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Should China Expand Its Medical Education Scale? Evidence From Comparative Research

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Abstract

Purpose: This study compares doctor staffing level and the scale of medical education in China with those of other countries and proposes policy recommendations for future adjustments to the scale of China's medical education.

Design/Approach/Methods: This study employs a literature review and descriptive analysis.

Findings: China had 1.98 medical doctors per 1,000 people in 2018, ranking 85th out of the 193 member-states of the World Health Organization (WHO). In 2017, China had 1.99 practicing doctors per 1,000 people, only ranking above Turkey (1.88) in Organisation for Economic Co-operation and Development (OECD) countries. China had only 10.28 medical graduates per 100,000 people—placing in the bottom third of OECD countries. China's provision of 1.4 medical schools per 10 million people was also significantly lower than the global average (3.9). However, the average number of students enrolled in medical schools (509) in China was significantly higher than the global average (160).

Originality/Value: Although the scale of admission in undergraduate medical education must be expanded in China, this needs to be achieved while controlling the average number of medical students per school and reducing enrollment in low-quality medical schools. Furthermore, it is necessary to establish new medical schools while improving the operating level of existing ones.

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Introduction

The global pandemic caused by the novel coronavirus, COVID-19, has revealed the vital role of doctors in maintaining national health and safety, underscoring the need to incorporate a medical workforce as part of national strategy. As a core component of human resources for health, doctors have a significant impact on the realization of comprehensive health. A discrepancy in the number of doctors—whether a shortage or a surplus—results in an increase in the cost of medical and health (M&H) services (Scheffler & Arnold, 2019). Indeed, a shortage of doctors affects the accessibility of M&H services and increases transportation and time costs for patients seeking medical care, thereby hindering the ability of M&H services to meet demands (Wu, 2018). In contrast, an oversupply of doctors indicates the poor utilization of limited resources for medical education (ME) and may result in low efficiency among doctors and the wastage of M&H resources.

The scale of ME (S-ME)—that is, the number of medical schools and students—has a direct impact on the supply of doctors and is an important basis for ensuring that the number of doctors meets the needs of society. More specifically, the number of doctors is largely determined by the number of medical schools and students enrolled in medical schools. At the same time, the demand for and supply of doctors and their staffing level are indicators that determine the direction of S-ME adjustments. In theory, the S-ME should be increased when the number of doctors is insufficient or the staffing level is too low; otherwise, the S-ME should be reduced. Compared with other disciplines in higher education, ME is characterized by being lengthy in duration and comprising multiple training segments. As such, making timely and scientific judgments on the appropriateness of the S-ME is critical to ensuring the effective supply of doctors and improving the efficiency of talent training.

ME in China has continued to develop rapidly in the 21st century. Indeed, the number of regular higher educational institutions (HEIs) operating an undergraduate medical program increased from 97 in 2000 to 182 in 2018. Similarly, the number of such HEIs offering master's degrees in medicine increased from 63 in 2000 to 133 in 2018, while the number offering doctoral programs increased from 31 to 57. Within the same period, the number of regular HEI graduates with a bachelor's degree in medicine or higher increased from 28,500 to 136,500, while the number of students graduating with a junior college degree increased from 14,900 in 2000 to 47,700 in 2017. The development of ME has been vital to the increase of doctor workforce in China. The number of licensed (assistant) medical doctors increased from 1.19 million in 2002 to 2.7 million in 2018—an increase of some 1.51 million doctors. During the same period, the number of practicing assistant doctors rose from 223,000 to 445,000, while that of practicing doctors grew from 969,000 to 2.255 million—increases of 222,000 and 1.286 million, respectively (National Health Commission of China, 2019).

Despite the expansion of China's S-ME and doctor workforce, there are disputes regarding the direction of S-ME adjustments. While the dominant opinion holds that the country's current S-ME is excessive and should be controlled or even reduced to prevent a surplus of doctors, others advance the opposite opinion. Concerns regarding the sufficient supply of trained doctors to meet M&H demands have been compounded by the COVID-19 pandemic. Accordingly, this study examines the practical experiences of other countries in terms of S-ME adjustments and compares the staffing level of doctors and S-ME in China with those of other countries. Based on its findings, this study proposes policy recommendations for the direction of China's S-ME adjustments.

To achieve this, this study conducts a literature review on S-ME adjustments in several countries and descriptive analysis calculating and comparing the staffing levels of doctors and S-ME in China and several other countries. In respect to indicators, this study uses the number of doctors per 1,000 people, number of medical graduates per 100,000 people, number of medical schools per 10 million people, and average medical school enrollment. Internal data, such as the number of medical students and schools in China in 2018, were obtained from relevant government departments. Public data were obtained from the official websites of the World Health Organization (WHO), World Federation for Medical Education, Organisation for Economic Co-operation and Development (OECD), and China's National Health Commission (NHC), as well as from the *NHC Yearbooks of Health Statistics* and *China Statistical Yearbooks*.

Adjustments to the scale of medical education in several countries

In international ME research and management practice, international comparisons of the demand for and supply of doctors provide an important basis for S-ME adjustments at the national or regional level. In the 1970s, the Japanese government implemented a policy initiative and aimed at establishing at least one medical school in every prefecture in an effort to address the shortage of doctors. By the mid-1980s, the annual number of medical graduates or doctors qualified to practice had doubled to 8,000, while the number of medical schools increased each year, reaching 80 in 1981 (Zhu, 2003). However, there was an about-turn in government policies from 1985 with strict controls imposed on the supply of doctors and a cap on the number of students enrolled in each medical school. Consequently, enrollment quotas declined by 7.8% between 1986 and 2006, and a shortage of doctors reemerged in 2007.

Of the 193 member-states of the WHO, Japan ranked 60 in the number of doctors per 1,000 people in 2008 (Toyabe, 2009). The country also consistently ranked lower than the majority of OECD countries over the 20th century (Shinjo & Aramaki, 2012). In 2007, Japan ranked 26th out of 30 OECD countries in respect to the number of doctors per 1,000 people and 28th in terms of the number of medical graduates per 100,000 people. The following year, Japan's Ministry of Education, Culture, Sports, Science, and Technology implemented a policy intended to increase medical school enrollment in an effort to address the shortage of doctors. As a result, enrollment numbers rose from 7,793 in 2008 to 8,486 in 2009, exceeding the highest recorded figures from the early 1980s. Enrollment rose to 8,846 in 2010—a 16% increase over-enrollment numbers at the beginning of the 21st century (Tanihara et al., 2011; Yuji et al., 2012). Although enrollment in Japanese medical schools has continued growing, this did not equate to an immediate increase in the supply of doctors since it takes several years for cohorts to train, graduate, and begin practicing. At 2.2 doctors per 1,000 people in 2010, Japan's supply of doctors was still significantly lower than the average of OECD countries (3.2) in 2011 (OECD, 2013).

Facing a similar shortage of doctors at the end of the 20th century, the United Kingdom implemented the National Expansion of Medical Schools strategy to increase the number of both medical schools and students. The number of medical schools subsequently increased from 22 in 2000 to 33 in 2013, while the number of doctors increased by 50% between 2000 and 2011—a significantly higher growth rate than almost all the other OECD countries. In 2013, a study concluded that England's medical schools should reduce their admission numbers by 2% and maintain this S-ME until evidence indicated the need for further adjustments (Department of Health England & Higher Education Funding Council England, 2012).

Meanwhile, despite sustained growth in the total number of doctors, France still faces a serious shortage of doctors. Essentially, France produced an insufficient number of young doctors amid a declining number of general practitioners, the effects of which were more obvious in small-sized and medium-sized cities and rural areas. The lack of doctors was especially severe in northern France (Le Vigouroux, 2012). To address this issue, France removed its restrictions on medical school enrollment numbers in 2020, with the number of medical students expected to increase by 20% per annum (France Government, 2019).

Finally, Singapore reported having 13,386 doctors in 2017, indicating a 3.2% increase compared to 2016. The country reports a doctor-to-population ratio of 1:420—that is, 2.4 doctors per 1,000 people (Ministry of Health of Singapore, 2018). Such increases are the result of policies addressing the country's changing demographic structure, with declining birth rates and an ageing population resulting in a sharp increase in medical demand. Accordingly, Singapore established a third medical school in August 2013 in an effort to expand its S-ME (Samarasekera et al., 2015).

Generally speaking, two major approaches were adopted to improve the balance between the demand for and supply of doctors, namely, adjusting the number of medical schools and/or scale of enrollment in medical schools. When there was a shortage of doctors, measures were taken to increase the number of medical schools and/or enrollment quota. In contrast, the number of students enrolled in medical schools was often reduced when there was an oversupply of doctors.

Comparison of doctor staffing level

According to WHO data, China had a total of 2.29 million medical doctors in 2017. With 1.98 doctors per 1,000 people, China ranked 85th out of the 193 WHO member countries, coming in below Germany (4.25), Italy (3.98), France (3.27), the United Kingdom (2.81), the United States (2.61), Japan (2.41), and Canada (2.31). Among the five BRICS (Brazil, Russia, India, China, and South Africa) countries, the number of doctors per 1,000 people in China was higher than that of South Africa (0.91) and India (0.86), but lower than Russia (3.75) and Brazil (2.16) (WHO, 2020).

As shown in Table 1, OECD data indicates that the number of practicing doctors in China per 1,000 people was 1.99 in 2017. Compared with the 32 OECD countries for which there were available data, China was only higher than Turkey (1.88) and ranked significantly lower than Austria (5.24), Norway (4.93), Lithuania (4.60), Switzerland (4.34), and Germany (4.31). It also ranked lower than most Western countries, including the United Kingdom (2.95), Canada (2.80), and the United States (2.61) (OECD, 2019a).

According to the online data released by World Economics, China ranked 86th in the world in terms of per capita gross domestic product in 2019. Comparing China with the five countries ranked above and below it (81st–85th and 87th–91st, respectively), China's number of doctors per 1,000 people was average to low, with the figure only higher than Nauru, Saint Lucia, and the Maldives (Table 2). Generally speaking, the low staffing level of doctors in China indicates a need to expand the S-ME, such as increasing the number of medical schools and/or medical students.

Comparison of the S-ME

As Table 3 shows, China reported 10.28 medical graduates per 100,000 people in 2018—a figure lower than 26 of the 36 OECD countries, including Belgium (28.79), Ireland (24.88), Latvia (22.13), Denmark (21.47), and Lithuania (19.27). However, it was higher than that of France (9.46), the United States (7.76), Canada (7.70), Korea (7.58), and Japan (6.94) (OECD, 2019b).

As Figure 1 illustrates, China reported 1.4 medical schools offering undergraduate programs per 10 million people in 2018. This was significantly lower than that of Cuba (12.2), Australia (8.9), the

Table 1. Doctor staffing levels in China and OECD countries, 2019/latest available data.

Country	Doctors per 1,000 inhabitants	Year
Austria	5.24	2018
Norway	4.93	2019
Lithuania	4.60	2018
Switzerland	4.34	2018
Germany	4.31	2018
Sweden	4.27	2017
Denmark	4.19	2018
The Czech Republic	4.04	2018
Italy	4.02	2019[P]
Spain	4.02	2018
Iceland	3.93	2019
Australia	3.75	2018
Slovak Republic	3.52	2018
Estonia	3.48	2018
Hungary	3.38	2018
France	3.37	2018
New Zealand	3.35	2018[e]
Ireland	3.34	2019
Latvia	3.30	2018
Israel	3.22	2018
Slovenia	3.18	2018
Belgium	3.13	2018
Luxembourg	2.98	2017
The United Kingdom	2.95	2019
Canada	2.80	2018[P]
The United States	2.61	2018
Japan	2.49	2018
Mexico	2.44	2018
Korea	2.39	2018
Poland	2.38	2017
Colombia	2.18	2018
China	**1.99**	**2017**
Turkey	1.88	2018
Chile	-	-
Finland	-	-
Greece		

(continued)

Table 1. (continued)

Country	Doctors per 1,000 inhabitants	Year
The Netherlands	-	-
Portugal	-	-

Note. (i) ^{e} = estimated value; (ii) ^{P} = provisional data.

Table 2. Comparison of doctor staffing level in China and countries at a similar level of economic development, 2018/latest available data.

Per capita GDP ranking	Country	Doctors per 1,000 people	Year
81	Russia	4.04	2017
90	Equatorial Guinea	4.00	2017
88	Bulgaria	3.99	2014
84	Argentina	3.96	2017
91	Kazakhstan	3.25	2014
87	Mexico	2.25	2016
89	Brazil	2.15	2018
86	**China**	**1.98**	**2017**
85	Nauru	1.24	2015
83	Saint Lucia	1.05	2009
82	The Maldives	1.04	2016

Source. World Health Organization. Medical doctors (EB/OL), 2021-03-30, https://apps.who.int/gho/data/view.main.HWFMEDv.
GDP = gross domestic product.

United Kingdom (8.5), France (7.9), Japan (6.7), the United States (5.9), Germany (5.2), Canada (4.6), and India (3.1). As of August 2017, 2,918 medical schools were in operation worldwide, indicating a global average of 3.9 medical schools per 10 million people. As such, China's ratio was also significantly lower than the global average.

As Figure 2 illustrates, China reported an average of 509 undergraduates enrolled in medical schools in 2018. This figure is much higher than that of India (106), the United States (113), Japan (144), Germany (156), Canada (172), the United Kingdom (174), and Australia (233). Based on the estimates presented by a Global Independent Commission for Education of Health Professionals for the 21st century, enrollment in the 2,420 medical schools around the world averaged at approximately 160 (Frenk et al., 2010). Others have reported an average enrollment of 181 in the 2,600 medical schools worldwide in 2012 (Duvivier et al., 2014).

Table 3. Number of medical graduates per 100,000 people in China and OECD countries, 2019/latest available data.

Country	Medical graduates per 100,000 inhabitants	Year
Ireland	25.15	2018
Latvia	23.44	2019
Denmark	23.04	2018
Lithuania	20.60	2018
Slovak Republic	17.66	2018
Belgium	17.63	2019
Portugal	17.11	2018
The Czech Republic	15.99	2018
Hungary	15.96	2018
Australia	15.84	2018
The Netherlands	15.77	2018
Austria	15.23	2018
Italy	15.07	2017
Spain	14.24	2018
Iceland	13.61	2018
Slovenia	13.55	2018
Sweden	13.11	2018
The United Kingdom	13.10	2019
Greece	12.40	2017
Mexico	12.26	2018
Finland	11.69	2018
Switzerland	11.69	2018
Turkey	11.54	2018
Germany	11.53	2018
France	10.85	2017
Poland	10.55	2018
Estonia	10.42	2019
China	**10.28**	**2018**
Norway	10.20	2018
New Zealand	9.79	2018
Chile	8.73	2018
The United States	7.95	2018
Canada	7.72	2019[P]
Korea	7.48	2018
Israel	7.41	2018

(continued)

Table 3. (continued)

Country	Medical graduates per 100,000 inhabitants	Year
Japan	7.14	2019
Luxembourg	0	0
Colombia	-	-

Note. (i) In China, medical graduates refer to those who have graduated with a bachelor's, master's, or doctorate degree in the discipline of clinical medicine; and (ii) [P] = provisional data.

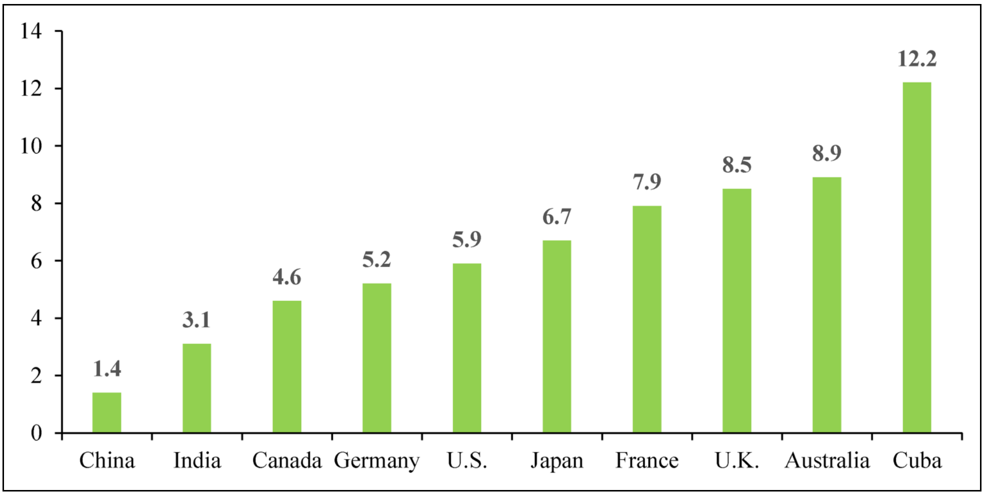

Figure 1. Number of medical schools per 10 million people in China and several other countries, 2018.

Discussion

While China's socioeconomic development is stable, the country is facing the increasingly serious problem of an ageing population and growing demands for high-quality M&H services. Therefore, China needs to ensure that its medical schools cultivate a sufficient number of high-quality doctors to better meet the needs of society and contribute toward the strategic goal of realizing a healthy China. From the global perspective, the staffing level of doctors in China appears to align with its level of economic development. However, we found that the staffing level of doctors in China was lower than those of many developed and developing countries, suggesting a need to increase the supply of doctors by expanding the S-ME.

Doctors in developed countries generally hold a bachelor's degree or above in terms of qualifications. In contrast, a large proportion of China's doctors graduated from secondary schools or

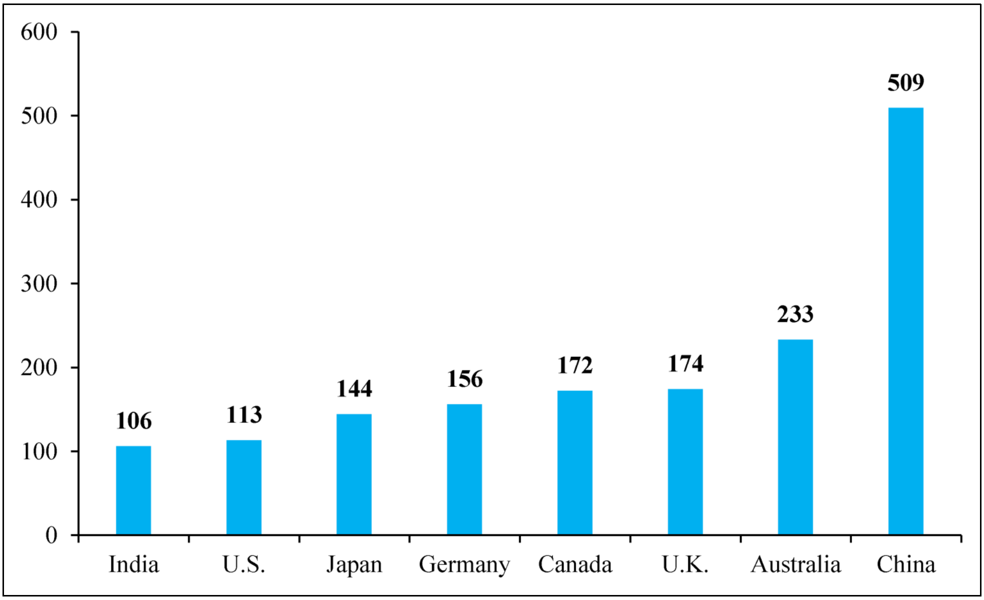

Figure 2. Average undergraduate enrollment in medical schools in China and several Organisation for Economic Co-operation and Development countries, 2018.

junior colleges. In 2018, 42.1% of physicians in China held a junior college degree or below. Accordingly, issued by the General Office of the State Council in September 2017, *Opinions on Strengthening Collaboration to Further Promote the Reform and Development of Medical Education* proposed the gradual expansion of undergraduate enrollment in medicine in order to improve the educational level of medical professions in China. Nonetheless, this gap becomes even more apparent when comparing the number of qualified doctors in China with that of developed countries. For example, the number of doctors with a bachelor's degree or above in China was only 1.12 per 1,000 people in 2018. An additional supply of approximately 2.08 million medical graduates with a bachelor's degree or above is needed to reach the staffing level of the United States, which has 2.61 doctors per 1,000 people.

Additionally, although regular HEIs in China produced 136,500 graduates with a bachelor's degree or above in 2018, the average pass rate in the National Medical Licensing Examination (NMLE) was only 70%. This indicates that China's undergraduate medical education is facing a significant challenge in terms of a demand–supply imbalance. Therefore, China's ME sectors must undertake the long-term tasks of increasing the number of physicians with high academic qualifications. Essentially, China must expand the enrollment scale of medical undergraduates in order to meet the demand for qualified physicians. However, this expansion needs to be premised on improvements in educational and teaching qualities as well as an increase in the NMLE pass rate.

There are two primary means of expanding the enrollment scale of medical undergraduates: increasing enrollment in existing medical schools and establishing new medical schools to enroll students. Characterized by high training costs and specialization, ME is generally regarded as elite education. Involving high operating costs, overseas medical schools seldom exceed an enrollment of 200 students per year. All OECD countries have implemented some form of control over medical school enrollment. For instance, England's Department of Health has clear regulations regarding the enrollment quota for each medical school, and its subsidy is restricted to medical students who meet the criteria stipulated in the admission policies and programs.

In contrast, there is a lack of scientific planning and management in respect to the enrollment scale of medical schools in China, resulting in a high degree of guesswork and lack of understanding when determining enrollment numbers. Many medical schools increased their number of enrollment without taking schooling conditions into consideration, which led to a decline in educational quality. In 2018, China's regular HEIs reported an average enrollment of 509 undergraduates in medicine. More specifically, enrollment in 28 schools exceeded 1,000, while the single-point enrollment of 59 colleges exceeded 600, accounting for 67.0% of total enrollment. Over-enrollment invariably leads to a shortage of teaching resources, negatively impacting ME quality. Among the top 10 colleges in terms of the scale of medical education, 4 colleges have NMLE pass rates below the national level. Therefore, China needs to establish a refined management system to ensure sound medical school enrollment. At present, policies to control, rather than expand, the average enrollment scale of medical schools are necessary. In this respect, focus should be placed on reducing medical school enrollment, especially those with an excessive enrollment rate and suffering from poor quality of education, thereby ensuring their quality and efficiency in producing physicians.

China's number of medical schools per 10 million people is less than half of the global average, lagging behind countries like Cuba, Australia, and the United Kingdom. A more serious issue is the vast disparity in teaching quality among China's medical schools, with a considerable number possessing an unsatisfactory teaching quality, exacerbating the country's lack of medical schools. Among HEIs operating an undergraduate medical program, the highest NMLE pass rate for 2018 was 100%, while the lowest was only 31.8%. While regular HEIs affiliated to provincial, prefectural, and municipal governments account for approximately three-quarters of the country's medical schools, their average NMLE pass rate is only 69.2%. Additionally, comprising approximately one-sixth of all medical schools, private colleges have an average NMLE pass rate of only 50.7%. In contrast, the pass rates of Steps 1 to 3 of the United States Medical Licensing Examination—taken by American and Canadian medical students—range between 94% and 97%, indicating minimal disparity in teaching quality between medical schools.

While there is an insufficient number of medical schools in China, their average enrollment is relatively high. Nonetheless, the operating quality of Chinese medical schools needs to be improved. Accordingly, it is important to increase the enrollment scale in an appropriate manner by improving the operating quality of existing medical schools while establishing new undergraduate colleges and professional placements for medicine. Among China's existing medical schools, high-level ones—such as those established under Project 985 and the Double First-Class University Plan—have a high proportion of operating undergraduate medical programs but a small number of institutions. In contrast, medical schools affiliated with local governments have a low proportion of operating undergraduate medical programs but a large number of institutions. Given the small enrollment scale of high-level medical schools and the significant disparity in total numbers between both types of schools, medical schools that are affiliated with local governments are still the main force in cultivating medical professionals.

In order to facilitate local HEIs' ability to fulfill their roles, it may be necessary to adopt supporting policies to ensure that medical schools affiliated with local governments continue enhancing their quality of education. In this respect, introducing incentivizing policies to guide graduates at most competitive medical schools to work at local HEIs may serve to improve qualifications of their faculties. The thorough implementation of policies involving assistance from counterparts may also be beneficial, with established medical schools facilitating the development of their counterparts in underdeveloped areas. Junior college is an important component of China's ME, playing an integral role in alleviating the shortage of primary healthcare professionals. In the future, the government could consider upgrading some high-quality junior colleges to undergraduate colleges.

Conclusion

Although China needs to improve its provision of ME, the situation is complicated by issues related to S-ME adjustment. While the scale of undergraduate enrollment in ME should be expanded, the average enrollment scale has to be controlled and enrollment in poor-quality medical schools reduced. At the same time, the S-ME has to be expanded by improving the operating level of existing schools and establishing new high-quality schools.

Contributorship

The first draft was produced by Jianlin Hou, Kaiju Liao, and Peng Liao under the guidance of Yang Ke and Weimin Wang. Ana Xie made substantial contributions to the revised manuscript. All authors contributed to data analysis and drafting and/or revising of the article and gave their final approval of the version to be published.

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