Peking University Health Science Center Model of Clinical Pharmacy Education and Clinical Pharmacist Services

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INTRODUCTION
In the 1950s, clinical pharmacy emerged in the United States and gradually developed into an indispensable component of the clinical services system. The American College of Clinical Pharmacy defines clinical pharmacy as a pharmaceutical field that focuses on the science and practice of rational drug use.[1] Since its emergence, people have explored the clinical drug management needs that can be provided by pharmacists. Initially, as a supplement to nurses, pharmacists worked in clinical settings and were mainly involved in reducing medication errors, controlling drug costs, and monitoring adverse reactions. The working model and laws and regulations regarding pharmacists had thus been explored and established at that time, but their position was not yet formally defined. In the 1970s and 1980s, a working model of clinical pharmacists became gradually established through the publication of clinical pharmacy guidelines and improvements to the evaluation system. In the 1990s, the focus of clinical pharmacy turned from drugs to patients; being patient-centered, clinical pharmacists reduced adverse reactions, decreased mortality, and improved treatment effectiveness, thus replacing some of internists’ work.[2]

Throughout the establishment and development of clinical pharmacy in the United States, rational drug use and medical cost control were always the goals and motivations of the industry. The role of clinical pharmacists in disease management can be summarized as addressing three main domains: first, clinical outcomes – improvement in various clinical indices and reductions in the incidence of adverse drug reactions, rates of hospitalization, lengths of stay, and mortality; second, humanistic outcomes – enhancement of patients’ quality of life and satisfaction with medical services; and third, economic outcomes and other indexes – a reasonable reduction in medical costs and labor costs.[3]

Based on the timeline of development in the United States, overall the current clinical pharmacy situation in China is still equivalent to that of the 1970s–1980s, i.e., the evaluation system for clinical pharmacy is being established, but the clinical pharmacists’ position has not yet been specified in the law or in the system. In the past decade, the development of clinical pharmacy has slowly progressed. With a deep understanding of the specialty by hospital administrators and doctors, clinical pharmacists’ passion for the work is being revitalized; however, there is still a large gap that needs to be addressed before reaching the most currently advanced levels, such as in the United States. There are many substantial obstacles to promote clinical pharmacy education and clinical pharmacist services in hospitals.

In addition to the problems with developing the specialty, issues also exist regarding talent cultivation; for example, there is no position reserved for clinical pharmacists and no standard service charge for services, and thus the work cannot be easily performed. In China, the threshold for a licensed pharmacist qualification is high; however, the stability of pharmacist teams is very uncertain because when licensed pharmacists perform services in medical institutions after obtaining qualification, they are confronted...
Peking University Health Science Center (PUHSC) has always been at the forefront of developing clinical pharmacy professionals and exploring and promoting clinical pharmacist services in China. In 2000, it established the Department of Pharmacy Administration and Clinical Pharmacy; in 2005, its development of a master’s degree in clinical pharmacy was approved; in 2006, together with the launch of a clinical pharmacist training pilot program initiated by the Ministry of Health, the First Hospital, People’s Hospital, and the Third Hospital of Peking University successively became pilot training sites; and in 2012, the First Hospital of Peking University became the national training base for clinical pharmacist teaching resources. Based on the exploratory efforts of more than 10 years, PUHSC has formed a China-specific “PUHSC model” of clinical pharmacy education and improvement of clinical pharmacist services in hospitals by capitalizing on the integration of medicine, teaching and research, and optimizing and integrating resources within the university, affiliated hospitals, and teaching hospitals.

**A Solid Foundation of Clinical Pharmacist Training**

In the United States, the training of clinical pharmacy students is similar to that of medical students: students have to complete 2 years of mandatory courses or 4 years of general undergraduate study, receive 4 years of graduate education in clinical pharmacy, and obtain a Ph.D. degree in clinical pharmacy (Pharm. D.) upon graduation.

In 2001, the School of Pharmaceutical Sciences of Peking University began recruiting 6-year direct master-bachelor students in pharmacy. The students spend five semesters (2.5 academic year) on general courses and basic pharmaceutical courses, make a two-way selection of an academic path with tutors in the 7th semester (3.5 academic years), enter a second tier specialty for graduate study, and finally obtain an M.Sc. degree (in clinical pharmacy). In the 7th semester, students who choose clinical pharmacy begin receiving professional studies including professional clinical pharmacy courses, rotations in basic clinical medicine courses, pharmacy rotations, clinical pharmacy specialty rotations, and research training. Other graduate education paths are also available, such as the 3-year master, 3-year doctor, and 5-year straight doctor programs. In 2011, after obtaining approval from the Ministry of Education, Peking University began recruiting graduate candidates for a master’s degree in clinical pharmacy, which further clarified the direction of clinical pharmacy education as targeting applied frontline work in clinics.

In terms of the academic structure, the 2.5 + 3.5 model in Peking University is comparable to the 4 + 2 or 4 + 4 education models in the United States. During the first five semesters, students receive China’s most advanced basic pharmaceutical courses, which are highly targeted toward professional training.

During their education, after completing the clinical pharmacy specialty courses and clinical medicine basic courses, all clinical pharmacy graduate students are sent to the pharmacy department of affiliated hospitals and teaching hospitals for practical learning; this time also strongly supplements the work of pharmacy service professionals in hospitals. After graduation, many students continue to work in hospital pharmacy departments and engage in clinical pharmacy services.

After decades of development and exploration, from 2005 to 2013, 61% of the clinical pharmacy graduates in the Department of Pharmacy Administration and Clinical Pharmacy, School of Pharmaceutical Sciences, Peking University, chose medical institutions for their employment and began working in clinical pharmacy services on the clinical front line. The affiliated hospitals thus obtained a good cohort of clinical pharmacists. For example, in Peking University Hospital, there are currently 25 clinical pharmacists (15 holding clinical pharmacist job training certificates) managing 1500 beds, which is higher than the provision of one pharmacist per 100 beds proposed in the “Regulations on Management of Pharmacists in Medical Institutions” (draft for comments); an additional 20 graduate students are engaged in supplementary work.

**Effects of Clinical Pharmacy Services**

The effectiveness of drug cost control was initially the most intuitive factor considered to evaluate pharmacist services and improve the recognition of pharmacists by patients and other medical professionals. In 2010, together with the national special program on the improvement of clinical antibiotic use launched by the Ministry of Health, Peking University Hospital obtained significant results demonstrating the effectiveness of pharmacist interventions. From 2010 to 2013, the total hospital drug expense increased from 799 to 1042 million Yuan, with a growth rate of 30.4%, while the amount of sales of antibiotics decreased against the trend from 104 to 93 million Yuan (the proportion of antibiotics in all drugs decreased from 13.05% to 8.93%). If there had been no clinical pharmacy intervention on antibiotics use, the amount of antibiotic sales in 2012 would have been 136 million Yuan, 42.89 million Yuan more than the actual amount, based on the 13.05% of antibiotics in the previous year. In terms of the existing health insurance and the total expense control system in Beijing medical institutions, this difference is equivalent to a savings of more
than 4 million Yuan for the health insurance fund.[5] The average antibiotic cost of urology operations, for instance, decreased from 2077.49 to 559.67 Yuan between 2013 and 2010, with a 27.7% decrease in antibiotic cost, while the rate of bacterial infection in surgery did not increase.[5]

In the 1990s, clinical pharmacists in Peking University Hospital reported cases of liver damage due to Zhuang Gu Guan Jie pills and kidney damage due to TCM Caulis aristolochiae manshurienis through therapeutic drug monitoring and adverse drug reaction monitoring; the hospital was thus able to stop the use of related TCM in a timely manner, thereby reducing the patients’ drug risks.[6] In the aforementioned national special program of improvement of clinical antibiotic use, Peking University Hospital authorized clinical pharmacists to monitor preventive drug use for Class I incisions in real time. Clinical pharmacists established a three-way communication with clinical doctors and appropriately managed and improved the antibiotic use. Compared with 2010, in 2013, the intensity of antibiotic use by inpatients decreased from 72 before the special national program to around 40. For seven Class I incision categories in which antibiotics use is not necessary in principle, the rate of antibiotic use was only 0.7%. The nosocomial infection rate and Class I incision infection rate did not increase due to the decreased rate of preventive drug use.[7] In recent years, anticoagulant pharmaceutical services have been implemented and shown a significant improvement in the efficacy and safety of patients with medication.[8]

Based on the aforementioned clinical pharmacy services, the Pharmacy Department of Peking University Hospital continued to develop the potential for internal management and constructed a one-stop service system consisting of logistics management, supply adjustment, and drug counseling. The speed of prescription deployment was improved, dispatching errors were decreased, waiting times for medicines were reduced, and patient satisfaction was improved.[9, 10]

**Affirmation of Clinical Pharmacists**

Affirmation of clinical pharmacists’ contribution was reflected in the fact that the clinical pharmacist position and services received deserved recognition. In December 2012, as Peking University Hospital’s leading department in the national rankings, the Department of Nephrology took the lead in implementing an integrated kidney disease diagnosis and treatment clinic. This was highly advocated by Professor Wang Haiyan, and together with nutritionists and psychologists, clinical pharmacists participated in conducting integrated diagnosis and treatment, which was a substantial step forward for pharmacists in improving chronic disease management. Along with the continuous recognition of clinical pharmacists’ work, the pharmacy department continued to invite several departments to implement integrated diagnosis and treatment clinics such as a chronic obstructive pulmonary disease clinic, an anticoagulation (atrial fibrillation) clinic, and a gynecology menopause 1-day clinic. The pharmacy department also tried to open an asthma clinic together with faculty from the Department of Pharmacy Administration and Clinical Pharmacy, School of Pharmaceutical Sciences.[11–14] As an important member of the medical services team, clinical pharmacists charged a consulting fee of 20 Yuan/time and provided counseling treatment service of no <20 min in a combined doctor–pharmacist–nutritionist–psychologist–nurse clinic. Based on its long-term unremitting efforts, the value of clinical pharmacists was fully recognized by the hospital; Peking University Hospital also specifically approved the bonus received by clinical pharmacists to be in accordance with that of an average internist.

The contribution of clinical pharmacists was also confirmed by the fact that clinical pharmacists participated directly in the management of hospital operations. Given its core component of rational drug use management and supervision, the pharmacy department became a department with both technical expertise and administrative function. The Drug and Therapeutics Committee of the Hospital consisted of three groups according to their functions: a clinical rational drug use steering group, drug adverse reaction monitoring network group, and rational antibiotic use group. The pharmacy department and clinical pharmacists played central roles in these groups. Each group meeting generated a formal written resolution based on the consensus after discussion, and the resolution was issued to the hospital as rational drug-specific provisions for clinical departments to comply with. The pharmacy department also participated in a clinical department assessment based on the provisions and rated the rational drug use of various clinical departments. The assessment results functioned as an evaluation indicator to determine the medical quality of clinical departments and directly affected the interests of the doctors.

First, the exploration and formation of the “PUHSC model” of clinical pharmacy education and clinical pharmacist services benefited from advanced education concepts. When establishing the specialty, faculty in the university and clinical hospitals thoroughly studied the development history and current status of world-class clinical pharmacy specialties and proposed the target of catching up with the United States, which was at the most advanced level. After a comprehensive analysis of self-status, the faculty formed a development path that was suitable for the PUHSC and was feasible. The moderately advanced clinical pharmacy specialty structure with a clear direction provided the most substantial talent pool for subsequent clinical pharmacist services. Second, the exploration and formation benefited from a responsible clinical attitude.

Many clinical treatment and medication habits had been determined based on many years of study by doctors or the department, and those habits had reached a strong consensus regarding safety, which led to prescribed behavior; however, together with the rapid development of medical technology, they inevitably fell behind the status quo. The PUHSC faculty dared to break these stereotypes; relying on
strong knowledge and skills, clinicians engaged in scientific dialog with pharmacists, accepted the objective laws of technological development, and improved the treatment protocols. In addition, the exploration and formation also benefited from the PUHSC culture of being “honest and kind”. The pharmacists’ interventions in clinical practice undoubtedly restricted doctors’ diagnoses and treatment and even affected personal interests; however, the resistance to development was not formed. The PUHSC staff, exhibiting the “honest and kind” culture, voluntarily made scientific choices and prioritized appropriate doctor behaviors and patient-centered care.

**Policy Suggestions**

**Strengthening clinical pharmacy education**

One policy suggestion is to include clinical pharmacy in the specialty directory. In 2008, the Academic Degrees Committee of the State Council and the Ministry of Education added clinical pharmacy to the “University Undergraduate Discipline Catalog” for institutions constructing future disciplines. However, the “Degree-Granting and Talent Cultivation Discipline Catalog” has not included this specialty yet, and thus universities cannot offer postgraduate studies based on the catalog. Only a few universities, such as Peking University, have been approved by the Ministry of Education to separately establish a clinical pharmacy specialty in the form of a self-constructed elective, while many other universities have had to anchor the specialty in pharmaceutics, pharmacology, and other related specialties.

Another suggestion is to establish doctor’s/master’s degrees in pharmacy. Most clinical pharmacy graduates at all levels receive degrees in science, but very few receive medical degrees. It is recommended for an established university to try to grant doctor’s/master’s degree in pharmacy and gradually implement them. In specialty classification and specialty settings, the difference between clinical pharmacy and general pharmacy should be emphasized; the education objective of working in clinic and the focus on application should be clarified, as this distinguishes clinical pharmacy students from graduates in science who mainly engage in basic research and drug development.

**Promoting the process of law and regulation establishment**

The legislative process of a “Pharmacist Law” should also be accelerated. The “Practicing Physicians Law” was enforced more than 10 years ago, but a “Pharmacist Law” has not yet been issued. The draft work raised the media’s attention more than 10 years ago, but a “Pharmacist Law” has not accelerated. The “Practicing Physicians Law” was enforced in 2009, and the “Pharmacist Law” should also be considered within the overall health-care picture. To establish a medical professional remuneration system that is in accordance with the characteristics of the medical industry, the remuneration of pharmacists should be considered together with that of physicians and nurses; the system should specify job responsibilities, assess job performance, develop remuneration standards, and reflect service value. A reasonable remuneration and performance evaluation system will help medical professionals consciously optimize the division of labor, contribute their own professional value throughout the process of medical care, and enhance medical institutions’ management and overall operating efficiency. When their rights and benefits are guaranteed, as the “gatekeeper” of drug safety, pharmacists effectively supervise and assist physicians in rational drug use, creating the conditions needed for medical and health system reform including “medical and drug separation”.

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**Conflicts of interest**

There are no conflicts of interest.

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