Invited Review Article

The Development and Trends in Pharmacy Education Across ASEAN Countries

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บทคัดย่อ

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ว. เภสัชศาสตร์อีสาน 2565; 18(1) : 1-20
รับบทความ: 18 ธันวาคม 2564 **แก้ไขบทความ:** 28 กุมภาพันธ์ 2565 **ตอบรับ:** 16 มีนาคม 2565

เภสัชศาสตรศึกษาของประเทศต่างๆ ในอาเซียนมีความหลากหลายและแตกต่างกัน ระยะเวลาของของการศึกษาระดับปริญญาตรีอยู่ระหว่าง 4 ถึง 6 ปี อาทิเช่น หลักสูตรการบริบาลทางเภสัชกรรม ในบางประเทศการสอบใบประกอบวิชาชีพเป็นข้อกำหนดในการขึ้นทะเบียนเป็นผู้ประกอบวิชาชีพเภสัชกรรม การทบทวนครั้งนี้มีวัตถุประสงค์เพื่ออธิบายถึงการพัฒนาและทิศทางของเภสัชศาสตรศึกษาในประเทศอาเซียน ขอบเขตของเนื้อหาประกอบด้วย จุดมุ่งหมายของเภสัชศาสตรศึกษาในประเทศอาเซียน อิทธิพลของการเป็นอาณานิคมหรือความสัมพันธ์กับต่างประเทศ รูปแบบและระยะเวลาของหลักสูตรที่หลากหลาย การเติบโตของเภสัชศาสตรศึกษาในภาคเอกชน ทิศทางของเภสัชศาสตรศึกษาในอนาคต ผลกระทบจากสถานการณ์การแพร่ระบาดของโรคติดเชื้อไวรัสโคโรนา (โควิด-19) และทิศทางในอนาคต การทบทวนและการปรับปรุงเป็นขั้นตอนที่สำคัญของการพัฒนาหลักสูตรให้ตอบความต้องการของสังคม และเพื่อเตรียมนิสิต/นักศึกษาให้มีความรู้และทักษะที่จำเป็นในการพัฒนางานการบริบาลทางเภสัชกรรมให้กับชุมชนหรือสังคมที่นิสิต/นักศึกษาไปปฏิบัติงาน เภสัชศาสตรศึกษามีทิศทางที่เน้นการบริการที่มีผู้ป่วยเป็นศูนย์กลางมากขึ้น เช่น งานเภสัชกรรมคลินิกหรือการให้บริบาลทางเภสัชกรรม และการพัฒนาวิธีใหม่ๆในการถ่ายทอดความรู้และการประเมินผล ที่เน้นการใช้ทักษะมากกว่าความรู้ด้านข้อมูล จากการแพร่ระบาดของโรคติดเชื้อไวรัสโคโรนา (โควิด-19) ส่งผลให้ต้องจัดการเรียนการสอนผ่านทางออนไลน์ เป็นการเปิดโอกาสให้มีห้องเรียนแบบไร้พรมแดน และความสามารถในการเข้าถึงข้อมูลด้านการศึกษา และได้เรียนรู้ความเชี่ยวชาญของผู้สอนทั่วโลก อย่างไรก็ตามความแตกต่างด้านระบบการเมือง ความพร้อมในการพัฒนาโครงสร้างพื้นฐาน การจัดลำดับความสำคัญในระบบบริการสุขภาพ และความพร้อมของอาจารย์ผู้สอนที่ได้ผ่านการฝึกอบรม ปัจจัยดังกล่าวนี้ส่งผลให้เกิดความแตกต่างและหลากหลายของเภสัชศาสตรศึกษาในกลุ่มประเทศอาเซียน แม้จะไม่พบความชัดเจนของการปรับประสานให้สอดคล้องกันของเภสัชศาสตรศึกษาและการทำงานข้ามประเทศระหว่างประเทศในอาเซียนภายใต้แนวคิดประชาคมเศรษฐกิจอาเซียน แต่ในอนาคตอันใกล้นี้สิ่งเหล่านี้อาจเกิดขึ้นได้

คำสำคัญ: เภสัชศาสตรศึกษา, อาเซียน, คณะเภสัชศาสตร์, การบริบาลทางเภสัชกรรม, การแพร่ระบาดโรคติดเชื้อไวรัสโคโรนา (โควิด-19)

The Development and Trends in Pharmacy Education Across ASEAN Countries

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Abstract

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IJPS, 2022; 18(1) : 1-20

Received: 18 December 2021 **Revised:** 28 February 2022 **Accepted:** 16 March 2022

Pharmacy education in ASEAN countries varies from country to country. The duration of a basic pharmacy degree ranges from four years for a Bachelor of Pharmacy (BS (Pharmacy)) degree to six years for a Doctor of Pharmacy (Pharm D) degree. A national licensing examination is required in some countries for registration/ licensing as a pharmacist. This review aimed to describe the development and trends in pharmacy education across ASEAN countries. The scope included the focus of pharmacy education in ASEAN countries; the influence of colonial powers or foreign alliances; varied models and duration; the growth of private education; trends in pharmacy education; the effect of the Covid-19 pandemic; and future directions. Changes in the pharmacy curriculum are a necessary step to meet the needs of society, and to prepare students with the necessary knowledge and skills to improve the provision of pharmaceutical care to the society that they serve. There appears to be an increasing focus in pharmacy education on patient-centered services such as clinical pharmacy/ pharmaceutical care, and the introduction of new methods of delivery and assessment that places emphasis on the demonstration of skills rather than the knowledge of facts. The Covid-19 pandemic has necessitated the delivery of online pharmacy education which has opened the avenue for a borderless classroom and the ability to access educational resources and the expertise of educators from around the globe. However, differences in political systems, the extent of the development of infrastructure, the priorities of the healthcare system and the availability of trained pharmacy educators results in a wide disparity in pharmacy education in ASEAN countries. It does not appear that the harmonization of pharmacy education and, consequently, the movement of pharmacists across the borders of ASEAN countries, as envisaged under the concept of the ASEAN Economic Community, will be possible in the near future.

Keywords: pharmacy education, ASEAN, schools of pharmacy, pharmaceutical care, covid-19 pandemic

Introduction

Pharmacy education around the world has undergone significant changes over the past 50 years. These changes were influenced by developments in the healthcare landscape, international partnerships, and the increasing number of educational institutions (primarily in the past 20 years) offering pharmacy degrees (Loo *et al*, 2017, Grabenstein, 2016, Hung, 2009, Pryitno, n.d.). However, these changes were not without challenges such as meeting the expectations of society, the funders of healthcare, the consumer, and the job market. Also, these changes were not similar across all countries and were dependent on the availability of infrastructure, the level of development and sophistication of the healthcare system, and the presence of trained educators (Chanakit *et al*., 2014). While colleges and schools of pharmacy primarily cater to local students, there are also students from other countries studying in pharmacy institutions. This provides an opportunity for students from other countries to have a broad-based education not just from an educational standpoint but also socially and culturally (Davey *et al*., 2013). While having significant benefits, there are also issues with adapting to a new culture, language, diet etc.

The International Pharmacy Federation (FIP) and the World Health Organisation (WHO) have proposed key pharmacist characteristics such as caregiver, decision-maker, communicator, manager, life-long learner, teacher, leader, and researcher (Anderson *et al*., 2009). However, these may remain as distant aspirations for certain countries, where ensuring sufficient supply of essential good quality and efficacious medicines is the primary challenge and first priority.

The practice of pharmacy also varies across different countries, with some having a relatively strong emphasis on patient care, while others focus on the pharmacist's supply and distribution role. Some countries have separated prescribing and dispensing functions between doctors and pharmacists, while others have a healthcare system where doctors both prescribe and dispense medicines (Inoue *et al*., 2016, Shafie *et al*., 2012).

The rise in the number of private (for profit) universities and colleges that offer pharmacy programs is a relatively recent phenomenon (Hasan *et al*., 2010). The graduates of these programs may have different goals and aspirations resulting from the heavy investment in education by their families (because of the relatively higher cost of private education) as compared to those who graduated from public universities of higher education. Consequently, most privately funded graduates enter the private sector because of the higher remuneration and better employee benefits available (Hasan *et al*., 2010).

ASEAN (Association of Southeast Asian Nations) was formed in 1967 with five founding members, Indonesia, Thailand, the Philippines, Singapore and Malaysia. It has grown in membership over the years and currently has 10 members with the inclusion of Brunei, Cambodia, Lao PDR, Myanmar, and Viet Nam. The motto of ASEAN is "One Vision, One Identity, One Community". Among the initiatives of ASEAN was the formation of the ASEAN Economic Community (AEC) with one of its objectives being the free movement of professionals among the ASEAN countries (Ishikawa *et al*., 2021). This paper combines the experience and observations of the authors to review the literature on the development and trends in pharmacy education in the ASEAN countries.

Pharmacy Education in ASEAN

Pharmacy education in ASEAN countries is varied with respect to providers of education, emphasis, and duration. Although there are programs at the certificate and diploma level in some countries, these programs will not be the subject of this review as they do not lead to the status of a professional accredited/registered pharmacist.

Table 1 Pharmacy education and pharmacist in ASEAN countries

Country	Pharmacy schools			Admission requirement (After completion of 11-13 years of primary and secondary education)	Duration of Pharmacy Program	Licensure	Postgraduate training	Registering as a pharmacist
	Public	Private	Total					
Thailand	14	5	19	General Aptitude Test (GAT), Professional Aptitude Test (PAT)	6-year PharmD (including 2,000 hours required for practice experiences)	National examination	Residency program (4 years)	Pass national licensing examination
Indonesia: 4 years	12	262	274	National examination for public university. Selection by the university for private university	4-year program and 1-professional degree (7-month clerkships in hospital, industry, drug store, primary health care and pharmaceutical distribution company)	National examination	No PharmD	Pass National licensing examination and oath ceremony.
Plus 1-year professional	12	38	50					
Viet Nam	10	22	32	National entrance exam	5-year program (including 1-month practice)	No	• First-level Diploma of Specialization in Pharmacy (FDSPharm) • Second-level Diploma of Specialization in Pharmacy (SDSPharm)	Graduates can be employed immediately in most public or private settings.
Philippines	7	94	101	College Admissions Test of the university	5-year program (1,200 hours required for practice experience)	National examination	PharmD (2 years): professional post-baccalaureate degree program that combines pedagogical and experiential learning.	Pass National licensing examination
Malaysia	5	16	21	1-2 years of pre-university matriculation at the stated universities, the Cambridge Higher School Certificate or HSC, the GCE A-level and certain diplomas conferred by the Ministry of Health, Malaysia, USM, UKM and MARA. (No national examination)	4-year program (8-week rotation) (1 year pre-registration training in either hospital pharmacy, community pharmacy, manufacturing pharmacy or wholesale trading pharmacy)	National examination – Qualifying Examination to Practice Pharmacy (QEPP)	PharmD (2.5 years)	All pharmacy graduates must pass the QEPP and undergo a 12-month pupilage in a hospital pharmacy, community pharmacy or pharmaceutical factory approved by the Pharmacy Board.

Table 1 Pharmacy education and pharmacist in ASEAN countries (*Continued*)

Country	Pharmacy schools			Admission requirement (After completion of 11-13 years of primary and secondary education)	Duration of Pharmacy Program	Licensure	Postgraduate training	Registering as a pharmacist
	Public	Private	Total					
Singapore	1	0	1	General Certificate of Education (GCE) in 'A' Level Examinations or equivalent exams	4-year program (1-year pre-licensing training)	National licensure examination	• PharmD degree (2 years) • Specialist Pharmacist Registration with specific criteria of completing post-baccalaureate education, full-time specialty residency training with more than 3 years of relevant experience – current recognized areas include cardiology, infectious diseases, geriatrics, oncology and psychiatry	3 (year 2-3, 2 of 6 weeks rotation in community pharmacy and hospital) +9-month practical experience before registration
Myanmar	2	0	2	National entrance examination	4-year program	No	The bachelor's degree holders with one-year government service in the pharmacy professional field must go through an entrance examination for Master course.	n/a
Lao PDR	1	0	1	National entrance examination	5-year program (including 7-months practice)	No	Master in Pharmaceutical Sciences Public Health (2 years)	Graduates can be employed immediately in most public or private settings.
Brunei	1	0	1	General Certificate of Education (GCE) in 'A' Level Examinations	4-year program	National examination	n/a	Pre-Registration for 1 year at the hospitals, health centers or private sectors and pass pre-registration test
Cambodia	2	3	5	National entrance examination	5-year program	National licensing examination	Specialist training in biology and cosmetology	Pass national licensing examination

n/a stands for not applicable.

Table 1 provides a summary of the details (entry qualifications, duration etc.) of pharmacy education in ASEAN countries compiled from various sources. It is obvious that there is wide variation.

Methods of teaching vary among ASEAN pharmacy schools depending on the available infrastructure and resources in the country. The most common mode of teaching is face-to-face lectures in classes ranging in capacity from 30 to 120 students. However, some pharmacy schools employ active learning approaches including allocating more class time for question and answer, providing students with pre-class assignments necessary for them to answer questions in class, role playing, game-based learning, and flipped classrooms to facilitate student engagement during face-to-face classroom sessions (Olson *et al*, 2022). For clinical skills and laboratory activities, ASEAN pharmacy schools use various active learning techniques including case-based discussions, problem-based learning (PBL), team-based learning (TBL), clinical case presentations, fishbowls, simulated and standardized patients, actual/simulated chart review, and monitoring. Combinations of traditional and active learning are implemented in science labs. The laboratory sizes vary from 8 to 60 students based on laboratory capacities (Olson *et al*, 2022).

Some universities. such as Sanata Dharma University in Indonesia, Mahasarakham University in Thailand, and the University of the Philippines, conduct inter-professional education (IPE) with students of other allied health professions including medicine, nursing, and public health (Olson *et al*, 2022).

Student assessments also use different modalities and in-person paper-based exams were the most commonly used method. Other assessment methods include objective-structure clinical examinations (OSCEs), objective-structured practice examinations, laboratory exercises and oral examinations (Olson *et al*, 2022).

Thailand

Thailand has a rich history in pharmacy education and the first pharmacy school, which became a part of Chulalongkorn University, was set up in 1914 and offered a certificate in compounding and later a certificate in pharmacy after 3 years of study. Under the British influence, the duration of the program was changed to 4 years in 1941 (although, surprisingly, it remained 3 years in Britain itself) (Chanakit *et al*., 2015), and to a 5-year program in 1957 (Chanakit *et al*., 2014). In 1993, the establishment of the US-Thai Consortium led to a shift in emphasis in Thai pharmacy education towards clinical pharmacy. This finally led to a decision by the Pharmacy Council of Thailand in 2008, to move to a 6-year Pharm D program. The US-Thai Consortium laid the groundwork by providing training towards Pharm D and adequate residency programs for Thai nationals in 10 US Colleges of Pharmacy (Nathisuwan *et al*., 2020). These graduates formed the backbone for the Pharm D program, especially in pharmaceutical care. However, to meet the needs of the country, the pharmaceutical industry and the job preference of pharmacy graduates, the Pharm D program in Thailand offers three tracks – pharmaceutical care, pharmaceutical and health consumer protection, and industrial pharmacy (Pharmacy Council of Thailand, 2019)

Among the challenges in moving towards the Pharm D program were the need for sufficient qualified Pharm D preceptors, defining the required competencies of the pharmacy graduates in different areas of practice, and monitoring of the quality of education (Chanakit *et al*., 2015). Apart from the increase in duration to six years, a 4-fold increase in experiential hours from 500 to 2000 was one of the changes necessary in the shift from BS (Pharmacy) to Pharm D (Kapol *et al*., 2008).

The number of institutions offering pharmacy programs has increased. In the early 1990s, there were only 6 public universities that offered the 5-year pharmacy program. In 2021, there were 19 pharmacy schools (14 public and five private) offering only the 6-year Pharm D program (Pharmacy Council of Thailand, 2021,

Chaiyakunapruk *et al.*, 2016). Thailand introduced a competitive national entrance examination for prospective pharmacy students in 1999 and admission is based on the scores in the examination, (General Aptitude Test (GAT), Professional Aptitude Test (PAT), as shown in Table 1). The examination is now included in the TCAS Thai University Central Admission System (Council of University Presidents of Thailand, 2021). Thailand also has a national licensing examination. Pharmacy graduates are generally able to obtain employment in most sectors related to pharmacy.

The Pharm D program and the implementation of a quality assurance system have been creating an impact on pharmacy practice in Thailand. Hospital pharmacists are involved in pharmacy education through preceptorship, both for inpatient and outpatient care (Chaiyakunapruk *et al.*, 2016). Community pharmacists also are preceptors for Pharm D students for health promotion services such as screening and education (Ploylearmsang *et al*, 2013) and advanced professional practice (e.g., medication use review, home care) (Chaiyakunapruk *et al.*, 2016,).

Indonesia

Pharmacy education in Indonesia is typically a 4-year program of undergraduate study, followed by one to 1.5 years of focused training based on skills and experiential training called Apothecary training (Mohamed *et al*., 2021). There are also alternate degrees in pharmacy that do not qualify the graduate to be registered as a pharmacist.

In 2000, there were 16 schools of pharmacy, but by 2021, this number grew to 274 colleges of pharmacy, made up of both public and private schools of pharmacy. However, only 50 schools of pharmacy offer the additional Apothecary training, which leads to registration as a professional pharmacist, as shown in Table 1. This limited availability of professional program is insufficient to meet the growing demand from undergraduate students for a professional degree (Cokro *et al*, 2021). One university has introduced specialist pharmacy degrees (Sp.Farmasi) in cardiology, oncology, and infection (Lin *et al*., 2020). In 2018, an Indonesian Pharmacist Competency Examination was introduced for entry into the profession and includes an Objective Structured Clinical Examination (OSCE) which assesses competencies in community pharmacy, hospital pharmacy, clinical pharmacy, industrial pharmacy, and pharmacy distribution (Lin *et al*., 2020). The Indonesian pharmacy schools have different levels of accreditation and less than 25% (50 institutions) offer the additional Apothecary training that leads to registration as a professional pharmacist. This has led to a poor perception of certain institutions' pharmacy education (Hermansyah *et al*., 2018). There is the national licensing examination in Indonesia, and pharmacy graduates have to pass and participate in an oath ceremony before being registered as pharmacists.

Pharmacy education in Indonesia is moving towards clinical pharmacy and this move is supported by the Indonesian Association of Higher Education of Pharmacy (APTFI). APTFI has developed and implemented a national pharmacy curriculum, including pharmacotherapy, for Indonesia since 2008 (Pryitno, n.d.). However, the pharmacist's role in clinical pharmacy services is growing quite slowly (Andayani *et al*, 2016). There are challenges to the role of pharmacists. For example, the definition of pharmaceutical service as a non-medical service by the health minister's regulations reduces the role of pharmacists in hospitals and results in low expectations of clinical pharmacists by physicians and patients (Cokro *et al*, 2021). Community pharmacy is developing, albeit slowly (Hermansyah *et al*, 2020). Most community pharmacies in Indonesia are not owned by pharmacists, and thus there are constraints in providing pharmaceutical care to patients (Sari *et al*., 2007).

Viet Nam

Viet Nam has a more than 100-year history in formal pharmacy education, with the establishment of the first pharmacy school in 1914. Although there are various levels of pharmacy education, only universities can confer a Bachelor of Pharmacy or postgraduate degrees (Vo *et al*., 2013). There is even a University of Pharmacy in Hanoi (Vo

et al., 2013). However, only graduates of the 5-year Bachelor of Pharmacy degree are recognized as fully qualified pharmacists and they form only 2% of the total pharmacy workforce. Although the country has a framework and legislation for the provision of clinical pharmacy services, the shortage of pharmacists trained in clinical pharmacy is a barrier to the provision of clinical pharmacy services (Vo *et al*., 2013). Additionally, while there is provision for clinical training through various legislation, education is still product-oriented but beginning to change. The impetus for change was provided by pharmacists who returned to Viet Nam after training in France, Australia, and Holland (Vo *et al*., 2013).

The number of pharmacy schools in Viet Nam has increased especially in the past 30 years (Vo *et al*., 2013). In 2010, there were 10 schools (8 public and 2 private), in 2012 there were 11 (2 private) and in 2019 there were 15 schools (Lin *et al*., 2020, Vo *et al*., 2013) The government is encouraging the setting up of more pharmacy schools (Vo *et al*., 2013). In 2021, there were a total of 32 pharmacy schools/faculties in Viet Nam (as shown in Table 1) and the 10 major schools are part of public universities. There are 3 possible examinations for admission into a pharmacy school; the National University-Entrance Examination, the National College-Entrance Examination administered by the Ministry of Education and Training; and Local Entrance Examinations organized by individual schools (Vo *et al*., 2013). There is no national licensing examination in Viet Nam, and pharmacy graduates can obtain employment in most sectors.

Serious shortages in the number of trained pharmacists and concerns over competency have spurred reforms in pharmacy education. Pharmacy assistants in community pharmacies, and small hospitals, are performing tasks that are the domain of qualified pharmacists. There is a wide gap between the increasing demand for qualified pharmacists and the country's limited capacity to train sufficient pharmacists to meet its need (Vo *et al*., 2013).

Philippines

There are at least 101 institutions offering the Bachelor of Science (BSc) in Pharmacy degree (Republic of the Philippines, 2021). Most of the institutions are private. The universities offer a Bachelor of Science in Pharmacy (e.g., University of the Philippines) or Bachelor of Science in Clinical Pharmacy (e.g., University of Santo Tomas) as a five-year undergraduate degree. There are two-year Master of Science in Pharmacy programs (Hospital Pharmacy). The undergraduate curriculum requires a minimum of 1,200 hours for experiential pharmacy practices (EPP) made up of 120 hours in Institutional Pharmacy, 180 hours in Public Health and Regulatory Pharmacy, 300 hours in Community Pharmacy, 300 hours in Hospital Pharmacy, and 300 hours in Industrial Pharmacy (CHED, 2021). There are some universities that offer specializations in industrial pharmacy or clinical pharmacy (with an additional one year of study or a 2-year Pharm D program (post-baccalaureate degree program). New legislation places emphasis on compliance with international quality standards for pharmacy education (Mohamed *et al*., 2021). The pharmacy graduates must pass a Pharmacy Licensure Examination before they can practice as pharmacists.

Community pharmacy rotations in the Philippines may take place in either the outpatient pharmacy of a hospital or in a stand- alone retail pharmacy. Students' practices include patient counseling, preparation of medications, and discussion of specific topics. However, in many community pharmacies, a licensed pharmacist is not present during the working hours of a pharmacy as there is only a requirement fora valid license to be kept in the pharmacy (Antigua *et al*, 2015). In hospital pharmacies in the Philippines, pharmacists and students are involved mainly with the distribution and preparation of medications and a multidisciplinary approach is not common. The Philippine Pharmacists Association (PPhA) model of education emphasizes the development of skills necessary for a pharmacist and the role of quality assurance in pharmacy education, practice, and regulation (Antigua *et al*, 2015).

Malaysia

The nation currently has 21 (five public and 16 private) educational institutions offering a degree in pharmacy. One institution also offers a 2-year postgraduate Pharm D program to those who already possess an undergraduate pharmacy degree. The qualification for registration set by the Malaysian Pharmacy Board is a pharmacy degree with at least four years duration. While there is a bias towards clinical pharmacy in most local institutions, especially in Years 3 and 4, the curriculum in branch campuses of foreign universities (British and Australian) tend to be biased towards community pharmacy and the ability to resolve medication-related issues. The relatively high number of institutions has resulted in competition for enrollment and a wide range in fees for a 4-year pharmacy degree. The high number of graduates poses challenges in the availability of training sites, especially public sector training sites, for the mandatory 1-year service for provisionally registered pharmacists, as shown in Table 1 (Rathore *et al*., 2010). Pharmacy graduates must pass a qualifying examination to practice pharmacy before they can be registered as pharmacists (Thomas, 2020).

Pharmaceutical services and products in the private sector and in community pharmacies cater to the consumer market, while government pharmaceutical services and products focus on ensuring access to medicines and promoting quality use of medicines. Medical doctors in private clinics and in some private hospitals dispense medicines to their patients (Sing, 2001).

Singapore

There is only one pharmacy school in Singapore. It is the Department of Pharmacy, Faculty of Science, National University of Singapore (NUS). Prior to university entry, all students must pass the Cambridge General Certificate of Education (GCE) 'A' levels including the science subjects chemistry, biology, physics and mathematics (Tee *et al*, 2012). The NUS offers a 4-year undergraduate degree program culminating in the Bachelor of Pharmacy (Honours) degree. Pharmacists in Singapore must be graduates with a bachelor's degree from Singapore or foreign universities that are accredited by the Singapore Pharmacy Council (SPC) and they must have no less than 12 months training in pharmacy practice provided by preceptors at practice sites approved by SPC. Part (12weeks) of the training can be completed in the 2nd and 3rd year of pharmacy school as two 6-week rotations in both community pharmacy and hospital pharmacy (Caroline *et al*., 2012). Pharmacy graduates must pass the National Licensure Examination before they can be registered as pharmacists.

There is a growing trend for specialization and accreditation of clinical pharmacists supported by the Singapore Ministry of Health. Pharmacy education and training have a strong emphasis towards training clinical pharmacists and clinical services - recognizing the crucial role of pharmacists in the multidisciplinary healthcare team. NUS started a post-baccalaureate Pharm D program in 2010. Hospital pharmacists provide inpatient and outpatient care. In 2007, the first pharmacist-led chronic disease management clinic introduced in Singapore was the Hypertension, Diabetes and Lipids Clinic (HDL-C). Many community pharmacies run free patient counseling services (e.g., smoking cessation service and medication review), and provide screening checks for chronic diseases (Tee *et al*, 2012).

Myanmar

There are two public pharmacy schools in Myanmar, the University of Pharmacy, Mandalay and the University of Pharmacy, Yangon. Both universities offer the 4-year full-time Bachelor of Pharmacy (B.Pharm.) degree. High school students who have passed the University Entrance Examination with appropriate scores can be admitted to the program. The university of Pharmacy, Yangon also offers Master of Pharmacy (M.Pharm.) and Doctor of Philosophy in Pharmacy (Ph.D.) degree programs (University of Pharmacy Myanmar, 2020). There is no National Licensure Examination required for registration as pharmacists.

Pharmacy programs provide four specializations: pharmaceutics, clinical pharmacology, pharmaceutical chemistry and pharmacognosy. The roles of pharmacists in Myanmar cover receiving verbal prescriptions from physicians, prescription review, counseling patients regarding prescription or non- prescription medicines, performing consultations with physicians and doctors, and selecting drug products to dispense. Pharmacists in Myanmar mainly rely on drug sales representatives for drug information (Wray, 2019).

Lao PDR

There is only one university that provides pharmacy education in Lao PDR, located in the capital, Vientiane, at the Faculty of Pharmacy, University of Health Sciences. The faculty has been supported by the Foundation Pierre Fabre, France, since 2005. A 4-year assistant pharmacy program was first established in 1967 and in 1968, the first Bachelor program of Pharmacy program was started. The Faculty of Pharmacy now offers a 5-year program. High school students must pass an entrance examination to study pharmacy. The intake is about 50 students per year. In the fifth year, students have internships in hospitals, community pharmacies, the pharmaceutical industry, and the community for a total time of 7 months. Upon graduation, they can be employed as pharmacists in both public and private settings. However, if they wish to be community pharmacists, they must have at least 5 years experience working in pharmaceutical field, before they can obtain a license to open a community pharmacy (Foundation Pierre Fabre, 2021, Sonoda *et al*., 2017). There is no National Licensure Examination required for registration as a pharmacist.

Due to limited government funding for medicines, the number of private pharmacies has increased dramatically, but about 95% are owned by non-pharmacists. The quality of pharmacy practice in both public and private sectors is suboptimal. Drugs without adequate labels and labels written in English or French may result in failure of drug monitoring and inappropriate use of drugs by the population (Syhakhang et al, 2001).

Brunei

A pharmacy program, Bachelor of Health Science Pharmacy (BHSc Pharmacy) in Brunei was first introduced by The Pengiran Anak Puteri Rashidah Sa'adatul Bolkiah (PAPRSB) Institute of Health Sciences (HIS) in 2016. It is a 4-year undergraduate program. The BHSc Pharmacy degree program is a full-time program with 2 semesters per year. The 6th and 7th semesters are the discovery year (DY). DY is for experiential learning where students can be attached to a laboratory for internship or research work or to do an incubation project either overseas or in Brunei. After completing the 4-year program, students must take the National Licensure Examination and complete 1-year of pre-registration training before they can be registered as a pharmacist (UBD PAPRSB, 2021).

Hospital pharmacy services include dispensing medication prescribed by a doctor, patient counseling, working with multidisciplinary teams, providing 24 hours on-call pharmacy service, providing drug information service to other health care professionals and the public (Ministry of Health, n.d.). Clinical pharmacists perform ward rounds services only at certain hospitals. Community pharmacies mainly provide dispensary services including supplying medication to doctors' clinics, inhaler technique counseling, and monitoring drug usage and wastage (Ministry of Health, n.d.).

Cambodia

Cambodia has five Schools of Pharmacy. They provide a 5-year pharmacy program. Prospective students must pass a national entrance examination to study pharmacy (University of Puthisastra, 2021, University of Health Sciences, 2021, Royal Academy of Cambodia, 2021, International University, 2021, Norton University, 2021). After graduation, pharmacy graduates are required to sit for a National Licensure Examination.

Many community pharmacy services are provided by non-pharmacists. A licensed pharmacist does not need to be present during the working hours of a pharmacy. Drug stores often have poor storage conditions which lead to degradation of medication (Yang *et al*, 2004).

Influence of colonial powers or foreign alliances

The influence of colonial powers and foreign alliances is obvious. Pharmacy education in Thailand, especially in the past two decades has been strongly influenced by the US-Thai Consortium, which led to the implementation of the 6-year Pharm D program in Thailand as the entry for pharmacy licensure in 2014. However, the influence, while strong, is not an exact copy of the US Pharm D program. Thailand allows the students of a Pharm D program the choice of a Pharm D in pharmaceutical care or a mixture of pharmaceutical care and industrial pharmacy or primarily industrial pharmacy, which includes research and development and product registration, in accordance with the needs of the country and the interests of the students (Chanakit *et al*., 2014). Brunei, Malaysia, and Singapore were former British colonies, and the influence of the British pharmacy education system is apparent, but again not an exact replica. Malaysia has an education system that incorporates some of the US education system with an emphasis on clinical pharmacy (Thomas, 2020). Vietnamese pharmacy education was influenced by the French system and about 100 years ago, Vietnamese pharmacy graduates had to sit for their examinations in France! (Lin *et al*., 2020)

There is formal and informal collaboration in education and exchange between developed and developing countries both within ASEAN and outside of ASEAN. For example, Taiwan, a developed country, assists pharmacy education in Viet Nam and Indonesia, while Thailand provides assistance to staff and students from Myanmar and Lao PDR (Lin *et al*., 2020).

Varied models and duration

As can be seen from Table 1, although there are 1- and 2-year certificate and diploma programs in pharmacy, most countries started with a 3-year pharmacy program, probably through the influence of the colonial powers or cooperation with other developed countries. Over the last 30-40 years, all pharmacy degrees that lead to registration or licensure as a pharmacist have become at least 4-year programs (Kapol *et al*., 2008). The 6-year PharmD program in Thailand has 2000 hours of experiential learning compared to 500 hours for the previous BS Pharmacy degree (Kapol *et al*., 2008). Some countries have competency standards and national licensing examinations for registration as pharmacists. Others do not have licensing examinations but graduates are required to pass a period, usually 1 year, of housemanship or pupillage or provisional registration training with a preceptor or master for licensure or registration as a pharmacist (Thomas, 2020, Caroline *et al*., 2012).

There are also differences in the duration and the names of pharmacy degrees available in ASEAN, which have a bearing on the content (Rathore *et al*., 2010). The factors that influence the duration and content of the pharmacy curriculum are varied and include colonial influences, foreign alliances, the maturity of the society, the standard of development, and the affluence of the country (Kapol *et al*., 2008). Education should reflect the needs of the country, the population, the economy, and the healthcare system (Lin *et al*., 2020). Therefore, patient-centered pharmacy education may not be relevant in developing and underdeveloped countries and the focus of pharmacy education in those countries should be appropriate for the state of development of the country. In some countries (e.g., Lao PDR, Myanmar), the procurement, distribution, and supply of medicines may be the greatest need (Steson *et al*, 2001, Aye et al, 2020). So, pharmacy education must follow a needs-based approach, first on current needs but also with an eye on future needs.

Growth of private education

The increase in private education in pharmacy is a recent phenomenon seen especially in Malaysia, Philippines, Indonesia, and Viet Nam (Loo *et al*, 2017, Pryitno, n.d, Republic of the Philippines, 2021, Vo *et al*., 2013), primarily because the limited places in public universities are unable to cater to the demand from interested students. Most, if not all, of these private institutions are for-profit institutions. There are different

models of private education (Rathore *et al*., 2010). The first is a private university that runs its own program that meets the requirements of the regulatory agency/pharmacy professional body. The second is the establishment of a foreign university campus in another country, which runs either the whole degree program in the ASEAN country using the foreign curriculum, while making minor adjustments for local regulatory requirements, or it could run the first few years of its program in the ASEAN country and the remaining years at the parent campus. A variation of this is a twinning program where the first few years of a foreign program are run at the ASEAN country by a local partner educational university and the remaining years are run at the parent country and campus. There are challenges to all these iterations primarily because there is a need for compliance with the regulatory requirements of two countries. Also, the ASEAN partners often feel they do not have enough say/input into the delivery of the program, the curriculum, assessment, and the relevance to local conditions as these aspects are determined/controlled by the parent institution. The third model of a private university is what is often called articulation. In this model, the first few years of the ASEAN program are recognized as equivalent to a foreign program and students are allowed to “articulate” or transfer credit to the foreign university and then complete the remaining years of the program in the parent institution (Davey *et al*., 2013). Sometimes the matching may not be equivalent, and students will have to make up for the deficiency in the foreign campus. The advantages of the different models of collaboration with foreign universities in private education is that it offers an opportunity to gain a degree from a better-known foreign university and often also an opportunity to work as a pharmacist in that country. It may also be a less costly option because the cost of living and tuition for the first few years in the ASEAN country, especially if you live with your family, will be cheaper than living the whole duration of the program in a foreign country (Davey *et al*., 2013).

The growth of private education has led to intense competition for the pool of qualified potential students. The factors that influence the choice of university include image/reputation/ranking of the university, financial factors such as fees and cost of living, and convenience, campus attributes and extracurricular activities (Loo *et al*., 2017).

Trends in pharmacy education in ASEAN

1. Increasing focus on clinical pharmacy/pharmaceutical care

Most countries begin with the basic sciences in the first two years and begin teaching practice subjects in the latter years. However, there is now greater emphasis being placed on introductory pharmacy practice experiences (IPPE), which has been mandated by ACPE in the US curriculum for more than 10 years (Pharm, 2009), and visits to hospital settings are included from semester 1. Additionally, there is increasing emphasis on Inter-Professional Education (IPE). Some ASEAN countries have already implemented this and it will continue to increase to simulate the real workplace scenario.

However, ASEAN countries do not have the same healthcare settings as more developed countries and while there is an emphasis on clinical pharmacy and pharmaceutical care, countries like Thailand also allow for a Pharm D in industrial pharmacy. Other ASEAN countries may follow the model in South Korea where students have the choice of several electives related to their choice of future work area – clinical, industrial or pharmacy research (Kim *et al*., 2013).

The increased focus, in varying extents in different countries, on patient-centered pharmacy education and the increasing prevalence of non-communicable diseases (NCD) consequent to economic development and sedentary lifestyles, has led to the inclusion of contemporary topics and skills for new areas such as lifestyle medicine (making changes in lifestyle and diet) (Hassali *et al*., 2012), immunization (Al-lela *et al*., 2012) and smoking cessation (Simansalam et al., 2015). For those who have already been

in practice and trained in a product-centered curriculum, there is a need to have opportunities for upskilling and continuing professional development (Minh *et al*., 2013).

While the emphasis on patient-centered pharmacy education may be more relevant in certain countries, there is still a need for pharmacists to provide services related to primary care, health promotion (Sookaneknun *et al*., 2009), public health (Hassali *et al*., 2009) and disease prevention and these topics must still be part of the pharmacy curriculum (Chanakit *et al*., 2015). This is especially relevant in the ASEAN region where most of the countries are in the developing nations category and still have pockets of the population for whom there is a lack of access to public health facilities.

As we move towards patient-centered pharmacy education there is a challenge in finding adequate practice sites and suitably experienced and qualified preceptors (Inoue *et al*., 2016) and hospitals offering services such as Therapeutic Drug Monitoring (TDM), Total Parenteral Nutrition (TPN), IV Admixture and Cytotoxic Drug Reconstitution Services for training of students (Hassan, 1993). This scarcity in the transition phase will continue until a critical mass of trained pharmacy practitioners and appropriate training sites are available.

The population dynamics of countries around the world are changing and the proportion of the elderly in the population is increasing as life expectancies increase. Pharmacy education should now include topics on geriatric medicine, services in aged-care facilities, aids to medication compliance and medicine consumption behavior in the elderly (Inoue *et al*., 2016, Hassali *et al*., 2009).

2. New methods of delivery of pharmacy education

There are changes taking place in the delivery of education in general and thus also in pharmacy education. The drivers for these changes include academic forces, social forces, technological forces, economic forces, political forces, and the expectations of society (Hassan, 1993, Rhoney *et al*., 2021). These forces affect pharmacy education in ASEAN countries to varying degrees. The change in the focus of the curriculum, the reality of a globalized world in which health professionals need to work together as a team, and the increasing use and availability of modern digital technology has resulted in new methods of delivery of the curriculum and for assessment.

There is greater emphasis on the student as a learner, who takes greater responsibility for learning. The flipped classroom is an approach where, prior to the class, students are given material to study, maybe view a recording, and then come to class for a more interactive session (Sams et al., 2012). This approach stimulates active learning as the student cannot just be a passive listener. This method is found to be useful in courses that initially do not have satisfactory student performance, but subsequently stimulate student learning interest (Goh *et al*., 2019). Case-based learning and inter-professional education (IPE) are also being used increasingly in recognition that good healthcare is a team effort and the need to identify and appreciate the skills of different members of the team (Tan *et al*., 2014). There is also increasing flexibility and students are offered opportunities to expand their skills in broad or discrete areas through electives, specializations, and minors in their pharmacy degrees.

Pharmacy education now also includes partnerships where best practices are shared (Lin *et al*., 2020) and students have the added benefit of guest lecturers from other universities and countries either physically or digitally. Overseas rotations in different settings help to broaden the knowledge and adaptability of pharmacy students (Ohtani *et al*., 2017).

Assessments are also changing from predominantly written and practical assessments to newer methods such as Objective Structured Clinical Examinations (OSCE), Objective Structured Pharmacy Examinations (OSPhE), where a student is required not just to demonstrate mastery of knowledge but also skill or competency (Awaisu *et al*., 2010).

The move towards new areas has also highlighted the issue of having sufficiently trained educators, especially

for assessment of professional competencies (Khan, 2010) and the benefit or otherwise of having non-pharmacy educators (Ahmadi *et al*., 2012). To some extent these changes can appear to have been relatively slow compared to some social science programs because of the accreditation and standards of professional boards of pharmacy who are either resistant or late to accept changes.

Effect of the Covid-19 Pandemic

The outbreak of the Covid-19 pandemic in ASEAN countries around March 2020 resulted in various restrictions such as Movement Control Orders (MCO), curfews, and lockdowns. This led to intermittent closure of university campuses (primarily affecting students), restriction of access to practice sites and challenges to the delivery of pharmacy programs (Lyons *et al*., 2020). The pandemic highlighted the need for education to be flexible (both in location and time) and the development of personalized learning using technology that necessitates the student to bear a greater responsibility for their learning. This has been described as inclusive pedagogy and the challenges that were faced were many (Rhoney *et al*., 2021, Olson *et al*., 2021).

Lectures could be delivered via online platforms such as Zoom, Teams, Webex etc. (which soon became household names!) but the readiness of institutions to transition to an online mode varied. The use of learning management systems (LMS) such as Moodle became essential (Rhoney *et al*., 2021). Some institutions were already delivering their programs in a hybrid mode (face-to-face and online), while for others it was a shock and a steep learning curve because of limitations in the availability of the necessary infrastructure (not only at the university but also nationally) for stable internet connections, especially in remote areas, and the supply of adequate devices for communication and participation in online learning. (Rhoney *et al*., 2021, Olson *et al*., 2021) Lectures were conducted synchronously and asynchronously according to the requirement of the subject and because of the time differences in the countries of international students who were not able to travel to the university.

Professional bodies and regulatory agencies had to adapt and make changes to their guidelines to allow for teaching and learning activities and assessments to continue during the pandemic. Experiential learning activities at external sites such as hospitals, industry, and community pharmacies could not be carried out because those facilities wanted to minimize the level of exposure to “outsiders” for their own protection and also for the protection of the “outsider”. Thus, these experiential learning activities were replaced with videos, online discussions, simulations, role play and briefings (Mohamed *et al*., 2021). Some pharmacy schools in Thailand, Malaysia, and the Philippines uniquely redesigned on-site activities in a hospital to remote teaching using medical record simulations. Case-based learning and team-based activities were also used during lockdown to allow students to learn from each other, develop team skills and think critically. Schools of Pharmacy in the Philippines, Thailand, Vietnam, and Lao PDR postponed some activities which needed face-to-face interactions (e.g., practical training, laboratory activities) to following semesters, while one school in Indonesia changed these activities to video on demand. However, there were challenges in remote teaching in some ASEAN pharmacy schools including cost of devices. Students at University of the Philippines Manila were given laptops through a fund-raising campaign of the UP-Pharmacy Alumni Association or a loan by the college. Unstable internet connections in some mountainous and rural areas also affected online learning. Loss of electricity due to system maintenance or calamities, such as strong typhoons, earthquakes, or flooding in some countries also disrupted online learning (Olson *et al*, 2022).

The pandemic caused all educational institutions to consider new education delivery models, either because they worked well during the pandemic or to be ready for another pandemic or natural calamity that would prevent face-to face interactions in the future. Remote learning using databases containing patient information, online interviews with patients in hospitals or homes and even simulated

patients (role play) will have to be used. Assessment will have to consider attainment of competency rather than a body of knowledge (Rhoney *et al*., 2021, Olson *et al*., 2021).

The experience with online and alternate methods of curriculum delivery will see greater use of technology such as artificial intelligence (AI), virtual reality (VR) and augmented reality (AR) and educational institutions in the ASEAN region are already working on these modalities not just as a response to the pandemic-like situations but as a viable and maybe better educational tools (Hassali *et al*., 2009). However, the question of whether healthcare programs, including pharmacy, can be taught without the element of "touch, feel and speak" and without in-person communication with health care professionals and patients remains. With the greater use of technology, there will be a need for evaluation of the relevance of attendance at classes and fixed duration of programs. Greater consideration will have to be given to accredited prior experiential learning (APEL) (Rhoney *et al*., 2021). These concepts are not new in the USA, Britain and other developed countries but will be new in ASEAN and therefore the need for cultural adaptations and reactions from society will have to be kept in mind.

Future Direction

It is apparent that the pharmacy curricula in ASEAN countries are not similar and not all are focused on patient care, as shown in Table 1. This is not unexpected as the needs of the various countries, their histories and their pace of development differ greatly. The important criteria to evaluate the adequacy of a curriculum are whether it meets national and societal needs, the required qualities of pharmacy education, and the needs of the graduates. Curriculum changes are taking place, but they will not immediately result in change in practice, they are a necessary first step (Chanakit *et al*., 2015). The AEC, and the greater freedom of movement of healthcare professionals across ASEAN countries was hoped to lead to harmonization in pharmacy education within ASEAN. However, the remaining disparities in course duration and the different emphases in the curricula may prevent this movement of pharmacists across ASEAN borders for some time to come (Chonsilapawit *et al*., 2016).

Community pharmacists are often perceived in some ASEAN countries as shopkeepers or businesspersons and not as healthcare professionals. This perception of the community pharmacist is especially prevalent in countries where there are different tiers of pharmacy personnel and often the patient- facing services and consultations are carried out by personnel who are not fully qualified or are designated as pharmacy assistants but legally allowed to operate like pharmacists (Hermansyah *et al*., 2018). To meet the expectations of the patient, pharmacists in these countries need to step out of the back room and allow the patient to consult and seek advice from the properly qualified pharmacist. The increasing emphasis in pharmacy education on patient-centered services is a step in the right direction. As part of the training and preparation of future healthcare professionals, pharmacy education should include the ability to articulate and champion the rights of patients towards better access to medicine and, where appropriate, self-care (Gauld *et al*., 2015).

Accrediting agencies and professional bodies provide guidelines and standards that apply to all pharmacy programs under their jurisdiction. However, while useful to benchmark and ensure required competencies, they are often not sufficiently agile in their ability to fulfill the changing healthcare needs of a country in a timely manner. Educational institutions, while meeting prescribed standards, must prepare pharmacy students for a changing environment and for life-long learning. The desire to continuously improve pharmacists' performance in their job functions should be inculcated even while as students (Rutter *et al*., 2012). Wherever possible, training should be provided in specialized and new areas, such as health informatics - an area that is becoming increasingly important (Chonsilapawit *et al*., 2016). With experience in online delivery, the expertise for teaching and training in new areas of practice are not limited or confined by geographical borders, but can be sourced from around the globe (Rhoney *et al*., 2021).

Conclusion

Pharmacy education in ASEAN is varied Pharmacy education impacts pharmacy practice through preceptorship (e.g. Thailand) and with pharmacy specialization (e.g., Singapore). Shortage of pharmacists is still prevalent in many ASEAN countries, which may explain non-pharmacists providing pharmacy services in community pharmacies in these countries. A national licensure examination has not been implemented in some countries. The vast differences in the resources and priorities of the healthcare systems in different ASEAN countries will be a significant barrier to introducing harmonized pharmacy education.

Acknowledgements

Thank you Dr. Phoutsathaphone Sibounheuang, Faculty of Pharmacy, University of Health Sciences, Lao PDR for information from Lao PDR, Christianus Heru Setiawan, School of Pharmacy, Sanata Dharma University, Indonesia for information from Indonesia, and Dr. Charles Mandy Ayran, College of Pharmacy, University of the Philippines Manila for information from the Philippines.

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