

Medical Education Reform in China: The Shanghai Medical Training Model

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In China, a growing and aging population has challenged the health care system. It is expected that China's population over 65 years old will reach 487 million, or nearly 35% of inhabitants, in 2050.¹ The burden on the health care system will be exacerbated by difficulty in accessing medical resources, especially in rural areas. The training of physicians who are qualified, respected, and trusted to serve in rural and urban communities must be increased to meet this need.

The concept of graduate medical education is relatively new in China. Traditionally, medical school graduates work directly as junior physicians without residency training after finishing medical school. With theoretical knowledge and clinical clerkships obtained in medical school, junior physicians' practical skills and knowledge were gradually acquired through an apprenticeship model, learning from senior physicians in the same department over an indefinite number of years. The training experience is variable in terms of length and quality, as there is no standardization or oversight.

This inconsistency has led to a devaluation of physicians practicing in the community, away from teaching hospitals. Many patients prefer to be treated in tertiary centers as the physicians there learned from the experts.² Patients may self-refer to specialists or physicians with more experience, resulting in an overloading of tertiary hospitals and underutilization of physicians practicing in community and rural areas. Given this social stigma, early career physicians tend to choose tertiary hospitals at the start of their medical career and are reluctant to work in community health care centers or regional hospitals, because they have insufficient social recognition and resources.^{3,4} Thus, reform in health care service delivery, particularly in the medical education system, is warranted to cultivate more primary care physicians and community-based and rural providers through

standardized medical training.⁵ These reforms would need to incorporate improved standardization and quality while being timely and cost-effective to encourage institutional implementation and student recruitment.

In 2009, the Chinese government launched a national health care reform policy, of which medical education reform is a key part.⁶ In 2010, Shanghai was chosen to be the pilot city for the national reform because it had relatively mature medical and educational resources. Several local health and education departments united and formed a special health reform leadership group to formulate plans and supervise the implementation. Shanghai's reform aims to create a better physician training system, enhance professional prestige, and promote a more harmonious medical care environment with better physician-patient relationships and improved learning environments for trainees. The 2 pillars of Shanghai's medical education reform are standardized residency training and standardized specialist training, with the aim of cultivating medical personnel of homogenized quality and high-level standards through a well-functioning postgraduate medical education system. There are 5 essential parts to Shanghai's health care reform: the "5+3+3" model (5-year bachelor's degree in medical school, plus 3-year residency training, plus 3-year specialty training), a standardized residency training, a primary care system, a health information project, and vertical integration of medical resources.^{7,8} After graduation from the standardized residency training (SRT), trainees obtain a certificate that is recognized throughout the country, indicating that they have completed residency training and can be recruited by health care institutes of different levels all over the nation as registered physicians. In this article, we describe the 5+3+3 model and its potential for dissemination throughout China's medical education system.

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TABLE

Current Medical Education Programs in China

Program	Degree Granted	No. of Adopting Medical Schools	Note
5-year	Bachelor of Medicine	> 300 medical schools and universities ¹⁰	Graduates typically work in hospitals either as primary care providers or specialists (after further training)
6-year	Bachelor of Medicine	Replaced by the 7-year program	5-year program + 1 year of foreign language curriculum
7-year	Master of Medicine	42 universities	All enrollment stopped since 2015, replaced by the “5+3” combined program
8-year MD	MD/Doctor of Medicine	15 universities	1 year of basic college education, 4 years of preclinical and clinical medical education, and 3 years of clinical skill training in a hospital setting
“5+3” combined	Master of Medicine	> 300 medical schools and universities	5-year program + 3 years of combined standardized residency training and mastery curriculum

Current Status of Medical Education in China

After graduation from high school, all students intending to continue their education take a national college entrance examination. It is a general examination for all majors and universities, not specific to medical school. The results of this examination largely determine which school and program students attend after high school.⁹

Currently, medical education in China is highly heterogeneous, including 5-year, 6-year, 7-year, and 8-year medical education programs. Different medical schools nationwide have adopted variable curricula and distinct continuing medical education paradigms (TABLE). These various systems have been based on medical education principles from the former Soviet Union and Britain. With various instructional methods and standards to evaluate the competency of the trainees, it is likely these programs would lead to discrepancies in the quality of training.

New Medical Education System in Shanghai

In order to meet the national goal of “Health China 2030,” China has urgently called for a reform of the primary and continuing medical educational training systems. In the United States, the model of 4 years of medical school plus a standardized length of time for each specialty’s training is well-established, evidence-based, and has been adopted nationwide.¹¹ However, this system cannot be copied mechanically in China. The cost of a general college education before medical school could be a major financial burden for most students from lower- or middle-income families. This,

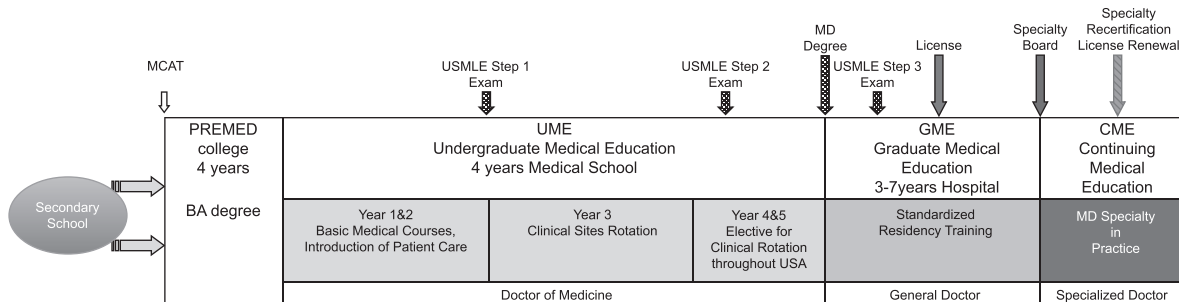
in addition to the generally lower compensation for physicians in China compared with that in the United States, would be a strong disincentive for pursuing an MD training. Furthermore, China’s large aging population and its urgent shortage of qualified physicians make the lengthy US model of medical education largely impractical.

To mitigate these problems, Shanghai has attempted to implement a standardized residency program aiming at training highly qualified physicians, diminishing public distrust,³ and more importantly, improving the accessibility and affordability of medical services. Shanghai City introduced a new medical education program in 2010,⁸ which includes the broad 5-year undergraduate medical education, a 3-year SRT program, and a 3-year specialized training program, also referred to as the 5+3+3 model program. FIGURE 1 illustrates the differences between the physician training system in the United States and the Shanghai model.

Phase 1: Standardized 5-Year Medical School Training

The degree granted after this 5-year program is Bachelor of Medicine. In the first 2 years, students study humanities, medical ethics, basic science, and basic medical courses such as medical history, biochemistry, anatomy, immunology, and physiology. In the next 2 years, students take clinical courses in specialties, including surgery, internal medicine, obstetrics and gynecology, pediatrics, psychiatry, family medicine, emergency medicine, and traditional Chinese medicine. During these 4 years, students take several nationally standardized assessments to

1A



1B

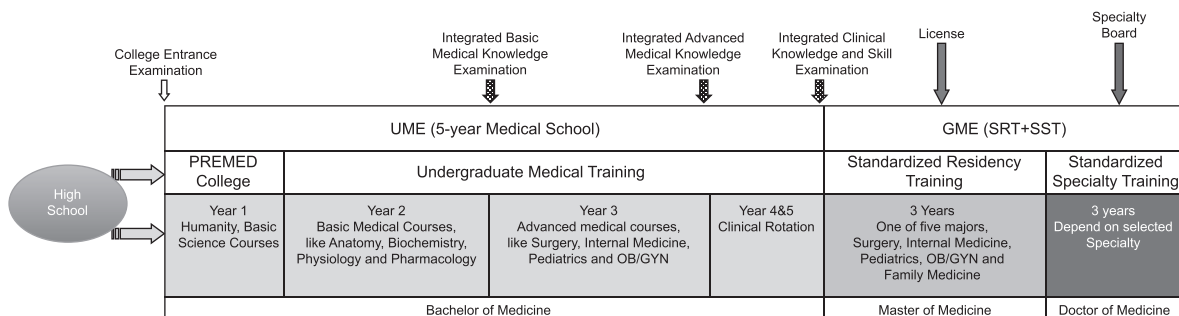


FIGURE 1

Physician Training System in the United States (A) and Under the Shanghai Model (B)

determine their progress. In their fifth year, students complete a 1-year clinical rotation, followed by a 2-part final examination that evaluates basic clinical knowledge and clinical skills. Graduates must then take a national medical licensing examination before they can apply for a medical license.

Phase 2: Standardized Residency Training Program

Phase 2 of the 5+3+3 model builds on the existing model for residency training in Shanghai. In 1988, various specialties and institutions began to train residents as hospital employees. In 2000, Shanghai started to standardize the program and widely implemented it in 2006. In 2009, after the national health care reform, Shanghai piloted the SRT program in tertiary hospitals, where all graduates received a standardized training program before employment. The training criteria in different tertiary hospitals were gradually established and standardized.¹²

Medical school graduates holding Bachelor of Medicine, Master of Medicine (basic science), and PhD degrees who desire to become practicing physicians are required to apply for one of these 3-year programs in qualified educational hospitals (the 64 authorized teaching hospitals in the city as of 2018).

The SRT program comprises 5 specialties: surgery, internal medicine, pediatrics, obstetrics and gynecology,

and family medicine, each with standardized rotation schedules. Residents choose one to train in and are assessed throughout their training by annual evaluations and comprehensive examinations, including an objective structured clinical examination (OSCE). After residency, the National Qualification Examination for Doctors is mandatory for trainees to be registered as a physician at their practicing institution.¹³

Our survey in collaboration with the Research and Education Division of Shanghai Municipal Health Commission found that in 2011, 1 year after the implementation of the SRT program, only 100 trainees had completed the program. By 2018, there were 14 597 trainees who had completed the program and acquired a certification. In a 2014 survey of the Shanghai SRT program recruitment, the number of residents enrolled in the SRT program increased from 1841 in 2010 to 3400 in 2017. Graduates with a masters' or doctorate degrees accounted for more than half of the new residents.

The SRT program is gaining momentum. By 2018, 23 318 trainees had been recruited into the Shanghai SRT program, along with the 14 597 trainees who had successfully completed the program (FIGURE 2).

Phase 3: Further Training

In order to acquire the SRT certification, trainees need to pass the National Medical Licensing Examination and

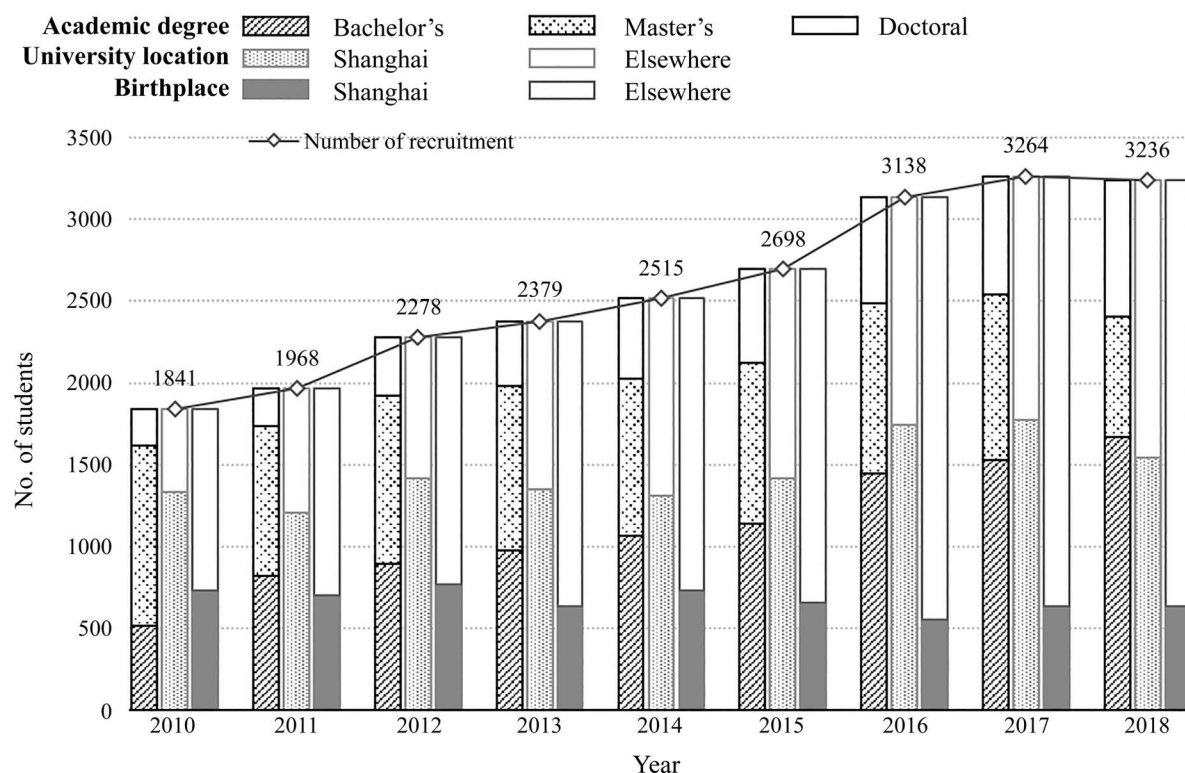


FIGURE 2
Recruitment and Student Background of Standardized Residency Training in Shanghai (2010–2018)

SRT completion examination, which are both nationally standardized. Therefore, after the SRT program, trainees are well qualified to provide safe care to most patients in their specialty and understand when to transfer them for subspecialty care, especially if practicing in areas with less consulting physician support or resources. However, in the Shanghai model, the post-residency medical education programs include the Standardized Specialty Training (SST) and PhD programs.

In January 2016, the Ministry of Health announced plans to initiate a pilot SST program. In this program, participants can pursue 2 to 4 years of training in any specialty after completion of the SRT program. Those who complete the SST program will receive a Doctor of Medicine degree, a demonstration of the holder's knowledge and skill in clinical medicine, which is equivalent to a doctorate degree in other subjects.^{4,14} However, this program has received complaints from medical students and junior doctors in China for fear of the lengthy process and limited compensation during SST.

Next Steps and Remaining Challenges

The continuing educational programs of the 5+3+3 model will gradually standardize the medical education and professional training for qualified physicians and physician-scientists in China. This is a

breakthrough for Chinese medical care and brings a promising future to China's overburdened medical care system. Shanghai's reform has already led to a remodeling of the medical education system in China. In early 2014, the National Health and Family Planning Commission of China issued "Guiding Opinions on Establishing a Nationwide Standardized Resident Training System," which proposes that by 2015, all provinces and regions will initiate SRT, and by 2020, all newly graduated clinicians with a bachelor's degree or above should receive SRT before practicing in medical facilities.

Nevertheless, there are challenges during the national adoption of this new educational system. Not every hospital likely has enough faculties to support the educational program. Since teaching hospitals in China are generally burdened with high outpatient and inpatient volumes, it is difficult for faculty to deliver effective teaching to residents, especially when there is not a good incentive mechanism in place. Residents in some of the leading programs reported issues such as variations in teaching quality and insufficient supervision.^{15,16} Currently, the Ministry of Health and the Ministry of Education in China design and evaluate the curricula, which undergoes continual improvement. For example, an investigation on internal medicine

programs found that case discussions most often occurred only once a week or less, which is likely too infrequent to provide an environment conducive to learning.¹⁷

Since a sophisticated competency framework to guide resident education is currently lacking in the Chinese graduate medical education system,¹⁸ it is essential to set up a nationwide standardized evaluation system with the involvement of third-party institutes, such as the Accreditation Council for Graduate Medical Education (ACGME) and the Accreditation Council for Graduate Medical Education–International (ACGME-I). The ACGME's 6 core competencies and their associated subcompetencies are useful guiding tools in terms of building and evaluating the full scope of a physician's practice of medicine. As of late 2018, Tongji University School of Medicine (TJSM) had started the process of ACGME-I accreditation in its affiliated hospitals, the first to introduce this accreditation system in mainland China. The aim of this campaign is to apply the well-recognized criteria to the Shanghai SRT program to make it more rigorous and comparable to its counterparts elsewhere.¹⁹ Moreover, with the ongoing efforts and progress made via undergraduate curriculum reconstruction and residency training standardization (including ACGME-I accreditation), TJSM is also trying to promote a new "5+3" program of training high-quality primary care providers, which grants them with an MD degree without having to complete the SST component of the model. Together with the societal efforts of raising the prestige of the profession and financial compensation for young physicians, these solutions are aimed to optimize training length and quality, and hopefully therefore the attractiveness of and recruitment into the profession.

Conclusions

Despite challenges, Shanghai's 5+3+3 system has thus far shown promise in solving some of China's most urgent health care needs via a reformulated training model. A more reliable accreditation and oversight from an outside agency with international criteria is crucial for the persistence of the system's quality and its spread to other areas of the country.

References

1. Woo J, Kwok T, Sze Fkh, Yuan Hj. Ageing in China: health and social consequences and responses. *Int J Epidemiol.* 2002;31(4):772–775. doi:10.1093/ije/31.4.772.
2. Hu Y, Zhang Z. Skilled doctors in tertiary hospitals are already overworked in China. *Lancet Glob Health.* 2015;3(12):e737. doi:10.1016/S2214-109X(15)00192-8.
3. Li X, Lu J, Hu S, Cheng KK, De Maeseneer J, Meng Q, et al. The primary health-care system in China. *Lancet.* 2017;390(10112):2584–2594. doi:10.1016/S0140-6736(17)33109-4.
4. Xu D, Sun B, Wan X, Ke Y. Reformation of medical education in China. *Lancet.* 2010;375(9725):1502–1504. doi:10.1016/S0140-6736(10)60241-3.
5. Hou J, Michaud C, Li Z, Dong Z, Sun B, Zhang J, et al. Transformation of the education of health professionals in China: progress and challenges. *Lancet.* 2014;384(9945):819–827. doi:10.1016/S0140-6736(14)61307-6.
6. Chinese Ministry of Health. The Standing Conference of the State Council of China adopted Guidelines for Furthering the Reform of Health-care System in Principle. http://www.gov.cn/jrzq/2009-04/06/content_1278721.htm. Accessed October 14, 2020.
7. Chinese State Council. Notice of the State Council on Issuing the Plan on Recent Priorities in Carrying out the Reform of Health Care System (2009–11). http://www.gov.cn/jzwgk/2009-04/07/content_1279256.htm. Accessed October 14, 2020.
8. Shanghai Municipal Commission of Health and Family Planning. Shanghai's Protocol to standardize resident training and assessment management. <http://wsjkw.sh.gov.cn/kjy2/20180815/0012-59316.html>. Accessed September 21, 2020.
9. Davey G, Lian CD, Higgins L. The university entrance examination system in China. *J Further Higher Educ.* 2007;31(4):385–396. doi:10.1080/03098770701625761.
10. Chinese Ministry of Education. Educational Statistics Yearbook of China. Beijing People's Education Press. <http://www.stats.gov.cn/tjsj/ndsj/2010/indexeh.htm>. Accessed October 14, 2020.
11. Anderson MB, Kanter SL. Medical education in the United States and Canada, 2010. *Acad Med.* 2010;85(9 suppl):2–18. doi:10.1097/ACM.0b013e3181f16f52.
12. Training Guidelines for Shanghai Standardized Residency Training Programs. <https://wenku.baidu.com/view/03374b93a9114431b90d6c85ec3a87c240288a94.html>. Accessed October 14, 2020.
13. National Medical Examination Center. <http://www.nmec.org.cn>. Accessed October 14, 2020.
14. National Health and Family Planning Commission of China. The instructions on pilot implementation of specialist standardization training. <http://www.nhc.gov.cn/qjjys/s3593/201601/b3954c40ef454bbc8ad3613d3e3f1f0f.shtml>. Accessed October 14, 2020.
15. Kang H, Fan J, Chen L, Xing L. Problems in the surgery residency training programs in Beijing. *Chinese J Med Educ Res.* 2011;10:385–388.

16. Zheng Y, Yan Z, Yu Q, Shao J, Wang J, Wang B. A study on residency training programs' faculty in Shanghai. *Chinese J Med Educ Res*. 2011;31:459–461.
17. Lam TP, Lam YY. Medical education reform: the Asian experience. *Acad Med*. 2009;84(9):1313–1317. doi:10.1097/ACM.0b013e3181b18189.
18. Zhao L, Sun T, Sun BZ, Zhao YH, Norcini J, Chen L. Identifying the competencies of doctors in China. *BMC Med Educ*. 2015;15:207. doi:10.1186/s12909-015-0495-y.
19. Lio J, Dong H, Ye Y, Cooper B, Reddy S, Sherer R. Standardized residency programs in China: perspectives on training quality. *Int J Med Educ*. 2016;7:220–221. doi:10.5116/ijme.5780.9b85.



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