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ORIGINAL RESEARCH

Equity and Prediction of Bed Allocation of the Department of Stomatology in Chinese Hospitals

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Objective: To analyze the equity of bed allocation of the department of stomatology in Chinese hospitals and predict the development in the next 5 years, so as to provide a scientific basis for promoting the development of oral health.

Methods: Data on the beds of the department of stomatology in Chinese hospitals from 2017 to 2021 were obtained from the China Health Statistical Yearbook. The Gini coefficient, Lorenz curve, Theil index and agglomeration degree were used to analyze the equity of the bed allocation, and the grey prediction model GM(1,1) was used to predict the development from 2022 to 2026.

Results: From 2017 to 2020, the Gini coefficient of bed allocation of the department of stomatology in Chinese hospitals was below 0.2 by population. From 2017 to 2021, the Gini coefficient of beds was above 0.6 by geography and between 0.2 and 0.3 by economy. The Theil index of beds ranged from 0.022 to 0.056 by population, from 0.532 to 0.564 by geography, and from 0.042 to 0.047 by economy. The inequity in the allocation by population was mainly from between regions, and the inequity in the allocation by geography and economy was mainly from within regions. Health resource agglomeration degree (HRAD) was greater than 2 in the eastern and central regions and less than 1 in the western region. HRAD/ population agglomeration degree (PAD) was greater than 1 in the northeast, eastern, and central regions and less than 1 in the western region. According to the prediction, the number of beds of the department of stomatology in Chinese hospitals will continue to increase, reaching 47,862.485 in 2026.

Conclusion: The equity of bed allocation was better by population and economy than by geography. The equity of beds in the western region is insufficient equity by population and geography, and the equity of beds in the eastern region is insufficient equity by economy.

Keywords: department of stomatology, beds, equity, prediction, China

Introduction

Oral health, whole body health, oral health is an important symbol that reflects the physical and mental health of the residents of a country or region.[1] In 2019, the Notice of the General Office of the National Health and Health Commission of China on the Issuance of the Healthy Dental Action Program (2019–2025) (National Health and Health Office Disease Control Letter [2019] No. 118) proposes to take the improvement of the people's oral health level as the foundation, and the improvement of the oral health service system as the support to improve China's oral health level in an all-round way. Oral health resources are a prerequisite for meeting people's growing demand for oral health services. The beds of the department of stomatology in hospitals are an important part of the oral health resources and an important infrastructure for the supply of oral health care services, and their allocation and equity play an important role in the development of the oral health services.[2] Under-allocation of beds leads to over-utilization of beds, which affects the timeliness of patients' access to medical services. Over-allocation of beds leads to unused beds and under-utilization of limited bed resources.[3] To analyze the equity of bed allocation is conducive to the rational use of limited bed resources and to better provide efficient and adequate medical services to the people. In the context of the Healthy Dental Action Program, it is important to analyze the equity of bed allocation of the department of stomatology in Chinese hospitals and predict the development in the next 5 years in order to promote the development of oral health.

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The level of socio-economic development is uneven, and the level of medical development is uneven in China.[4] What is the situation of health resources in China, especially the allocation of bed resources, is a question worth studying. At present, research on bed resource allocation focuses on the following three areas. First, bed resources have been studied separately as a resource for health resource allocation, including disparity in hospital bed allocation at the county level in China,[5] differences in the regional distribution and inequality of beds in China,[6] and a fair bed allocation during COVID-19.[7] Second, research on the correlation between bed resources and health services, including multidrug-resistant organisms may be associated with bed allocation and utilization efficiency in health institutions,[8] and hospital bed supply and inequality related to maternal mortality in China.[9] Third, research on models related to hospital bed allocation, including a data-driven hybrid three-stage framework for hospital bed allocation,[10] and data-driven model for capacity allocation of inpatient bed in a Chinese public hospital.[11] Specifically, the research on the oral health resources and service utilization focuses on the following three areas. First, an analysis of the situation of oral health human resources, including the current status of oral health human resources in northern China and future needs,[12] oral health human resources to meet the oral health needs of 12-year-old children in China,[13] and other contents. Second, oral health status surveys, including oral health and dental status of people with epilepsy in rural China,[14] oral health status and oral health knowledge, attitudes and behaviors among rural children in Shaanxi, western China,[15] and assessment of oral health status and related factors in adolescents aged 12–15 years in the Gansu Province of China,[16] etc. Third, the status of oral health care utilization, including the oral health care utilization patterns among preschool children in Beijing,[17] and factors associated with oral health care utilization among adults and older adults in China,[18] etc. The literature shows that current studies are more in the investigation of the current status of oral health status and less in the allocation of health resources, especially the resources of the bed allocation of the department of stomatology, so there is a need for in-depth analyses of the bed allocation of the department of stomatology in Chinese hospitals.

In the context of the Healthy Dental Action Program, the Gini coefficient, Lorenz curve, Theil index and agglomeration degree were used to analyze the equity of the bed allocation of the department of stomatology in Chinese hospitals from 2017 to 2021, and the grey prediction model GM (1, 1) was used to predict the development of beds from 2022 to 2026, to provide a scientific basis for promoting the development of oral health in China.

Materials and Methods

Data Sources

The data on the beds of the department of stomatology in Chinese hospitals were obtained from the China Health Statistical Yearbook from 2018 to 2022, and the data on population, geographical area, and gross domestic product (GDP) were obtained from the China Statistical Yearbook from 2018 to 2022. The beds of the department of stomatology in Chinese hospitals refer to fixed actual beds, including regular beds, simple beds, and beds undergoing sterilization and repair, and beds out of service due to expansion or major repair.

Region Division

According to the division principles of the revitalisation of the northeast region, the pioneering development of the eastern region, the rise of the central region and the development of the western region, the Chinese mainland (excluding Hong Kong, Macao and Taiwan) was divided into four regions: the northeast region (Heilongjiang, Jilin and Liaoning), the eastern region (Beijing, Tianjin, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong and Hainan), the central region (Shanxi, Henan, Hunan, Hubei, Jiangxi and Anhui), and the western region (Chongqing, Sichuan, Guangxi, Yunnan, Guizhou, Shaanxi, Gansu, Inner Mongolia, Qinghai, Ningxia, Xinjiang and Tibet).

Data Analysis

The Gini coefficient, Lorenz curve, Theil index and agglomeration degree were used to analyze the equity of the bed allocation of the department of stomatology in Chinese hospitals from 2017 to 2021, and the grey prediction model GM (1,1) was used to predict the development of the beds from 2022 to 2026.

The Gini coefficient is widely used to assess the equity of health resource allocation,[19] and the Gini coefficient takes a value between 0 and 1. The smaller the Gini coefficient, the smaller the variability in bed resource allocation, and the

better the equity. Values below 0.2 indicate absolute equity, 0.2 to 0.3 indicate comparative equity, 0.3 to 0.4 indicate relative equity, and 0.6 or more indicate a dangerous state of high inequity.[20] The formula for the Gini coefficient by population allocation is:

$$G = 2 \times \left[0.5 - 1 \div 2 \sum_{i=1}^{n} (X_i - X_{i-1})(Y_i + Y_{i-1}) \right]$$

Where, X_0=0, Y_0=0, n is the number of areas, ordered from smallest to largest according to the average ownership of each provincial administrative region, X_i is the cumulative percentage of population, and Y_i is the cumulative percentage of beds. The Gini coefficient by geography and by economic allocation was calculated by replacing the number of population with geographic area and GDP.

The Lorenz curve is the beds ordered from smallest to largest according to the average ownership of each provincial administrative region, with the cumulative percentage of population (geographical area, GDP) as the horizontal coordinate and the cumulative percentage of beds as the vertical coordinate, and the points are connected to obtain the Lorenz curve. The further the Lorenz curve is from the equity line, the lower the equity.[21]

The Theil index can measure overall inequality, as well as differences within and between regions and the extent to which they contribute to overall inequality, with the higher its value indicating worse equity and the lower its value indicating better equity.[22] The formula is:

$$T = \sum_{i=1}^{n} P_i \log \frac{P_i}{Y_i}$$

Where, n is the number of areas, P_i is the number of people (geographic area, GDP) in the i^{th} area as a proportion of the total population (geographic area, GDP), and Y_i is the number of beds in the i^{th} area as a proportion of the total number of beds.

Agglomeration degree is used to measure the degree of concentration of a factor of production in a lower unit relative to that in a higher unit, and has a wide range of applications in the health sector.[23] Health resource agglomeration degree (HRAD), population agglomeration degree (PAD), and economic agglomeration degree (EAD) are commonly used to measure equity in the allocation of health resources.[24] The evaluation standard is HRAD greater than 1 indicates better equity of beds by geographic allocation. HRAD/PAD (HRAD/EAD) greater than 1 indicates better equity of beds in relation to the agglomeration population (economy). The formula is:

$$HRAD_i = \frac{\left(\frac{HR_i}{HR_n}\right) \times 100\%}{\left(\frac{A_i}{A_n}\right) \times 100\%}$$

Where, HRi is the number of beds in area i, HRn is the total number of beds, Ai is the land area in area i, and An is the total land area. The population (economic) agglomeration degree is calculated by replacing the number of beds by the number of population (economic).

The grey prediction model GM(1,1) has the characteristics of small amount of sample data, high prediction accuracy, and can be used for long-term prediction, etc., and has been widely used in the field of medicine and health in recent years.[25] The GM(1,1) model is constructed by accumulating the raw data series, constructing the accumulation matrix and the constant vector, then solving the grey parameters a and u by the least squares method, and finally establishing the time response equations, which are the specific calculation formulas of the GM(1,1) model (k is the time series). The formula is:

$$\hat{X}^{(1)}(k+1)(X^{(0)}(1)\frac{u}{a})e^{-ak} + \frac{u}{a}$$

The posterior error ratio (C value) and the probability of small error (P value) are used to test the accuracy of the prediction model, when $P \geq 0.95$ and $C \leq 0.35$ indicates that the model accuracy level is 1, when $0.35 < C \leq 0.50$ and $0.80 \leq P < 0.95$ indicates that the model accuracy level is 2, when the model accuracy level is 1 or 2, it means that the prediction model is reliable and can be used for prediction.

Results

Basic Information of Beds of the Department of Stomatology in Chinese Hospitals

The number of beds of the departments of stomatology in Chinese hospitals has increased from 32,277 in 2017 to 38,604 in 2021, and the number of beds per 1000 populations has increased from 0.023 2 in 2017 to 0.028 6 in 2021. In absolute terms, the eastern region has the highest number of beds, followed by the central region, the western region is third, and the northeast region has the lowest. In terms of the number of beds per 1000 populations, the eastern and northeast regions are relatively better off, while the western region is relatively worse off (Table 1).

Gini Coefficient of Beds of the Department of Stomatology in Chinese Hospitals

In 2017–2020, the Gini coefficient of beds of the department of stomatology in Chinese hospitals by population was below 0.2, in a state of absolute equity. In 2017–2021, the Gini coefficient of beds by geographical area was above 0.6, in a state of high inequity. In 2017 −2021, the Gini coefficient of beds by economy was between 0.2 and 0.3, in a state of relative equity. The equity of the beds shows that the allocation by population is better than the allocation by economic, and the allocation by economic is better than the allocation by geographic (Table 2).

Lorenz Curves of Beds of the Department of Stomatology in Chinese Hospitals

The Lorenz curves of beds of the department of stomatology in Chinese hospitals in 2017 and 2021 show that the Lorenz curve by geographic allocation is farthest from the equity line, while the Lorenz curve by population and economic allocation is closer to the equity line, indicating that equity by population and economic allocation is better than equity by geographic allocation (Figure 1).

Theil Index of Beds of the Department of Stomatology in Chinese Hospitals

In 2017–2021, the Theil index of beds of the department of stomatology in Chinese hospitals ranged from 0.022 to 0.056 by population allocation, from 0.532 to 0.564 by geographic allocation, and from 0.042 to 0.047 by economic allocation, with better equity by population and economic allocation than by geographic allocation. The values of the Theil index by population are smaller within regions than between regions, indicating that the inequity of the allocation by population comes

Table 1 Basic Information of Beds of the Department of Stomatology in Chinese Hospitals

Year	The Number of Beds					The Number of Beds Per 1000 Populations				
	Northeast Region	Eastern Region	Central Region	Western Region	Chinese Hospitals	Northeast Region	Eastern Region	Central Region	Western Region	Chinese Hospitals
2017	3143	12,946	8890	7298	32,277	0.028 9	0.024 3	0.024 1	0.019 4	0.023 2
2018	3247	13,729	9198	7737	33,911	0.030 0	0.025 5	0.024 8	0.020 4	0.024 3
2019	3176	14,764	9801	7737	35,478	0.029 4	0.027 5	0.026 3	0.020 4	0.025 4
2020	3184	15,616	10,405	7774	36,979	0.032 3	0.027 7	0.028 5	0.020 3	0.026 2
2021	3149	16,749	10,513	8193	38,604	0.032 4	0.033 0	0.028 8	0.021 4	0.028 6

Table 2 Gini Coefficient of Beds of the Department of Stomatology in Chinese Hospitals

Year	By Population	By Geography	By Economy
2017	0.182	0.673	0.243
2018	0.175	0.673	0.236
2019	0.176	0.683	0.240
2020	0.197	0.689	0.250
2021	0.243	0.692	0.244

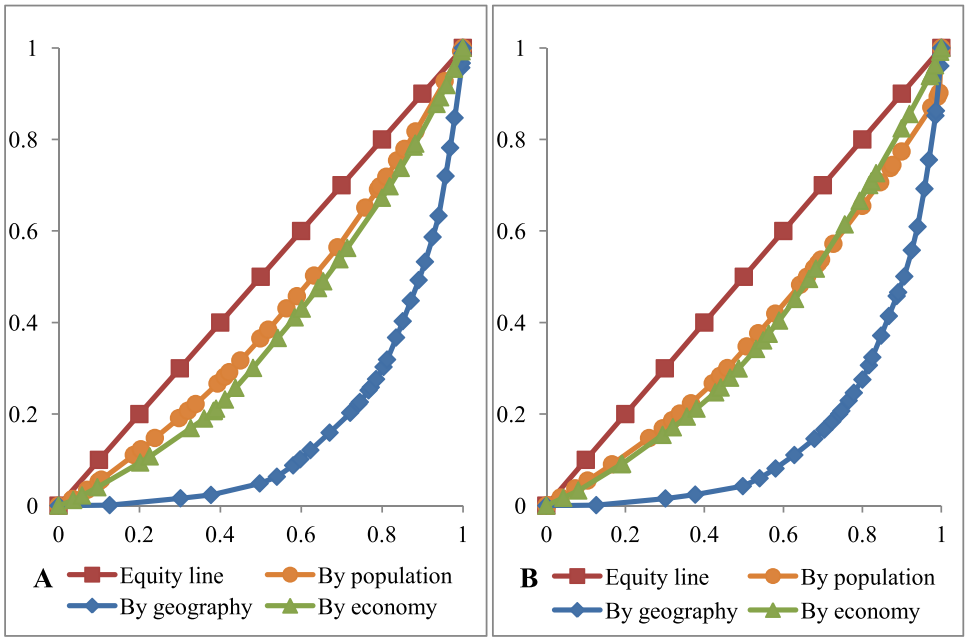

Figure 1 Lorentz curves of beds of the department of stomatology in Chinese hospitals in 2017 (**A**) and 2021 (**B**).

mainly from between regions. The values of the Theil index by geography and economy are larger within regions than between regions, indicating that the inequities by geography and economy come mainly from within regions (Table 3).

Theil Index Contribution Rate of Beds of the Department of Stomatology in Chinese Hospitals

In 2017–2021, the Theil index contribution rate of between regions by population allocation exceeded 65%, indicating that the inequity by population allocation mainly comes from between regions. The Theil index contribution rate of within regions by geographic and economic allocation exceeded 72%, indicating that the inequity by geographic and economic allocation mainly comes from within regions (Figure 2).

Agglomeration Degree of Beds of the Department of Stomatology in Chinese Hospitals

From the perspective of PAD, the PAD of the eastern and central regions is greater than 2, and that of the northeast and western regions is less than 1, indicating that the population is mainly concentrated in the eastern and central regions, and that the population of the northeast and western regions is relatively small. From the perspective of EAD, the EAD of the eastern region is greater than 5, and that of the northeast and western regions is less than 1, indicating that the economy of the eastern region is

Table 3 Theil Index of Beds of the Department of Stomatology in Chinese Hospitals

Year	By Population			By Geography			By Economy		
	Theil Index	Within Region	Between Region	Theil Index	Within Region	Between Region	Theil Index	Within Region	Between Region
2017	0.024	0.008	0.016	0.540	0.439	0.101	0.044	0.038	0.006
2018	0.022	0.007	0.015	0.532	0.433	0.099	0.042	0.036	0.006
2019	0.023	0.007	0.016	0.555	0.449	0.106	0.042	0.033	0.009
2020	0.028	0.009	0.019	0.554	0.448	0.106	0.047	0.034	0.013
2021	0.056	0.018	0.038	0.564	0.453	0.111	0.043	0.031	0.012

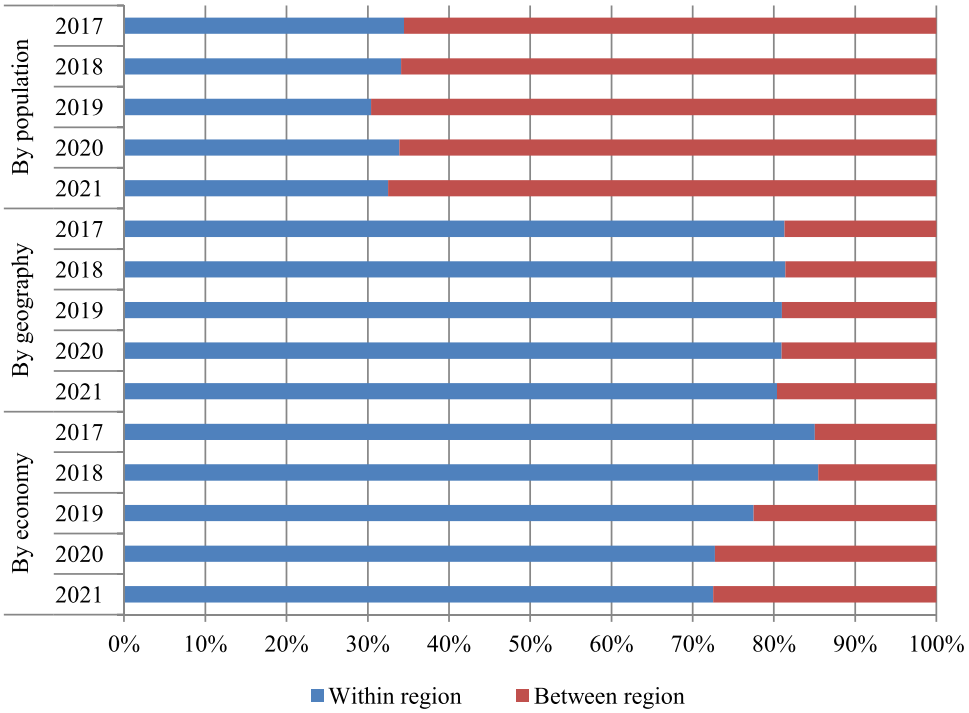

Figure 2 Theil index Contribution rate of beds of the department of stomatology in Chinese hospitals.

more developed, and that the economy of the northeast and western regions is relatively backward. From the perspective of HRAD, the HRAD of the eastern and central regions is greater than 2, and that of the western region is less than 1, indicating that the beds of the department of stomatology in Chinese hospitals are mainly concentrated in the eastern and central regions, and relatively fewer in the western region. From the perspective of HRAD/PAD, the HRAD/PAD of the northeast, eastern, and central regions was greater than 1, indicating better equity of allocation by population; the HRAD/PAD of the western region was less than 1, indicating insufficient equity of allocation by population. In terms of HRAD/EAD, the HRAD/EAD of the northeast, central, and western regions was greater than 1, indicating better equity of allocation by economy; the HRAD/EAD of the eastern region was less than 1, indicating insufficient equity of allocation by economy (Table 4).

Prediction Model and Test results of Beds of the Department of Stomatology in Chinese Hospitals

The data of the beds of the department of stomatology in Chinese hospitals in 2017–2021 were used as the original data series, the prediction model was established according to the calculation steps of the grey prediction model GM (1, 1), and the accuracy of the prediction model was examined by using the posteriori error ratio (C-value) and the probability of small error (P-value). The results showed that the prediction models for Chinese hospitals, the eastern region, the central region, and the western region had a P greater than 0.95, a C less than 0.35, and an accuracy level of 1, indicating that the fitting effect of the model was good. The prediction model for the northeast region has a P of 0.800, a C of less than 0.35, and an accuracy level of 2, indicating that the fitting effect of the model is qualified. Based on the requirements of the model's accuracy level, the model can be used for extrapolated prediction (Table 5).

Prediction Results of Beds of the Department of Stomatology in Chinese Hospitals, 2022–2026

According to the prediction, the trend of change between the predicted value and the actual value of beds of the department of stomatology in Chinese hospitals from 2017 to 2021 is consistent, with a relative error within 2.044%, indicating that the prediction has good reasonableness. From 2022 to 2026, the number of beds of the department of

Table 4 Agglomeration Degree of Beds of the Department of Stomatology in Chinese Hospitals

Year	Region	HRAD	PAD	EAD	HRAD/PAD	HRAD/EAD
2017	Northeast region	1.169	0.940	0.769	1.243	1.520
	Eastern region	4.085	3.915	5.384	1.043	0.759
	Central region	2.550	2.460	1.929	1.036	1.322
	Western region	0.318	0.382	0.280	0.833	1.136
2018	Northeast region	1.150	0.932	0.745	1.234	1.543
	Eastern region	4.123	3.920	5.356	1.052	0.770
	Central region	2.511	2.460	1.950	1.021	1.288
	Western region	0.321	0.383	0.284	0.839	1.132
2019	Northeast region	1.075	0.927	0.646	1.159	1.664
	Eastern region	4.238	3.917	5.243	1.082	0.808
	Central region	2.557	2.467	2.167	1.037	1.180
	Western region	0.307	0.382	0.278	0.803	1.106
2020	Northeast region	1.034	0.839	0.606	1.232	1.705
	Eastern region	4.301	4.073	5.289	1.056	0.813
	Central region	2.605	2.395	2.032	1.088	1.282
	Western region	0.296	0.382	0.297	0.774	0.998
2021	Northeast region	0.979	0.864	0.588	1.133	1.666
	Eastern region	4.419	3.821	5.301	1.156	0.834
	Central region	2.521	2.496	2.035	1.010	1.239
	Western region	0.299	0.399	0.297	0.749	1.007

Table 5 Prediction Model and Test Results of Beds of the Department of Stomatology in Chinese Hospitals

Region	Parameter Value	Prediction Model	P	C	Accuracy Level
Chinese hospitals	a=−0.043, u=31,823.406	$772\ 356.209e^{^{\circ}043k}$-31,823.406	1.000	0.000	Level 1 (good)
Northeast region	a=0.009, u=3274.901	$-360\ 734.889e^{-0.009k}$-3274.901	0.800	0.155	Level 2 (qualified)
Eastern region	a=−0.065, u=12,468.095	$204\ 762.846e^{^{\circ}065k}$-12,468.095	1.000	0.001	Level 1 (good)
Central region	a=−0.045, u=8703.410	$202\ 299.111e^{^{\circ}045k}$-8703.410	1.000	0.041	Level 1 (good)
Western region	a=−0.018, u=7447.575	$421\ 052.167e^{^{\circ}018k}$-7447.575	1.000	0.122	Level 1 (good)

stomatology in Chinese hospitals will continue to increase, and it will reach 47,862.485 in 2026. According to the prediction, the number of beds of the department of stomatology in Chinese hospitals in the eastern, central and western regions will continue to increase, reaching 23,170.089, 13,360.827 and 8837.550 respectively in 2026. According to the prediction, the number of beds of the department of stomatology in Chinese hospitals in the northeast region will show a decreasing trend, reaching 3007.847 in 2026 (Table 6).

Discussion

The Gini coefficient, the Lorenz curve, and the Theil index all show that the equity of beds of the department of stomatology in Chinese hospitals by population and economy is better than that by geography, indicating that the equity by geography is worse.[26] We believe that there are two reasons for this. First, the allocation of health resources has long been based on the number of population per 1000, which ignores the impact of geographical factors on the allocation of health resources. Geography is an important factor affecting the accessibility of health services to the population, and some residents of remote areas have difficulty in accessing health services due to long distances, thus reducing the equity of health services for the local population.[27] Second, the construction of beds mainly depends on the input of the administration, and the regional economy is the basis for the input of the administration. In theory, the more economically developed a region is, the more it can invest in health services. Regions with a higher level of economic development have a more complete allocation of beds, while regions with a lower level of economic development have a relative

Table 6 Prediction Results of Beds of the Department of Stomatology in Chinese Hospitals, 2022–2026

Year	Chinese Hospitals		Northeast Region		Eastern Region		Central Region		Western Region	
	Predictive Value	Relative Error (%)	Predictive Value	Relative Error (%)	Predictive Value	Relative Error (%)	Predictive Value	Relative Error (%)	Predictive Value	Relative Error (%)
2017	32,277.000	0.000	3143.000	0.000	12,946.000	0.000	8890.000	0.000	7298.000	0.000
2018	33,934.989	0.071	3232.102	0.459	13,755.322	0.192	9312.977	1.250	7648.297	1.146
2019	35,425.514	0.148	3203.181	0.856	14,681.752	0.557	9742.752	0.594	7787.726	0.656
2020	36,981.506	0.007	3174.518	0.298	15,670.578	0.349	10,192.359	2.044	7929.696	2.003
2021	38,605.843	0.005	3146.112	0.092	16,726.001	0.137	10,662.716	1.424	8074.254	1.449
2022	40,301.525	—	3117.959	—	17,852.508	—	11,154.778	—	8221.448	—
2023	42,071.686	—	3090.059	—	19,054.886	—	11,669.548	—	8371.325	—
2024	43,919.598	—	3062.409	—	20,338.245	—	12,208.073	—	8523.934	—
2025	45,848.676	—	3035.005	—	21,708.039	—	12,771.451	—	8679.326	—
2026	47,862.485	—	3007.847	—	23,170.089	—	13,360.827	—	8837.550	—

shortage of beds.[28] Therefore, administrative departments should consider population, geographical and economic factors when planning the construction of beds of the department of stomatology in Chinese hospitals, so as to improve the coverage of oral health services.[29] At the same time, it is also necessary to pay attention to the situation of oral health services in remote and backward areas, and to raise the level of oral health services for all through measures such as promoting appropriate dental technology and supporting dental health personnel.[30]

In terms of the Theil index contribution rate, inequality by population allocation comes mainly from between regions, while inequality by geographic and economic allocation comes mainly from within regions. China's population is concentrated in the eastern and central regions, while the western region is relatively sparsely populated, and the difference in population level between regions is the main source of inequality by population.[31] There are more beds of the department of stomatology in densely populated areas and fewer beds of the department of stomatology in sparsely populated areas, and this difference is particularly pronounced between the eastern and western regions, resulting in inequity between regions.[32] Therefore, from the population point of view, the allocation of beds of the department of stomatology should focus on equity between regions, and the western regions should be strongly supported to improve the allocation of beds of the department of stomatology. In terms of geography and economy, inequity comes mainly from within regions, indicating that differences between provincial administrations within regions are the main reason for the impact of equity. There are large differences in the allocation of beds of the department of stomatology in different areas within the same region.[33] For example, in the western region, the number of beds of the department of stomatology per 10,000 square kilometers in Chongqing is 82.17 in 2021, while it is only 0.35 in Tibet, and this large difference leads to inequity within regions. Therefore, from the geographical and economic point of view, regions should actively develop their specialty economy, so as to promote the development of oral health services through economic development. At the same time, it is also necessary to focus on coordinating the distribution of bed resources within regions in order to maximize the coverage of the population.[34]

In terms of agglomeration degree, the equity of bed of the department of stomatology by population and geographical allocation is insufficient in the western region, and by economic allocation in the eastern region, indicating that there is some room for improvement in the allocation of beds of the department of stomatology.[35] In the western region, due to the long-term underinvestment and late development of the health services, the overall socio-economic level is poor, and the financial base that can be invested in the development of the health services is weak, the growth of bed resources is mainly in the general hospitals and traditional Chinese medicine hospitals, and although the growth of beds of the department of stomatology has been promoted by the policy inclination of the administrative departments, the number of beds allocated by population is still insufficient.[36] The western region is sparsely populated, the cost of oral health services is high, and the remote location and service radius make it difficult for many patients to conveniently access oral health services. In addition, there is no urgent need to increase the number of beds and other resources when there is a shortage of dental health care personnel, which leads to inequity by geographical allocation of the beds of the department of stomatology in the western region. Therefore, it is necessary to further increase the financial investment in the western region and to further improve the construction of beds of the department of stomatology. At the same time, it is important to strengthen the training of community health workers in oral health skills and to reduce the distance that residents have to travel to access oral health services.[37] In the eastern region, the level of socioeconomic development is higher, and the number of beds in the department of stomatology is insufficient in relation to the level of economic development. The eastern region is densely populated, has a higher level of socio-economic development, and the people are more aware of oral health services and also have a better ability to pay,[38] with a greater demand for oral health services.[39] Therefore, it is necessary to strengthen the bed allocation of the department of stomatology in the eastern region based on the population and the level of economic development, and to introduce dental health personnel to meet the growing demand for oral health services by the people.

According to the prediction, the number of beds of the department of stomatology continues to increase, and the beds of the department of stomatology in the northeast region show a decreasing trend, indicating that it is important to pay attention to the development of beds of the department of stomatology in the northeast region. With the development of China's economy and the growth of people's awareness of oral health services, the demand for oral health services has continued to increase, which has further contributed to the growth of beds of the department of stomatology.[40] It is worth noting that there is a decreasing trend in the northeast region, and we believe that there are two reasons for this. First, the economic transformation in the northeast region is difficult, the "revitalization of the northeast" policy has not achieved

significant results, the pressure of the economic downturn has led to insufficient investment in the development of health services, the growth of beds of the department of stomatology is weak. Second, the population loss in the northeast region is serious, health resources allocation by population as a standard does not have the demand for growth, the people's needs are not much, which led to a trend of reducing the number of beds of the department of stomatology. Therefore, the northeast region should rationally plan for the development of oral health resources based on population and economic development.

Limitations

Although we used the Gini coefficient, Lorenz curve, Theil index and agglomeration degree to analyze the equity of the beds allocation of the department of stomatology in Chinese hospitals from 2017 to 2021, and the grey prediction model GM (1, 1) to predict the development of the beds in the next 5 years, this study still has some limitations. First, we evaluated the equity of the bed allocation of the department of stomatology in Chinese hospitals based on health resource equity studies, which is a commonly used equity method in similar studies. Second, this study was based on the fact that beds are an important infrastructure for the provision of oral health services, and did not include the most dynamic dental human resources in oral health services. Third, although we have pointed out the lack of equity of beds in the western region and the predicted decreasing trend of beds in the northeast region, there are a variety of factors that influence the allocation of health resources, but this study did not consider the actual demand for oral health services.

Conclusion

In the context of the Healthy Dental Action Program, it is important to analyze the equity of bed allocation of the department of stomatology in Chinese hospitals and to predict its development in the next five years, in order to promote the development of oral health services. The main findings and suggestions of this study are as follows. The Gini coefficients of beds of the department of stomatology in Chinese hospitals by population and economy were less than 0.3, and that by geography was more than 0.6. The Lorenz curve by geographical allocation was farthest from the equity line, and that by population and economic allocation was closer to the equity line. The equity of beds by population and economy is better than the equity by geography. In terms of the Theil index contribution rate, the inequity in allocation by population mainly comes from between regions, and the inequity in allocation by geography and economy mainly comes from within regions. In terms of the agglomeration degree, the inequity in the allocation by population and geography was insufficient in the western region, and the inequity in the allocation by economy was insufficient in the eastern region. According to the prediction, the bed allocation of the department of stomatology in Chinese hospitals will continue to increase, while the trend in the northeast region is decreasing. Therefore, administrative departments should consider population, geographical and economic factors when planning the construction of beds of the department of stomatology, so as to improve the coverage of oral health services. At the same time, it is also necessary to raise the level of oral health services for all through measures such as promoting appropriate dental technology and supporting dental health personnel.

Data Sharing Statement

The data for this study are available at China Health Statistics Yearbook (http://www.nhc.gov.cn). The specific situation has been explained in the text.

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Disclosure

The author declares that they have no competing interests in this work.

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