt{(0.393 - 0.752)^2 + (0.412 - 0.650)^2 + (0.551 - 0.593)^2 + (0.355 - 0.630)^2 + (0.477 - 0.477)^2} = 0.5141
\]
In a similar way, the $D_i^+$ and $D_i^-$ of Tianjin region are 0.3876 and 0.3621 respectively; and the $D_i^+$ and $D_i^-$ of Hebei region are 0.4901 and 0.3306 respectively. See Table 3 for details.

Finally, it is calculated that the closeness and ranking of the overall use of the Beijing-Tianjin-Hebei medical and health services with the best plan. The calculation formula is as follows: $C_i = \frac{D_i^-}{D_i^+ + D_i^-}$. Besides, select $C_i$ between 0 and 1. The closer $C_1$ is to 1, the closer the evaluation object is to the best level; on the contrary, the closer $C_1$ is to 0, the closer the evaluation object is to the worst value. On the basis of this, the closeness of the overall utilization of medical services in Beijing, Tianjin, and Hebei to the best plan (see Table 3) is as follows:

- **C in Beijing**: $C_i = \frac{D_i^-}{D_i^+ + D_i^-} = \frac{0.5141}{0.2448 + 0.5141} = 2.61$
- **C in Tianjin**: $C_i = \frac{D_i^-}{D_i^+ + D_i^-} = \frac{0.3621}{0.3876 + 0.3621} = 1.30$
- **C in Hebei**: $C_i = \frac{D_i^-}{D_i^+ + D_i^-} = \frac{0.3306}{0.4910 + 0.3306} = 1.01$

### Table 3. The utilization of medical and health services in Beijing, Tianjin and Hebei, the best as well as the worst distance, and the sorting results.

| Region | $D_i^+$ | $D_i^-$ | $C_i$ | Sorting result |
|--------|--------|--------|------|---------------|
| Beijing | 0.2448 | 0.5141 | 2.61 | 1 |
| Tianjin | 0.3867 | 0.3621 | 1.30 | 2 |
| Hebei | 0.4901 | 0.3306 | 1.01 | 3 |

### 3 Results

1. The average number of visits to Beijing residents was significantly higher than that in Tianjin and Hebei. According to the situation in Tables 1 and 2, it can be seen that compared with Hebei, the advantage of using medical services in Beijing is that the average number of visits by residents of its medical institutions is significantly higher than the other two regions. It is 10.92. The normalized data is 0.752, ranking first in Beijing, Tianjin, and Hebei.

2. Number of patients’ daily consultations that the medical institutions’ doctors are responsible for in Tianjin is higher than that in Beijing and Hebei. As can be seen in Table 2, compared with Beijing and Hebei, there is only one indicator which is the number of patients’ daily consultations that the medical institutions’ doctors are responsible for in the Tianjin area that is optimal. The original data is 9.90 after normalization and the data is 0.688, ranking first in Beijing, Tianjin and Hebei.

3. The number of daily inpatient beds that the medical institutions’ doctors are responsible for in Hebei is much higher than that in Beijing and Tianjin. It can also be seen in Tables 1 and 2 that the number of daily inpatient beds that the medical institutions’ doctors are responsible for in Hebei region (the original data for Beijing is 1.40 and the normalized data is 0.715) are much higher than Beijing and Tianjin.

### 4 Discussion

#### 4.1 Advantages and Disadvantages of Utilizing Medical Services in Beijing.

Beijing, Tianjin and Hebei have a wide range of high-quality medical and health resources, and Tianjin and Hebei are adjacent to Beijing. More than 20% of the foreign patients treated by medical institutions in Beijing are from Hebei, forming an average number of visits by Beijing residents
First advantage. On the one hand, the demand for medical and health services in the Hebei area has been diverted, resulting in insufficient demand for outpatient health resources in Hebei, resulting in the waste of outpatient health resources at medical institutions in Hebei. On the other hand, there are overcrowding in medical institutions in Beijing and problems such as "difficult to see a doctor". Its essence is a waste of the entire medical and health resources, and it does not meet the Pareto optimal allocation principle. [5] In addition, some patients returned to Hebei for hospitalization after diagnosis, which made the doctors in the medical institutions in Beijing area bear the bed days every day, the lowest among the three places in Beijing, Tianjin and Hebei.

4.2 Advantages and “Embarrassments” of Medical Services in Tianjin.
Because the medical and health resources in Tianjin are obviously inferior to Beijing, especially the number of medical and technical personnel is significantly less than Beijing, but the medical institutions in this area also have to undertake a part of the inspection and diagnosis tasks of patients who come to Hebei for treatment. Regional medical institutions have the highest average daily burden of doctors and doctors, as well as the “embarrassing” situation of heavy workload.

4.3 Advantages and Disadvantages of Utilizing Medical Services in Hebei.
Patients from the Hebei region will be returned to Hebei for hospitalization or treatment due to expensive medical treatment or other reasons that cannot be treated in Beijing after being diagnosed at a Beijing clinic. This depends on the advantages of using medical services. On the other hand, the waste of medical resources for inspection and diagnosis in Hebei and the waste of medical resources for hospitalization in Beijing are wasted.

5 Conclusion
Although the average number of visits to residents in Beijing is high, the average number of doctors per day and the number of hospital beds per day are lower than those in Tianjin and Hebei, indicating that the number and quality of health technicians in Beijing are better than Tianjin and Hebei. The main manifestations of the use of Beijing-Tianjin-Hebei medical and health services are obvious and there is no unified system connection. Therefore, it is necessary to comprehensively manage the utilization of medical and health services in Beijing-Tianjin-Hebei region from the perspective of the coordinated development of medical and health services in Beijing-Tianjin-Hebei region, especially the overall planning of the allocation of health technicians, so as to narrow and gradually eliminate the phenomenon of the gap. The holistic governance here is the governance action that government agencies and organizations achieve effective coordination and integration through full communication and cooperation, so that the policy objectives of each other are consistent, the means of policy implementation are mutually reinforcing, and the goal of cooperation is achieved. Therefore, without changing existing jurisdictional boundaries or establishing new super institutions, by coordinating or integrating the actions of existing independent organizations or institutions, we will continue to move from decentralized to centralized, from partial to integrated, and from broken to integrated. A government governance scheme that provides the public with integrated, seamless, and non-separable holistic services. To realize the sharing of high-quality medical and health resources in the Beijing-Tianjin-Hebei region, and to promote the coordinated development of medical and health services in this region by attracting high-quality medical and health technicians to Hebei.

Acknowledgement
In this paper, this research was supported by the Tianjin Philosophy and Social Science Planning Project "Beijing-Tianjin-Hebei Health Service Demand and Utilization Research" (Project Number: TJZZ15-011).
References

[1] Liao Gailong, Sun Liancheng, Chen Youjin, etc. Marxist Encyclopedia Diagram Vol. 2 [M]. Beijing: People’s Daily Press, 1993: 1635.

[2] Xin Qiushui, Wang Lianghu, Bao Xiankang, etc. Institutional Lag and Institutional Improvement-A Research Report on the Questionnaire Survey of Villagers’ Autonomy in Twelve Villages of Five Counties in Anhui Province [J]. Fujian Forum (Humanities and Social Sciences), 2004 (9): 107-110.

[3] Xie Qiushan. The Lag of Local Government Function and the Governance Dilemma of Social Public Sector-Analysis On the Basis of the Case of Square Dance Conflict [J]. Journal of Public Management, 2015 (3): 23-32.

[4] Zhang Fengrong. Theoretical Progress and Policy Lag Analysis of Big Data Social Governance Research [J], Xue Hai, 2018 (3): 36-42.

[5] Wang Xiaojie. Quantitative Research on Equalization of Medical Services in Beijing, Tianjin and Hebei: Analysis on the Basis of AHP Method [J]. China Health Economics, 2015 (10): 48-50.