

# The Study on Strategic Issues of Medical Education and Clinical Training in China

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**Abstract:** This study proposes policy recommendations for improving the quality of medical education and clinical training in China. Using strategic issues research methods such as data and information analytics, we interpreted the requirements for the homogenization of medical education and clinical training, along with a balanced mechanism between medical professionals' supply and medical demands. Our results suggest that first, it is important to enhance the strategic position of medical education and clinical training, and establish a coordination mechanism at the national level. Second, we recommend planning for the enrollment of China's medical schools based on the systematic analysis of medical demand and promote reform of the medical curriculum system. We suggest gradually arriving at a tradition of elite education and a homogenization of clinical training. Third, we argue in favor of progressively abolishing entrance examinations and dissertations for master's and doctoral degrees in the clinical sector, combining clinical training with degree granting, and promoting the role transition of clinicians from "institutional staff" to "medical professionals." Fourth, we recommend accelerating a pilot reform for personnel compensation and performance evaluation systems to reshape the attractiveness of a medical career. It is imperative to build a public health-oriented clinical training system based on the concept of "health for all," and it is also important to reform traditional Chinese medicine's higher education and explore a new clinical training model for residents. We recommend establishing a National Health Research Foundation to improve the innovation capabilities of clinical research in China.

**Keywords:** medical education; clinical training; Doctor of Medicine; coordination mechanism; National Health Research Foundation

## 1 Introduction

Historically, health was related to the rise and fall of a country and the survival of a nation. In the new era, without the health of the people, there would be no moderately prosperous society, and there would be no way to realize the great rejuvenation of the Chinese nation. The important foundation and support for the realization of national health

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lies in medical education. The cultivation of medical and health personnel is an important part in constructing a strong educational, medical, and technological country as proposed by the 19th National Congress of the Party. In order to realize these three strategies, the foundation lies in education and the key focus lies in talent. The training programs of medical and health personnel includes three stages of college education, post-graduation education, and continuing education. These concern clinical training in clinical prevention and treatment, science and technology, public health, and traditional Chinese medicine. Many departments are involved, engaging in complex system engineering, such as the Ministry of Education; the National Health Commission; the Ministry of Human Resources and Social Security; the Department of Science and Technology; the National Administration of Traditional Chinese Medicine; and other competent authorities.

For the new era to achieve a healthy nation and moderately prosperous society, there is a need to scientifically plan the appropriate scales and structures for the training of medical and health personnel in China, and formulate and improve the management systems and training models to adapt to the needs and laws of the industry. There must be a system in place that better meets the requirements for the people's health needs and economic and social development, as these have become issues that urgently need to be studied and resolved. Based on the spirit of the National Conference on Health and Wellness, the essence of the National Conference on Reform and Development of Medical Education, and the objectives of the *"Healthy China 2030" Program*, the Chinese Academy of Engineering's comprehensive team from the major consulting project, "Research on Strategies for Training Medical and Health Talents in China," has adopted information, benchmarking, investigation, and prediction research methods alongside expert consultation. Based on a comprehensive analysis of the overall current training of medical and health talents in China, research focused on the overall supply-demand balance mechanism for medical and health clinical training and the improvement of clinical training quality. Based on research on college, post-graduation, public health, and traditional Chinese medicine educations, we will consolidate the major dilemmas and key issues as faced by China's medical and health clinical training program, learn from international experience, and—according to China's national conditions—proactively put forward the overall policy recommendations for the training of medical and health personnel in China.

## 2 Overall status

The strategic significance and logical relationship of clinical training in various medical and health specialties/fields are mainly reflected by the following five aspects: (1) College education is the source and starting point of medical and health clinical training; (2) clinical medical talents are the key teams that serve the public's medical needs; (3) medical science and technology talents are the core elements in building a powerful country in science, technology, and health development in China; (4) public health personnel are important forces in improving our disease prevention and control ability to ensure national security; and (5) Chinese medical talents are an assured means to inherit the attributes of China's traditional culture to develop a new medical system.

This paper analyzes and evaluates the general manifestation behind the cultivation of medical and health talents in China both horizontally through comparison of science, technology, agriculture, and medicine, and vertically through comparison of the internal structures of medicine.

### 2.1 Significant increase of medical students

Between 2011 and 2015, there were 2.79 million medical graduates from ordinary colleges and universities, accounting for 8% of the total number of graduates from these colleges and universities—an increase from the 860 000 that graduated between 2006 and 2010. There were 290 000 medical postgraduates finishing their studies, which accounted for 10.4% of the total number of postgraduates in ordinary universities. Since the 2009 implementation of the "new medical reform," the total number of healthcare technical talent has significantly increased from 5.53 million in 2009 to 8 million in 2015, and the number of practicing (assistant) doctors has increased from 2.33 million in 2009 to 3.04 million in 2015 [1].

At the same time, the educational background and professional title structure of health technicians is gradually increasing and becoming optimized, meeting the need for medical and health reforms and developments for talent.

### 2.2 Structure and training of medical talent

By the end of 2015, medical undergraduates and above accounted for 16.5% of the four core disciplines of science, engineering, agriculture, and medicine. Ranking third, they were roughly the same as the number of science graduates (16.7%), but significantly lower than the number of engineering graduates (61.6%) [2]. However, the

average annual growth rate of medical graduates was the highest. In the past five years, the proportion of medical master's graduates to the total number of graduate students has been stable at around 12%, and the number of master's graduates has exceeded those of science since 2011. However, the total number of talents with doctoral degrees is still less than those with engineering and science degrees, and less than half of that for engineering, supporting the need for a large number of technical talents for the process of China's reform, opening up, and industrialization. According to *Japanese Science and Technology Indicators 2016* [3], in science and technology powers such as the US, Japan, the UK, and Germany, the number of doctors of medicine and doctors of science ranks highest among all the doctorates per million people. The proportion of medical doctors in China is low for the total number in doctoral training. Generally speaking, the number of medical doctorates awarded in China is only 6.6%, lower than that of engineering (37%), science (13%), management (11%), and law (8%), and is equivalent to the number of literature doctorates. In Japan, the number of medical doctors is 2.5 times that of engineering, and five times that of science, reflecting the educational philosophy of medical elites in developed countries. From the college and university levels, training for medical students in China is also low. Before 2012, the scale of medical graduates in secondary vocational colleges was higher than that in medical universities and colleges. This situation began to reverse in 2013, and by 2016, the total number of medical graduates in the two types of colleges was basically the same.

### 2.3 Establishing a clinical medical training system

A clinical medical training system has essentially been established, with a "5+3" program (five years of undergraduate clinical medical education plus three years of standardized resident training or three years of postgraduate professional education as a Master of Medicine) as the primary model, and a "3+2" program (three years of clinical medical education in junior colleges plus two years of assistant general practitioner training) as the supplementary model. The standardized training system for residents has been fully implemented in 31 provinces, autonomous regions, and municipalities across the country, and a standardized training system for specialists is being explored.

## 3 International experience

### 3.1 Personnel training standards

Health care is related to life saving and physical health, therefore it determines the particularity of medical education and clinical training. One such aspect is the unique educational model. The distinguishing feature of medical education from other disciplines or industries is that it emphasizes a close connection between college education and work practice, and requires smooth transitions between the three sequential stages of college education, post-graduation education, and continuing education. The second aspect is the unique training standard. In the US, the end-point of clinical medicine is to obtain a medical doctor's degree (MD) upon graduation from a medical college or university. The graduate medical education system focuses on the training of resident doctors as its content and the training of qualified doctors as its goal. The continuing medical education system has a main objective of training specialized medical students. In the UK, France, Australia, and Japan, the clinical medical education provides undergraduate education lasting five or six years, or provides residency training/research to obtain an MD, rather than a master's degree.

The "4+4" clinical medical education model started in North America at the beginning of the twentieth century and is one of the mainstream models of medical education in the world. This model is to select the best among multi-major undergraduates who wish to study medicine; these selected students then enter medical schools to study clinical medicine after completing undergraduate education and obtain an MD upon graduation. This model includes four years of undergraduate education plus four years of medical school education, hence the name "4+4" educational model. It specifically provides future medical education to undergraduates of various majors at the university if they are willing to study medicine, and besides completing the study content of their original majors, graduating, and obtaining a bachelor's degree, they must study certain basic medical courses during the university period. These are known as "pre-med" courses such as biology and chemistry, and are undertaken in order to meet the requirements for medical school entrance examinations. Medical school is for undergraduate students with a variety of professional backgrounds that are interested in studying medicine, and is considered well-suited for a medical practitioner's clinical education. This model positions medical education as a graduate education and is based on undergraduate education in a multidisciplinary context.

### 3.2 Supply and demand balance mechanism

The international research on supply and demand mechanisms for medical and health personnel shows that the US and the UK have elite and homogeneous education, which mainly determines the enrollment of medical students by the number of resident positions or the number of students who receive per capita appropriation as a means to control the enrollment scale. Both countries attach importance to the scientific evaluation and prediction of the enrollment scale of clinical medical education [4–7]. This enlightenment to China has included the cultivation of medical talents as required by cross-departmental macro-coordination and regulation; the balance of talent supply and demand needs to fully consider the characteristics of funding and doctors' employment; the engagement of medical students with training bases as "social people" after post-graduate education; and the use of the medical schools' strict quality requirements such as "stringent admission and stringent graduation," and a high threshold for doctors to enter, thus to limit the number of trainees.

## 4 Key issues

Through investigation and research, expert consultation, and other means, the major issues of training medical and health personnel in China include the following five aspects.

### 4.1 Reform of management system and mechanisms

The independent running model of medical education has gained the consensus of the health system, yet there are still differences in the university system, especially in the contradiction between the emphasis on academic papers in the "double first class" construction and the ultimate goal of medical education, which is to cultivate qualified doctors. As a complex and systematic project, medical education has not yet established a national medical education system with unified leadership, clear responsibilities, and independent supervision.

### 4.2 Diversity of educational systems

In China, medical talent that graduates from technical secondary school, junior college, undergraduate level, master's degree level, and doctor's degree level can all be doctors. Due to the different training models, the doctoral level is uneven, and a high-quality and reliable medical system cannot be formed. It also harms the equalization and fairness of the medical system to a great extent. The difference in the levels of teachers in residential and specialized training bases (hospitals) and the emphasis on education in medicine will also affect the homogeneous training of clinicians.

### 4.3 Establishment of an internal multidisciplinary model

Medicine goes beyond just science; it is also human science and sociology. Therefore, the development of medicine needs multidisciplinary support. In China, medical students, no matter if their training is a product of the five- or eight-year schooling system, receive a medical education from the undergraduate level. The training's weak mathematical and engineering background affects its interdisciplinary innovative ability. At present, only Peking Union Medical College in China has officially implemented the "4+4" clinical medical education model starting in September 2018, enrolling undergraduates from different disciplines and backgrounds. The enrolled medical students have a multidisciplinary undergraduate background and multidisciplinary knowledge, skills, and thinking, which injects multidisciplinary "DNA." In addition, public health professionals predominantly take the traditional five major health courses, which lack management, sociology, psychology, and other aspects, and furthermore, the connection between clinical medicine and public health is not close enough.

### 4.4 Unbalanced talent supply and demand

Compared with the increasing demand for health, the total number of medical and health personnel is still insufficient. Enrollment expansion in colleges and universities and the drop in the quality of students (social environment) have led to the overall decline in the quality of clinical training. The number of colleges and universities carrying out medical education in China is too large, and the number of students enrolled is too high, resulting in uneven qualities in clinicians. There is a structural imbalance between the supply and demand of talent, and a mechanism that balances this has not yet been established. The quantity and quality of the training of talent in public health and preventive medicine cannot meet the needs of the transformation of health and health work from "taking treatment as the center" to "taking people's health as the center" for the new era. There is a phenomenon of the expression, "thin at both ends, and weak in the middle," within the Chinese medicine talent team, with the first

part referring to the extreme shortage of high-level leading talent and the small number of general practitioners who hold the dialectical thinking and ability of Chinese medicine, and the last part referring to the need to improve the clinical thinking of Chinese medicine specialists and the ability of Chinese medicine to solve clinical issues.

#### 4.5 Improvement of talent development policies

The decline in job appeal and professional identity has led to a serious loss of medical talent. The reforms process of the personnel remuneration system is still lacking in breakthroughs and innovation, especially as the number and quality of training for general practitioners is insufficient. The talent training, employing, and incentive mechanisms need to be perfected. The public health and preventive medicine industries suffer from serious brain drain due to low relative salaries, difficult career promotions, high work intensity, and low social status. The scientific research-oriented doctor evaluation system does not adapt to the professional characteristics, which leads to the frequent retraction of papers and seriously affects the international image of China, while the treatment of returnees and local talent is unbalanced, and the “title-oriented” evaluation mechanism leads to a disorderly talent flow.

### 5 Policy recommendations

Focusing on the core concept of the “transformation from a disease-centered talent training system to a health-centered talent training system,” this paper focuses on the aspects of strategic orientation, enrollment, medical education, standardized training, employment, and policy environment, and we recommend the following seven policy suggestions on the training of public health, Chinese medicine, and medical science talents in China.

#### 5.1 Establishing a macro-management mechanism

Establishing an inter-departmental National Medical Education Committee has been recommended at the national level as a macro-management coordination body for medical education as well as a state-level medical education management, guidance, and supervision agency.

Society should promote the establishment of a consensus in the higher education system on the independent running model of medical colleges. Comprehensive universities should accurately grasp the special laws of education in medicine, realize and perfect the functions of medical colleges, strengthen the overall coordination of medical education in medical colleges, and ensure the overall development of medical education.

The rise of the world’s technological powerhouses is accompanied by the rise of medical and health science and technology innovation, and its mounting position in the national science and technology innovation system. The level of medical and health science and technology innovation has become an important symbol for world science and technology powers. It is suggested that China implement the strategy of giving priority to medical science and technology, and take the training of medical talent, medical science, and technology innovation as priority and as the key areas for China’s higher education, science, and technology innovations.

#### 5.2 Realization of elitism and homogenization

A national long-term development plan for medical education should be formulated, and a dynamic monitoring and early warning mechanism for talent demand should be established. On the basis of ensuring uniformity in the standardized training base, a talent supply and demand balance mechanism for restricting the educational scale and structure of undergraduate education by post-graduate education posts will be gradually established.

Promoting the reform of medical education curriculum systems, from traditional disciplines (anatomy and embryo formation) to organ systems and clinical issues, is suggested. In regard to China’s ageing population, it is deemed appropriate to push forward the curriculum system reform from centering on “medical treatment” to emphasizing “lifecycle health prevention and healthcare.” As the new rounds of scientific and technological revolutions and industrial transformation occur—represented by artificial intelligence, big data, omics, and other frontier sciences—the reform of the curriculum system will be promoted, featuring the integration of medical science with engineering, science, information technology, and humanities.

The training of clinicians should adhere to the principle of moderately lacking and emphasize quality. Based on the current shortage of talent at the grassroots level, the gradual realization of the elite training of medical education is proposed in stages. Aside from medical colleges and universities subordinate to the Ministry of Education, the provincial medical colleges should gradually implement overall first-tier enrollment. In the future, the “3+2” model (three years of clinical medical education in junior colleges plus two years of assistant general practitioner training) will be gradually cancelled as it is temporary and excessive to solve the remote needs at the grassroots level. The

“5+3” model (five years of clinical medical undergraduate education plus three years of standardized resident training) will be gradually realized to establish unified and homogeneous training.

There is need of reforming the eight-year clinical medical education to train elite talent with comprehensive quality by strengthening the general and basic education systems of the eight-year medical students and integrating them into the education of frontier subjects. In addition, there is a need to explore the “4+4” or “3+5” elite education reform pilots within clinical medicine which take comprehensive disciplines (life sciences, science, engineering, and humanities) as its source of students, and recruit outstanding students from non-medical majors at comprehensive universities to study for a Doctor of Medicine. Last, supporting policies to train high-level medical talents with “multidisciplinary backgrounds” and “complex types” should be established.

### **5.3 Unification of regulation and professional promotion**

The only goal of clinical medicine as a specialty is to cultivate excellent and qualified clinical doctors. It is suggested that the system for the Master of Medicine and doctor’s entrance examination should be gradually abolished, along with the system of degree theses. Residents that pass the standardized training should be directly awarded a Master of Medicine degree, and specialists that pass the standardized training should be directly granted the doctoral degree in clinical medicine. The research doctors engaged in basic research or clinical research positions within research hospitals will also study for a Doctor of Science degree (PhD) as a “medical scientist” (MD plus PhD).

Further suggestions are to strengthen the overall implementation of the standardized training system for resident doctors; ensure the teaching input of standardized training; improve the teaching quality; ensure homogenized training of the discipline training base; train a group of general practitioners that have undergone formal medical education and have received general discipline training as soon as possible; and to explore and pilot the establishment of a standardized and specialized training system for specialists.

After the above-mentioned standardized training, doctors will gradually become social persons instead of being merely employed by hospitals. This will socialize the identity of doctors as well as their pension and medical insurance—which will be provided by the social security system—to enable doctors to practice at multiple places, and promote the flow of medical resources.

### **5.4 Implementation of personnel compensation and evaluation systems**

On the premise of ensuring the high-quality development of medical services, comprehensive policies for supporting clinicians should be implemented from the aspects of social support, children’s education, economic income, and career development. Policies are recommended to implement and increase doctors’ remuneration, especially for grassroots doctors, through the design of a remuneration system in order to guide the transfer of good doctors and medical resources to the grassroots level, and to solve common, frequently occurring, and minor diseases.

There should be a special incentive system established for grassroots talent. Upon completion of undergraduate internships and general practitioner training, doctors willing to work at the grassroots level will be selected to provide a policy guarantee for their subsequent personal development and reasonable mobility.

The guiding principle is to improve the level of clinical professional ability and solve clinical application problems, adhering to the principles of following laws, encouraging innovation, conducting scientific evaluation, and promoting reforms in a classified manner. Academic papers should be evaluated more scientifically and reasonably, and should not be regarded as the basic condition to apply to professional titles of all categories and levels of personnel. There should be more targeted evaluation standards established according to the characteristics of the different levels of medical and health institutions, and different professions and health personnel on posts. The establishment of an evaluation system that is more in line with the characteristics of medical and health institutions and conducive to stimulating innovation of clinical researchers should be explored—national clinical medical research centers are proposed as the pilot.

### **5.5 Building a public health clinical training system centered on general health**

A large public health clinical training system that combines college, post-graduate, and continuing education systems should be built. Undergraduate students in colleges and universities emphasize “core competences,” while academic degree graduates emphasize “innovation competence,” and professional degree graduate students and continuing education emphasize “post competences.” At the post-graduation education stage, a public health doctor training system will be established and incorporated into the standardized training system for resident doctors.

Standardizing undergraduate education is recommended through a stabilization (in Midwest China) and moderate compression (in East China) coexistence; the optimization of postgraduate education; the cultivation of a master's degree in public health (MPH); the reduction of academic master's degrees and gradually based on doctoral degrees; the piloting of a public health degree in doctoral training; and the reduction (in Western China) / stop (in Central and Eastern China) of the enrollment of junior college students majoring in public health and preventive medicine.

National standards should be established for public health hospital calibration, professional access, and career access in order to cultivate a wide range of public health compound talents and broaden the entrance of professional degree graduates to relevant industries that are not limited to medical and health industries.

It is necessary to strengthen the clinical training ability of employing units, affiliate the provincial centers for disease control and prevention (CDC) directly to universities, and train "double-position" public health teachers. The government's full responsibility in the public health education reform should be implemented, and there should be a mechanism led by the government and National Health Commission with multi-sectoral cooperation and participation of the whole society, and an optimized environment and policy guarantee for the development of public health talent.

### 5.6 Active promotion of Chinese medicine talent

We will explore a new model for the standardized training of Chinese medicine residents, deepen the pilot reforms and degree convergence, and link high-level master-apprentice education with degree education.

We will improve the training model of the long-term Chinese medicine education system and increase the training of outstanding innovative talents based on inheritance. The postdoctoral program for traditional Chinese medicine inheritance will be deepened, and the national postdoctoral system will be combined with the training of traditional Chinese medicine talent to educate young and high-level talents in the backbone of traditional Chinese medicine inheritance. We will promote the training models and mechanisms using a combination of traditional Chinese and Western medicine practitioners.

### 5.7 Establishing a national health research fund

Basic judgments on the current situation of medical science and technology innovation in China concerns the rapid development of basic research, and the weak innovation ability of clinical research as well as new drug research and development, leading to the lack of local evidence for the prevention and treatment of the Chinese population. In China, 95% of the patented drugs and 95% of the medical equipment is monopolized by foreign companies, which is the predominant reason for expensive medical treatment. China's clinical research funding only equals to one-fourth of the funding for basic biomedical research, while this ratio is basically 1:1 in the US [8,9]. Therefore, it is necessary to balance the investments in basic and clinical research, and tilt them toward the latter, in order to promote the improvement of clinical research capabilities. At present, the only competitive and regularly funded projects are from the National Natural Science Fund. In China, the National Health Research Fund should be established by drawing lessons from the National Institutes of Health (NIH), the Japan Agency for Medical Research and Development (AMED), the French Institute of Health and Medical Research (INSERM), and so on. It should be positioned as a key fund for clinical research and complementary to the National Natural Science Fund (focusing on basic research).

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