

The paradox of healthcare capacity in high-income regions: a provincial analysis of health system strain in China

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Abstract. China's healthcare system faces new problems of a shortage of healthcare workers, hospital overcrowding and unequal development of healthcare facilities. Examine the relationship between healthcare resource allocation and healthcare system pressure at the provincial level in China in this paper. Using provincial-level data from the China Statistical Yearbook 2020-2023, a Health System Strain Index (HSSI) is constructed in this paper based on healthcare workforce availability, hospital bed capacity and utilisation intensity. Pooled OLS, Random Effects and Fixed Effects models were employed, and among them, the Fixed Effects model was chosen for the final estimation. Economic and other changes have increased the demand for healthcare among the public. High-income areas have relatively high demand for healthcare services and are thus more likely to be strained. To improve the sustainability of healthcare services, one must increase the scale of resources and enhance the efficiency of resource allocation; at the same time, strengthen primary healthcare, improve regional coordination of medical institutions, etc.

Keywords: Healthcare system pressure, shortage of healthcare workers, hospital bed occupancy rate, healthcare infrastructure, China

1. Introduction

1.1. Background and healthcare development

China has achieved good economic growth and development of healthcare in recent years. China has significantly reduced the mortality and incidence of infectious diseases for children and mothers, extended health insurance coverage to almost all people, continuously increased investment in medical facilities and healthcare staff, and carried out public health reforms to improve access to healthcare for all. In the past ten years, healthcare costs have increased at a rate of 5-10 percentage points higher than the growth of GDP. At the same time, with high economic growth and increased incomes, more and better health care services have become available to the public.¹

¹ World Bank Group. (2026). Healthy China: Deepening Health Reform in China.

The Government of China has built a good healthcare system. China is a large developing country in the world, and it is very difficult for the government to build a large-scale and effective healthcare system [1]. With the continuous efforts of the various governments, a total of 1,093,551 healthcare institutions will have been built across the Chinese mainland by the end of 2025. There are 38,710 hospitals and over a million grass-roots clinics (as of 2025, according to the China Statistical Yearbook). It is becoming increasingly convenient for ordinary people to access medical care and basic public health services and health management. At present, 90.8% of the families live within a 15-minute driving distance of the nearest medical facility, and more than half of all medical check-ups are conducted at primary care hospitals. The health of the people is protected at all times in all areas and throughout their entire lives; at the same time, the level of people's health continues to rise steadily.²

1.2. Problem statement

Economic development has been linked to better healthcare facilities and better health outcomes in the past. Provinces with a higher gross domestic product per capita, such as Beijing, Shanghai, Jiangsu, Zhejiang and Guangdong, generally have more developed healthcare facilities, a larger number of doctors and higher healthcare expenditures than less-developed areas [2]. Recent evidence also shows substantial regional disparities in the distribution of healthcare resources across China, with higher resource density generally concentrated in eastern regions and significant inequalities remaining across geographical areas [3]. These areas are expected to place less demand on the healthcare system and offer better service quality.

Recently, some studies have reported an odd result in China's healthcare system. Although these high-income areas are relatively well-endowed with medical institutions, they have also begun to show symptoms of health crises. Large tertiary hospitals in economically developed areas frequently report overcrowding, long waiting times, high bed occupancy rates and excessive workloads for healthcare staff [4]. Patients from less developed provinces often have to travel to large urban hospitals for better medical care, thus increasing the demand on already overloaded medical institutions [5]. The distribution of high-quality medical resources is also strongly associated with regional economic development. High-quality medical resources are disproportionately concentrated in economically developed areas and major cities, which may further attract patients from other regions [6].

Therefore, the problem of low health-care-service accessibility persists. The quality of the healthcare system is also affected by factors such as the location and use efficiency of resources, as well as other reasons for people's mobility and different levels of regional healthcare. To design policies that promote all-weather and long-term development of healthcare across the country, we must first understand why the healthcare pressure in resource-rich provinces has not been alleviated.

2. Results

2.1. Descriptive statistics

Table 1 shows that the dataset contains 124 observations and reports substantial variation in per capita disposable income, elderly population share, government health expenditure and population density.

² National Health Commission of the People's Republic of China. (2025). 2024 statistical bulletin on the development of China's health sector.

Table 1. Descriptive statistics

Variable	Obs	Mean	SD	Min	Max
HSSI	124	.5129492	.129707	.2189	.8607
PPIncome	124	35328.94	14042.8	2700	84834
Elderly	124	13.97669	3.285433	5.67	21.1
HE	124	716.7733	420.6871	118.13	2185.46
Pop	124	433.1532	562.3216	3	2978

Note: HSSI = Health System Strain Index; PPIncome = per capita disposable income (yuan); Elderly = elderly population share (%); HE = government health expenditure (yuan per capita); Pop = population density (people per unit area). Obs = number of observations; SD = standard deviation.

2.2. Panel regression statistics

Table 2 presents the pooled OLS, random-effects, fixed-effects and clustered fixed-effects estimates. The models contain year fixed effects, and the clustered fixed-effects specification is used for the main estimation results.

Table 2. Panel regression results

Variables	(1) HSSI	(2) HSSI	(3) HSSI	(4) HSSI
Inppincome	-0.0933*** (0.0285)	-0.0103 (0.0213)	0.0150 (0.0196)	0.0150*** (0.00510)
Elderly	-0.0279*** (0.00320)	-0.0108* (0.00557)	0.0240*** (0.00898)	0.0240* (0.0136)
lnhe	0.0776*** (0.0153)	0.0450* (0.0273)	-0.0455 (0.0440)	-0.0455 (0.0476)
lnpop	0.0464*** (0.00927)	0.0181 (0.0156)	-0.932 (0.722)	-0.932 (0.743)
Year = 2020	0	0	0	0
Year = 2021	0.00671 (0.0237)	-0.0139 (0.0120)	-0.0450*** (0.0120)	-0.0450*** (0.0139)
Year = 2022	-0.0590** (0.0238)	-0.0814*** (0.0133)	-0.118*** (0.0149)	-0.118*** (0.0220)
Year = 2023	0.0194 (0.0250)	-0.0259 (0.0163)	-0.0896*** (0.0203)	-0.0896** (0.0339)
Constant	1.138*** (0.282)	0.417* (0.250)	5.357 (3.908)	5.357 (4.035)
Observations	124	124	124	124

Note. HSSI = Health System Strain Index. The models contain year fixed effects. Column (1) is the pooled OLS estimate; column (2) is the random effects estimate; column (3) is the fixed effects estimate; and column (4) is the fixed effects estimate with clustered standard errors. Standard errors are in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$.

2.3. Model selection tests

The results in Table 3 reject the null hypothesis of no panel effects ($\chi^2 = 89.80$, $p < 0.001$), supporting the use of panel estimation rather than pooled OLS. As shown in Table 4, the Hausman test rejects the null hypothesis that the random-effects estimator is consistent ($\chi^2 = 30.31$, $p < 0.001$). Therefore, the fixed-effects model is selected.

Table 3. The Breusch-Pagan LM test

Statistic	Value
HSSI	.0168
e	.0015
u	.0068
Test Statistic	Value
$\chi^2(1)$	89.80
p value	<.001

Note. Breusch–Pagan Lagrange Multiplier test was conducted to determine whether a random-effects model is preferred over a pooled OLS model. The null hypothesis states that the variance across entities is zero ($Var(u) = 0$). Results rejected the null hypothesis of no panel effects ($\chi^2(1) = 89.80$, $p < 0.001$), indicating that panel estimation was preferred to pooled OLS.

Table 4. Hausman test

	(b) FE	(B) RE	(b-B) Difference	Standard Error
lnppincome	.0150	-.0103	.0254	.0071
Elderly	.0240	-.0107	.0348	.0086
lnhe	-.0455	.0450	-.0905	.0423
lnpop	-.9328	.0181	-.9509	.8257
year				
2021	-.0450	-.0139	-.0311	.0066
2022	-.1183	-.0814	-.0369	.0107
2023	-.0896	-.0259	-.0637	.0166
Test Statistic	Value			
$\chi^2(4)$	30.31			
p value	<.001			

Note. FE = fixed effects model; RE = random effects model. The Hausman test rejected the null hypothesis that the Random Effects estimator was consistent ($\chi^2(4) = 30.31$, $p < 0.001$). Therefore, the Fixed Effects model was selected.

2.4. Main results (clustered FE)

According to the estimation results, per capita disposable income (lnppincome) positively and significantly affects the Health System Strain Index (HSSI). Based on the above analysis, more economically developed areas are under increasing pressure from healthcare demands; it is reasonable to expect that richer regions will see more people needing specialized medical services. A typical case of this phenomenon is Malaysia; its healthcare resources and the number of sick people vary greatly from place to place [7]. It has shown that

patients are willing to travel across areas or even countries to receive better-quality and more accessible medical services; therefore, regions with excellent medical resources will likely be attractive to patients.

The proportion of older people is positively correlated with HSSI and is statistically significant at the 10% level; thus, an aging population will increase the burden on the healthcare system. Malaysia has seen a significant increase in the proportion of older people recently; for instance, the share of people aged 60 and over in 1990 was only about 5.7%, but by 2020, it had risen to around 10%.³

As a result, the need for chronic disease management, long-term care and continuous medical services has been increasing. This finding is consistent with evidence that population ageing in China has been accompanied by increasing healthcare needs and utilization among older adults, particularly because of the growing prevalence of chronic diseases and age-related health conditions [8]. Therefore, an ageing population is placing increasing pressure on healthcare infrastructure and service capacity, especially in developing countries where the health system has been expanding relatively slowly in response to changing age structures.

On the other hand, Government health expenditure (lnhe) is negatively correlated with HSSI, but not significantly so. Therefore, the differences in provincial healthcare expenditure are mainly due to time-invariant regional characteristics and do not directly reflect pressure on the healthcare system. Similarly, research in India has shown that although the government has increased investment in primary healthcare facilities for the public, access to and quality of services for rural residents have not risen significantly.

Although the government has increased the number of healthcare facilities, shortages of medical staff, uneven distribution of facilities and limited accessibility remain problems [7].

Population density (lnpop) is also not significantly correlated with HSSI after controlling for province and year effects. Based on evidence from rural healthcare systems in India, it can be seen that areas with a high population density may still face insufficient healthcare access due to a lack of facilities and medical resources.⁴

After controlling for unobserved provincial characteristics and year effects, higher per capita disposable income is associated with a greater burden on the health system. Therefore, richer provinces will have a larger demand for medical services and face more pressure on health resources due to their high living standards.

3. Conclusion

3.1. Main findings

China's Healthcare Capacity Paradox: Why Economically Developed Provinces are Still Strained in Their Healthcare Systems Despite Rich Medical Resources. First of all, the performance of the healthcare system is not determined by how much money is spent on construction or government investment in healthcare institutions; other factors that also influence it include people's health needs, resource allocation, demographic changes and regional differences in healthcare development, etc.

Panel data of the 31 provinces in China from 2020 to 2023 are used in this paper to study the effect of pressure on the healthcare system on various economic, demographic and health-related factors. Based on the above analysis, the problem of healthcare pressure in China's provinces is varied, and this difference stems from various reasons.

³ Department of Statistics Malaysia. (2020). Population and demographic statistics Malaysia 2020. Department of Statistics Malaysia.

⁴ Ministry of Health and Family Welfare. (2023). Rural Health Statistics 2021–2022. Government of India.

Therefore, an increase in health care facilities will not necessarily reduce the demand for them. Economically developed areas generally have more complete healthcare facilities, cutting-edge medical equipment and a large number of doctors and other medical staff; therefore, they are attractive destinations for people in other regions to seek medical care. Therefore, the healthcare system in a resource-rich area may face problems of excessive demand concentration and uneven use of healthcare resources.

3.2. Policy implications

This paper believes that the development of health care involves both supply-side and demand-side factors, and will help us better understand the actual situation of health care. Economic development has supported the construction of medical institutions, and at the same time, changes in the living conditions of the people have led to an increased demand for high-quality medical services. Therefore, in the construction of an all-encompassing healthcare system, more resources need to be added and the efficiency and fairness of medical services improved.

Areas in China also have different healthcare systems, as shown by this study. Different areas have different distributions of health resources; therefore, people in poorer areas have limited access to medical care and are restricted in terms of movement. Therefore, the construction of an integrated healthcare system at all levels must be promoted to distribute medical resources reasonably based on the health needs of different areas and avoid concentration in prosperous areas.

In short, based on the above analysis, easing pressure on the healthcare system needs to take into account all these factors at the same time. The paradox of healthcare capacity indicates that a good health system should be able to meet the fluctuating health requirements of the people in a timely manner, not just have more resources.

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