Fairness and Forecast Analysis of Health Human Resource Allocation in Taiwan

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Abstract. This study provides a descriptive statistical analysis and predictive analysis using the grey model GM (1,1) to examine Taiwan's current healthcare human resources status. The following discussion results were obtained: Taiwan has achieved specific accomplishments in terms of human healthcare resources, with a relatively large overall quantity and high growth rate. However, there are still issues of the unreasonable county and regional distribution of healthcare human resources in Taiwan, indicating a need for further optimization. It is projected that healthcare human resources in Taiwan will continue to increase with a more rational structure. The predictive analysis shows that both mainland China and Taiwan will experience a further increase in the supply of human healthcare resources. However, compared with mainland China, Taiwan still maintains a higher healthcare human resource supply level. The findings of this study are of great significance for understanding the current status and future development trends of human healthcare resources in Taiwan and provide a reference for the rational allocation of human healthcare resources in mainland China.

Keywords: Taiwan, Health human resources, Current situation, Forecast.

1 Introduction

Healthcare human resources are an essential component of a country or region's healthcare system and are the most dynamic factor in the healthcare sector. In the field of healthcare, the allocation of human resources is one of the critical elements for achieving sustainable development and providing quality medical services[1]. The rational allocation of human healthcare resources is essential to implementing relevant national policies, ensuring harmonious social development, and guaranteeing essential medical services for the population. After the reform and opening-up in mainland

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China, the medical and healthcare system reform promoted the rapid growth of human healthcare resources and achieved good results[2-3]. However, the current supply of healthcare human resources in mainland China still needs to meet the healthcare service demands of the population[4-6]. In comparison, Taiwan has emphasized and cultivated human healthcare resources earlier, resulting in an adequate supply of human resources and a relatively rational structure.

Given the current global health challenges and ever-changing population demographics, research on healthcare human resources has become critically important. By comprehensively collecting and analyzing healthcare human resource data in Taiwan, we can gain a comprehensive understanding of the quantity, distribution, training, and demand for healthcare professionals. Additionally, we will use predictive models and trend analysis methods to forecast healthcare human resources' future demand and supply. This study will provide important references for mainland China in managing and developing human healthcare resources. It is essential for optimizing the allocation and distribution of healthcare human resources and improving the quality and efficiency of medical services.

2 Review of the Literature

2.1 Relevant International Studies on Human Resources for Health

International research on healthcare resource allocation encompasses three aspects: resource assessment, allocation, and optimization. These studies employ various methods and models to assess the demand and supply of healthcare resources, explore the equitable distribution and optimized allocation of healthcare resources, and enhance the coverage and quality of healthcare services. However, further research is still needed to address the ever-changing healthcare needs and resource challenges and to drive continuous improvement in healthcare resource allocation.

Resource assessment studies: Among the studies in health resource assessment, Okoroafor et al.[7] the Workload Indicator, Staffing Needs Method, was applied to quantify frontline health human resource needs[8]. Whyle and Olivier, who proposed a scoring system for resource scarcity and risk during the COVID-19 pandemic, aimed to ensure efficient and ethical allocation of health resources with limited resources[9]. explored the importance of social values for health policy making and system design through a mixed methods review and evidence mapping. These studies offer different perspectives and approaches to health resource assessment and provide valuable insights into relevant decision-making and policy development.

Resource allocation research: Resource allocation is the key to achieving equitable distribution of health resources. Ordu et al.[10] proposed an innovative decision support tool for health resource allocation that provides an effective aid to decision-makers through prediction, simulation, and optimization methods.Rodrigues et al.[11] worked on improving triage systems for more equitable, safe, and efficient resource allocation.Wakida et al.[12] on the other hand, focused on the challenges of integrating mental health services into primary care in rural Uganda, exploring primary care providers' perspectives. In addition, Lu et al.[13] 's study focused on the impact of referral reform

on healthcare resources in Beijing, China, and aimed to analyze the impact of the reform on resource equity and spatial accessibility. These studies provide insights and methods for improving health resource allocation and guide the development of more effective policies and strategies.

Resource optimization studies: Resource optimization aims to achieve optimal utilization and allocation of health resources. Shen and Sun[14] focused on China's Yangtze River Delta region. They provided evidence on health resource allocation in the region by estimating the spatial correlation and convergence of health resources. Tolerable et al.[15] identified the main challenges faced and proposed potential solutions for African healthcare systems. Kang et al.[16] quickly measured the spatial accessibility of COVID-19 healthcare resources using Illinois, USA, as a case study. Scott et al.[17] 's study discusses the problem of resource allocation and rationing in nursing care. In addition, Wang[18] study highlights the importance of geographic information systems (GIS) in public Health. These studies provide valuable insights and methods for health resource allocation and promote a deeper understanding of allocation and optimization.

2.2 Relevant Studies on Human Resources for Health in Taiwan

The study of health resource allocation in Taiwan focuses on regional differences and inequalities, health resource assessment and efficiency, and policy and practice experiences.

Regional differences and inequalities studies: In the study of health resource allocation in Taiwan, scholars have extensively explored regional differences and inequalities, including studies of Taiwan's dentist resources[19] , community nursing resources[20] , Taiwan's aboriginal health resources[12] and the lack of accessibility, and also explored studies related to social determinants and health inequalities[21-25]. These studies have contributed to developing targeted policies. These studies provide essential references for developing targeted policies and measures to address regional disparities and inequalities in the allocation of health resources in Taiwan.

Health resource assessment and efficiency studies: Health resource allocation studies in Taiwan also focused on health resource assessment and efficiency issues. By applying dynamic network data envelopment analysis methods, these studies assessed the efficiency of hospital and pharmacy utilization in Taiwan. They conducted empirical studies on the effectiveness of healthcare services in various counties and cities in Taiwan[26-27]. These studies aimed to optimize health resource allocation and improve the quality of healthcare services.

Policy and Practice Experience: In studying health resource allocation in Taiwan, scholars also summarized the policy development and practice experience. Researchers have reviewed the development and implementation of relevant policies and evaluated their effects. Examples include exploring the policy transformation of the long-term care system[28], the establishment and future development of Taiwan's National Health Insurance Research Database[29], and Taiwan's government initiatives and cooperative governance experiences in response to COVID-19.[30] . These findings have important implications for improving health resource allocation policies, optimizing resource allocation practices, and improving the efficiency and quality of health services.

3 Data and Methods

3.1 Data Sources

The data primarily originated from the "Annual Report" of the "Executive Yuan" of Taiwan in 2021. This report obtained data on various healthcare human resources in Taiwan from 2007 to 2021 and statistical data on healthcare human resources in various cities (counties) of Taiwan in 2021. Some data were sourced from the "China Health and Health Statistics Yearbook" in 2022, which provided relevant healthcare human resources data for mainland China from 2007 to 2021.

3.2 Research Methodology

The grey model GM (1,1) is a predictive model proposed by Chinese scholar Professor Ju-Long Deng in the early 1980s. It has been widely applied in fields such as agriculture and socioeconomics and has achieved significant accomplishments. The GM (1,1) model is the fundamental model in grey system prediction, and it predicts the magnitude of time series data. It is characterized by simple calculations, good predictive accuracy, and the flexibility of not strictly requiring sample size and probability distribution. The basic steps for establishing the GM (1,1) model are as follows:

In the first step, the data sequence is generated by accumulating the data once to obtain . where where

In the second step, construct the cumulant matrix with the constant term vector that is:

$$\mathrm{B} = \begin{bmatrix} -\frac{1}{2}(\chi^{(1)}(1) + \chi^{(1)}(2)) & 1 \\ \vdots & \vdots \\ -\frac{1}{2}(\chi^{(1)}(N-1) + \chi^{(1)}(N)) & 1 \end{bmatrix} \tag{1}$$

$$Y_N = [\chi_1{}^{(0)}(2), \chi_1{}^{(0)}(3), \cdots, \chi_1{}^{(0)}(N)]^T \tag{2}$$

In the third step, the least squares method $\widehat{\ }$ solves the gray parameter.

$$\hat{a} = \begin{bmatrix} a \\ u \end{bmatrix} = (B^T B)^{-1} B^T Y_N \tag{3}$$

In the fourth step, the gray parameter is substituted into the time function:

$$\hat{\chi}^{(1)}(t+1) = \left(\chi^{(0)}(1) - \frac{u}{a}\right) e^{-at} + \frac{u}{a} \tag{4}$$

In the fifth step, the$\hat{\mathrm{X}}^{(1)}$ The derivative reduction yields:

$$\hat{\chi}^{(0)}(t+1) = -a\left(\chi^{(0)}(1) - \frac{u}{a}\right) e^{-at} \tag{5}$$

Step 6, calculate$\chi^{(0)}(t)$ and$\hat{\chi}^{(0)}(t)$ the difference between$\varepsilon^{(0)}(t)$ and the relative error$e(t)$ and

Step 7, model diagnosis and application of the model for prediction.

4 Results and Analysis

4.1 Basic Situation of Health Human Resources Allocation in Taiwan

As of the end of 2021, the total population of Taiwan was 23,375,314, with a total of 347,555 healthcare technical personnel. Among them, Western medical doctors, traditional Chinese medicine practitioners, dentists, pharmacists, pharmaceutical technicians, laboratory technicians, and nursing professionals accounted for 15.012%, 2.149%, 4.529%, 10.351%, 2.975%, and 52.726% of the total healthcare technical personnel, respectively.

From 2007 to 2021, the annual growth rates per 10,000 people for healthcare technical personnel, Western medical doctors, traditional Chinese medicine practitioners, dentists, pharmacists, pharmaceutical technicians, laboratory technicians, and nursing professionals in Taiwan were 3.930%, 2.863%, 3.390%, 2.930%, 1.735%, 2.191%, and 3.874%, respectively (Table 1). These growth rates were higher than the population growth rate of 0.24%.

Table 1. Health technicians of all types per 10,000 people in Taiwan, 2007-2021 (unit/person)

Year	Health technicians	Dr. West	Chinese Medicine Physician	Dentist	Pharmacists and Pharmacy Technicians	Laboratory Technician	Nurses and Nurse Practitioners
2007	93.538	15.615	2.118	4.678	12.213	3.329	49.582
2008	97.071	16.123	2.219	4.815	12.476	3.428	51.563
2009	101.019	16.384	2.288	4.910	12.797	3.548	54.101
2010	104.117	16.789	2.312	5.032	12.953	3.617	55.675
2011	107.754	17.224	2.398	5.163	13.477	3.694	57.411
2012	110.776	17.558	2.462	5.314	13.731	3.753	59.033
2013	113.701	17.954	2.557	5.474	13.977	3.853	60.288
2014	115.882	18.333	2.627	5.624	14.151	3.897	60.898
2015	119.405	18.732	2.681	5.747	14.267	3.942	63.095
2016	122.845	19.052	2.736	5.910	14.405	3.993	65.212
2017	127.181	19.666	2.839	6.101	14.648	4.056	67.719
2018	132.641	20.124	2.917	6.239	14.769	4.111	71.136
2019	138.410	20.990	3.006	6.409	14.962	4.211	73.281
2020	143.431	21.665	3.099	6.548	15.166	4.320	75.759
2021	148.685	22.321	3.195	6.734	15.391	4.423	78.396

Note: Health technicians in Taiwan include: Western medicine physicians, Chinese medicine physicians, dentists, pharmacists, pharmacy technicians, medical examiners (students), medical radiologists (nurses), nurses, midwives (nurses), dental veneers (students), dietitians, physical therapists (students), functional therapists (students), clinical psychologists, consultative psychologists, respiratory therapists, speech therapists, audiologists and dental technicians (students).

The allocation of healthcare resources in the counties of Taiwan is deemed unreasonable. Overall, in 2021, Taiwan's healthcare human resources distribution was relatively uneven. Nine cities, including New Taipei, Taipei, and Taoyuan, concentrated a significant number of human healthcare resources, with the overall number of various

personnel per 10,000 people in these cities being higher than that in the thirteen counties (Table 2).

Table 2. Health technicians of all types per 10,000 people by city (county) in Taiwan, 2021 (units/people)

Region	Health technicians	Dr. West	Chinese Medicine Physician	Dentist	Pharmacists and Pharmacy Technicians	Laboratory Technician	Caregivers and Nurses
New Taipei City	106.230	15.696	2.724	6.881	12.896	2.323	51.426
Taipei City	247.608	45.199	4.262	13.536	23.000	9.444	121.364
Taoyuan City	131.672	19.499	2.535	5.941	12.568	3.283	72.417
Taichung City	164.362	24.386	5.221	7.229	17.260	5.008	83.921
Tainan City	155.140	21.374	3.206	6.235	16.476	4.495	85.346
Kaohsiung City	165.418	26.083	3.315	7.057	17.594	4.744	87.981
Yilan County	143.735	15.909	1.908	4.415	11.848	3.572	88.531
Hsinchu County	109.229	12.335	1.842	4.952	11.710	3.579	59.835
Miaoli County	97.347	10.944	2.063	3.679	11.074	2.806	53.328
Changhua County	129.273	17.493	3.210	4.947	13.909	3.808	69.974
Nantou County	113.509	13.735	2.990	3.300	13.838	3.114	61.168
Yunlin County	107.994	13.550	2.432	2.701	13.147	3.417	61.451
Jiayi County	118.078	18.143	1.682	2.108	11.676	3.203	71.090
Pingtung County	125.267	14.793	1.989	3.120	13.699	3.319	75.941
Taitung County	131.967	15.371	2.484	3.234	11.153	3.890	79.808
Hualien County	197.163	28.380	3.236	4.574	14.190	6.037	116.848
Penghu County	82.095	11.943	0.470	3.479	7.147	3.197	42.223
Keelung City	122.288	21.595	2.116	5.522	12.583	3.077	63.878
Hsinchu City	155.642	21.231	2.983	8.042	14.736	5.435	81.235
Chiayi City	260.721	35.848	4.155	9.028	25.007	8.726	144.413

Kinmen County	41.685	6.429	0.495	1.342	3.179	1.625	22.255
Lianjiang County	94.540	13.192	0.000	6.596	8.062	5.130	45.438

The allocation of regional health resources in Taiwan needs to be more balanced. The Executive Yuan of Taiwan has divided Taiwan into four regions: Northern Taiwan (New Taipei City, Taipei City, Taoyuan City, Keelung City, Hsinchu City, Hsinchu County, Yilan County, Kinmen County, and Lienchiang County), Central Taiwan (Taichung City, Miaoli County, Changhua County, Nantou County, Chiayi County, and Yunlin County), Eastern Taiwan (Taitung County, Hualien County), and Southern Taiwan (Tainan City, Kaohsiung City, Chiayi City, Penghu County, and Pingtung County). Regionally, Eastern and Southern Taiwan had more health technicians, Western medicine practitioners, examiners, nurses, and nurses per 10,000 people than Northern and Central Taiwan; Central Taiwan had the highest number of Chinese medicine practitioners per 10,000 people, and Northern Taiwan had the highest number of dentists per 10,000 people (Table 3).

Table 3. Regional health technicians of all types per 10,000 people in Taiwan in 2021 (unit/person)

Region	Health technicians	Dr. West	Chinese Medicine Physician	Dentist	Pharmacists and Pharmacy Technicians	Laboratory Technician	Nurses and Nurse Practitioners
Average	148.685	22.321	3.195	6.734	15.391	4.423	78.396
Northern Taiwan	148.094	23.526	2.920	7.963	15.014	4.458	75.459
Central Taiwan	137.924	19.367	3.795	5.272	14.909	4.118	73.307
Eastern Taiwan	171.147	23.189	2.936	4.039	12.978	5.180	102.068
Southern Taiwan	159.353	23.183	3.082	6.269	16.839	4.619	87.200

The uneven distribution of healthcare human resources in Taiwan is mainly influenced by regional economic disparities and policy orientation. Urban and economically developed areas attract more healthcare professionals due to better career opportunities and living conditions. Government policies and investments also tend to concentrate in regions with higher population density and healthcare demand. Additionally, differences in infrastructure and geographic accessibility further exacerbate the imbalance. These factors collectively contribute to the current inequitable allocation of health human resources.

4.2 GM (1,1) Model Building and Prediction

4.2.1 Measurement of the Number of Health Technicians in Taiwan.

The GM (1,1) model functionality of the Data Processing System module was utilized to perform a three-time series analysis on the number of healthcare technical personnel in Taiwan from 2007 to 2021. The results showed that the model parameters

were a=0.1666 and b=6515.4. The fitted equation was x(t+1)=-36048.56456exp(-0.166576t)+39113.616686, and the evaluation of the model's fitting effect was rated as "very good" (C=0.0757, p=1.0000). The relative errors between the actual and fitted values for 2022 to 2031 were all within 10%, indicating a good fit (Table 4). Using the established model for prediction, the projected number of healthcare technical personnel in Taiwan for the years 2022 to 2031, based on the natural growth trend, is estimated to be 356,079, 368,349, 381,120, 394,399, 408,197, 422,524, 437,393, 452,818, 468,813, and 485,396, respectively.

Table 4. Comparison of actual and fitted values of the GM (1,1) model for the number of health technicians

Year	Observed values	Fitted value	Error	Relative Error
2008	97.071	92.232	4.839	4.985
2009	101.019	100.975	0.044	0.043
2010	104.117	108.931	-4.814	-4.624
2011	107.754	115.872	-8.118	-7.534
2012	110.776	119.505	-8.729	-7.880
2013	113.701	119.891	-6.190	-5.444
2014	115.882	117.471	-1.589	-1.372
2015	119.405	115.737	3.668	3.072
2016	122.845	115.192	7.653	6.230
2017	127.181	118.502	8.679	6.824
2018	132.641	126.340	6.301	4.750
2019	138.410	136.928	1.482	1.071
2020	143.431	147.720	-4.289	-2.990
2021	148.685	157.596	-8.911	-5.993

4.2.2 Measurement of the Number of Various Types of Health Technicians per 10,000 People in Taiwan.

The GM (1,1) model function in the Data Processing System module was used to analyze the prediction of health technicians, Western physicians, Chinese physicians, dentists, pharmacists and pharmacy technicians, laboratory technicians, nurses, and nurses per 10,000 people in Taiwan, from 2007 to 2021. The fitting effect was evaluated well (Table 5).

Table 5. Theoretical model of GM (1,1) model for all types of human health resources per 10,000 people

Category	Theoretical model	Model Parameters		Fitting effect		Fitting effect evaluation
		a	b	c	p	
Health technicians	x(t+1)=58.075885exp(0.098860t)-44.406620	-0.09886	4.39004	0.368	1.0000	Very good

Dr. West	x(t+1)=6.890486exp(0.101833t)-5.259742	-0.101833	0.535616	0.3921	1.0000	Very good
Chinese Medicine Physician	x(t+1)=0.380738exp(0.068057t)-0.335288	-0.068057	0.022819	0.0629	1.0000	Very good
Dentist	x(t+1)=-1.537974exp(-0.059607t)+1.606178	0.059607	0.095740	0.0495	1.0000	Very good
Pharmacists and Pharmacy Technicians	x(t+1)=-16.384796exp(-0.093184t)+17.094651	0.093184	1.592947	0.5190	0.7857	General
Laboratory Technician	x(t+1)=13.598347exp(0.012891t)-13.284864	-0.012891	0.171260	0.3800	1.0000	Very good
Caregivers and Nurses	x(t+1)=42.021444exp(0.088314t)-34.465979	-0.088314	3.043823	0.3989	1.0000	Very good

According to the predictive analysis using the GM (1,1) model, by the year 2031, the number of healthcare technical personnel, Western medical doctors, traditional Chinese medicine practitioners, dentists, pharmacists, pharmaceutical technicians, laboratory technicians, and nursing professionals per 10,000 people in Taiwan is projected to be 248.367, 34.111, 4.292, 8.731, 19.891, 5.629, and 128.214, respectively. These categories' average annual growth rates are estimated to be 5.274%, 4.287%, 3.034%, 2.679%, 2.548%, 2.551%, and 4.921%, respectively (Table 6).

Table 6. Projected human resources per 10,000 people for all types of Health in Taiwan, 2016 to 2025 (units/person)

Year	Health technicians	Dr. West	Chinese Medicine Physician	Dentist	Pharmacists and Pharmacy Technicians	Laboratory Technician	Caregivers and Nurses
2022	162.613	23.876	3.293	6.886	15.852	4.485	85.929
2023	170.050	24.760	3.391	7.068	16.215	4.593	89.680
2024	177.924	25.696	3.491	7.256	16.598	4.706	93.635
2025	186.267	26.688	3.595	7.449	17.001	4.823	97.805
2026	195.114	27.742	3.703	7.648	17.424	4.944	102.205
2027	204.503	28.861	3.813	7.853	17.869	5.070	106.849
2028	214.475	30.051	3.927	8.063	18.337	5.201	111.754
2029	225.075	31.318	4.045	8.280	18.830	5.338	116.937
2030	236.354	32.669	4.166	8.502	19.347	5.480	122.416
2031	248.367	34.111	4.292	8.731	19.891	5.629	128.214

4.3 Measurement of the Number of Health Technicians per 10,000 People in Taiwan and Mainland China

From 2007 to 2021, the number of healthcare technical personnel per 10,000 people in Taiwan increased by 58.957%, while in mainland China, it increased by 114.247%. In 2007, the number of healthcare technical personnel per 10,000 people in Taiwan (93.538) was 2.514 times higher than in mainland China (37.200). However, by 2021, the ratio of healthcare technical personnel per 10,000 people in Taiwan (148.685) and mainland China (79.700) will decrease to 1.895. According to the estimations, by 2031, Taiwan and mainland China will have 248.367 and 141.312 healthcare technical personnel per 10,000 people, respectively, further narrowing the gap between the two. However, Taiwan is still significantly higher than mainland China (Figure 1).

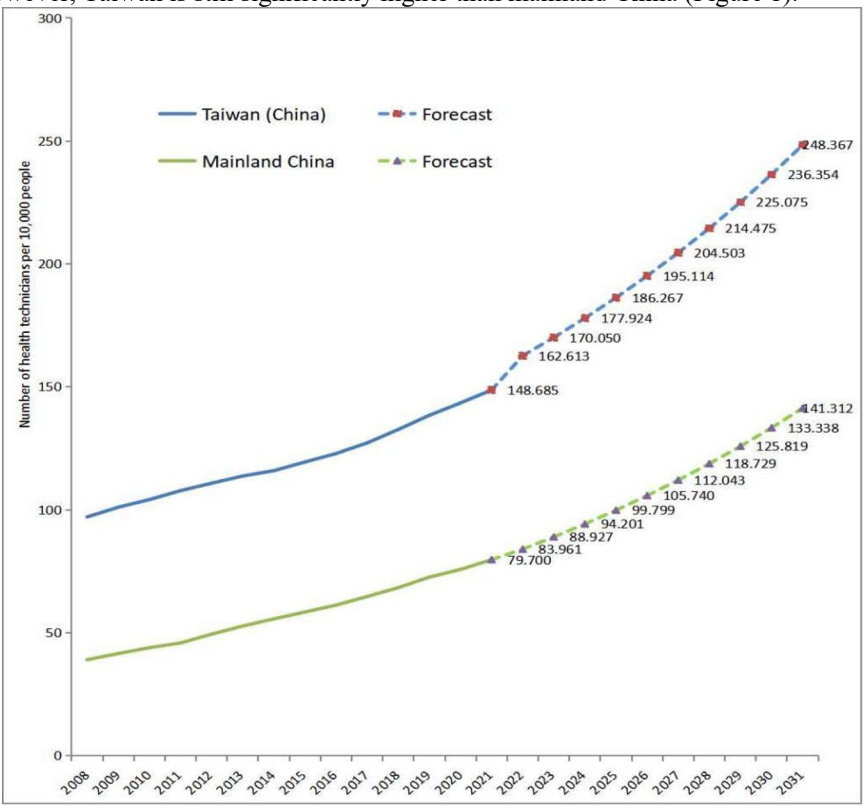

Fig. 1. Number of health technicians per 10,000 people in Taiwan and mainland China and their projections (units/person)

5 Discussion

Based on the analysis of the basic situation of human healthcare resources in Taiwan over the past 15 years and the prediction of future development trends, it can be concluded that the supply of human healthcare resources in the region will continue to

increase. The structure of human healthcare resources will become more rational, providing a valuable reference for allocating human healthcare resources in mainland China.

This study conducted a descriptive statistical analysis of the current status of human healthcare resources in Taiwan and performed predictive analysis using the grey model GM (1,1). The following discussion results were obtained: Taiwan has achieved specific accomplishments in terms of human healthcare resources, with a relatively large overall quantity and high growth rate. However, there are still issues of the unreasonable county and regional distribution of human healthcare resources in Taiwan, indicating a need for further optimization. In the future, healthcare human resources in Taiwan will continue to increase, and the structure will become more rational. The predictive analysis shows that both mainland China and Taiwan will experience a further increase in the supply of human healthcare resources. However, compared with mainland China, Taiwan still maintains a higher healthcare human resource supply level. The findings of this study are of great significance for understanding the current status and future development trends of human healthcare resources in Taiwan and provide a reference basis for the rational allocation of human healthcare resources in mainland China.

This study has important implications for other regions internationally. Firstly, through a comprehensive analysis and prediction of the current status of human healthcare resources in Taiwan, the study provides a valuable reference framework for other countries or regions to understand and evaluate their healthcare human resource supply. The study adopts descriptive statistical analysis and the grey model GM (1,1), revealing the quantity, structural characteristics, and future development trends of human healthcare resources in Taiwan, thus providing valuable experiences and insights for other countries or regions in healthcare human resource planning and policy formulation. Secondly, the study highlights the issues of healthcare human resource allocation in Taiwan, such as the imbalance between counties and regions and the phenomenon of oversupply. This finding prompts other countries or regions to reflect on and adjust their strategies for allocating human healthcare resources to avoid resource concentration issues or limited distribution. By drawing from the experiences of Taiwan, other regions can focus more on fairness and rationality, ensuring that resources are effectively meeting the needs of different regions and populations in healthcare human resource planning and allocation.

In summary, this study provides important implications for other regions worldwide. It offers a comprehensive analysis and prediction of the current status of healthcare human resources in Taiwan. It also reveals the existing issues and comparisons with mainland China, providing valuable experiences and references for other countries or regions in healthcare human resource planning, allocation, and policy formulation. This will promote the development of global healthcare human resources and enhance the quality of healthcare services, achieving sustainable development of the healthcare sector through mutual learning and sharing of best practices.

The forecast results offer valuable guidance for future policy and resource allocation. Policymakers can use these predictions to identify potential shortages and surpluses, enabling targeted interventions such as incentives for rural practice and improved training programs. Integrating predictive analysis into planning will support more balanced

and effective healthcare workforce distribution, ultimately enhancing service quality and accessibility across Taiwan.

6 Conclusion

This study conducted a systematic analysis of the current status and future trends of health human resource allocation in Taiwan using descriptive statistics and the grey model GM (1,1). Our findings indicate that Taiwan possesses a relatively abundant supply of health human resources with a high growth rate, reflecting its success in talent cultivation and development. However, significant imbalances in resource allocation persist at the county and regional levels, suggesting that fairness and rationality require further optimization. The forecast analysis projects that by 2031, Taiwan's health human resource supply will continue to increase with a more rational structure. Compared to mainland China, Taiwan is expected to maintain a higher level of per capita resources, although the gap between the two is predicted to narrow. This study contributes by providing empirical evidence to understand the dynamics of Taiwan's health human resources and by highlighting the challenges of equitable allocation. These findings are of direct value for policy making in Taiwan aimed at achieving more balanced resource distribution and also serve as a reference for other countries or regions facing similar challenges. Future research should further explore the underlying socioeconomic factors driving these distribution imbalances and assess the effectiveness of specific policy interventions in enhancing allocation fairness.

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