

Analysis on the Allocation Status and Fairness of TCM Resources in Guizhou Province

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Abstract: *Background:* TCM plays an important role in ensuring people's health and developing TCM undertakings. However, some studies have shown that the current allocation of TCM and health resources in China is relatively poor, and there are few regional research literature. *Objective:* To analyze the status and fairness of TCM (Traditional Chinese medicine) resources in Guizhou Province and provide evidence-based basis for health administrative departments. *Methods:* The status of TCM resources in Guizhou and the fairness of Lorenz curve, gini coefficient and health density index. *Results:* From 2010 to 2019, The TCM and health resources in Guizhou province have increased year by year, The average annual growth rate of TCM doctors per 1,000 people and their ownership per 100 square kilometer was 13.88% and 14.43%, respectively; Regarding the Gini coefficient, By population distribution is mainly located at 0.2-0.4, By area, the distribution is mostly below 0.3, The Gini coefficient of the economic distribution showed an overall downward trend, In 2019, Chinese pharmacists had the lowest economic distribution (0.093), The highest distribution by population distribution of practicing (assistant) physicians in 2015 (0.523); In terms of density-based exponential growth, In 2019, The highest bed density in Guizhou Province (0.3506), The lowest density of mechanism number (0.0016). *Conclusion:* The resources grow overall, but the total amount is relatively small; the region is unbalanced; the fairness by economic allocation is better than allocation by population than allocation by area. Therefore, the health administrative departments perform their functions, optimize the resource structure, strengthen the layout of TCM industry, give full play to the local characteristics, and stimulate the potential of TCM and health services.

Keywords: Traditional Chinese Medicine Resources, Fairness, Gini Coefficient, Health Density Index

1. Introduction

As an important component of medical and health undertakings, the gradually improved allocation mechanism of TCM and health resources plays an important role in ensuring people's health and the development of TCM, which has attracted the research interest of scholars. Shen Yuandong et al in 2002 for the first time of Chinese medicine health resources allocation investigation [1], after Wang dandan [2], Xu Chao [3], Xia Qing [4] and others studied the Chinese medicine medical institutions health resource allocation fairness, points out that the current Chinese medicine health resources allocation structure is unreasonable, poor fairness, regional development, talent shortage is more prominent, but

less regional resource allocation research literature, such as research of Guangdong province [5], lead to regional Chinese medicine development is difficult to get effective guidance. Guizhou province, as a province rich in traditional Chinese medicine and health resources, has the characteristics of multi-ethnic coexistence, unbalanced economic development, and complex geographical environment. It is of great significance to study the fairness of its resource allocation, which is the key to improve the fairness of medical services and realize a "healthy China". However, only Zhou Minghua conducted a study on the fairness of TCM health resources in Guizhou Province based on the concentration degree and Til index, but the time range is small and the research perspective needs to be supplemented [6]. Therefore, by studying the three dimensions of population, geography and economy, this paper

analyzes the fairness of TCM and health resource allocation in Guizhou Province from 2010 to 2019 by using the Lorentz curve, Gini coefficient and health density index, so as to provide reference for health administrative departments.

2. Data and Methods

2.1. Selection of Data Sources and Indicators

The TCM and health resource data, population data, economic data (GDP) and geographical area come from the macroeconomic database of Guizhou Province, Guizhou Statistical Yearbook and the portal websites of the people's governments of all cities and prefectures. The interception time line is 2010-2019, and the TCM health resource indicators include the number of professional TCM hospitals (number), the number of beds (zhang), practicing (assistant) doctors (persons) (hereinafter referred to as traditional Chinese medicine doctors) and TCM pharmacists (officers) (persons).

2.2. Research Methods

Excel is used to conduct descriptive analysis of the current situation of resource allocation, draw Lorentz curve and calculate Gini coefficient and health density index.

2.2.1. The Lorentz Curve

The Lorentz curve can intuitively reflect the fairness of health resources. In this study, we drew the Lorentz curve by population in 2010 and 2019 as the horizontal axis in 2019, 2010 and 2019, and 2010 and in 2010 and 2019 as the vertical axis [7]. In general, the closer the Lorentz curve is to the absolute fairness line, the better the resource allocation fairness is [8].

2.2.2. Gini Coefficient

Quantitative analysis of the fairness of the configuration is impossible, so the Gini coefficient (Gini coefficient, G), which

is calculated as follows as [7]:

$$G = \sum_{i=1}^n X_i Y_i + 2 \sum_{i=1}^n X_i (1 - V_i) - 1 \quad (1)$$

In the formula, X_i is the proportion of the population (area / economy) of each city in the total population (total area / total economy) of Guizhou Province; Y_i is the proportion of a health resource index in the corresponding total number of health resources of each city; $V_i = Y_1 + Y_2 \dots Y_i$ is the cumulative percentage of health resources. Gini coefficient is less than 0.2 is absolute fair, less than 0.3 is relatively fair, 0.3~0.4 is relatively reasonable, more than 0.4 is alert state, above 0.5 indicates a great gap, and more than 0.6 is highly unfair state [8].

2.2.3. Health Density Index

In 1996, in order to overcome the shortage of health resource allocation based only on population distribution evaluation, Zheng Xiaohua added geographical factors and first proposed the health density index (Health Resource Density Index, HRDI), so as to better reflect the fair of health resource allocation [9]. The calculation formula is as follows:

$$HDRI = \sqrt{(\text{Health resources per thousand population} \times \text{Health resources per square kilometer})} \quad (2)$$

3. Results

3.1. Allocation Status of TCM and health Resources in Guizhou Province from 2015 to 2019

From 2010 to 2019, all indicators of TCM health resources in Guizhou increased year by year, and the annual growth rate of ownership per square kilometer was higher than that of population per 1,000 people, with traditional Chinese medicine doctors growing the fastest. See Table 1.

Table 1. Allocation of TCM and health resources in Guizhou Province from 2010 to 2019.

year	Ownership per thousand people				Ownership per 100 square kilometers			
	Traditional Chinese pharmacist	Practicing (Assistant) physician	Number of bed	Number of institutions	Traditional Chinese pharmacist	Practicing (Assistant) physician	Number of bed	Number of institutions
2010	0.019	0.091	0.237	0.002	0.367	1.801	4.676	0.041
2011	0.020	0.103	0.287	0.002	0.404	2.037	5.643	0.041
2012	0.022	0.116	0.350	0.002	0.444	2.286	6.916	0.044
2013	0.026	0.134	0.423	0.003	0.522	2.669	8.404	0.053
2014	0.029	0.139	0.501	0.003	0.575	2.769	9.984	0.057
2015	0.039	0.117	0.581	0.003	0.787	2.345	11.633	0.063
2016	0.041	0.139	0.637	0.003	0.822	2.812	12.849	0.063
2017	0.042	0.237	0.675	0.003	0.837	4.770	13.606	0.069
2018	0.055	0.336	0.706	0.004	1.126	6.861	14.435	0.072
2019	0.057	0.386	0.772	0.004	1.176	7.935	15.878	0.073
Annual growth rate%	13.88	19.41	14.22	6.28	14.43	19.95	14.72	6.76

3.2. Distribution of TCM and Health Resources in Various Regions of Guizhou Province in 2019

In 2019, Bijie and Zunyi's TCM and health resources per 1,000 people per 1000 and per 100 square kilometers were higher than the average level of Guizhou, and southwest and southeast Guizhou were both lower than the average level. See Table 2.

Table 2. Allocation of TCM and health resources in various regions in Guizhou in 2019.

Area	Ownership per thousand people				Ownership per 100 square kilometers			
	Traditional Chinese pharmacist	Practicing (Assistant) physician	Number of bed	Number of institutions	Traditional Chinese pharmacist	Practicing (Assistant) physician	Number of bed	Number of institutions
Anshun	0.020	0.127	0.249	0.0020	1.206	7.857	15.404	0.124
Bijie	0.075	0.670	1.129	0.0071	2.239	19.952	33.609	0.212
Guiyang	0.071	0.487	0.750	0.0036	1.463	9.983	15.366	0.075
Litupanshui	0.067	0.302	0.288	0.0021	1.705	7.694	7.338	0.054
Qiandongnan	0.026	0.154	0.506	0.0031	0.651	3.851	12.632	0.078
Qianan	0.047	0.317	1.245	0.0034	0.839	5.616	22.046	0.061
Qianxinan	0.041	0.265	0.427	0.0035	0.708	4.552	7.326	0.060
Tongren	0.054	0.354	0.894	0.0023	0.634	4.154	10.481	0.026
Zunyi	0.154	1.065	1.885	0.0058	1.935	13.416	23.752	0.073
Total	0.057	0.386	0.772	0.0035	1.176	7.935	15.878	0.073

3.3 Fairness Analysis

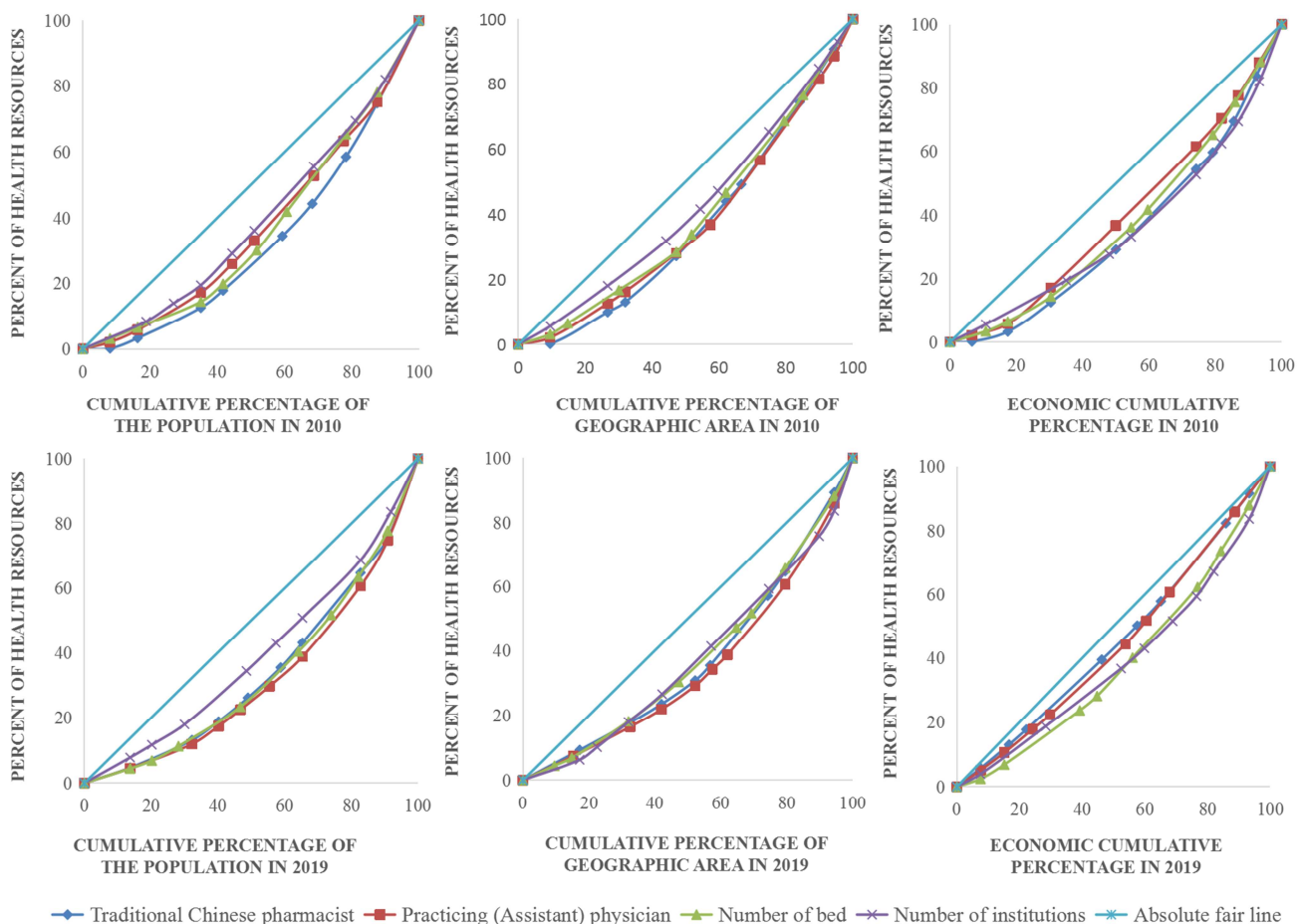
3.3.1. The Lorentz Curve

The number of institutions by population and by area distribution curve is closer to the equity line, and its equity is significantly better than other health resources. Compared with 2019, the Lorentz curve is closer to equity in 2010, and is significantly better than fairness by population and by area.

See Figure 1.

3.3.2. Gini Coefficient

According to population distribution, Gini coefficient has more volatility, mainly at 0.2-0.4, 0.0, good fairness, lowest in 2018 (0.191), highest in 2015, highly fair, best in 2010 (0.502), by area distribution, Gini coefficient is declining and more fair. See Figure 2.

**Figure 1.** The Lorentz curve for 2010 and 2019.

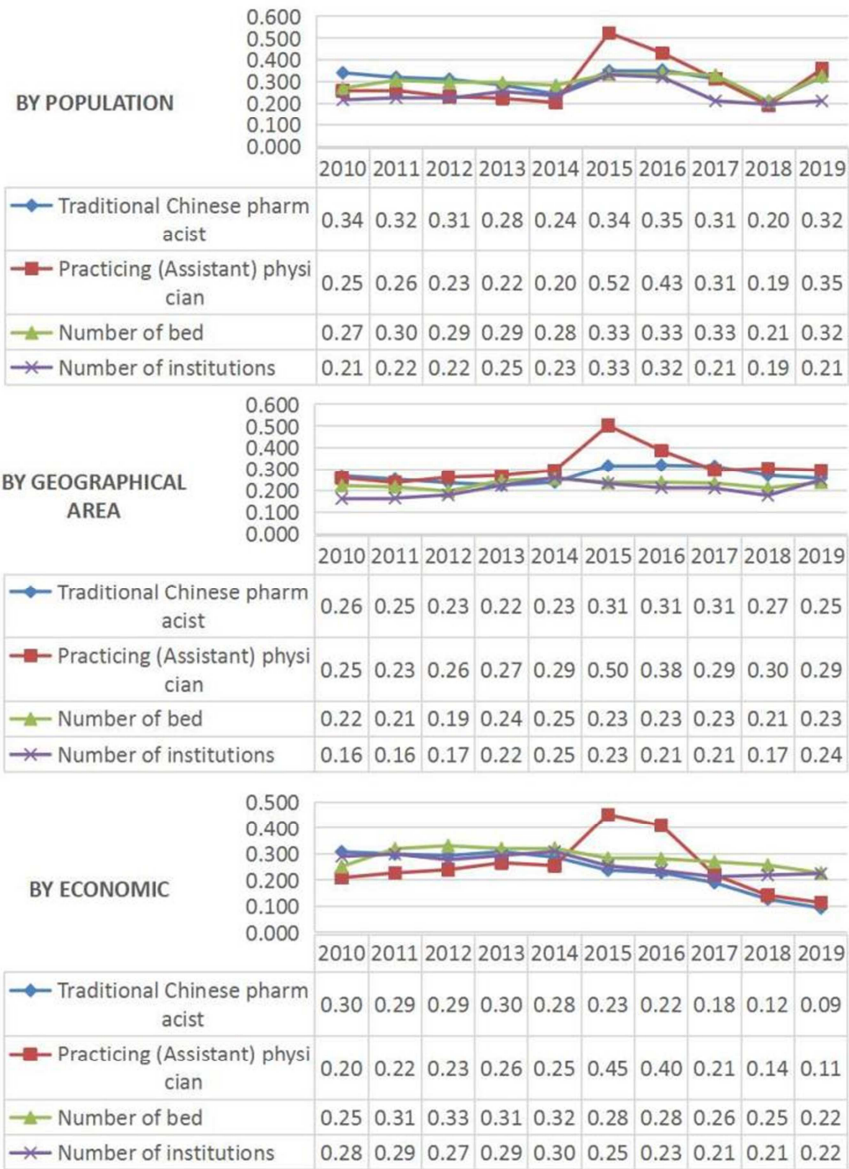


Figure 2. Line plot of the Gini coefficient.

3.3.3. Health Density Index

Compared with 2010, the density index of TCM medicine and health resources increased significantly in 2019, among which the TCM pharmacists in Qianxinan Prefecture increased by 116 times, and the number of institutions in Tongren decreased. The density indexes of Tongren and Qianxinan Prefecture were both lower than the average level of Guizhou, and only the health density index in Guiyang was higher than the average level. See Table 3.

4. Discussion

4.1. The Allocation of TCM and Health Resources in Guizhou Province Has Increased Overall, But the Total Amount is Still Relatively Low

From 2010 to 2019, the numbers of ownership per thousand population and per 100 square kilometers of doctor and

ownership per thousand population of institutions decreased in 2015, 2016 and 2015, respectively, while the other indicators showed an increasing trend. The number of doctors per 1,000 people and per 100 square kilometers grew the fastest, with the largest increase in 2017. This may be related to the introduction of policies and regulations of Guizhou Province's 13th Five-Year TCM Development Plan of Guizhou Province, which has promoted the development of TCM. The annual growth rate and increment of TCM pharmacists are lower than that of TCM physicians, which may be related to the discipline attribute of TCM and people's demand for TCM and health services. In addition, in 2016, the number of traditional Chinese medicine doctors per 1,000 people in Guizhou province was lower than that of Guangdong, twice the gap [10]. The number of beds and institutions per 1,000 people and that per 100 square kilometers were lower than in the Beijing-Tianjin-Hebei region [11]. The government should continue to increase the financial input and policies for

TCM, appropriately increase the number of TCM colleges and universities, introduce relevant supporting policies, increase the enrollment of TCM majors, optimize the structure of TCM education, and improve the quality of education, so that more outstanding talents are "willing to learn and willing to come". Secondly, we should improve the working environment and doctor-patient relationship of TCM talents, create a good career development prospect, meet their self-realization needs,

and make them "willing to stay". In addition, according to the practice of the development of TCM in Guizhou Province, we should lead the construction of TCM medical consortium, reasonably determine the number of institutions, beds and other resources, improve the TCM service capacity of medical institutions at all levels, and promote the realization of grassroots primary diagnosis and hierarchical diagnosis and treatment.

Table 3. Density of TCM and health resources in 2010 and 2019.

index	Traditional Chinese pharmacist		Doctor of traditional Chinese medicine		Number of bed		Number of institutions	
	2010	2019	2010	2019	2010	2019	2010	2019
Anshun	0.0079	0.0523	0.0523	0.1449	0.1048	0.2842	0.0012	0.0023
Bijie	0.0074	0.0452	0.0452	0.2424	0.0811	0.4084	0.0007	0.0026
Guiyang	0.0141	0.0681	0.0681	0.2483	0.1567	0.3822	0.0009	0.0019
Litupanshui	0.0039	0.0226	0.0226	0.1387	0.0537	0.1323	0.0008	0.0010
Qiandongnan	0.0095	0.0390	0.0390	0.1060	0.0873	0.3476	0.0013	0.0021
Qianan	0.0138	0.0366	0.0366	0.1311	0.1373	0.5148	0.0009	0.0014
Qianxinan	0.0001	0.0095	0.0095	0.1099	0.0371	0.1768	0.0006	0.0014
Tongren	0.0065	0.0345	0.0345	0.1280	0.1003	0.3230	0.0009	0.0008
Zunyi	0.0085	0.0494	0.0494	0.2735	0.1523	0.4843	0.0011	0.0015
Total	0.0083	0.0405	0.0405	0.1752	0.1052	0.3506	0.0009	0.0016

4.2. The Regional Configuration Level Is Not High, and the Configuration Is Not Balanced

In 2019, nine states only Zunyi and bijie two regions of each thousand mouth medicine health resources allocation are higher than the average level in Guizhou province, its GDP in the top three, and other areas health resources gap is obvious, the gap is larger, such as Anshun per thousand mouth medicine resources have the lowest, and its GDP is the lowest. The results of this study verify that the higher the economic level of development, the higher the level of health resource allocation, and the agglomeration of medical resources caused by economic development differences produces an obvious "Matthew effect" [10]. In terms of density index, compared with 2010, the density of TCM health resources in 2019 has increased significantly. However, in terms of regional health density in 2019, the health density of various TCM health resources in Guiyang and Bijie alone was higher than the provincial average. The reasons are: first, Guiyang has relatively rapid economic development, high total health resources and relatively small regional geographical area, which makes high density index of Guiyang [12]; second, the insufficient macro-control efforts of health administration departments, resulting in unbalanced regional allocation and high allocation difficulty [13]. In addition, Bijie has relatively many TCM and health resources, but there has no relative advantages in its economic level, population number, policies and regulations, and they do not conform to the general law of health economy, which may have something to do with the larger total number of country doctors [14]. Therefore, the health administrative departments should reasonably plan medical and health resources and improve the rationality of the distribution of TCM and health resources in the province. Secondly, policies should be studied to improve the working environment of TCM talents, create good career development

prospects, meet their self-realization needs, and make them "willing to stay". Finally, increase the support for less developed areas, such as payment transfer support, doctors practice, promote the reasonable flow of TCM human resources, in order to change the current situation of less TCM health human resources, weak TCM service ability, narrow the gap between regions, improve the coordination of regional development.

4.3. Equity of Allocation: Better by Economic Distribution Than by Population Distribution Than by Area Distribution

Compared with the Gini coefficient of total health resources in Guizhou, TCM doctors and pharmacists distributed by population have higher fairness, but lower by area, indicating that TCM health resources are more fair by population than by geographical area [14]. Compared with the fairness of traditional Chinese medicine doctors in Guangdong Province, the fairness of distribution by population is lower than that of distribution by area and higher than that of Guangdong Province; According to economic distribution, it is lower than that of Guangdong Province in 2010-2017 and higher than of Guangdong Province in 2018-2019 [15]. However, in 2018, the fairness of the population distribution of TCM institutions, beds and TCM doctors in Guizhou province was lower than the national and western average levels, and the distribution by area was higher than the national and western average levels of [16, 17]. Overall, the fairness analysis result was consistent with other similar studies in China, with the fairness by geographical distribution lower than distribution by population [14], but the higher fairness by economic distribution than distribution by population, and inconsistent with the results of Guangdong Province [15], which may be related to the level of economic development in the two provinces. In addition, the fairness of TCM allocation of

human resources is lower than that of material resources, especially in Qianxinan Prefecture and other regions, indicating that the allocation of TCM human resources is poor. The result is consistent with Dai Guolin's research results on TCM resources in China in 2009-2018 [17]. Therefore, the health administrative department should, according to *the outline of TCM development strategic planning (2016-2030)*, in the allocation of TCM and health resources should combine population, geography and economy, considering the regional service population, service radius, geographical transportation and other factors, attach importance to the accessibility of TCM and health resources, and coordinate regional development. In addition, the growth of the total amount of TCM health resources should be carried out in step with the regional balanced regional development and the balanced development of all kinds of health resources, and the TCM allocation plan should be formulated to take into account efficiency and fairness. Ethnic minority areas should attach importance to the excavation and training of ethnic medical and health personnel, rely on the geographical conditions, economic level, policies and regulations of ethnic minority areas, promote the development of traditional Chinese medicine with ethnic medicine, and optimize the structure of traditional Chinese medicine and health resources in ethnic minority areas.

5. Conclusions

It is found that the overall allocation of TCM and health resources in Guizhou province is increasing, but the total amount is still relatively low. Its fairness shows this characteristics: regional allocation level is not high, unbalanced allocation; by economic distribution is better than by population distribution than by area. Suggest that the administrative department of health give full play to the public functions, considering the influence of population, geographical environment and economic conditions, the scientific health planning, layout of traditional Chinese medicine industry, to build an efficient TCM health resource allocation mechanism and operation security system, better stimulate the TCM health service potential in various region.

The multi-dimensional analysis perspective of this study provides ideas for the equity analysis of relevant resource allocation in other regions. Next, this study will select multiple provinces for a controlled study to compare the differences between different provinces.

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