

Running Medical Education System and its Development in China

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Abstract

Background: The release of the Healthy China Strategy and the aftermath of COVID-19 have prompted us to deliver more high-level medical talents to meet the urgent needs in the up-coming future. The purpose of this study is to review the current medical education systems in China and analyze its developing direction of medical education from a long-term perspective. **Main text:** The comprehensive medical education systems in China are analyzed as follows. Current conditions of medical education in China: 1. Parallel running of multiple medical education systems; 2. Synergistic development of medical education in different regions; 3. Continuous improvement of the diversified medical curriculum; 4. Multiple departments collaborative management mechanism in medical education. The model of foreign medical education: 1. American model; 2. British model; 3. Japanese model. Prospects for the future of medical education in China: 1. Establishing unified medical degrees with clear objectives; 2. Focusing on general practitioners and primary care; 3. Strengthening medical humanities and public health education; 4. Improving the management mechanism between colleges and affiliated hospitals. **Conclusions:** This review integrates the current situation of medical education in China and successful foreign medical education models, and then proposes interventions for reform in order to cultivate medical personnel that meet future needs in China. This review may serve as a reference for the educational efforts of medical schools in China.

Running Medical Education System and its Development in China

The Current and Future of Medical Education in China

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Author biosketch

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Declaration of Interest Statement

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Author contributions

Both HC and KL were involved in the conception and design of the study, and the drafting and revision of the paper. We both give final approval for the paper to be published and agree to be accountable for all aspects of the work.

Ethic statement - Not applicable

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Main text: The comprehensive medical education systems in China are analyzed as follows. Current conditions of medical education in China: 1. Parallel running of multiple medical education systems; 2. Synergistic development of medical education in different regions; 3. Continuous improvement of the diversified medical curriculum; 4. Multiple departments collaborative management mechanism in medical education.

The model of foreign medical education: 1. American model; 2. British model; 3. Japanese model.

Prospects for the future of medical education in China: 1. Establishing unified medical degrees with clear objectives; 2. Focusing on general practitioners and primary care; 3. Strengthening medical humanities and public health education; 4. Improving the management mechanism between colleges and affiliated hospitals.

Conclusions: This review integrates the current situation of medical education in China and successful foreign medical education models, and then proposes interventions for reform in order to cultivate medical personnel that meet future needs in China. This review may serve as a reference for the educational efforts of medical schools in China.

Keywords: Medical education, Present, Future, China, COVID-19

Highlights:

In the context of the COVID-19 and China's health strategy, we should objectively examine the current situation of the operation of China's medical education system.

In the process of medical education development, China has continuously borrowed from the experience of foreign developed countries. Here we propose measures to optimize China's medical education system to meet medical needs in the future.

Introduction

The global outbreak of COVID-19 has brought the unprecedented burden to the healthcare system all round the world. The COVID-19 pandemic underscored the severe deficit of medical resources, in which the shortage of medical personnel is more striking. Therefore, it forced us to rethink of the running medical education system and its future. In recent decades, Chinese government has never stopped the actions in optimizing the medical education system to adapt the rapidly growing healthcare demand [1]. In this article, we summarized the situation of the medical education system nowadays in China and analyzed the developing direction for the future.

In order to meet the demand for high-quality medical personnel in China's healthcare, the reform of medical education in China has gone through several epoch-making stages, including the merge of independent medical schools into comprehensive universities in 1998 [2]; the establishment of the accreditation system for clinical medical specialties in 2008 [3]; the initiation of the standardized residency training system in 2013 [2]; the accreditation by the World Federation of China's clinical medicine program in 2020; and the medical education development in China entered a new era with the release of the "Healthy China 2030 Planning Outline" put the people's healthcare issues to a national strategic level [4].

The fight against COVID-19 has directly tested the medical education system worldwide [5]. The noble spirit and superior medical skills shown by the medical staff in times of crisis highlighted the success of medical personnel training in China. However, while huge progress has been made in medical education, it is also clear that medical personnel will need to acquire more comprehensive capabilities in the future, such as multidisciplinary integration and crisis response skills. In the context of COVID-19 and the Health China strategy, we should objectively examine the problems faced by medical education system in China. We also have to consider the developing direction of medical education in China by referencing the models of other medical education systems from a longer-term perspective.

Methods

We identify the present and future of medical education in China from different types of research through a systematic review.

Literature search

All authors participated in the literature search. Articles from the Web of Science and PubMed databases were searched. The search was conducted from 2012 to May 2023 and the keywords used in the search were "Medical education", "Present", "Future", "China" and "COVID-19". The retrieved articles were also searched manually in journals and on the internet to ensure a more comprehensive search.

Inclusion and exclusion criteria

We included experimental and non-experimental research in English. Articles described the current state of medical education in China, the problems faced or future directions for development. Dissertations, letters, opinions or views, and commentaries were excluded.

Literature extraction

From the databases, 78 articles were initially screened for relevance to medical education in China. 13 articles were added through a manual search of the journal and an internet search. 15 articles were removed as duplicates by EndNote X9 software (Clarivate Analytics, USA). Two authors extracted 36 articles from the titles and abstracts of the articles based on inclusion and exclusion criteria. Six authors read and discussed the full text of the 36 extracted articles and removed 5 articles that did not fit the theme of the study. Finally, 31 articles were identified as relevant to this study. The complete search strategy is shown in **Figure 1**.

Current medical education in China

With the rapid growth of medical education in China, colleges are trying the best to deliver more highly qualified medical personnel to the healthcare service. However, we are still facing challenges on the way forward.

1. Parallel running of multiple medical education mechanisms

The basic path of medical education is clear in China, but there are multiple ways to complete clinical medical education (3-year, 5-year, "5+3" integration, 8-year) [6]. With the strengthening of coordination and cooperation between education and healthcare facilities, China has gradually established a standardized medical personnel training system that bridges college education and post-graduation education. College education is a prerequisite for applying to practice medicine[6]. There are two stages of post-graduation

education: the first stage is residency training, which is now mandatory[7]; The second stage is specialist physician training, which has not yet been fully implemented. **Figure 2** shows the main pathways to main ways to complete medical education in China.

Postgraduate degrees in China are divided into professional degrees and academic degrees. The professional postgraduate focuses on the development of clinical skills during the 3 years of study. A professional degree master's graduate certificate, degree certificate, physician qualification certificate and standardized training completion certificate are awarded after successful graduation [8]. It is allowed to apply for a professional doctoral education in following days. Academic postgraduates receive 3 years of scientific research training and award academic degree master's graduate certificate and degree certificate after publication in peer-reviewed national or international journals. After a further 3 years of standardized residency training and physician qualification examinations, the academic master is eligible to conduct clinical activities in the hospital. Continuing academic doctoral education is also an option for academic masters. Medical graduates with an academic degree tend to pursue medical research in the future [6].

2. Synergistic development of medical education in different regions

Different living environments, behaviors, and economic situations lead to differences in the demand for medical resources between rural and urban rural and urban areas in China[9, 10]. The parallel running of multiple medical education mechanisms has produced a diverse range of medical personnel to meet the demand for healthcare services in different regions. The “5+3” integrated and 8-year medical graduates tend to stay in cities to provide demanding healthcare services. The 5-year undergraduate education and 3-year junior college education have been delivering medical personnel to rural areas in recent years[11].

In addition, China has been strengthening the training of primary health care personnel with a focus on general practitioners since 2017. The “Opinions on Medical Education Reform” issued by China clearly proposes to combine 3-year junior college education with a 2-year general practice residency training program to train as assistant general practitioners. The policy strongly supports the recruitment of rural students to medical schools, and tuition fees are waived for students who are oriented to rural areas after graduation, which is of great significance to the demand for personnel in rural areas[8]. The gap between urban and rural medical standards cannot be ignored. The establishment of hierarchical treatment and urban assistance to rural areas in China are also making efforts to promote the coordinated development of medical services.[12, 13].

3. Continuous improvement of the diversified medical curriculum

With the growing demand for medical care, China has incorporated the medical humanities into its curriculum in addition to emphasizing the development of professional skills for medical students [14, 15]. Medical humanities belong to interdisciplinary education, which includes disciplines such as philosophy, sociology, political theory and pedagogy. Medical humanities education can enhance the social responsibility, empathy and understanding of medical students [4]. However, most medical schools in China face a shortage of teachers and funding for the development of the humanities. Reports indicate that there is a lack of 200,000 pediatricians, over 200,000 anesthesiologists, and 161,000 general practitioners in China [16, 17]. Undergraduate courses directed at pediatrics, anesthesiology, and general medicine have been gradually promoted in China.

The outbreak of COVID-19 has tested the development of public health disciplines in China [18]. Public health-related infectious diseases, microbiology, epidemiology, and evidence-based medicine have been present in undergraduate medical education, which has provided a solid foundation for the active performance of Chinese medical personnel in the fight against the epidemic. The low proportion of public health courses and the lack of training in public health emergencies require more attention in China [5]. The ongoing epidemic has also contributed to a change in teaching methods. The internet-based distance learning becoming more widely accepted by public. Distance learning with easily updated and disseminated also meet the medical needs of different regions and is more conducive to the development of medical education in remote rural areas [19]. Funding, technology and quality assurance are areas where distance learning needs to be improved

in the future [20].

4. Multiple department collaborative management mechanism in medical education

Medical education in China includes college education and post-graduation education, which are completed in schools and affiliated hospitals [8]. It is significant to improve the management mechanisms of schools and affiliated hospitals. China has established a management mechanism for medical education with the participation of multiple departments, including education, health and finance, to jointly negotiate major policies and issues in medical education. The Ministry of Education is responsible for the administration and teaching management in affiliated hospitals. The medical services provided by the affiliated hospitals have not changed, and medical services remain the responsibility of the health department, thus creating a situation where the education department, the health department and the university share management. This multiple management is prone to problems of unclear division of responsibilities and complex working procedures [21].

The medical education modes worldwide

During the development of medical education, China has constantly learned from the experiences of foreign developed countries[22]. Here we again sort out some typical foreign medical education models to explore a model suitable for China.

1. American mode

The “4+4” model established by United States (US) is well known: medical students need to complete 4 years of general university education and receive a bachelor’s degree before entering medical school. After admission to medical school, medical students undergo four years of medical education, culminating in an M.D. degree [23]. Earning an M.D. is a prerequisite for admission to practice medicine. Medical students enter the residency training after completing the medical school [24]. They register as general practitioners after the first phase of training, and as specialists after the second phase of training in related specialties. Many medical schools in the US also promote the M.D. / Ph.D. program, which is to add the Ph.D. training to M.D.[25]. It usually requires 4-5 years of research training with the goal of developing leaders in the field of medical research.

2. British mode

Students in the UK apply to university after high school, and after 3 years of general undergraduate study they go on to medical school for 4 years of medical study. Or they enter university after high school for 2 years of pre-clinical study followed by 2-3 years of clinical medicine. The final degree is the Bachelor of Medicine and Surgery (MBBS), which is a requirement for physician registration. In the UK, there are medical masters and doctoral degrees, but they are not directly linked to the practice of medicine. After obtaining the MBBS, medical students have to go through several stages of post-graduate medical education, including pre-registration residency, senior residency, chief residency and senior chief residency [26]. In the chief residency stage, physicians can apply for the doctoral degree, which is awarded after a period of full-time research in a research position with corresponding results; surgeons can obtain a master’s degree after 1 to 1.5 years of full-time research work. The master’s and doctoral degrees are not necessarily linked to post-graduate education, but chief residents may not be promoted to senior chief resident until obtaining master’s or doctoral degrees [27].

3. Japanese mode

Medical schools in Japan are a 6-year program for high school graduates, and a bachelor’s degree in medicine is awarded upon graduation [28]. Obtaining a bachelor’s degree in medicine is a requirement for admission as a physician. After graduating, medical undergraduates take the national medical examination and are certified as physicians [29]. A further 2 years of clinical training is required to become a full-fledged clinician. After completing their undergraduate education, medical students can pursue 4-8 years of postgraduate education to obtain a Ph.D. degree. The goal of the Ph.D. degree is clearly to develop the knowledge and

abilities necessary to conduct independent medical research [30, 31]. **Figure 3** shows the models of medical education in developed countries.

Prospects for the future of medical education in China

The above model of medical education abroad shows that medical education abroad is an elite education with a unified academic system and an emphasis on clinical practice. The foreign experience combined with the current situation in China to analyze the future of medical education.

1. Building unified medical degrees with clear objectives

To establish a system of training clinical medical talents with “5+3” (5 years of undergraduate education in clinical medicine + 3 years of standardized residency training or 3 years of postgraduate education for master’s degree in clinical medicine) as the mainstay and “3+2” (3 years of specialist education in clinical medicine + 2 years of training for assistant general practitioners) as a supplement. The master’s degree will be abolished and a separate M.D. degree in medicine will be established [1]. In the “5+3” integrated medical professional training model, the M.D. degree will be conferred directly upon completion of 5 years of undergraduate education, 3 years of standardized training and specialist training in relevant disciplines. The MD degree is also awarded to those who have completed the 8-year clinical education. The purpose of the “5+3” and the 8-year training model is to cultivate medical personnel with excellent clinical capabilities. Medical professionals with an interest in research may receive 2-3 years of research training after obtaining M.D. degree, and then be awarded an additional Ph.D. degree after achieving certain achievements in the relevant field. The “3+2” program provides high-quality medical staffs for the grassroots.

2. Focusing on general practitioners and primary care

Increasing the training of general practitioners through standardized training for residence and training for assistant general practitioners. Improving the training policy for directed general practice, and expanding the scale of general practitioner training appropriately according to demand. Enhancing policy and financial support for medical schools in disadvantaged areas. Giving full play to the leading role of high-level medical colleges to improve the level of education run by weak colleges. Improving the health service capacity of rural grassroots medical personnel through expert support and cadre training. It is recommended that a grassroots-oriented doctor training program should be developed to encourage medical staffs to join the grassroots[32]. More efforts should be made to improve the working environment in rural areas to enhance the attractiveness of the grassroots medical career [33]. The career development prospects of grassroots doctors should be broadened, and preferential policies should be formulated in terms of title assessment, social security and job establishment. Giving praise and rewards to doctors who have been rooted in the grassroots, and enhancing the sense of professional honor and belonging of grassroots doctors[34].

3. Strengthening medical humanities and public health education

In order to improve the humanistic quality of medical students, it is recommended that colleges set up medical humanities research centers and incorporate humanities into the curriculum [35]. It is also necessary to increase policy guidance and financial support to build a capable team of humanistic education teachers. Regular humanities forums are held in schools and hospitals to actively create a humanities atmosphere and provide a platform for all medical students to interact with each other [36]. Experts in medical humanities are regularly hired to give lectures on humanities to medical students. Emphasis should be placed on the exemplary role of clinical lead teachers in medical humanities education. Increasing social acceptance is a prerequisite for promoting the development of public health [37]. Actively adjust the structure of medical personnel and provide policy preference for students applying for public health in undergraduate and postgraduate enrollment. The proportion of public health subjects in the curriculum is appropriately increased. Increase investment in public health education and establish “public health emergency drill centers” in provinces to provide regular training for medical personnel in responding to various public health emergencies[5].

4. Improving the management mechanism between colleges and affiliated hospitals

It is suggested that to give full play to the function of medical schools in coordinating the development of medical education [38]. A certain degree of autonomy in enrollment, teaching, discipline construction, scientific research, talent introduction, and funding management should be granted to medical schools [39]. It is a good choice to give the medical school the authority to manage and supervise the teaching and scientific research of affiliated hospitals. Granting medical schools right to review medical technical titles makes them an academic management entity. It is important to establish communication channels and feedback mechanisms to achieve synergy between colleges and clinical institutions.

Conclusions

Although medical education in China has developed rapidly and made certain achievements, it needs further reform in the context of COVID-19 and the Health China strategy. This review integrates the current situation of medical education in China and successful foreign medical education models, and then proposes interventions for reform in order to cultivate medical personnel that meet future needs in China. This review may serve as a reference for the educational efforts of medical schools in China.

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Figure 1. Flow chart of search results.

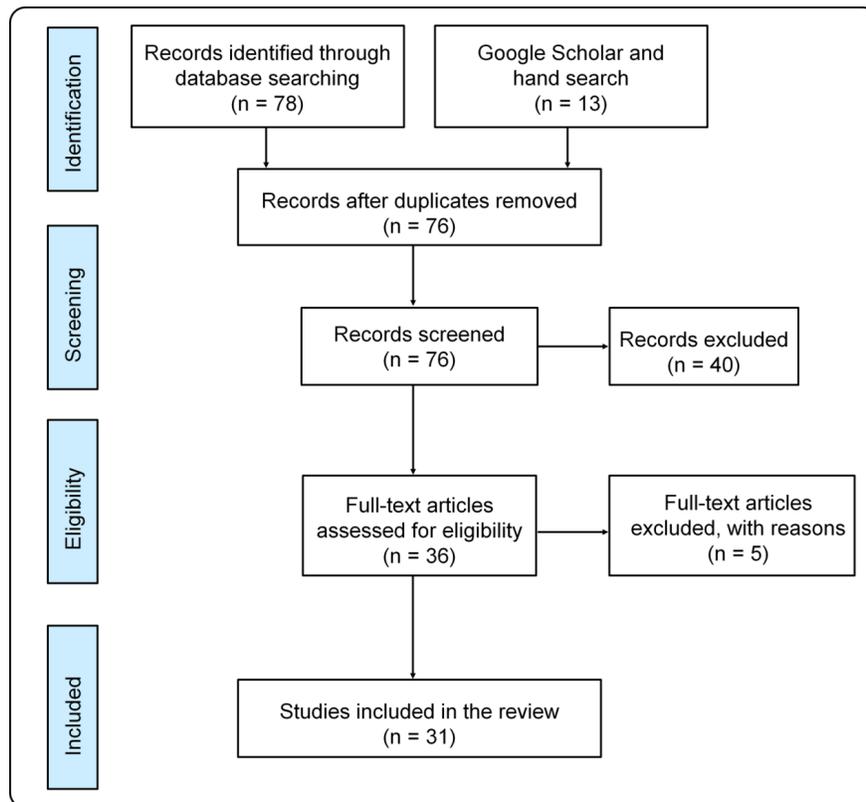
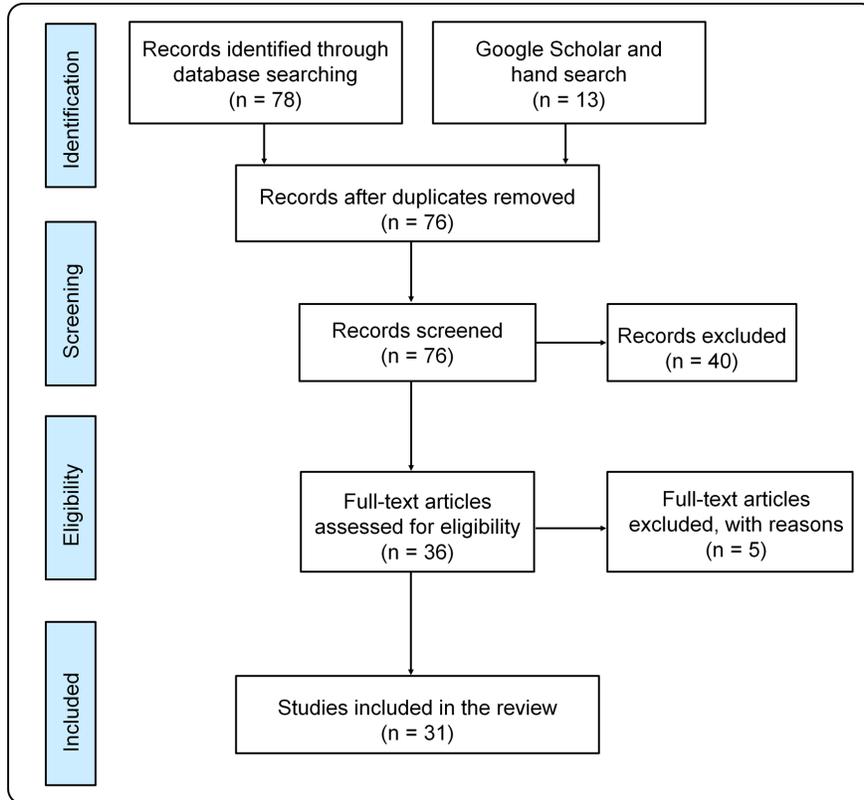


Figure 2. The main pathways of medical education in China.

Pathways	Educational system	Institutional education	Standardized training for residents	Standardized training for specialist physicians	Full years & Final degree
1	3-year system	3 years clinical medicine junior college education	2 years of assistant doctor training + 3 years of resident training	2-5 years	10-13 years & Non-degree
2	5-year system	5 years of clinical medical undergraduate education	3 years	2-5 years	10-13 years & Bachelor's degree
3	"5+3"-year system	5 years of clinical medical undergraduate education + 3 years of postgraduate education and residency training	0 years	2-5 years	10-13 years & Master's degree
4	5-year + 3-year system	5 years of clinical medical undergraduate education + 3 years of academic or professional postgraduate education (Entrance exam required)	0 or 3 years (Depends on the type of master's degree)	2-5 years	10-16 years & Master's degree
5	8-year system	Medical undergraduate and postgraduate education of varying years	1-3 years (Depends on policy)	2-5 years	11-16 years & Doctoral degree
6	"5+3"+3-year system	5 years of clinical medical undergraduate education + 3 years of postgraduate education and residency training + 3 years of doctoral education (Entrance exam required)	0 years	2-5 years	13-16 years & Doctoral degree
7	5-year + 3-year + 3-year system	5 years of clinical medical undergraduate education + 3 years of academic or professional postgraduate education + 3 years of doctoral education (Entrance exam required)	0 or 3 years (Depends on the type of master's degree)	2-5 years	13-19 years & Doctoral degree

Figure 3. Medical education model in developed countries.

Countries	Model	General undergraduate study	Medical study	Standardized training
USA	“4+4+X”	4 years	4 years	X years
UK	“3+4+X”	3 years	4 years	X years
JAP	“6+2”	0 years	6 years	2 years



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1	3-year system	3 years clinical medicine junior college education	2 years of assistant doctor training + 3 years of resident training	2-5 years	10-13 years & Non-degree
2	5-year system	5 years of clinical medical undergraduate education	3 years	2-5 years	10-13 years & Bachelor's degree
3	"5+3"-year system	5 years of clinical medical undergraduate education + 3 years of postgraduate education and residency training	0 years	2-5 years	10-13 years & Master's degree
4	5-year + 3-year system	5 years of clinical medical undergraduate education + 3 years of academic or professional postgraduate education (Entrance exam required)	0 or 3 years (Depends on the type of master's degree)	2-5 years	10-16 years & Master's degree
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Countries	Model	General undergraduate study	Medical study	Standardized training
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JAP	"6+2"	0 years	6 years	2 years