

Special Article

Emergency medicine in China: present and future

Y. Veronica Pei, Feng Xiao

Department of Emergency Medicine, University of Maryland School of Medicine, Baltimore, MD 21201, USA (Pei YV);
University of Maryland Emergency Medicine Network, Baltimore, Maryland, USA (Xiao F)

Corresponding Author: Y. Veronica Pei, Email: veronica.pei@gmail.com, vpei@smail.umaryland.edu

BACKGROUND: Emergency medicine was inaugurated, as an official specialty in China, only 25 years ago, and its growth in clinical practice and academic development since that time have been remarkable.

METHODS: This paper is a critical and descriptive review on current situations in emergency medicine in China, based on the literature review, personal observations, interviews with many Chinese emergency medicine doctors and experts, and personal experience in both China and USA.

RESULTS: The current practice of emergency medicine in China encompasses three areas: pre-hospital medicine, emergency medicine, and critical care medicine. Most tertiary emergency departments (EDs) are structurally and functionally divided into several clinical areas, allowing the ED itself to function as a small independent hospital. While Chinese emergency physicians receive specialty training through a number of pathways, national standards in training and certification have not yet been developed. As a result, the scope of practice for emergency physicians and the quality of clinical care vary greatly between individual hospitals. Physician recruitment, difficult working conditions, and academic promotion remain as major challenges in the development of emergency medicine in China.

CONCLUSION: To further strengthen the specialty advancement, more government leadership is needed to standardize regional training curriculums, elucidate practice guidelines, provide funding opportunities for academic development in emergency medicine, and promote the development of a system approach to emergency care in China.

KEY WORDS: International Emergency Medicine; China; Emergency Medical System; Curriculum; Training

World J Emerg Med 2011;2(4):245-252
DOI: 10.5847/wjem.j.1920-8642.2011.04.001

INTRODUCTION

With a population of 1.3 billion, China requires an enormous health care system to meet the medical needs of its own people as well as foreign nationals. Based on 2010 data from the Chinese Ministry of Health, the Chinese health system comprises more than 936 000 health care institutions, including 20 918 hospitals and 901 719 grass-roots health care institutions such as community health centers.^[1] Between 2000 and 2010, outpatient visits to health facilities more than doubled from 2.1 billion to 5.8 billion. Inpatient admissions almost tripled from 53 million to 142 million. In 2010, emergency departments (EDs) in China managed 79

million patient visits. Intrinsic to the country's large population and its distribution over a large geographic area, access to emergency care and the quality of that care remain significant challenges faced by the Chinese health care system.

Rapid economic and technologic advances have led to demographic and epidemiologic changes in the Chinese population, for example, toward an increased incidence of injuries sustained in road traffic accidents as well as chronic conditions such as coronary artery disease, stroke, cancer, and diabetes. These changes in the indigenous population coupled with a rising influx of foreign nationals have heightened the demand for improvements

in acute and emergency health care. As a result, there is a growing need for the development of a well-designed and responsive emergency medical system in China.

Although emergency medicine in China has undergone tremendous growth since the 1980s, it is still an area of medicine that requires further specialty definition and formalized training. Since the establishment of the Chinese Association of Emergency Medicine in 1986, the specialty of emergency medicine (EM) in China has grown tremendously and now encompasses three main areas: pre-hospital medicine, emergency medicine, and critical care medicine. There are several models of clinical practice in existence depending on the practice setting. The current model of emergency medicine practice in urban China is based primarily on a multi-specialist approach using practitioners from medical subspecialties to deliver emergency care in their own area of expertise in the ED. However, as patients presenting to the ED become increasingly complex, with undifferentiated chief complaints, it is becoming evident that specialized training emergency medicine is necessary.

SOCIAL HEALTH INSURANCE FOR EMERGENCY SERVICES

Social health insurance in China is still undergoing massive reforms. After the formation of the new Chinese government in 1949, the government faced the major challenge of providing access to health care for a sizeable population. In the 1970s, the Chinese government created a community-based Rural Cooperative Medical System (RCMS) program, which financed health care for the rural population with great success.^[2] Urban residents who were employees of state-owned enterprises were also given free health care. However, in the early 1980s, market reforms led to a drastic reduction in hospital funding from the central government, from almost complete coverage to only 10% to 20% of the total health care costs.^[3] As a result, the Chinese population incurred high out-of-pocket expenses for health care and was left with a fee-for-service system at hospitals. In 2010, the World Bank reported that the average out-of-pocket health expenditure per household is 82.6%.^[4]

Continued reforms moving toward universal health insurance have maintained the urban and rural population sectors. The new system is built on a cost-sharing structure in which the government, employers, and employees share the costs of health care. Employees of government-owned institutions are required to contribute toward health insurance for a city-wide risk pool. This

plan covers inpatient stays and only a small portion of outpatient visits and medications. Private insurance plans are available for the people who are unemployed or self-employed and for those working in the private or foreign sector. In all cases, the proportion of out-of-pocket expenses is still significant.

Most health care institutions participate in the country's universal health plan, where the patients can bill a small portion of their hospital costs directly to their insurance cards. However, under most circumstances, patients are required to pay a deposit for non-life-threatening ED visits and hospitalizations before receiving treatment. In cases where patients cannot afford therapy, families often withdraw care and return home with their loved ones. Several provincial governments recently passed governing policies dictating that all urgent, emergent, and critical conditions must be treated first regardless the patient's ability to pay.

In an effort to survive in the competitive market economy, EDs have developed marketing strategies promoting their customer service, quality of patient care, and improved patient care environment. Many hospitals are building new EDs to alleviate the crowding and to improve the physical aesthetics to attract more patients. However, to meet the demands of patients and to overcome reimbursements caps placed by insurance companies, overuse of diagnostic tests and prescription drugs has become a significant problem.^[5]

EMS SYSTEM

Background and history

The pre-hospital care system in China has been in development since 1980, when the Chinese Ministry of Health issued the Directives to Further Strengthen the Emergency Care in Urban Areas.^[6] In 2002, the Administrative Committee of the Emergency Medical Center (First Aid Station) Branch of the Chinese Hospital Association (EMCBCHA) was established under the direction of the Ministry of Health to assist in the planning and development of a nationwide pre-hospital care system. Significant improvements have been achieved in the quality of pre-hospital care over the past 30 years, but deficiencies, as delineated by the EMCBCHA are as follows:^[7]

1. Pre-hospital aid development is unbalanced, with great disparities in the nation.
2. There are no national standards for pre-hospital care management, and certain current policies are counter-productive.

3. Multiple emergency response systems co-exist, and they are often in unhealthy and disordering competition.

4. There is a lack of systematic planning of emergency systems.

5. There is a lack of information exchange and sharing.

Models of pre-hospital care

Although the Chinese Ministry of Health mandated that "120" be used as the official medical emergency number in 1996, multiple emergency numbers (e.g., "120", "119", "110", "122", "95120") have been adopted within the same geographic region. In some areas, tertiary care hospitals serve as the base for pre-hospital ambulance services as well as dispatch centers and often have their own emergency phone numbers. The co-existence of emergency response networks within a city or region often creates confusion.

Lack of expenditures for health care from the central government and disparities in local resources have contributed to the high variability in the quality and availability of pre-hospital medical services between regions. At present, more than 300 "emergency centers" can be identified throughout the country.^[8] At least four emergency medical system (EMS) models have been developed as a result of wide range of economic resources and geographic needs across different regions.^[8] Those models range from private ambulance services, stand-alone emergency centers, stand-alone 120 centers, and hospital-based ambulance services as well as combinations of those designs. Until recently, Beijing had two medical emergency systems: the 120 system under the management of Beijing Health Bureau, and the 999 system operated by the Beijing Red Cross. In July 2011, they were combined into a city-wide centralized dispatching network, through which an ambulance is dispatched from either partner based on the location of the incident. This collaborative effort is expected to have a significant impact on response time and quality of care.

Gap between training and technology

Chinese health bureaus have spared no expense in the development of the technologic aspects of the pre-hospital care system. Many medium to large cities such as Shanghai and Beijing have global positioning system (GPS) technology at dispatch centers to monitor pre-hospital ground units. This technology allows the dispatch centers to know the status of each unit, which aids in identification of the closest vehicle available

to respond to a call for assistance. It also enables a dispatcher to shut down a vehicle in the event of unauthorized access.

Communication and personnel training remain major challenges to pre-hospital care systems in China. Effective communication between pre-hospital providers and receiving hospitals has been difficult to achieve. In most cases, receiving hospitals receive little or no notification that critically ill patients are being transported to them. Medical direction and pre-notification are sometimes used in systems that have hospital-based ambulance stations, but this process is inconsistent at best. In these instances, the pre-hospital personnel are also hospital staff members, which at times allows pre-notification of the base ED.

Pre-hospital crews usually include a driver, a transporter who functions as a basic care provider, a nurse, and a physician. The specific combination of personnel varies between different EMS models. Training and certification of pre-hospital personnel also vary between regions. China does not have equivalent positions to the emergency medical technician (EMT) and paramedic levels that are familiar in the United States. In regions with a stand-alone 120 center, pre-hospital personnel tend to be dedicated physicians with very little post-graduate training; hospital-based models may use specialized trained emergency physicians or other junior hospital staff physicians with little training in emergency medicine. Patient transport protocols vary based on the EMS model adopted for the region. In general, pre-hospital providers can recommend transport to the closest appropriate facility, but the patient's preference takes precedence in determining the receiving hospital. This is especially true in EMS models that use local hospitals as satellite ambulance stations. Because of the absence of transfer guidelines and patients' preference for larger and more reputable centers, tertiary care centers are often inundated with emergency and transfer patients.

In larger cities such as Shanghai, the pre-hospital system is much more robust. A protocol manual has been created and pre-hospital care personnel receive regular training. The Pudong district in Shanghai has a well-established EMS system, led by Director Xue Qun Wang, that provides regular training, has stringent requirements for documentation, and monitors ambulance records for quality assurance. Given the variations in resources and geography across China, the process of establishing national standards on personnel training, practice standards, and certification will continue to pose a significant challenge.

EMERGENCY MEDICINE

Practice of emergency medicine

In 1983, China established its first emergency department at the Peking Union Medical College Hospital in Beijing, under the leadership of Professor Xiaohong Shao. Over the next few years, emergency departments quickly emerged in many hospitals across the country. By the end of the 1990s, all hospitals at the levels of province, prefecture and county were equipped with emergency departments.

Several models of emergency medicine practice have been adopted in China. The rise of a market economy and resource limitations have led hospitals within the same city to adopt different models of practice and establish various areas of specialty emphasis. In Beijing, for example, the Beijing Tiantan Hospital specializes in neurosurgical emergencies, while the Chinese People's Liberation Army (PLA) General Hospital First Affiliated Hospital (formerly PLA 304 Hospital) serves as the regional burn center. Until 2005, the Beijing Emergency Medical Center coordinated pre-hospital care through the "120" system as well as acted as a stand-alone trauma and emergency hospital.^[9]

Most urban tertiary care centers have adopted a multi-specialist approach where emergency room physicians are primarily internists. Patients presenting with surgical or subspecialty related complaints are typically evaluated by on-call specialists after triage. Upon arrival, patients are triaged into different areas based on their chief complaints. For example, many EDs contain specific treatment rooms designated for obstetrics/gynecology, ENT, dermatology, neurology, and other subspecialties. A separate treatment area is staffed by surgeons. In contrast, in some centers, such as the Chinese PLA General Hospital First Affiliated Hospital, emergency physicians evaluate all patients presenting to the emergency.

Hospital crowding, lengthy in-hospital stays, and high demand for outpatient services have all contributed to extended stays in the emergency department. In addition, inpatient wards have become highly specialized so that patients with multiple conditions are often refused admission by individual specialties. The result is that the ED is often left to manage patients who require admission or observation but have been deemed undesirable for sub-specialty inpatient services. At tertiary care hospitals, ED stays can range from weeks to months. In extreme cases, chronic stable ventilator-dependent patients have remained at the ED for years because of the lack of outpatient facilities. To meet this

demand, EDs have begun to establish observation areas, inpatient wards, and even Emergency Intensive Care Unit (EICUs). Thus, the role of the Chinese emergency physician has evolved over the years to include acute, inpatient, as well as critical care medicine. In EDs with a strong surgical presence, attending physicians who are trained as surgeons are able to perform emergent operations such as appendectomy, splenectomy, and intracranial hematoma evacuations. With the increasing demand for comprehensive emergency services, many urban hospitals have constructed stand-alone "emergency buildings" that contain their own inpatient wards, ICUs, and operating suits rather than the typical emergency department. In essence, the ED in a large urban center functions as an independent emergency hospital within the larger hospital.

Working conditions

Emergency physicians as well as resident physicians typically work 40 to 50 hours per week. Some university hospital centers require attending physicians to be on-call in the evenings, but the majority of attending physicians cover the ED during normal business hours. After-hour patient care is primarily provided by resident physicians and supervised by senior or chief residents who have received a minimum of three years of post-graduate clinical training. In smaller community centers, emergency physicians work 8 to 12 hour shifts around the clock.

The working environment can be a challenge in itself. EDs are regularly overcrowded and under-staffed. The patient volume of an urban ED typically ranges from 150 000 to 200 000 per year. Patients often overflow into the hallways and, in some instances, the hospital lobby area. The Chinese culture is very family oriented. It is not uncommon for an entire family of several generations to accompany the sick or the injured to the emergency department and be intimately involved in their care. This frequently adds to the chaos and confusion in a busy ED. The challenge of providing customer oriented care to such a large volume of patients as well as increasing threats of legal action related to medical error have added to the already stressful working environment.

As a new specialty in China, emergency medicine is significantly undervalued in most centers and suffers from lack of recognition and support among other departments and hospital administration. Emergency physicians are not viewed as "specialists" by the general public and do not have admitting privileges in most hospitals. In the present economy, hospitals are

struggling financially to survive within the complex system of private and public insurance. This has resulted in competition between hospitals and departments for patient services. Many hospitals have implemented a financial quota that must be met by each department, which directly affects individual physician compensation. Unfortunately, this environment has placed EDs at a disadvantage, given the high proportion of patients without ability to pay and the high costs of managing acutely ill patients. In addition, this has contributed to ED crowding because specialty wards are able to selectively admit patients based on their ability to pay.

Training

The post-graduate emergency medicine training process is highly complex in China. About ten years ago, EM residency training became centralized at the municipal level, based on joint guidelines issued by the Ministry of Health and the Ministry of Education of the People's Republic of China. Residency programs are based at training sites approved by a branch of the local health bureau. Although government-directed guidelines provide basic training directions, the detailed core curriculum, the process of resident evaluation, and certification requirements are highly variable among training sites.

The first EM post-graduate training took place in 1984 at the Peking Union Medical College Hospital. Because specialty certification in EM has not been established, formal training is not required to practice emergency medicine in China. For physicians who choose to obtain training in EM, several options are available. Graduates from medical schools can receive a number of differed degrees based on their years of study. A general 4-year medical degree is considered to be an undergraduate degree, while graduates of 7 or 8 year degree programs also received a master or doctoral degree. Graduates from medical school can apply directly to hospitals for physician-in-training positions, which eventually lead to staff positions at the same hospital. Physicians from lower level and rural hospitals also receive training at larger academic centers for 6- to 12-month post-graduate fellowships. These physicians receive the same training as staff physicians, and they return to their own hospital once the training is completed. Physicians can choose to complete a master's degree or PhD program in emergency medicine after medical school. These degrees do not replace clinical residency, but they are a necessary standard for promotion in academic institutions.

China has no formal accreditation process for graduate medical education. Therefore, a standardized post-graduate EM training curriculum has not been established. The absence of a national certifying body for the EM specialty has led to variable training standards across programs. Recently, the Department of Emergency Medicine at Peking Union Medical College Hospital was commissioned by the Ministry of Health to develop a training curriculum for specialty training in emergency medicine. Since the practice of emergency medicine in China consists mainly of internal medicine, most of the training curriculum has been focused accordingly. Off-service rotation in surgical specialties constitute very little of the overall training curriculum. As stated previously, most resident physicians remain at the same hospital as staff physicians after completion of their training. Thus, the training curriculum at individual hospitals tends to reflect the institution's own style of practice rather than global learning objectives. For example, an emergency physician training at a primarily adult hospital will receive little or no training in pediatric emergency medicine. The perception is that training should be focused on clinical presentations applicable to the individual hospital practice environment. However, there is a growing recognition among Chinese emergency physicians that more standardized training is needed. In 2010, the Shanghai Health Bureau and a group of emergency medicine experts led by Dr. Yiming Lu developed a standardized 3-year training curriculum in EM for the region of Shanghai. Each trainee participates in a standardized, multi-specialty curriculum, including rotations in medical and surgical specialties, pediatrics, obstetrics/gynecology, as well as medical and surgical critical care. The aim of this program is to train a new generation of emergency physicians with a standardized skill set that can be adapted to any ED within the Shanghai region. If successful, it is hoped that this model will be adopted throughout China.

Recruitment

Recruitment of emergency physicians remains a challenge at most institutions. Heavy workloads, difficult working conditions, limited reimbursements, and lack of recognition and respect from colleagues all contribute to the difficulty in recruiting emergency physicians. Most hospitals staff their EDs with rotating residents from other specialties and very limited numbers of EM attending physicians. For many physicians who work in an ED, emergency medicine was not their initial specialty of choice. However, as recognition of the

specialty of emergency medicine grows in China, the number of graduating physicians interested in EM is increasing quickly.

Academic development

As in other nations in the early stages of emergency medicine development, the majority of senior emergency medicine faculty members were grandfathered in from other specialties. Given the complex scope of practice of EM in China, emergency physicians are struggling with the development of basic and clinical research in their newly defined specialty. Funding for academic development in China has tends to support basic laboratory research and well-established specialties. At present, the main topics of research in EM are basic science investigations related to resuscitation, toxicology, and critical care medicine. Chinese emergency physicians have eagerly accepted new technology from developed countries, but a lack of population-based clinical studies and practice standards have limited the development of evidence-based practices in China.

There are two professional emergency medicine societies in China: the Chinese Society of Emergency Medicine (CSEM) and the Chinese College of Emergency Physicians (CCEP). CSEM, a sub-group of the Chinese Medical Association, hosts bi-annual national educational meetings. CCEP was created in 2009, with the mission of promoting the development of emergency medicine through advocacy, training, research, and education. Several national EM specialty journals are in publication. The *Chinese Journal of Emergency Medicine* (CJEM), published monthly, is the official journal of CSEM. In 2010, the Second Affiliated Hospital of Zhejiang University Medical School started a quarterly publication of China's only EM journal in English, the *World Journal of Emergency Medicine*.

FUTURE DIRECTIONS

As a young specialty, emergency medicine in China is struggling to survive in a traditional culture with more than 2000 years of medical history and domination by subspecialty development. Harsh working conditions, lack of recognition and support from other specialties and hospital administrators as well as rising health care costs have all slowed the growth and development of this specialty in China. Rapid economic development and urbanization in China have resulted in epidemiologic and demographic transitions in terms of disease burden toward chronic illnesses and injuries.^[10] While it has been

recognized that the ability to provide care to acutely ill patients is essential to a health care system, China needs to strengthen its emergency medical system through financial support and standardization of residency training and continuing medical education in order to respond effectively to its changing health care priorities. Recent natural disasters such as the earthquake in Sichuan reinforced the need for improvements in disaster preparedness and response.

Scope of practice

The current practice of EM encompasses many roles, including EMS, acute patient care, ward medicine, and intensive care. However, no single model of emergency medicine practice has emerged. While there is a trend toward the specialty model of EM practice internationally, the achievability of such a model of practice in China is questionable. Given China's vast population, complex health system, and variability in economic capabilities, a single model of practice may not be feasible. China is in the midst of developing its own models, which are tailored to the needs of regional health systems and influenced by the increasing expectations of those who require emergency care. Emergency physicians in China first need to develop a consensus as to their scope of practice. This first step is critical to future specialty development, as it is fundamental to the development of residency training requirements and specialty certification. Training emergency physicians to diagnosis and manage a full spectrum of acute illnesses across all ages may be a challenge in China. Once emergency medicine has delineated its scope of practice, the subspecialties of critical care and pre-hospital care can be developed. The CSEM and CCEP have been leaders in this mission and will continue to offer direction for this development.

Training and certification

After emergency medicine model(s) of practice have been defined, a national standardized residency training curriculum and certification process can then be developed. Standardized training and certification ensures that core competencies are met for each physician trained to be an emergency physician. Given the current state of emergency medicine in China, a number of models may be required based on regional health system needs. Thus, the training curriculum and certification may need to be a tiered process that matches regional practice models. Monitored training and certification will contribute significantly to ensuring high quality patient care.

Continuing medical education (CME)

There are very limited informative and evidence-based educational resources available to emergency physicians in China. Several textbooks have been published by well-respected experts in the specialty, but no single authoritative reference for EM practitioners in China has been produced. For the purposes of annual evaluation and academic promotion, all physicians are required to have at least 10 category 1 (national) CME hours and 20 category 2 (regional) CME hours. Requirements vary between clinical sites. Most CME activities are sponsored by pharmaceutical or medical equipment companies. A systematic and up-to-date educational platform is critical for advancing emergency medicine as a specialty and ensuring continued quality patient care.

Collaboration

International collaborations can be a critical component of specialty development and are widely in use in China. At a systems level, collaborations can improve and enhance current emergency response systems. Integration of pre-hospital and hospital emergency care remains a major challenge. Interdepartmental collaborations should be enhanced to further the development of emergency medicine in China. Policies regarding consultation and admission procedures should be established so that patient flow through the ED can be optimized. Inter-departmental educational conferences can enhance knowledge and communication between the ED and other departments. The exchange of knowledge between faculty members and residents can be a valuable learning experience for all members involved.

Advocacy and research

Chinese emergency physicians are struggling to define themselves as specialists. One of the most important roles of Chinese emergency physicians is to advocate for policies, programs, and funding that support further development of their specialty. Advocacy can be performed through professional organizations such as the Chinese Society of Emergency Medicine and may involve working with local government agencies, other medical professionals, hospital administrators, the general public, academic institutions, and civic organizations.^[11]

At the hospital level, the ED cannot be expected to sustain itself as an individual department but must be viewed as a vital component of each hospital organization. Although EDs often face a large financial burden, it must be recognized that they provide medical services to the community when no other such services

are available. Moral and ethical concerns prevent the ED from turning away patients in need of emergency medical treatment. The ED should not be expected to bear this burden alone. ED administrators should advocate for clinical as well as financial support from hospital administrators so that their valuable service to the community can be sustained.

Funding should be provided by government agencies to establish baseline patient population data and support additional research. More research is needed to ensure that clinical decisions are appropriate to the Chinese population. Additional research in EM training and education, the clinical management of acutely ill patients, and administrative policies in the practice of EM is also needed. State and regional government agencies should jointly finance a systems approach to EM development. The current highly fragmented emergency care system, fraught with poor inter-agency communication and disjointed patient care, is not sustainable considering the rising public demand for quality health care. In addition to improving patient care standards, focus should be placed on improved integration of pre-hospital, emergency department, and in-patient care for patients requiring emergency services.

As emergency medicine develops in China, it will continue to face new challenges. With the development of a specialty model of practice, new educational and specialty requirements will ensue. Continued advancement in education, research, and clinical practice will be vital to the maturation of the specialty. Coordinated efforts from current leaders in emergency medicine, academic institutions, and government agencies will be critical to the continued development of emergency medicine in China.

Personal Interviews (in alphabetic order)

Dr. Ya Cao, Professor, Central South University; Assistant Dean, Xiang Ya Medical College of Central South University; Vice Mayor, Changsha, China)

Dr. Faping Chen, President, Third Xiang Ya Hospital, Xiangya Medical College of Central South University, Changsha, China

Dr. Echo Guo, Deputy Director, Shanghai Medical Emergency Center, Shanghai, China

Dr. Shubin Guo, Assistant Director, Department of Emergency Medicine, Peking Union Medical College Hospital, Beijing, China

Dr. Zhong Jie He, Past Director, Department of Emergency Medicine, Central People's Liberation Army Hospital First Affiliate Hospital formerly known as 304 Hospital, Beijing, China

Dr. Chunsheng Li, Director, Department of Emergency Medicine, Chaoyang Hospital, Beijing, China; President, Chinese Association of Emergency Medicine

Dr. Leon Li, Attending Physician, Department of Emergency Medicine, Shanghai United Family Hospital

Dr. Xiangming Li, Assistant Director, Department of Emergency Medicine, Xiang Ya Hospital, Xiangya Medical College of Central South University, Changsha, China

Dr. Xiaogang Li, Director, Department of Emergency Medicine, Xiang Ya Hospital, Xiangya Medical College of Central South University, Changsha, China

Dr. Yi Li, Attending Physician, Department of Emergency Medicine, Peking Union Medical College Hospital, Beijing, China

Dr. Zhongmin Liu, President, Shanghai East Hospital, Shanghai, China

Dr. Sui Ma, Past Director, Department of Emergency Medicine, Peking Union Medical College Hospital, Beijing, China

Dr. Zaimei Peng, Director, Department of Emergency Medicine, Xiangya Second Hospital, Xiangya Medical College of Central South University, Changsha, China

Dr. Shuangquan Qin, Director, Department of Emergency Medicine, Changde First People's Hospital of Hunan Province, Changde, China

Dr. Hong Shen, Director, Department of Emergency Medicine, Central People's Liberation Army Hospital, formerly known as 301 Hospital, Beijing, China

Dr. Dongwei Shi, Attending Physician, Department of Emergency Medicine, Zhongshan Hospital, Shanghai, China, personal communication, 2004

Dr. Guomao Tang, Director, Department of Emergency Medicine, Xiangya Third Hospital, Xiangya Medical College of Central South University, Changsha, China

Dr. Xuequn Wang, Director, Shanghai Pudong New Area Emergency Center, Shanghai, China

Dr. Zhong Wang, Assistant Director, Department of Emergency Medicine, Peking Union Medical College Hospital, Beijing, China

Dr. Tengda Xu, Attending Physician, Department of Emergency Medicine, Peking Union Medical College Hospital, Beijing, China

Dr. Xuezhong Yu, Director, Department of Emergency Medicine, Peking Union Medical College Hospital, Beijing, China; President, Chinese College of Emergency Medicine

Dr. Yongchun Zhao, Past Director, Beijing Emergency Medical Center, Beijing, China

Dr. Jiru Zhou, Director, Changsha Emergency Medical Center, Changsha, China

Dr. Hudong Shu, Assistant Director, Department of Emergency Medicine, Peking Union Medical College Hospital, Beijing, China

ACKNOWLEDGEMENTS

Some aspects of this work were supported by two grants from the China Medical Board. The authors would like to especially thank Peking Union Medical College Hospital, Ruijin Hospital, Xiang Ya Hospital, Changde First People's Hospital of Hunan Province, all the Chinese emergency physicians who shared their

insights (see list of key interviews), the Ronald Regan Institute of Emergency Medicine at the George Washington University, and the Department of Emergency Medicine at the University of Maryland School of Medicine.

Funding: Some aspects of this work were supported by two grants from the China Medical Board.

Ethical approval: None.

Conflicts of interest: The authors declare no financial or other conflict of interest related to this article.

Contributors: Pei YV and Xiao F proposed and wrote the first draft. All authors contributed to the design and interpretation of the study and to further drafts.

REFERENCES

- 1 China Health Statistics 2011. Ministry of Health of the People's Republic of China. Available at: <http://www.moh.gov.cn/publicfiles//business/cmsresources/mohbgt/cmsrsdocument/doc12294.pdf>. Accessed August 12, 2011.
- 2 Liu YL. Development of the rural health insurance system in China. *Health Policy and Planning* 2004; 19: 159-165.
- 3 Hou XY, FitzGerald G. Introduction of emergency medicine in China. *Emerg Med Australas* 2008; 20: 363-369.
- 4 World Health Organization National Health Account Database. The World Bank Group (2011). Available at: <http://data.worldbank.org/indicator/SH.XPD.OOPC.ZS>. Accessed on September 10, 2011.
- 5 Healthcare in China. 2006. IBM Corporation. <http://www-935.ibm.com/services/us/imc/pdf/g510-6268-healthcare-china.pdf>. Accessed September 9, 2011.
- 6 Burkle FM, Zhang X, Patrick W, Kalinowski E, Li Z. Emergency medical service systems in the United States and China: a developmental comparison. *Prehospital Disaster Med* 1994; 9: 244-251.
- 7 Emergency Medical Center (First Aid Station) Branch of Chinese Hospital Association. China Emergency Medical Service System. Available from: <http://www.emss.cn/eng/emcbcha.asp>. Accessed May 1, 2008.
- 8 Lui CZ. Issues of standardization of pre-hospital care in China [Chinese]. In: Proceedings of the 10th National Congress on Emergency Medicine, Shanghai, China, 2004: 17-19.
- 9 Beijing Emergency Medical Center. Available at <http://beijing.emss.cn/>. Accessed September 22, 2011.
- 10 Mathers CD, Lopez AD, Murray CJL. The burden of disease and mortality by condition: data, methods and results for 2001. In *Global Burden of Disease and Risk Factors*, ed. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL, pp 45-240. New York: Oxford University Press.
- 11 Smith J, Haile-Mariam T. Priorities in global emergency medicine development. *Emerg Med Clin N Am* 2005; 23: 11-29.

Received July 20, 2011

Accepted after revision November 19, 2011