American Journal of Pharmaceutical Education **2012; 76 (8) Article 146.**

REVIEW

Bachelor's Degree Programs in Clinical Pharmacy in China

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This paper describes the status of the bachelor's degree in clinical pharmacy education in China, with particular focus on educational institutions, programs, and curricula. The authors conducted a systematic literature review of clinical pharmacy education articles published from 2006 to 2011. To ensure the completeness of the investigation, an e-mail was sent or telephone call made directly to the colleges whose curriculum information could not be obtained by the above methodology. Twenty-three colleges offered a program in clinical pharmacy education in 2011. The colleges award either a bachelor of science or a bachelor of medicine degree with programs ranging from 4 to 5 years in duration. The 5-year BS degree program was most popular. Although the number of clinical pharmacy programs in China has steadily increased, more graduates and standardization of curricula are needed to meet the country's steadily expanding need for quality health care.

Keywords: development, bachelor degree, clinical pharmacy, education, China

INTRODUCTION

Economic and social progress is the cornerstone of the development of higher education.[1] The Food and Agriculture Organization of the United Nations regards Engel's coefficient as a measure of the standard of living in a country or region.[2] Based on Engel's coefficient, China is expected to become a wealthy society by 2020. With the rapid development of the economy, medical resources have gradually become abundant, resulting in people having higher expectations for the quality of healthcare services. The Ministry of Public Health in 2002 enacted the Provisional Regulations on Pharmaceutical Administration for Medical Institutions to satisfy the increasing demand for enhanced healthcare services. These regulations recommend that "the clinical pharmacist should take part in the diagnosis and treatment of disease, provide pharmaceutical care, and improve the quality of medical care."

The steady growth in healthcare services, evolution of the pharmaceutical industry, and shortage of clinical pharmacists have encouraged many colleges in China to establish pharmacy training programs equivalent to the doctor of pharmacy (PharmD) program in the United States.[3] Clinical pharmacy education is an important development of modern pharmacy education in China.[4] The purpose of this research is to describe the status of the development of clinical pharmacy education in China, with particular interest in educational institutions, programs, and curricula.

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DATA COLLECTION

Data on pharmacy education in China was collected from the Chinese Pharmaceutical Yearbook (2006 to 2011), the China Education Yearbook (2006 to 2011), and the Web sites of colleges that offer clinical pharmacy education. Chinese databases for academic journals, including VIP, CNKI, and WANFANG, as well as ScienceDirect and PubMed, were used to obtain articles published between 2006 and 2011 on clinical pharmacy education in China. Public search engines, such as Google and Baidu, were also used to obtain pertinent information from the Internet. Khachan and colleagues[5] used a similar method. A Boolean search was conducted using the following search terms: clinical pharmacy education and China, clinical pharmacy schools and China, clinical pharmacy programs and China, universities and pharmacy and China, colleges and pharmacy and China, and clinical pharmacy programs and bachelor degree and China. To ensure the completeness of the investigation, e-mail or telephone inquiries were made directly to the colleges for which curriculum information could not be obtained using the above methodology.

SUMMARY OF PROGRAMS OFFERED

In 1989, the West China School of Pharmacy at Sichuan University offered the first 5-year bachelor of science (BS) degree in clinical pharmacy. Although interest in clinical pharmacy education increased over the next 9 years, it was not considered feasible at that time in the country's development and was abolished in 1998.[3] In 2006, the Ministry of Education allowed China Pharmaceutical University to reestablish its 5-year BS degree in

clinical pharmacy.[6] The number of colleges that offer clinical pharmacy education has since increased from 15 in 2006 to 25 in 2011.

Table 1 lists the colleges with clinical pharmacy programs and the format of each program, ie, 4 or 5 academic years. Most clinical pharmacy programs consist of 5 academic years (10 semesters) of full-time study, except for Kunming Medical College.

The Ministry of Education requires the awarding of the BS degree to students graduating from a clinical pharmacy program. However, 4 of the 11 colleges teach clinical pharmacy within a pharmacy program for which a bachelor of medicine (BM) degree is awarded instead. As a new program, the teaching content of the clinical pharmacy program is more likely to include both pharmacy and clinical medicine courses. Which degree should be awarded to clinical pharmacy graduates remains a matter of debate. Some colleges, such as Bengbu Medical College, Hubu College of Science and Technology, Taishan Medical College, and Nanchang University, hold the opinion that clinical pharmacy education is a type of physician education; therefore, the BM degree should be awarded. The others colleges that offer a clinical pharmacy program have the opposite view. Hence, 2 types of degrees are offered (BS and BM) and graduates with either degree are eligible for licensure as pharmacists. The BM degree is awarded only to those who major in clinical pharmacy, and these graduates are not eligible for licensure as physicians.

In China, disciplines are catalogued into first or second levels. First levels are similar to majors in the US, while second levels are the equivalent of minors or areas of concentration within a major. More than 1,400 students were enrolled in clinical pharmacy programs in China in 2011 (Table 1). Of these, 635 were enrolled in pharmacy programs with a "second level" or minor in clinical pharmacy, 53 were enrolled in clinical medicine programs with a minor in clinical pharmacy, and 765 were enrolled in clinical pharmacy programs.

The employment rate for clinical pharmacy graduates reached 99.5% in 2011. This figure is considerably higher than that for other pharmacy programs. Also,

Table 1. Clinical Pharmacy Education Programs in China

Program	Colleges and Schools	Program Duration (years)	Degree Awarded	Enrollment in 2011
Clinical Pharmacy	Capital Medical University	5	BS	20
	China Medical University	5	BS	114
	China Pharmaceutical University	5	BS	60
	Chongqing Medical University	5	BS	150
	Harbin Medical University	5	BS	95
	Kunming Medical College	4	BS	40
	Guangdong Pharmaceutical University	5	BS	62
	Nanjing Medical University	5	BS	60
	Xuzhou Medical College	5	BS	100
	Sichuan University	5	BS	0
	Shenyang Pharmaceutical University	5	BS	64
Pharmacy	Beihua University	4	BS	40
(Clinical Pharmacy)	Bengbu Medical College	4	BM	Uncertain
	Clinical Medicine College of China Medical University	5	BS	140
	Dalian Medical University	5	BM	100
	Fudan University	4	BS	Uncertain
	Jilin Medical College	4	BS	40
	Huazhong University of Science and Technology	4	BS	Uncertain
	Hubu College of Science and Technology	5	BM	115
	Tianjin University of Traditional Chinese Medicine	4	BS	50
	Taishan Medical College	5	BM	60
	Xi'An Medical College	4	BS	90
Clinical Medicine (Clinical Pharmacy)	Nanchang University	5	BM	53

Abbreviations: BS = bachelor of science; BM = bachelor of medicine.

72% of clinical pharmacy graduates were employed by Grade 3A hospitals, which are the best hospitals in China.

Compared with the general BS program in pharmacy, a standardized curriculum for clinical pharmacy has not been established. Instead, each school offers a diverse curriculum that includes a mix of humanities and social sciences, biomedical sciences, pharmaceutical sciences, clinical sciences, and pharmacy practice experiences (PPEs). The 4-year program has a 6-month pharmacy practice experience requirement, whereas the 5-year program has a 1-year pharmacy practice experience requirement. A systematic curriculum that encompasses the requisite tools for comprehensive training is lacking.[7] An innovator in clinical pharmacy education, Chongqing Medical University suggested a curriculum for all clinical pharmacy programs in China (Appendix 1) in 2011. Various institutions such as Shandong University, Sichuan University, People's Medical Publishing House, and so on, strongly agree with this proposed curriculum.

DISCUSSION

The number of colleges that offer clinical pharmacy programs has steadily increased (Figure 1). By 2011, 23 colleges and schools of pharmacy provided clinical pharmacy education through 1 of 3 types of programs: pharmacy major with clinical pharmacy minor, clinical medicine major with clinical pharmacy minor, and clinical pharmacy major. The first 2 types of programs are set up mainly in local colleges upon the approval of the provincial department of education, whereas the third program requires the approval of the Ministry of Education. Also, the number of colleges that offer the pharmacy major with clinical pharmacy minor has decreased yearly. Meanwhile, the number of colleges offering a clinical pharmacy major has grown fast and this may become the predominant type of clinical pharmacy program offered in China. Only 1 college, Nanchang University, now offers the clinical medicine major with clinical pharmacy minor leading to the BM degree. Xuzhou Medical College set up a BM program in 2006, but changed to a BS degree with a pharmacy major and clinical pharmacy minor in 2008.

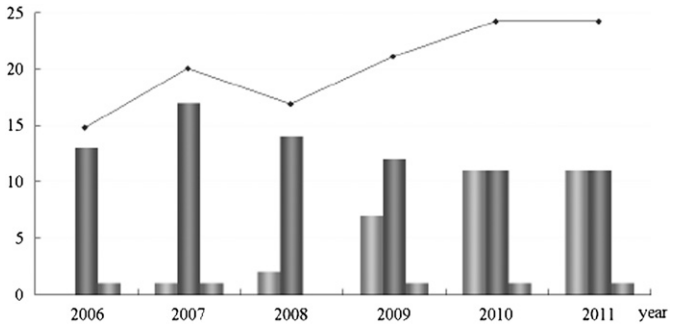

Figure 1. Increase from 2006-2011 in number of colleges that offer clinical pharmacy education in China. (Red denotes the number of pharmacy programs with a Clinical Pharmacy minor, yellow denotes clinical medicine programs with a clinical pharmacy minor, green denotes clinical pharmacy programs. The line depicts the increase in total number of programs.

The duration of the clinical pharmacy program and degree awarded remain inconsistent. School officials have not implemented uniform standards for these. Some experts and scholars in pharmacy education require the establishment of a lengthy schooling system for training clinical pharmacists before the awarding of a degree.[8-10] Innovative programs in clinical pharmacy education have begun in several colleges. Shandong University has provided a 7-year master of medicine (MM) program in clinical pharmacy since 2003. Peking University and Fudan University offer a 6-year master of science (MS) program in clinical pharmacy. Several colleges also have a 3-year master's degree program in clinical pharmacy, and only students who already have a bachelor's degree can enroll in the program.

There is still a large shortage of clinical pharmacists in China. According to the statistics of the Pharmacy Administration Commission of the Chinese Hospital Association, more than 2400 new clinical pharmacists will be needed annually through 2015 to satisfy the requirements of the Ministry of Public Health.[11] However, the total number of new students enrolled in clinical pharmacy programs each year is approximately 1,500, which is far from adequately satisfying society's needs. Therefore, gradually expanding the scale of enrollment and training more clinical pharmacists will be necessary.

The employment rate for clinical pharmacy graduates in China is considerably higher than that for other pharmacists. Clinical pharmacy graduates primarily work in hospitals as clinical pharmacists, whereas regular pharmacy graduates generally work in pharmaceutical companies as researchers. Also, the responsibilities of a clinical pharmacist include ensuring patient safety and optimal medication therapy outcomes, unlike regular pharmacy graduates, who take on the responsibility of ensuring an appropriate supply of drugs. Finally, the salary of a clinical pharmacist is 10% to 40% higher than that of a regular pharmacy graduate.

In contrast with other viewpoints, faculty members at Chongqing Medical University believe that the clinical pharmacy program curriculum must equip graduates with professional competencies that ensure patient safety and optimal medication therapy outcomes when they enter

pharmacy practice. Pharmacotherapy must be the core course of the clinical pharmacy program to satisfy the educational requirements for a clinical pharmacist. Biomedical science (including anatomy, pathology, biochemistry, pathophysiology, and immunology), pharmaceutical science (including medical chemistry, pharmacology, and pharmaceutics), and social/behavioral/administrative science (including pharmacoeconomics, pharmacy law, ethics, and professional communication) must be of adequate depth, scope, timeliness, and sequence to provide the foundation and support for the study of pharmacotherapy. After completing the curriculum in the classroom, students should participate in 1.5 years of PPEs. The PPEs should apply, integrate, reinforce, and advance the knowledge, skills, and attitudes of the students. Moreover, PPEs should include direct interaction with primary, acute, and chronic patient populations, and collaborate with other healthcare professionals in the pharmacy department (10 weeks) and clinical departments (58 weeks).

CONCLUSIONS

With the steady growth in healthcare services, the evolution of the pharmaceutical industry, and shortage of clinical pharmacists, China has achieved considerable progress in improving clinical pharmacy education. Colleges that offer clinical pharmacy programs are steadily increasing each year. The development of the program is moving in a highly significant direction in pharmacy education. To address the needs of society, many colleges are reforming clinical pharmacy education to better train clinical pharmacists.

ACKNOWLEDGMENTS

This study was completed with support from the research project of Chongqing Higher Education Teaching (Grant Nos. 0813020 and 093114).

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Appendix 1. Clinical Pharmacy Curriculum Suggested by Chongqing Medical University

Title	Credits
Academic Year 1	
FALL	
Law	3.0
Mathematics	4.5
Physics	3.5
Physics Experiments	1.5
Inorganic Chemistry	3.5
Inorganic Chemistry Experiments	1.5
English	4.0
Electives	1.0-4.0
SPRING	
Chinese History	2.0
Career Guidance I	1.0
English	4.0
Anatomy	1.5
Anatomy Experiments	3.0
Histology & Embryology	2.0
Histology & Embryology Experiments	2.0
Analytical Chemistry	4.5
Analytical Chemistry Experiments	1.5
Organic Chemistry	4.5
Organic Chemistry Experiments	3.0
Electives	1.0-4.0
Academic Year 2	
FALL	
Philosophy I	3.0
English	4.0
Physiology	3.0
Physiology Experiments	2.0
Biochemistry	4.5
Biochemisty Experiments	2.0
Pathogen Biology	2.0
Immunology	1.5
Immunology Experiments	2.0
Electives	1.0-4.0
SPRING	
Philosophy II	4.0
Chinese Medicine	3.0
Pathology	3.0
Medical Psychology	2.0
Pathology Experiments	2.0
Medicinal Chemistry	6
Professional Communication	3.0
Electives	1.0-4.0
Academic Year 3	
FALL	
Pathophysiology	3.0
Pharmaceutical Literature	2.0
Pharmacology I	5.5
Pharmacology Experiments I	5.0
Ethics	2.0
Pharmaceutics	4.5
Pharmaceutics Experiments	2.0
Medical Genetics	1.5
Pharmacy Law	3.0
Pharmacoeconomics	2.0
Electives	1.0-4.0
SPRING	
Career Guidance II	1.0
Statistics	5.0
Diagnosis	3.0
Pharmacogenetics	2.0
Epidemiology	2.0
Pharmacology II	5.5
Pharmacology Experiments II	2.0
Pharmacokinetics	2.0
Pharmacotherpy I	4.0
Electives	1.0-4.0
Academic Year 4	
FALL	
Pharmacotherpy II	24.0
Electives	2.0-8.0
SPRING	
PPEs	23.0
Academic Year 5	
PPEs	46.0

[a] In Chinese colleges, an academic year is typically divided into 2 semesters lasting 18 weeks each.