# Role of clinical pharmacists for managing infectious diseases in Thailand

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Prescription medications play a vital role in modern healthcare. New medications continue to improve health outcomes and quality of life in patients with both acute and chronic diseases.[1-2] However, with these advances come the growing challenge of assuring that patients receive maximum benefit with the minimum amount of risk from the use of these sophisticated and complex therapies.[3] This challenge is being addressed by the health care provider whose professional expertise is the effective and safe use of medications.

The increased utilization of prescription medications is also associated with a greater likelihood of "adverse drug events" (ADEs) due to both the appropriate and inappropriate use of the medications. Between 44,000 - 98,000 Americans die each year as a result of medical errors.[4] Preventable "medication errors" (errors occurring in the medication-use process) are among the most common medical mistakes, incurring at least $3.5 billion a year in extra hospital costs alone.[5] Many study show outcome of clinical pharmacist prevent medication errors and save hospital cost.[6-7]

This field of pharmacy practice focuses on patient-oriented rather than drug product-oriented service. Already, the level of interaction between physicians and pharmacists in the developed world is high, resulting in safer, more effective, and less costly drug therapy.[8-9]

**History of clinical pharmacist**

How has clinical pharmacy advance commenced? Clinical pharmacy services were developed in the 1960's after extensive reports in the medical literature regarding drug interactions and medication errors. In 1971 articles such as: "the physician's contribution to hospital medication errors" and "Medication errors in the seventies" were published. Since 1971 a lot of other articles can be mentioned on the topic of medication errors with significant titles in 2006.[10-11] In US almost all of the growth from 1989-1998 in total number of pharmacist was due to increased numbers of clinical pharmacists, a five times increase.[12-13]

From systematic review about medication errors in 1998, adverse drug events affect approximately 10% of patients in hospitals and result in increased rates of morbidity and mortality. These adverse events extend hospital stays an estimated 1.7 to 2.2 days and increase costs by approximately 100,000 Baht for patients who are affected.[10,11,14]

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A controlled clinical trial to estimate the effect of clinical pharmacist participation on medical rounds in the ICU on the rate of preventable ADEs caused by medication ordering errors had been conducted. During a 6-month period in a large urban teaching hospital, clinical pharmacist participated on rounds with the ICU team and remained in the ICU for consultation in the morning and was available on call throughout the day. The rate of preventable prescribing ADEs decreased by 66% from 10.4 per 1,000 patient days (95% confidence interval (CI), 7-14) before the intervention to 3.5 (95% CI, 1-5; $p < 0.001$) after the intervention.[15]

Constructivism is another educational theory that has been applied in pharmacy education. The teacher (preceptor) facilitates learning, rather than transmitting knowledge. In accordance with the principles of constructivism, the preceptor explores inconsistencies between students' current understanding and their experiences.[16-17] Doctor of Pharmacy (Pharm D) is the program aims to provide students with knowledge, skills and abilities to practice effectively as a clinical pharmacy practitioner involved in medicine use and pharmaceutical care individually, review and monitor a patient's medication regimen demonstrate clear communication skills in clinical/non-clinical scenarios and apply research methodologies relevant to clinical pharmacy practice understand management/social issues in pharmacy and their relevance to clinical pharmacy practice small group interactive teaching and discussion settings are the usual teaching method format, and student participation is encouraged. Some sessions of teaching occur on wards at teaching hospitals, illustrating the practical use of drug therapy.[18]

In addition to the new degree program and the additional clinical rotations, pharmacy residency program were implemented. These post graduate training programs act as a bridge from student to practitioner. In the setting of post graduate training, the learner (resident) also uses self-directed learning skills. There have many specialty of pharmacy residency and fellowships include Infectious disease specialty.[19] The system provide for a first year of residency training (postgraduate year 1 [PGY1]) that enables entry-level practitioners to enhance and broaden their competencies, and advanced-level (PGY2, etc.) specialized residencies that promote development of the abilities necessary to provide patient care in specialized settings or to special patient populations. The PGY1 residency has the minimum prerequisite for practice in direct patient care settings. In PGY2 residency programs, the residents have continued to increase the ability levels that were initially developed during the PGY1 experience. Also, residents are expected to acquire additional depth of knowledge in one or more specialized areas to the degree that "in practice areas where board certification exists, graduates are prepared to pursue such certification". There are currently approved goals and objectives in 16 designated focus areas for PGY2 residencies: clinical pharmacokinetics, critical care, drug information, geriatric pharmacy, infectious disease pharmacy, internal medicine pharmacy, nuclear pharmacy, nutrition support pharmacy, oncology pharmacy, pediatric pharmacy, pharmacotherapy pharmacy, pharmacy practice management, primary care pharmacy, psychiatric pharmacy, medication use safety and advanced area of practice.[20-21]

In Thailand, we previously have only bachelor of pharmacy program which is a five-year program development of courses to tracts, areas of interests, including clinical pharmacy aspect in 5 years programs. Currently, another transition in pharmacy education is occurring in Thailand, all Thai pharmacy

schools have recently expanded to a 6-year doctor of pharmacy curriculum. Doctor of Pharmacy (Pharm D) program first curriculum in Asia has been established at Faculty of Pharmaceutical Sciences, Naresuan University in 1992. Until now, there are 11 universities with Pharm D program in Thailand offer the 6-year curriculum. For post pharm D graduated, Board Certified Pharmacotherapy Training Program has training pharmacy residencies and fellowships in 4-year program that specialized residency training in internal medicine, pediatrics, nutrition support, oncology, infectious diseases, cardiology, renal diseases, critical care and clinical pharmacist competency.[22]

**Role of clinical pharmacist**

There have been several attempts to define clinical pharmacy but the best known is probably that of the ACCP in 2005. The clinical pharmacist and the roles of the clinical pharmacist in the health care system which were outlined as follows: Clinical Pharmacy is a health science discipline in which pharmacists provide patient care that optimizes medication therapy and promotes health, wellness, and disease prevention. The practice of clinical pharmacy embraces the philosophy of pharmaceutical care; it blends a caring orientation with specialized therapeutic knowledge, experience, and judgment for the purpose of ensuring optimal patient outcomes.

As a discipline, clinical pharmacy also has an obligation to contribute to the generation of new knowledge that advances health and quality of life.[23] Clinical pharmacy activities may influence the correct indication, dose, route, dosage form, administration knowledge of drugs, patient adherence, drug interaction and adverse drug reaction of medicines at three different levels: before, during and after the prescription is written.[24]

Several studies have been published on the effect of clinical pharmacy services on different patient outcomes: humanistic (e.g. quality of life, satisfaction), clinical (e.g. better control and management of chronic diseases), economic (e.g. reduction in healthcare costs). From systematic review and meta-analyses, “US Pharmacists’ Effect as Team Members on Patient Care”, this study had searched articles from many of medical databases including the following criteria: 1) evidence of pharmacist involvement in direct patient care (able to discern pharmacist contribution); 2) comparison group present; and 3) patient-related out-comes reported (outcomes must be therapeutic, safety, or humanistic). Result of this study found 298 articles were included in this systematic review. Regarding patient characteristics, 26 studies included pediatric patients (less than 18 years), whereas 218 studies included adults aged 18 to 65 years; and 164 studies included adults older than 65 years. Disease states frequently reported in order were hypertension, dyslipidemia, diabetes, anticoagulation, asthma/chronic obstructive pulmonary disease, infection, and psychiatric conditions. Results were found favoring pharmacists’ direct patient care over comparative services conducted for hemoglobin A1c, LDL cholesterol, blood pressure, adverse drug events, Medication adherence, patient knowledge, and quality of life-general health meta-analyses were significant ($p < 0.05$). Clinical pharmacist can improve health care team for take care the patient.[3]

**Clinical pharmacist specialist for infectious diseases**

Clinical outcome, patient safety, cost savings and reduction of antimicrobial resistance are outcomes associated with optimizing antimicrobial use. The development of antimicrobial management teams and

the promotion of the role of the clinical pharmacist in antimicrobial prescribing are recommended strategies for improving prescribing practice. Clinical pharmacist specialized in infectious diseases (ID pharmacist) has been developed for more than 20 years ago in the US. The ID pharmacist focuses their practice on the pharmaceutical care in patients with various acute infections, patients with chronic diseases caused by infections (such as HIV), and patients at risk for infections (such as immunocompromised patients). The ID pharmacists, through the application of pharmacokinetic and pharmacodynamic concepts, can assist the prescriber in the appropriate antibiotic selection, dosing strategy, and route of administration. Whereas pharmacokinetics focuses on the relationship between drug concentration and time, pharmacodynamics focuses on the relationship between drug concentration and pharmacologic effect or pharmacology. While still an evolving science, pharmacodynamics may offer the clinician an objective measure in the form of outcome parameters that may be used to guide antibiotic selection and dosing. Several investigators have suggested that attaining a specific magnitude of an appropriate pharmacodynamic outcome parameter can effectively predict clinical success or failure for pairings of antibiotic and bacteria.[25-27]

Moreover, role of ID pharmacist in antimicrobial stewardship teams, which has been greatly increased since joint guidelines were published in 2007 by the Infectious Diseases Society of America (IDSA) and the Society for Healthcare Epidemiology of America (SHEA).[28] This team is responsible for ensuring optimal use of antimicrobials within the institution and would be led by an infectious diseases (ID) physician. Other team members recommended by the IDSA are an infection control practitioner, a clinical microbiologist and a clinical pharmacist, with the latter being responsible for providing information related to addition or deletion of antimicrobials from the hospital formulary.

The scope of the ID pharmacist have been published both in the Atlantic (Europe and the USA) as well as Australia.[25]

1. Educational role directed at

- Clinicians at the point of care and generally, junior staff induction programmes, medicine information helpline

- Nursing and technical staff

- Patients compliance, patient medicines helpline (UK NHS)

- Pharmacists

2. Monitoring of antimicrobial use (an overlooked fact is that in the UK all prescriptions are reviewed by pharmacists)

- Collection and analysis of data on local prescribing

- Compliance to policies

- Prescribing errors

3. Audit and feedback

- Includes evaluation of impact of clinical guidelines on process of care, patient outcomes and antimicrobial resistance patterns

4. Clinical role in the context of an antimicrobial management programme in conjunction with colleagues on antimicrobial management team (inpatient and outpatient management)

- Prominent role in policy making, development and update of clinical practice guidelines (part of antibiotic steering group)

- Identification of patients on antimicrobials that may benefit from therapeutic intervention by the antimicrobial management team

- Initiation of sequential therapy (intravenous to oral switch)

- Dose adjustments

- Therapeutic drug monitoring (e.g., amino-glycosides, glycopeptides)

5. Member of the infection control committee

- Integrating antibiotic control with infection control

Many studies have been shown the favorable impact of clinical pharmacists. Carling et al. evaluated the impact of an interventional multidisciplinary antibiotic management program which a clinical pharmacist with special training in infectious diseases shares the responsibility for evaluating each patient and making recommendations with an infectious diseases physician who serves as team leader on expenditures for antibiotics and on the incidence of nosocomial infections and antibiotic-resistant pathogens during 7 years in Carney Hospital showed that following implementation of the program was significant decrease in the use of parenteral broad spectrum antibiotic ($P < 0.0001$) and nosocomial infections caused by *Clostridium difficile* ($P = 0.002$) and resistant *Enterobacteriaceae* ($p = 0.02$). The program also appeared to have a favorable impact on vancomycin-resistant enterococci (VRE) rates without a sustained impact on methicillin-resistant *Staphylococcus aureus* (MRSA) rates.[29]

In the study "Impact of mecA Gene Testing and Intervention by Infectious Disease Clinical Pharmacists on Time to Optimal Antimicrobial Therapy for *Staphylococcus aureus* Bacteremia at a University Hospital", the results show that recommendations of infectious disease (ID) clinical pharmacist on specific antimicrobial therapy at the time of mecA gene test result availability would decrease the time to receipt of optimal antimicrobial therapy (OAT) against *Staphylococcus aureus* infections from $64.7 \pm 36.8$ to $39.3 \pm 15.5$ hours ($p = 0.002$) which may result in decreased mortality.[30] From the study"Determination of Optimized Multidisciplinary Care Team for Maximal Antiretroviral Therapy Adherence", it is found that clinical pharmacist who are trained to help patients manage and adhere to complex antiretroviral regimens can improved 8.1% of adherence among patients both naive and experienced patients [31]

Bantar et al. report the impact of multidisciplinary antimicrobial treatment team on prescribing practice, antibiotic use, cost savings, and bacterial resistance. The cumulative total savings during the 18 months of intervention was $913,236 and decreased resistance to ceftriaxone by *Proteus mirabilis* and *Enterobacter cloacae* and methicillin-resistant *Staphylococcus aureus*.[32]

**Clinical pharmacist in Thailand**

Currently, clinical pharmacists are viewed by the public, government, physicians, nurses and other health professionals, or patients as the preeminent health care professionals responsible for providing patient care that ensures optimal medication therapy outcomes in the prevention and treatment of disease or rational medication use with many activities such as obtaining admission interview for patient's medication history, a participating in patient care rounds, assessing drug order entry, monitoring drug responses, discharge medication counseling, and referring a targeted patient to drug counseling unit. The provision of pharmaceutical care by clinical pharmacist can be accomplished efficiently through activities. All disciplines concerned showed favorable attitudes toward the pharmacist's participation in patient care at ward level.

Awiphan and Thadapark had shown that the most pharmacists had positive attitude toward pharmaceutical care activities in hospital pharmacists, which was shown to have statistically significant relationship with all domains in pharmaceutical care scales, except the proactive activity in patient care dimension. Besides, the results showed that 60% of pharmacists agreed that pharmaceutical care can prevent predictable problems such as some adverse drug reaction.[33]

Siriprapat et al. determine cost savings of pharmaceutical care implementation and medication related problems from parenteral antibiotics and antisecretory drugs at medical wards, Loei Hospital. Data were collected in patients who were admitted from December 13, 2004 to March 11, 2005. Pharmaceutical care activities including evaluating patients' medications in order to identify can resolve (93.36 %)and prevent medication related problems by making a contact to involving physicians using either verbal or written communication. The most problems were changed in route and discontinuation therapy. The total cost savings for all medication related problems were 28,723.05 baht in which the highest percentage (46.47%) of cost savings was from drugs.[34]

## Conclusion

The Clinical ID Pharmacist is responsible for development, implementation, and documentation of the antimicrobial stewardship program for the hospital. The effectiveness of a preauthorization program depends on who is making the recommendations. Restriction of antibiotics use through a program requiring approval from a chief resident or attending physician had no impact on its use. Recommendations from an antimicrobial management team consisting of a pharmacist and an infectious diseases physician resulted in increased antimicrobial appropriateness, increased clinical cure, and a trend towards improved economic outcome, compared with recommendations made by infectious diseases fellows.

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