science, engineering and health studies

Review Article

Science, Engineering and Health Studies
https://lio1.tci-thaijo.org/index.php/sehs
ISSN (Online): 2630-0087

Pharmacy education in Myanmar: The past, present, and future

Mi Mi Saw[1,2], Leurat Anuratpanich[3], and Nattiya Kapol[4]*

[1] Department of Pharmaceutics, University of Pharmacy, Yangon 11031, Myanmar
[2] Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand
[3] Department of Pharmacy, Social and Administrative Pharmacy Excellence Research (SAPER) Unit, Faculty of Pharmacy, Mahidol University, Bangkok 10400, Thailand
[4] Division of Social and Administrative Pharmacy, Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand

***Corresponding author**:
Nattiya Kapol
kapol_n@su.ac.th

***Received**: 27 September 2024*
***Revised**: 18 December 2024*
***Accepted**: 24 December 2024*
***Published**: 3 April 2026*

***Citation**:
Saw, M. M., Anuratpanich, L., & Kapol, N. (2026). Pharmacy education in Myanmar: The past, present, and future. Science, Engineering and Health Studies, 20, 26010001.

ABSTRACT

This review article aimed to describe an overview of pharmacy education, including the challenges and barriers to pharmacy education in Myanmar. Pharmacy education in Myanmar is a content-based education system. The curriculum's courses in undergraduate professional subjects are related only to pharmaceutical sciences; those related to clinical, social and administrative sciences are not covered. Clinical pharmacy is implemented in postgraduate programs; however, it is not sufficiently developed. Moreover, the subject of social and administrative pharmacy has not yet been implemented in Myanmar. Updating the curriculum and establishing a pharmacy council were identified as key challenges because the current curriculum does not align with modern pharmacy practices, and the absence of a regulatory pharmacy council limits the standardization, governance, and advancement of pharmacy education, particularly in specialized areas within pharmacy schools. The rapid and ongoing change in pharmacy worldwide forces pharmacy education in Myanmar to adapt to patient and public safety and efficiency in drug utilization. It is concluded that a four-year pharmacy program should be revised to address the challenges and barriers worldwide.

Keywords: pharmacy education; challenges; barriers; curriculum; Myanmar

1. INTRODUCTION

Pharmacy education is essential for the development of pharmacy-related human resources, which should be produced according to public needs (Chanakit et al., 2015). The International Pharmaceutical Federation Education Development Team (FIPEd), the World Health Organization (WHO), and the United Nations Educational, Scientific and Cultural Organization (UNESCO), all aim to enhance global pharmacy education (Anderson et al., 2010; Chanakit et al., 2014). Pharmacy education is a priority area for the International Pharmaceutical Federation (FIP), which represents pharmacists and pharmaceutical scientists worldwide. The FIP is leading the global pharmacy education taskforce (Anderson et al., 2008), which aims to promote needs-based education as a mechanism to evolve pharmacy education worldwide (Anderson et al., 2008, 2012). This initiative aims to address current and future societal and pharmaceutical health needs through the FIP Global Pharmacy Taskforce Report (Alsharif, 2017; Gall et al., 2012). FIP can capitalize on its distinctive worldwide network of academic institutions, professional associations, policymakers, and significant pharmaceutical stakeholders by means of the worldwide mobilization for the advancement of pharmaceutical education (Etukakpan et al., 2023).

To enhance pharmacy practice and patient outcomes, pharmacy education is undergoing a significant transformation on a global scale. These days, pharmacists are providing more sophisticated services than just dispensing drugs, such as collaborative drug therapy management, comprehensive medication safety systems, and improving patient transitions (Al-Ghananeem et al., 2018). Health profession instructors must stay current on these areas of improvement, even with the swift changes and transformations occurring in healthcare settings. These include improvements from fragmented, outdated and static curricula that increase the risk of skill gaps in graduates (Etukakpan et al., 2023).

Myanmar, a developing country, is one of the Association of Southeast Asian Nations (ASEAN) countries located in the Southeast Asia region, with an area of 680,000 km^2 surrounded by Thailand, Lao PDR, China, India, and Bangladesh (Latt et al., 2016). The population of the Republic of the Union of Myanmar was 54,653,269 on 8th December 2024, which is equivalent to 0.67% of the total world population (Worldometer, 2024). For pharmacy education, two universities currently offer undergraduate and postgraduate pharmacy programs, under the Ministry of Health, in Myanmar (University of Pharmacy, Mandalay, 2024b; University of Pharmacy, Yangon, 2024b).

To produce pharmacy graduates who can meet societal expectations, it is essential to have a thorough understanding of the situation in Myanmar pharmacy and pharmaceutical education within the country's context. To achieve a high-quality global infrastructure for pharmacy, the educational system should be mapped to the required competencies of pharmacists to provide the relevant pharmaceutical services for meeting the health needs in any given country's context (Bruno et al., 2010).

In Myanmar, skill shortages have been observed in many settings, but they have been especially noticeable in hospitals. The scope of responsibility of hospital pharmacists in Myanmar is very limited. Most hospital pharmacists focused on procurement functions (Aye & Anantachoti, 2020). Therefore, their careers are more product-oriented. They are expected to focus on patient care in hospitals, community, and pharmaceutical public health, which are very limited roles for pharmacy graduates in Myanmar (Aye & Anantachoti, 2020).

Therefore, it is necessary for a transformed pharmacy education system in Myanmar to meet the expectations of pharmacists and pharmaceutical scientists. It is essential to have a deep understanding of the situation of Myanmar's pharmacy and pharmaceutical education according to the country's context. This review article aimed to describe the overview containing the past, present, and future of pharmacy education in Myanmar. Moreover, challenges and barriers to pharmacy education can be identified to obtain a better understanding of the situation and identify the key obstacles and areas to transform to support the transformation of pharmacy education in Myanmar.

2. OVERVIEW OF PHARMACY EDUCATION

2.1 Degree and programs

Historically, a two-year diploma course, Diploma in Paramedical Sciences (D.P.M.S.), was initially established as pharmacy training in 1964 in the compound of Yangon General Hospital. This training started with the Department of Pharmacy, organized by the Institute of Paramedical Sciences. However, pharmacy was separated from the Institute of Paramedical Sciences to the Institute of Pharmacy, where a Bachelor of Pharmacy (BPharm) bridge course, a two year program, had started for those who had finished a two year degree in the paramedical sciences course at Tahton Road campus (former BOC College of Engineering and Mining) in Yangon, in 1992. It was only selected for three batches through the entrance exams and ended in 1998. Then, it was upgraded to a four-year program, BPharm (regular course), in 1993. The current place of the Institute of Pharmacy, Yangon, is at Waibargi Myothit in North Okkalapa Township, and the name was officially changed from the Institute of Pharmacy to the University of Pharmacy, Yangon, in 2005 (University of Pharmacy, Yangon, 2024b). Another university of pharmacy was set up on 22nd May 2000 with the name of the Institute of Pharmacy, at Ba Htoo Hostel on the campus of the Institute of Medicine Mandalay. The institute was moved to the former mental hospital on 35th Street between 65th and 66th Streets on 25th June 2000. On 4th May 2004, it finally came to its current place, on Htone Bo-Myitnge, a two-way road near Taw-twin village, Amarapura Township, Mandalay Division, Myanmar. The name was officially changed to the University of Pharmacy, Mandalay in 2006 (University of Pharmacy, Mandalay, 2024b).

In the past, there were about 50 students graduating from each university per year. Currently, the average number of students admitted to each university is approximately 130 students per year, and about 200–260 pharmacy graduates are produced annually from both universities. In every admission, female students typically outnumber male students. The data from the two universities of pharmacy showed that the cumulative number of pharmacy graduates is about 4,222 as of July 2023 (Ministry of Health, Myanmar, 2023). In both universities, a Master of Pharmacy (MPharm) is a 2- or 3-year program that started in 2003. The course for a Master of Pharmacy first started with a general course, and in the first year, there were also Pharmaceutics, Pharmacognosy, Pharmaceutical Chemistry, and Pharmacology. The thesis was submitted in the second year. Later, it was changed into specialized subject areas like Pharmaceutics, Pharmacognosy, Pharmaceutical Chemistry, and Clinical Pharmacy, and the specialized Master of Pharmacy program was started in 2018 at both universities. The Doctor of Philosophy (PhD) program in Pharmaceutics, Pharmacognosy, Pharmaceutical Chemistry, and Clinical Pharmacy was started in 2014. There were about 15–20 students selected per year for the Master of Pharmacy in each school, so the total number of students was around 165 (University of Pharmacy, Mandalay, 2024a; University of Pharmacy, Yangon, 2024a). A three-year Doctor of Philosophy program was started in 2014, with about 5–8 students per year. For both schools, the total number of students was around 21 (University of Pharmacy, Mandalay, 2024a; University of Pharmacy, Yangon, 2024a).

The Bachelor of Pharmacy program focuses on foundational pharmaceutical sciences and practical skills, which aims to produce competent pharmacists capable of providing safe and effective healthcare and quality pharmaceutical products, keeping pace with developed countries in the region. Meanwhile, the Master's program emphasizes pharmaceutical research and advanced

pharmacology, and the PhD program is designed for developing expertise in pharmaceutical research and clinical pharmacology. The continuum of pharmacy education programs in Myanmar can be seen in Figure 1.

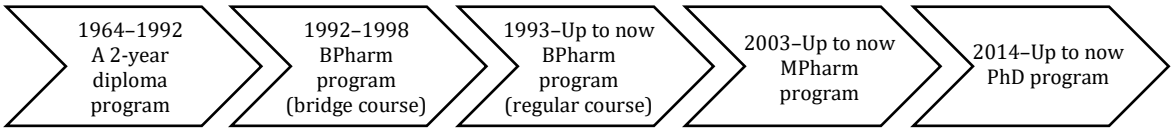


Figure 1. Continuum of pharmacy programs in Myanmar

2.2 Admission requirements

A 2-year diploma in Paramedical Sciences was obtained if a person had a Bachelor of Science (BSc) and had passed the entrance examination. The admission requirements for a 2-year Bachelor of Pharmacy (bridge course) were that those who had a diploma in Paramedical Sciences and passed the entrance examination could attend this course. However, pharmacy students for a 4-year Bachelor of Pharmacy (regular course) must pass the matriculation examination for enrollment and are selected by a merit system in both universities. The first and foremost batch of 163 students was selected through a matriculated entrance examination in Mandalay. To attend a 2- or 3-year Master of Pharmacy (MPharm) program, candidates must hold a Bachelor of Pharmacy (BPharm) degree, have 1–2 years of work experience in the governmental sector, and pass both written and oral entrance exams in their chosen specialization (Clinical Pharmacy, Pharmaceutics, Pharmaceutical Chemistry, or Pharmacognosy) and English language. For the Doctor of Philosophy in Pharmacy program, candidates must hold an MPharm degree and pass written and oral entrance exams in their MPharm specialization and English language.

2.3 Curriculum

Currently, in both universities, the subjects of the curriculum are the same. The subjects of the curriculum of the Bachelor of Pharmacy include foundation and professional courses. As shown in Table 1, in the first year, English, Mathematics, Botany, Zoology, Chemistry, Myanmar Language, Behavioral Science, Anatomy, and Biochemistry are taught as foundation subjects as well as Physiology subjects, which can be learned in the second year. Other foundational subjects, like Pathology and Microbiology (Pharmaceutical and Medical Microbiology), are taught in the third year. However, the foundational subject, Pharmacology, is taught in the second, third, and fourth years. There are only professional subjects like Pharmaceutics I and II, Pharmacognosy, and Pharmaceutical Chemistry in the second, third, and fourth years. The Total Personal and Professional Development (TPPD) program is also put into the Bachelor of Pharmacy curriculum, where traditional ceremonies, cultural and social activities, and special talks are included (University of Pharmacy, Yangon, 2013). Field visit training is built for third-year students as well as for final-year students (fourth-year students), and they are sent to pharmaceutical industries, traditional medicine and public hospitals for about three to six weeks in the final year. In the second year, they have an opportunity to learn together with other healthcare professionals to obtain interprofessional development.

Review and revision of the undergraduate pharmacy curriculum were done in 2011–2012, and Microbiology (combined Medical Microbiology and Pharmaceutical Microbiology) was added to the third-year of the course. Medical Microbiology and Pharmaceutical Microbiology became separate subjects in 2016. Review and revision were also conducted for a specialized master's program. The course for a Master of Pharmacy first started with a general course, and in the first year of the Master of Pharmacy program, Pharmaceutics, Pharmacognosy, Pharmaceutical Chemistry, and Pharmacology are taught. The thesis was to be submitted in the second year of the Master of Pharmacy program. Later, it was changed into specialized subject areas like Pharmaceutics, Pharmacognosy, Pharmaceutical Chemistry, and Clinical Pharmacy for the Master of Pharmacy program in 2018. There are research degree courses in the Doctor of Philosophy program, and specialized subjects like Pharmaceutics, Pharmacognosy, Pharmaceutical Chemistry, and Clinical Pharmacy can be chosen in this program (University of Pharmacy, Mandalay, 2024b; University of Pharmacy, Yangon, 2024b). There are no specialized subjects for the Master of Pharmacy and Doctor of Pharmacy in Social and Administrative Pharmacy.

The field visit training of Master's and PhD students are located in the Central Research Center of Pharmaceuticals and Food, Food and Drug Administrations (FDA), Department of Medical Research, Myanmar Pharmaceutical Factories (MPF), Fame Pharmaceutical Industries and Pharmaceutical Factory, Pyin Oo Lwin and Sagaing, Department of Medical Research, National Poison Control Center, hospitals, and central drug stores.

The PhD program research areas include Pharmacognosy, focusing on the phytochemistry of medicinal plants and herbal medicine; Pharmaceutics, covering cosmeticology, self-medication, pharmaceutical technologies, and the formulation of natural and pharmaceutical products; Pharmaceutical Chemistry, emphasizing the physicochemical properties of pharmaceutical compounds; and Clinical Pharmacy, which includes pharmaceutical care, pharmacological and toxicological studies, clinical pharmacokinetics, and biopharmaceutics (University of Pharmacy, Mandalay, 2024b; University of Pharmacy, Yangon, 2013, 2024b).

On 28th May, 2024, the Union Minister of the Ministry of Health attended a meeting to coordinate the course schedule and curriculum for medical and health-related universities, including the universities of pharmacy, under the new KG+12 education system. The new system spans 13 years (KG+, Grades 1–5 primary, Grades 6–9 middle, and Grades 10–12 high school), replacing the old 11-year system. Starting 21st December, 2024, students who pass the KG+12 and entrance exams can enroll in these universities. The Union Minister emphasized aligning course duration and curricula with ASEAN and international standards while addressing national needs for quality human resources. The Minister also highlighted

the importance of setting training periods that meet the country's needs without overburdening parents. Finally, reviewing and revising the curriculum for universities under the Ministry of Health, including the universities of pharmacy, will continue to be prioritized and completed on time (Ministry of Health, Myanmar, 2024b).

Table 1. Subjects in each program of pharmacy schools in Myanmar

Degree	Years	Course title	Teaching hours
Bachelor of pharmacy (BPharm)	First year	English	160
		Mathematics	56
		Botany	126
		Zoology	126
		Chemistry	234
		Myanmar language	90
		Behavioral science	44
		Anatomy	96
		Biochemistry	147
	Second year	Physiology	132
		Pharmaceutics	276
		Pharmacognosy	166
		Pharmaceutical chemistry	151
		Pharmacology	120
	Third year	Pharmaceutics	180
		Pharmaceutical microbiology	76
		Pharmacognosy	169
		Pharmaceutical chemistry	212
		Pharmacology	200
		Medical microbiology	100
		Pathology	136
	Fourth year	Pharmaceutics (I),	220
		Pharmaceutics (II)	220
		Pharmacognosy	190
		Pharmaceutical chemistry	287
		Pharmacology	200

2.4 System of pharmacy schools in Myanmar

Pharmacy schools in Myanmar are currently regulated by the Ministry of Health (Latt et al., 2016). The key institutions offering pharmacy programs include the University of Pharmacy, Yangon and the University of Pharmacy, Mandalay. Both universities are publicly funded. Moreover, the accreditation of pharmacy schools is one of the requirements in Myanmar. A few prospective pharmacists have an opportunity to go overseas and pursue a postgraduate degree, a Master of Pharmacy or Doctor of Philosophy in Pharmacy degree, through government permission of a scholarship program, as well as their own budgets. Pharmacists who are working in the public sector (governmental sector) have an opportunity to attend postgraduate programs. However, pharmacists in the private sector do not have an opportunity to attend postgraduate programs in local universities. Currently, the Myanmar pharmacy undergraduate curriculum is exposed to a 4-year (B.Pharm) program. The professional subjects are more focused on a product-oriented curriculum. There is also a content-based education system in Myanmar, and career opportunities for pharmacists are mostly in the product-oriented area (Aye & Anantachoti, 2020). Currently, the permission letter from the Ministry of Health has been accepted to conduct research for the development of competency standards and a new curriculum. The Naypyitaw State Academy (NSA) project is being implemented in Naypyidaw, Myanmar. The government hoped that not only Naypyitaw but also Yangon and Mandalay Universities would be at the top of the nation as well as be included in the list of the world's best universities. The current selected subjects to be opened are arts and sciences, economics, law, social sciences, sports and medical subjects (The Global New Light of Myanmar, 2022). However, it is needed to open a pharmacy school according to this project, because of shortages of pharmacists in the working areas.

2.5 Career opportunities and workforce of pharmacy graduates

In Myanmar, pharmacy students who graduated from two universities of pharmacy work in the area of hospitals, pharmaceutical industries, the Food and Drug Administration, traditional medicine, academics, research, pharmaceutical companies, drug stores, non-government organizations, international non-government organizations (INGOs), and others. There were 605 pharmacists working in public settings according to the government database in 2020. They are employed not only in the governmental sector but also in the private sector. Most pharmacy graduates serve under the Ministry of Health, followed by the Ministry of Industries (Aye & Anantachoti, 2020). Currently, there are six departments in the Ministry of Health, and they are the Department of Public Health, Department of Medical

Services, Department of Human Resources for Health, Department of Medical Research, Department of Traditional Medicines, and Department of Food and Drug Administration (Ministry of Health, Myanmar, 2024a). The salaries of pharmacists, pharmaceutical scientists, and pharmacy and pharmaceutical technicians assigned to the public sector are less than those in the private sector. The estimated pharmacist density of Myanmar is 0.51–0.73 pharmacists per 10,000 population (Aye & Anantachoti, 2020). The limited numbers are admitted and selected for postgraduate pharmacy programs (University of Pharmacy, Mandalay, 2024a; University of Pharmacy, Yangon, 2024b). Moreover, the number of pharmacists in the workforce, like other healthcare professionals, has been reduced because of the political crisis between 2021 and 2022, and some of them took part in the Civil Disobedience Movement (CDM).

2.6 Activities of pharmacists and pharmacy students in the Covid-19 pandemic

In Myanmar, the infection and death rate of the COVID-19 infectious disease increased in 2020, so pharmacists working in other areas, like academic pharmacists, pharmacists in the pharmaceutical industry, regulatory pharmacists and pharmacy students participated as volunteers at hospitals for the COVID-19 infectious patients, and at the COVID-19 center. Their functions were contact tracing, store management, inventory management, pharmaceutical supply chain, RNA extraction, real-time PCR testing, health education and inspection of whether to open or not industries during the Covid-19 pandemic (Myanmar Pharmaceutical Association, 2020b; Society of Myanmar Pharmacists, 2020).

Globally, there is a significant shift occurring in the role and contribution of pharmacists in the overall context of healthcare delivery. Patient safety and accountability for therapy outcomes have gained more attention as medication therapy has grown in complexity, accessibility, and use across a wider range of patient populations. Many nations are undergoing significant changes in pharmacy education as a result of their realization of the numerous advantages that society can gain by using pharmacists as effectively as possible in the delivery of healthcare. The roles and duties that pharmacists can and should have in the provision of healthcare services are being examined, and the competences necessary to carry out these roles and responsibilities successfully are being articulated. Educational outcomes, competencies to be achieved, curricular content and structure will need to be modified (Rouse & Meštrovic, 2014).

2.7 Pharmacy education across continents

Outcome-based education or a competency-based education system is used in the United States of America (USA) (Accreditation Council for Pharmacy Education, 2015; Medina et al., 2013), Canada (Association of Faculties of Pharmacy of Canada, 2017), Great Britain (General Pharmaceutical Council, 2011), Australia (Stupans et al., 2015) and Japan (Ozawa, 2018; The Pharmaceutical Society of Japan, 2018). In ASEAN countries, developing countries such as Thailand (Kapol et al., 2008; Maitreemit et al., 2008), Indonesia (Cokro et al., 2021), and Vietnam, (Mahidol University, 2022), developed a competency standard, and an outcome-based education or competency-based education system was applied. In developed countries like Malaysia (Pharmacy Board Malaysia, 2018) and Singapore (Singapore Pharmacy Council, 2018), standards for under-graduate pharmacy programs have been developed, and those standards have been applied. Currently, in Myanmar, the pharmacy education system is a content-based education and career opportunities for pharmacists are generally in the product-oriented area. Therefore, this traditional-based education system should be changed to a competency-based education and outcome-based education system in Myanmar (Table 2).

As shown in Table 2, the professional associations and councils and ministries have published competency standards and standards for undergraduate pharmacy students. They are the Accreditation Council for Pharmacy Education for the PharmD program in the USA (Accreditation Council for Pharmacy Education, 2015); the Association of Faculties of Pharmacy of Canada (AFPC), for the end of a baccalaureate or doctorate program or entry-to-practice pharmacy degree programs (Association of Faculties of Pharmacy of Canada, 2017); the Pharmacy Council Thailand developed a competency standards preregistration program (Kapol et al., 2008); the national curriculum or competency standards for vocational and undergraduate programs by the Association of Indonesian Pharmacy Higher Education, 2013 and Indonesian Ministry of Health, 2016 (Cokro et al., 2021); General Pharmaceutical Council for the Initial Education and Training of Pharmacists for the first professional degree in pharmacy in Great Britain (General Pharmaceutical Council, 2011); Singapore Pharmacy Council in Singapore (Singapore Pharmacy Council, 2018), and the Ministry of Health (Malaysia) for undergraduate program (Pharmacy Board Malaysia, 2018). However, there is no pharmacy council, and the Myanmar Pharmaceutical Association was set up in 2013. There is no publication and development of the standards for pharmacy competency and curriculum by the association, the Ministry of Health or the Ministry of Education in Myanmar.

In developed countries, the number of schools and the number of pharmacy graduates produced annually are described. In the USA, there are 129 pharmacy schools producing 12,719 pharmacy graduates annually (Supapaan et al., 2019); in Japan there are 74 schools and 9,912 pharmacy graduates per year (Supapaan et al., 2019); in South Korea there are 35 schools and 1372 pharmacy graduates annually (Kawaguchi-Suzuki et al., 2019b); in the UK there are 22 schools and 3,000 pharmacy graduates per year (Sosabowski & Gard, 2008), and in Canada there are 10 schools and about 1,400 pharmacy graduates per year (Supapaan et al., 2019). Of the developing countries in ASEAN, the Philippines has 83 schools and 23,400 pharmacy graduates annually (Kawaguchi-Suzuki et al., 2019a); Thailand has 19 pharmacy schools and 1,680 pharmacy graduates annually (Chanakit et al., 2014); Vietnam has 26 pharmacy schools and 4,300 pharmacy graduates annually (Vo et al., 2013); Cambodia has 3 pharmacy schools and 280 pharmacy graduates annually (Aye & Anantachoti, 2020), and Indonesia has 230 pharmacy schools and 1,589 pharmacy graduates annually (Cokro et al., 2021). In addition, in the developed ASEAN countries, Malaysia has 21 schools and 1,200 pharmacy graduates annually (Kawaguchi-Suzuki et al., 2019a), and Singapore has 1 school and approximately 140–170 graduates (Ministry of Health, Singapore, 2022).

In Myanmar, there are only 2 schools, with about 200–260 pharmacy graduates produced each year. The number of licensed pharmacists (per 10,000 of population) in developed countries, is 9 in the USA (Supapaan et al., 2019), 21 in Japan (Supapaan et al., 2019), and 6.5 in South Korea (Kawaguchi-Suzuki et al., 2019b). However, in ASEAN countries, the number of licensed pharmacists (per 10,000 of population) in Thailand in 2013 was 4 (Chanakit et al., 2014), and in Vietnam, it was 1.2 in 2006 and 2.5 in 2020 (Vo et al., 2013). Additionally, the number of licensed pharmacists (per 1,000 of population) was 0.1 in Lao PDR (World Health Organization, 2013), and there was a pharmacist ratio of 1 per 7,700 Indonesian residents (Cokro et al., 2021). The estimated pharmacist density of Myanmar (0.51–0.73 pharmacists per 10,000 population) conformed to the FIP 2017 findings and was 4 times lower than the Southeast Asian countries (Aye & Anantachoti, 2020). Therefore, new pharmacy schools should be opened to overcome the numerical shortage of pharmacists.

In developed countries, the course lengths are similar. Most are approximately 6 years for a Doctor of Pharmacy, including pre-entry standards and internships, in the USA, Canada, Japan (Supapaan et al., 2019), and South Korea (Kawaguchi-Suzuki et al., 2019b). Boyle (2020) urged that in all the glorious variety of pharmacy schools and colleges, degrees, and programs, they are united by their profession and distinguished by their earned expertise, skills, and interests in the USA. They are educating pharmacists, not "PharmDs". However, in the UK, there is a five-year undergraduate (MPharm) program with a 6-month sandwich placement that would equate to 6 months of preregistration training to become a pharmacist (Sosabowski & Gard, 2008). The General Pharmacy Council published standards in 2011 for initial education and training of pharmacists, in which mentioned that in Great Britain, a four-year (MPharm) degree is separate from the 52-week pre-registration training, with one exception: a five-year (MPharm) degree with two intercalated periods of pre-registration training (General Pharmaceutical Council, 2011). In Australia, there are a four-year bachelor's degree program, a two-year Master's degree program and following successful completion of one of these university-based bachelor's or master's degree programs, graduates must complete approximately 12 months of internship in a practice setting under the supervision of a pharmacy board-approved pharmacist (Marriott et al., 2008). In developed ASEAN countries, Singapore has a Bachelor of Pharmacy (a 4-year undergraduate and one-year preregistration training and experiential learning) program to become pharmacists (Ministry of Health, Singapore, 2022; Singapore Pharmacy Council, 2018) and it is also starting a PharmD program. However, in Malaysia, it is a 4-year program with practical learning (Pharmacy Board Malaysia, 2018), and graduates are required to pass a pre-requisite for registration (known as housemanship) by the Pharmacy Board Malaysia for one year (Widayati et al., 2020). In developing ASEAN countries, Thailand has a 6-year (PharmD) program (Chanakit et al., 2014). However, Indonesia has a (B.Pharm) program, a 4-year undergraduate program with several mandatory intensive training sessions and a one-year professional preregistration program (Cokro et al., 2021). Moreover, Vietnam has a 5-year (B.Pharm) program (Vo et al., 2013). On the other hand, in the Philippines, they have a 4-year program and pharmacy graduates are required to complete 360 hours of internship prior to taking the Pharmacist Licensure Examination (Kawaguchi-Suzuki et al., 2019a). In Brunei, the pharmacy degree is a four-year Bachelor of Pharmacy followed by a mandatory one-year pre-registration training program before registration. In Lao PDR, pharmacy students complete a five-year integrated program. In Cambodia, there is also a five-year program that includes clerkships in hospitals, pharmacies, and the pharmaceutical industry, and students must pass the national licensing examination (Widayati et al., 2020). In Myanmar, the undergraduate program is only a 4-year undergraduate (B.Pharm) program. In comparison, the pharmacy education in the USA, Canada, and Thailand requires a six-year PharmD program, which places a stronger focus on clinical practice than the four-year Bachelor of Pharmacy in Myanmar. In addition, there is no experienced learning and intensive training program, but field trip training is included in Myanmar (University of Pharmacy, Mandalay, 2024b; University of Pharmacy, Yangon, 2024b).

USA, Canada, Japan (Supapaan et al., 2019), South Korea (Kawaguchi-Suzuki et al., 2019b), the UK (Sosabowski & Gard, 2008), and Australia (Marriott et al., 2008) have examinations to become registered pharmacists. In ASEAN countries, developing countries such as Thailand (Chanakit et al., 2014), Indonesia (Cokro et al., 2021), the Philippines (Kawaguchi-Suzuki et al., 2019a), Vietnam (Vo et al., 2013), Cambodia, Malaysia (Pharmacy Board Malaysia, 2018), and Brunei (Widayati et al., 2020) have to take a registration exam. The developed countries of Singapore (Singapore Pharmacy Council, 2018) have to take a registration exam. There is no registration exam in Myanmar. A pharmacy council should be implemented in Myanmar for the regulation of the quality of education and national licensure examination. Therefore, a pharmacy council is essential to taking the registration exam, as well as for the regulation of pharmacists and pharmacy schools for the improvement of the quality of pharmacy education in Myanmar.

In developed countries, academic staff pursue curricula to prepare students for future specialized fields in pharmacy. On the other hand, in developing countries, patient-centered curricula and public health pharmacies are focused on tackling ever-changing health environments (Bates et al., 2013). The schools of pharmacy in ASEAN countries have different educational systems and curricula with varying amounts of direct patient care experience and national licensing examination systems. These may directly affect the ability of graduates to provide pharmaceutical care for patients in various countries (Olson et al., 2022). Myanmar is one of the developing countries that is more focused on a product-centered curriculum. Although the clinical pharmacy subject has been started, it is not well-developed, as experienced learning in patient-centered care is not well-developed in Myanmar. An appropriate balance of the curricular components of basic sciences, pharmaceutical sciences, biomedical and clinical sciences, socioeconomic and behavioral sciences, with practical experience, has been recommended by the WHO (Nunes-da-Cunha & Fernandez-Llimos, 2017). The components of the undergraduate program (PharmD) in the USA include basic biomedical sciences, pharmaceutical sciences, social/ behavioral/administrative pharmacy sciences, and clinical sciences (Accreditation Council for Pharmacy Education,

2015). In Japan, in 2018, topics on the curriculum included pharmaceutical sciences, fundamental pharmaceutical sciences, health and environmental sciences, therapeutics, clinical pharmacology, pharmacotherapy, pharmacokinetics, pharmacy practice experiences, and research. Some components are different from those in the USA, and Kampo was included (The Pharmaceutical Society of Japan, 2018). In the UK, the 5-year undergraduate (MPharm) curriculum topics were related to basic sciences, pharmaceutical sciences, biomedical and clinical sciences, and administrative pharmacy and research projects, but it did not include socioeconomic and behavioral sciences (Sosabowski & Gard, 2008). However, in 2011, the standards published by the General Pharmacy Council included topics related to social economic and administrative pharmacy (SEAP) (General Pharmaceutical Council, 2011). In Australia, for undergraduate courses, physical, chemical, biological, and social sciences are included in the early years, and pharmacy practice subjects were added from the first year. The course then leads to more applied and discipline-specific topics, with a strong focus on clinical education (Marriott et al., 2008). In Singapore, in 2018, topics were matched with basic sciences, medical sciences, pharmaceutical sciences and clinical sciences, social and behavioral sciences, and pharmacoeconomic and outcomes consisted (Singapore Pharmacy Council, 2018). In Malaysia, in 2018, basic health sciences and topics matched with pharmaceutical sciences and clinical sciences were added to the undergraduate 4-year curriculum, but social, administrative, and economic pharmacy sciences were not included (Pharmacy Board Malaysia, 2018). In Thailand in 2013, the undergraduate Doctor of Pharmacy curriculum (PharmD) topics were related to pharmaceutical sciences, clinical sciences, and social and administrative pharmacy sciences, but consumer protection and some components in the curriculum were different in the USA (Chanakit et al., 2014). In Indonesia, 2021, subjects related to pharmaceutical sciences and clinical sciences were included, but socio-economic, social/behavioral/administrative pharmacy sciences were not included (Cokro et al., 2021). In the Philippines, topics related to basic medical or health sciences and topics matched with pharmaceutical sciences, administrative pharmacy, and thesis or research were included, but clinical sciences and socioeconomic and behavioral sciences were not added (Kawaguchi-Suzuki et al., 2019a). In Myanmar, 2022, it included basic sciences, medical sciences, and topics related only to pharmaceutical sciences, but clinical, social, administrative, and economic pharmacy are not included. As with Vietnam (Vo et al., 2013), the clinical pharmacy subject was added to postgraduate programs, but it is not well-developed in these countries. However, there is a natural products course in Singapore (Singapore Pharmacy Council, 2018), pharmacognosy and plant chemistry course in the Philippines (Kawaguchi-Suzuki et al., 2019a) and a pharmacognosy course in Malaysia (Pharmacy Board Malaysia, 2018), Vietnam (Vo et al., 2013) and Myanmar, but they were not included in other countries.

Some ASEAN countries still lack pharmacists to serve in healthcare delivery services. This situation creates an opportunity for the pharmacist workforce movement among nations. The problem is that variations in core curricula and quality among schools of pharmacy will result in differences in pharmacists' competency and capability (Widayati et al., 2020). Currently, the undergraduate pharmacy curriculum in Myanmar is structured as a 4-year BPharm program, and the professional subjects focus more on a product-oriented curriculum. In addition, the traditional education system should be changed to a competency-based education system in Myanmar because the current pharmacy education system has not been applied to a competency-based education system. The UK defines a skills shortage as a stated difficulty in recruiting individuals from the external labor market under prevailing market conditions, specifically with a particular skill set due to a low number of applicants. This shortage is caused by at least one of the following reasons: lack of required skills, lack of work experience that a company demands, or lack of qualifications that a company demands (Schwalje, 2011). The identification of the numerical, distribution, and skilled pharmacist shortages has occurred in Myanmar (Aye & Anantachoti, 2020). The reduced number of pharmacists and pharmaceutical scientists due to political conflict rings alarm for patient and public safety. Nevertheless, in Myanmar, the Ministry of Health permits people to conduct research on the development of competency standards for pharmacy graduates and the development of a new pharmacy curriculum. Therefore, it could assist in the transformation of content-based to competency-based pharmacy education and the implementation of this system and a new curriculum. Therefore, it could overcome skill shortages. It may also be overcome by enlarging existing pharmacy schools and encouraging the establishment of new pharmacy schools, including private schools and permitting pharmacists who are working in the private sector to attend a postgraduate program in Myanmar. Therefore, if a pharmacy school opened in NSA, the competency-based education system with a new curriculum could be implemented. Fortunately, if the pharmacy school were opened at NSA in Naypyidaw, the transformation of a content-based education system with a new curriculum could be implemented in this area, and this change could help to overcome shortages of pharmacists, both numerical and skill shortages. Moreover, it is better to provide future graduates with employment options that complement their skill set and knowledge. To create these opportunities and motivate recent graduates to pursue them, productive communication between academia, practice, and government will be necessary to achieve this goal. It makes sense that new graduates would find it frustrating to start working in environments that do not make the most of their advanced training and expertise. The availability of infrastructure and the needs for healthcare in these nations should be the basis for any opportunities to grow the practice (Al-Ghananeem et al., 2018).

3. CHALLENGES AND BARRIERS TO THE TRANSFORMATION OF PHARMACY EDUCATION

There are challenges and barriers facing the transformation of pharmacy education in Myanmar and other countries. Challenges need to be recognized and overcome for the successful implementation of competency-based education (CBE). Successful examples of CBE in medicine, veterinary medicine, and other fields begin and end with academy-

wide efforts to create the competencies, tools, and resources needed for implementation. These efforts support and deliver development programs, advocate for a growth mindset, and promote change within the profession to meet healthcare and societal needs. Additionally, they create new learning trajectories for students (Sibicky et al., 2024). From the situation analysis, the problems in each faculty are not different, and the problems in Thailand and other countries have started similarly in the structure of the faculty and the system of working. It appears that perceptions about faculty development are improving, potential adopters are expanding, and contextual factors are mandating a greater focus on this process. Given these changes, the future for the growth and further dissemination of faculty development in medicine is positive (Nawanopparatsakul et al., 2009). CBE has been increasingly adopted in pharmacy education, mainly in developed countries. Transforming a traditional pharmacy program into CBE offers several potential benefits but can also be associated with significant challenges. Successful implementation of the CBE program requires strong and supportive institutional leadership, proper curricular design, implementation, and management, and a focus on faculty training and development (Katoue & Schwinghammer, 2020). The challenges and barriers that should be overcome for the transformation of pharmacy education are described as follows.

3.1 Challenges

The transformation of pharmacy education in Myanmar is undergoing significant changes and is facing a range of challenges.

3.1.1 Competency-based education

This transformation is essential to ensure the quality of pharmacy graduates and their preparedness for professional practice in an increasingly complex healthcare environment, in which the provision of healthcare within a clinical setting is often a complex and intricate task, particularly when managing chronic illnesses, comorbidities, and polypharmacy. Competency-based education emphasizes practical skills, critical thinking, and the ability to apply knowledge in real-world scenarios. To achieve this, developing and implementing comprehensive competency standards is vital.

Another significant challenge in pharmacy education in Myanmar is the limited availability of Continuing Pharmacy Education (CPE) programs. Currently, such programs are not widely available, and participation in them is not compulsory. CPE is vital for pharmacists to maintain up-to-date knowledge and skills in a field that is constantly evolving due to new medical research, pharmaceutical advancements, and changes in healthcare policies. Making CPE mandatory would help ensure that pharmacists remain competent throughout their careers, continually improving their knowledge and expertise. In turn, this would enhance the professionalism of pharmacists and contribute to better health outcomes for patients. The expansion of CPE programs is necessary for Myanmar to foster a healthcare workforce that can deliver high- quality, patient-centered care (Myanmar Pharmaceutical Association, 2020a; University of Pharmacy, Mandalay, 2024b; University of Pharmacy, Yangon, 2024b).

3.1.2 Curriculum gap

At present, the curriculum is mainly centered on pharmaceutical sciences, but this leaves critical gaps in areas such as clinical pharmacy and social and administrative pharmacy (SAP) sciences. Clinical pharmacy focuses on the direct care of patients and the optimal use of medications to improve patient outcomes, while SAP sciences cover the broader social, economic, and administrative aspects of pharmacy practice, including healthcare systems and policy. Integrating these subjects into the curriculum is crucial for developing well-rounded pharmacy professionals who are equipped to meet the needs of a rapidly evolving healthcare sector. Updating the curriculum will better prepare graduates to provide comprehensive pharmacy services, addressing both clinical needs and broader healthcare challenges.

3.1.3 Regulatory challenges

Another key issue in transforming pharmacy education in Myanmar is the establishment of a pharmacy council (Aye & Anantachoti, 2020). A pharmacy council is essential for creating a robust regulatory framework that supports the profession and ensures the ongoing development of pharmacy education and practice. One of the council's primary functions would be to establish a pharmacy licensure exam system. This exam would serve as a quality control measure, ensuring that pharmacy graduates meet the necessary standards before entering professional practice. Beyond the licensure exam, the pharmacy council would also be responsible for developing policies, guidelines, and laws related to pharmacy education, including the creation of competency standards for graduates. These measures would help align pharmacy education with international standards and ensure that pharmacists in Myanmar are well-prepared to contribute to patient care and public health.

In addition to regulatory oversight, the establishment of new pharmacy schools—both public and private—has become a pressing need. Myanmar is facing a shortage of pharmacists, which could affect the quality and availability of healthcare services. Allowing the establishment of private pharmacy schools, along with additional public ones, would help to address this shortfall by increasing the number of pharmacy graduates entering the workforce. However, it is essential that these schools are regulated by the forthcoming pharmacy council, which would ensure that they meet high standards of education and produce competent graduates. The expansion of pharmacy schools, coupled with proper regulation, would not only address the numerical shortage of pharmacists but also improve the overall quality of pharmacy education and services in Myanmar (Aye & Anantachoti, 2020).

To formalize the establishment of a pharmacy council, a council law must be enacted (Aye & Anantachoti, 2020). This legislation would provide the legal framework for the creation of the council, allowing it to operate with the authority needed to oversee pharmacy education and practice. However, the enactment of this law requires the approval of the Ministry of Health in Myanmar. Once established, the pharmacy council would have the power to regulate pharmacy schools, enforce competency standards, and ensure that pharmacy graduates are well-equipped to serve the public and contribute to the healthcare system.

In addition to national factors, global influences such as advancements in technology, free trade, globalization and harmonization, and the energy crisis also pose challenges

to pharmacy education. For instance, in Thailand, national factors like public management quality assurance (PMQA), new financing and budgeting systems, income-contingent student loans (ICL), autonomous universities, new health laws emphasizing prevention and promotion, and a new student admission system impact pharmacy education. Professional factors, such as new regulations and accreditation by the Pharmacy Council of Thailand, the increase in pharmacy schools, heightened nationaland international competitiveness, interdisciplinary collaboration, emerging technologies, and residency programs with board certification in pharmacotherapy and consumer protection, further influence the landscape (Nawanopparatsakul et al., 2009). These factors compel pharmacy schools to redesign their curricula to meet these evolving challenges.

Similar to the situation in Bangladesh, challenges related to healthcare policy, interprofessional collaboration, physical infrastructure, financial resources, development of a clinically oriented curriculum, shortage of experienced clinical faculty and preceptors, limited availability of experiential sites, and graduate employability must be addressed before introducing a PharmD program (Islam et al., 2014).

There are numerous challenges related to government policies, interprofessional collaboration, educational offerings, competencies, and training. This requires considerable collective efforts from the government, educational systems, associations, and other stakeholders to improve the role of pharmacists (Cokro et al., 2021).

In conclusion, the transformation of pharmacy education in Myanmar is an ongoing process that requires significant reforms in both educational content and the regulatory framework. Shifting to competency-based education, updating the curriculum to include clinical and social pharmacy sciences, establishing a pharmacy council, and expanding pharmacy schools are critical steps in ensuring that pharmacy graduates are prepared to meet the needs of modern healthcare. Additionally, making CPE programs more widely available and mandatory will further enhance the professionalism and competency of pharmacists in Myanmar, ultimately improving healthcare outcomes for the public.

3.2 Barriers

Pharmacy education in Myanmar faces several barriers that hinder its development. One significant barrier is the limited budget available to support advancements and improvements in the field (Ministry of Health and Sports, Myanmar, 2016). Additionally, there is a shortage of qualified academic staff, particularly in specialized areas such as clinical pharmacy and social and administrative pharmacy (University of Pharmacy, Mandalay, 2024a; University of Pharmacy, Yangon, 2024b). This shortage is exacerbated by the misallocation of personnel, with clinical pharmacy courses being taught under the Pharmacology Department and social and administrative pharmacy courses being taught under the Pharmaceutics Department. This improper assignment of qualified individuals to specialized areas further obstructs the progress of pharmacy education (University of Pharmacy, Mandalay, 2024a; University of Pharmacy, Yangon, 2024b).

Moreover, there is a pressing need for more innovative and experiential learning methods to be incorporated into the curriculum. Laboratory-based courses require significant upgrades to include advanced technology and modern teaching approaches (University of Pharmacy, Mandalay, 2024b; University of Pharmacy, Yangon, 2024b). Without innovative strategies and a commitment to change from all stakeholders, including educators, practitioners, regulators, policymakers, and those responsible for assuring educational quality, the necessary transformation in education and practice will not occur at the expected rate (Rouse & Meštrovic, 2014).

Additionally, the absence of a dedicated pharmacy department at the ministerial level under the Ministry of Health presents a significant obstacle (Health in Myanmar, 2011; Latt et al., 2016; Saw et al., 2019). Most pharmacy professionals within the Ministry of Health occupy low- to mid-level positions, and there are few high-level pharmacists involved in decision-making processes. This lack of leadership and decision-making authority among pharmacy professionals further limits the scope for professional development and policy influence within the healthcare system.

As in Vietnam, obstacles to the improvement of the quality of pharmacy education include a lack of involvement of professional bodies in the improvement of the quality of pharmacy education. There is a lack of qualified pharmacy academics and poor institutional infrastructure; innovative teaching methodologies are limited, and places in postgraduate pharmacy programs are scarce. Additionally, continuing education opportunities for lifelong learning for all practitioners are few and not compulsory (Vo et al., 2013).

In conclusion, pharmacy education in Myanmar is confronted with numerous barriers that impede its progress. The limited budget, shortage of qualified academic staff, and the misalignment of personnel in key specialized areas such as clinical pharmacy and social and administrative pharmacy all contribute to these difficulties. Additionally, the outdated curriculum, particularly in laboratory-based courses, needs to be revamped to incorporate modern technology and innovative learning methods. The absence of a dedicated pharmacy department within the Ministry of Health exacerbates these issues, as pharmacy professionals often lack representation in high-level decision-making roles. Overcoming these barriers will require significant reforms, including better resource allocation, updated educational practices, and stronger leadership within the pharmacy profession to ensure its growth and alignment with global standards.

4. SUMMARY

The rapid and ongoing changes in the global pharmacy landscape compel pharmacy education in Myanmar to evolve to meet the demands of patient safety and the efficient use of medications. To address these challenges, it is essential to revise the current four-year pharmacy program to align with international standards and better prepare graduates for the complexities of modern healthcare. The implementation of clinical pharmacy is essential for providing pharmaceutical care to patients, while social and administrative pharmacy is crucial for ensuring patient and public safety and improving drug utilization nationwide. Additionally, the establishment of a pharmacy council is crucial for regulating pharmacy graduates, schools, and the overall quality of pharmacy

education. This body would play a key role in setting competency standards and ensure that graduates are well-equipped for professional practice.

To address the shortage of pharmacists in Myanmar, opening new pharmacy schools is necessary. Furthermore, pharmacists working in the private sector should be allowed to pursue postgraduate education in Myanmar, which would help address the ongoing skills gap. The success of these initiatives depends on the dedicated efforts of academic leaders and policymakers, who hold significant responsibility and accountability for the transformation of pharmacy education in the country. Their leadership is essential to drive the necessary reforms that will enhance the profession and improve healthcare outcomes.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the financial support from the Research and Creative Fund, Faculty of Pharmacy, Silpakorn University.

AUTHOR CONTRIBUTIONS

M.S. conceived the idea, conducted the literature review, and drafted the manuscript. L.A. and N.K. critically reviewed and revised the manuscript. N.K. edited the manuscript and responded to the reviewers' comments. All authors discussed the results and contributed to the final manuscript.

REFERENCES

Accreditation Council for Pharmacy Education. (2015). *Accreditation standards and key elements for the professional program in pharmacy leading to the doctor of pharmacy degree (Standards 2016)*. https://www.acpe-accredit.org/wp-content/uploads/Standards2016FINAL.pdf

Al-Ghananeem, A. M., Malcom, D. R., Shammas, S., & Aburjai, T. (2018). A call to action to transform pharmacy education and practice in the Arab world. *American Journal of Pharmaceutical Education*, *82*(9), Article 7014. https://doi.org/10.5688/ajpe7014

Alsharif, N. Z. (2017). Purposeful global engagement in pharmacy education. *American Journal of Pharmaceutical Education*, *81*(10), Article 6882. https://doi.org/10.5688/ajpe6882

Anderson, C., Bates, I., Beck, D., Brock, T., Futter, B., Mercer, H., Rouse, M., Wuliji, T., & Yonemura, A. (2008). The WHO UNESCO FIP pharmacy education taskforce: Enabling concerted and collective global action. *American Journal of Pharmaceutical Education*, *72*(6), Article 127. https://doi.org/10.5688/aj7206127

Anderson, C., Bates, I., Brock, T., Brown, A. N., Bruno, A., Futter, B., Rennie, T., & Rouse, M. J. (2012). Needs-based education in the context of globalization. *American Journal of Pharmaceutical Education*, *76*(4), Article 56. https://doi.org/10.5688/ajpe76456

Anderson, C., Bates, I., Futter, B., Gal, D., Rouse, M., & Whitmarsh, S. (2010). Global perspectives of pharmacy education and practice. *World Medical & Health Policy*, *2*(1), 5–18. https://doi.org/10.2202/1948-4682.1052

Association of Faculties of Pharmacy of Canada. (2017). *AFPC educational outcomes for first professional degree programs in pharmacy pharmacy in Canada 2017*. https://www.afpc.info/system/files/public/AFPC-Educational%20Outcomes%202017_final%20Jun2017.pdf

Austin, Z., & Ensom, M. H. (2008). Education of pharmacists in Canada. *American Journal of Pharmaceutical Education*, *72*(6), Article 128. https://doi.org/10.5688/aj7206128

Aye, L. N., & Anantachoti, P. (2020). Pharmacy workforce in Myanmar public sector. *The Thai Journal of Pharmaceutical Sciences*, *44*(4), 267–273. https://doi.org/10.56808/3027-7922.2464

Basak, S. C., & Sathyanarayana, D. (2010). Pharmacy education in India. *American Journal of Pharmaceutical Education*, *74*(4), Article 68.

Bates, I., Bruno, A., & Arakawa, N. (2013). *FIPEd global education report*. International Pharmaceutical Federation (FIP). https://www.fip.org/files/fip/FIPEd_Global_Education_Report_2013.pdf

Boyle, C. J. (2020). We are educating pharmacists, not "PharmDs". *American Journal of Pharmaceutical Education*, *84*(9), Article 7829. https://doi.org/10.5688/ajpe7829

Bruno, A., Bates, I., Brock, T., & Anderson, C. (2010). Towards a global competency framework. *American Journal of Pharmaceutical Education*, *74*(3), Article 56. https://doi.org/10.5688/aj740356

Chanakit, T., Low, B. Y., Wongpoowarak, P., Moolasarn, S., & Anderson, C. (2014). A survey of pharmacy education in Thailand. *American Journal of Pharmaceutical Education*, *78*(9), Article 161. https://doi.org/10.5688/ajpe789161

Chanakit, T., Low, B. Y., Wongpoowarak, P., Moolasarn, S., & Anderson, C. (2015). Does a transition in education equate to a transition in practice? Thai stakeholder's perceptions of the introduction of the doctor of pharmacy programme. *BMC Medical Education*, *15*(1), Article 205. https://doi.org/10.1186/s12909-015-0473-4

Cokro, F., Atmanda, P. F. K., Sagala, R. J., Arrang, S. T., Notario, D., Rukmini, E., & Aparasu, R. (2021). Pharmacy education in Indonesia. *Pharmacy Education*, *21*(1), 432–442. https://doi.org/10.46542/pe.2021.211.432442

Etukakpan, A., Uzman, N., Ozer, O., Tofade, T., Leite, S. N., Joda, A., Choonara, Y., Mwila, C., Azzopardi, L. M., & Mantel-Teeuwisse, A. K. (2023). Transforming pharmaceutical education: A needs-based global analysis for policy development. *Exploratory Research in Clinical and Social Pharmacy*, *9*, Article 100234. https://doi.org/10.1016/j.rcsop.2023.100234

Gall, D., Bates, I., & Bruno, A. (2012). *FIP global pharmacy workforce report 2012*. International Pharmaceutical Federation. https://www.fip.org/files/members/library/FIP_workforce_Report_2012.pdf

General Pharmaceutical Council. (2011). *Future pharmacists: Standards for the initial education and training of pharmacists*. https://assets.pharmacyregulation.org/files/document/future_pharmacists_standards_for_the_initial_education_and_training_of_pharmacists.pdf

Health in Myanmar. (2011). *Myanmar healthcare system*. https://www.mohs.gov.mm/Main/content/publication/health-in-myanmar-2011

Islam, M. A., Gunaseelan, S., Khan, S. A., Khatun, F., & Talukder, R. (2014). Current challenges in pharmacy education in

Bangladesh: A roadmap for the future. *Currents in Pharmacy Teaching and Learning*, *6*(5), 730–735. https://doi.org/10.1016/j.cptl.2014.05.020

Kapol, N., Maitreemit, P., Pongcharoensuk, P., & Armstrong, E. P. (2008). Evaluation of curricula content based on Thai pharmacy competency standards. *American Journal of Pharmaceutical Education*, *72*(1), Article 09. https://doi.org/10.5688/aj720109

Katoue, M. G., & Schwinghammer, T. L. (2020). Competency-based education in pharmacy: A review of its development, applications, and challenges. *Journal of Evaluation in Clinical Practice*, *26*(4), 1114–1123. https://doi.org/10.1111/jep.13362

Kawaguchi-Suzuki, M., Hogue, M. D., Khanfar, N. M., Lahoz, M. R., Law, M. G., Parekh, J., Zairina, E., Hong, J., Robles, Y. R., & Van Thang, V. (2019a). Cultural sensitivity and global pharmacy engagement in Asia: India, Indonesia, Malaysia, Philippines, and Vietnam. *American Journal of Pharmaceutical Education*, *83*(4), Article 7215. https://doi.org/10.5688/ajpe7215

Kawaguchi-Suzuki, M., Law, M. G., Prisco, J., Head, K., Fu, L., Yumoto, T., Kamei, J., Yang, M., Cheng, K.-j., & Hogue, M. D. (2019b). Cultural sensitivity and global pharmacy engagement in Asia: China, Japan, South Korea, and Taiwan. *American Journal of Pharmaceutical Education*, *83*(4), Article 7214. https://doi.org/10.5688/ajpe7214

Latt, N. N., Cho, S. M., Htun, N. M. M., Saw, Y. M., Myint, M. N. H. A., Aoki, F., Reyer, J. A., Yamamoto, E., Yoshida, Y., & Hamajima, N. (2016). Healthcare in Myanmar. *Nagoya Journal of Medical Science*, *78*(2), 123–124.

Mahidol University. (2022). *2022 US-Thai pharmacy consortium virtual meeting*. https://mahidol.ac.th/th/2022/2022-us-thai-pharmacy/

Maitreemit, P., Pongcharoensuk, P., Kapol, N., & Armstrong, E. P. (2008). Pharmacist perceptions of new competency standards. *Pharmacy Practice*, *6*(3), 113–120. https://doi.org/10.4321/s1886-36552008000300001

Marriott, J. L., Nation, R. L., Roller, L., Costelloe, M., Galbraith, K., Stewart, P., & Charman, W. N. (2008). Pharmacy education in the context of Australian practice. *American Journal of Pharmaceutical Education*, *72*(6), Article 131. https://doi.org/10.5688/aj7206131

Medina, M. S., Plaza, C. M., Stowe, C. D., Robinson, E. T., DeLander, G., Beck, D. E., Melchert, R. B., Supernaw, R. B., Roche, V. F., & Gleason, B. L. (2013). Center for the advancement of pharmacy education 2013 educational outcomes. *American Journal of Pharmaceutical Education*, *77*(8), Article 162. https://doi.org/10.5688/ajpe778162

Ministry of Health, Myanmar. (2023). *Attending and giving speeches at welcoming ceremonies for those who will serve as intern doctors for one year from July 2023 in major teaching hospitals*. Facebook. https://www.facebook.com/MinistryOfHealthMyanmar?mibextid=ZbWKwL [in Myanmar]

Ministry of Health, Myanmar. (2024a). *Departments under MOH*. https://www.mohs.gov.mm/

Ministry of Health, Myanmar. (2024b). *A meeting to coordinate the course schedule and curriculum for those who passed the university entrance examination under the new education system KG+ 12*. Facebook. https://www.facebook.com/MinistryOfHealthMyanmar?mibextid=ZbWKwL [in Myanmar]

Ministry of Health, Singapore. (2022). *Professional training and education for pharmacists*. Health Professionals Portal. https://hpp.moh.gov.sg/career-practice/pharmacists-professional-training-education/

Ministry of Health and Sports, Myanmar. (2016). *Myanmar national health plan (2017–2021)*. WHO. https://extranet.who.int/countryplanningcycles/planning-cycle-files/myanmar-myanmar-national-health-plan-2017-2021

Myanmar Pharmaceutical Association. (2020a). *Continuing pharmaceutical education (CPE)*. Facebook. https://www.facebook.com/events/723726214480571/?acontext=%7B%22event_action_history%22%3A[%7B%22surface%22%3A%22page%22%7D]%7D [in Myanmar]

Myanmar Pharmaceutical Association. (2020b). *Volunteer pharmacists*. Facebook. https://www.facebook.com/myanmarpharmaceuticalassociationmpa/ [in Myanmar]

Nawanopparatsakul, S., Keokitichai, S., Wiyakarn, S., & Chantaraskul, C. (2009). Challenges of pharmacy education in Thailand. *Silpakorn University International Journal*, *9–10*, 19–39.

Nunes-da-Cunha, I., & Fernandez-Llimos, F. (2017). *Educational contents for a patient-centred undergraduate pharmacy curriculum*. CIPF.

Olson, P. S., Srimongkon, P., Tan, B. K., Nacabu-an, S. M. J., Sibounheuang, P., Setiawan, C. H., Van Hung, N., Leelathanalerk, A., Potisarach, P., Sungthong, B., Ploylearmsang, C., Seesin, T., Chanasopon, S., Kanjanasilp, J., Manwiwattanakun, G., & Jungnickel, P. W. (2022). Pharmacy students' preparation to provide pharmaceutical care for patients with non-communicable diseases in six ASEAN countries: A qualitative study. *Currents in Pharmacy Teaching and Learning*, *14*(11), 1353–1364. https://doi.org/10.1016/j.cptl.2022.09.027

Ozawa, K. (2018). Progress of pharmacy education in Japan-model core curriculum for pharmacy education and the evaluation standards. *Journal of Asian Association of Schools of Pharmacy*, *7*, 8–14.

Pharmacy Board Malaysia. (2018). *Standards on approval and recognition of pharmacy programme 2018*. Ministry of Health Malaysia. https://www.pharmacy.gov.my/v2/sites/default/files/Standards%20on%20Approval%20and%20Recognition%20of%20Pharmacy%20Programme%202018.pdf

Rouse, M., & Meštrovic, A. (2014). *Quality assurance of pharmacy education: The FIP global framework* (2nd ed.). International Pharmaceutical Federation.

Saw, Y. M., Than, T. M., Thaung, Y., Aung, S., Shiao, L. W.-S., Win, E. M., Khaing, M., Tun, N. A., Iriyama, S., Win, H. H., Sakisaka, K., Jimba, M., Hamajima, N., & Saw, T. N. (2019). Myanmar's human resources for health: Current situation and its challenges. *Heliyon*, *5*(3), Article e01390. https://doi.org/10.1016/j.heliyon.2019.e01390

Schwalje, W. (2011). What is the difference between a skills shortage and a skills gap? *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1941313

Sibicky, S. L., Daugherty, K. K., Chen, A. M. H., Rhoney, D., & Nawarskas, J. (2024). Enabling factors for the implementation of competency-based curricula in colleges and schools of pharmacy. *American Journal of Pharmaceutical Education*, *88*(4), Article 100681. https://doi.org/10.1016/j.ajpe.2024.100681

Singapore Pharmacy Council. (2018). *Standard for undergraduate pharmacy education and training in Singapore*. https://file.go.gov.sg/standards-for-pharmacy-undergraduate-education-training.pdf

Society of Myanmar Pharmacists. (2020). *Volunteer pharmacists and pharmacy students in COVID-19*.

Facebook. https://www.facebook.com/Society-of-Myanmar-Pharm acists-103933351483152/

Sosabowski, M. H., & Gard, P. R. (2008). Pharmacy education in the United Kingdom. *American Journal of Pharmaceutical Education*, *72*(6), Article 130. https://doi.org/10.5688/aj7206130

Stupans, I., McAllister, S., Clifford, R., Hughes, J., Krass, I., March, G., Owen, S., & Woulfe, J. (2015). Nationwide collaborative development of learning outcomes and exemplar standards for Australian pharmacy programmes. *International Journal of Pharmacy Practice*, *23*(4), 283–291. https://doi.org/10.1111/ijpp.12163

Supapaan, T., Low, B. Y., Wongpoowarak, P., Moolasarn, S., & Anderson, C. (2019). A transition from the BPharm to the PharmD degree in five selected countries. *Pharmacy Practice*, *17*(3), Article 1611. https://doi.org/10.18549/PharmPract.2019.3.1611

Tan, E. Y., & Faller, E. M. (2022). Pharmacy education in selected countries from the Western Pacific Region: Status quo and moving ahead. *International Journal of Innovative Science and Research Technology*, *7*(9), 259–268. https://doi.org/10.5281/zenodo.7108949

The Global New Light of Myanmar, (2022). *Yangon university, Mandalay university and NSA must be top the nation as well as involved on the world's best universities: Senior General*. https://www.gnlm.com.mm

The Pharmaceutical Society of Japan. (2018). *Model core curriculum for pharmacy education: 2015 version*. Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. https://www.pharm.or.jp/eng/pdf/education/ModelCoreCurriculumforPharmacyEducation_FullText.pdf

University of Pharmacy, Mandalay. (2024a). *Numbers of pharmacy graduated students*. http://www.uopmdy.gov.mm

University of Pharmacy, Mandalay. (2024b). *Courses and departments*. http://www.uopmdy.gov.mm

University of Pharmacy, Yangon. (2013). *Facts and figure.* http://www.uopygn.gov.mm

University of Pharmacy, Yangon. (2024a). *Numbers of pharmacy graduated students*. http://www.uopygn.gov.mm

University of Pharmacy, Yangon. (2024b). *Programs and departments*. http://www.uopygn.gov.mm

Vo, T.-H., Bedouch, P., Nguyen, T.-H., Nguyen, T.-L.-H., Hoang, T.-K.-H., Calop, J., & Allenet, B. (2013). Pharmacy education in Vietnam. *American Journal of Pharmaceutical Education*, *77*(6), Article 114. https://doi.org/10.5688/ajpe776114

Widayati, A., Istyastono, E., & Faller, E. (2020). Projected niches emerging in pharmacy education among ASEAN countries. *Pharmacy Education*, *20*(2), 145–148. https://doi.org/10.46542/pe.2020.202.145148

World Health Organization. (2013). *Human resources for health country profiles: Lao People's Democratic Republic*. https://www.who.int/publications/i/item/9789290616368

Worldometer. (2024). *Myanmar population*. https://www.worldometers.info/world-population/myanmar-population/#google_vignette

Silpakorn University

Table 2. Basic information about pharmacy education among countries

No	Countries	Number of pharmacy schools	Pharmacy graduate per year	Number of licensed pharmacists (per 10,000 of population)	Year that transition to an all-PharmD program has been started	Practice training	Academic program, length (years)	National licensing exam	References
1	USA	129	12,719	249,642 (9)	2000	C, H, O (1,000–1,800 practice hours)	PharmD (6 years)	Required	(Supapaan et al., 2019)
2	Japan	74	9,912	276,517 (21)	2006	C, H (6 months)	PharmD (6 years)	Required	(Supapaan et al., 2019)
3	South Korea	35	1,372	53,492 (6.5)	2009	N/A	PharmD (6 years)	Required	(Supapaan et al., 2019)
4	Pakistan	43	40	12,000 (0.7)	2004	C, H	PharmD (5 years)	Required	(Supapaan et al., 2019)
5	Thailand	19	1,680	28,272 (4.2)	2010	C, H, I, O (2,000 practice hours)	PharmD (6 years)	Required	(Supapaan et al., 2019)
6	Canada	10 in 2008	About 1,400	-	2007	The length of this internship varies across the country but is generally 3–4 months in duration. In addition to this in service training period, candidates for licensure are required to complete a series of provincial and national examinations	PharmD (6 years)	Required	(Austin & Ensom, 2008) (Association of Faculties of Pharmacy of Canada, 2017)
7	Taiwan	Nine in 2017	1,446 in 2016	31,036 in 2016	-	-	4–6 years	-	(Kawaguchi-Suzuki et al., 2019b)
8	China	218 in 2011	Approx. 7,000 in 2005	408,431 in 2017	-	-	BS/BPharm (4–5 years)	-	(Kawaguchi-Suzuki et al., 2019b)

Table 2. Basic information about pharmacy education among countries (continued)

No	Countries	Number of pharmacy schools	Pharmacy graduate per year	Number of licensed pharmacists (per 10,000 of population)	Year that transition to an all-PharmD program has been started	Practice training	Academic program, length (years)	National licensing exam	References
9	India	1113 in 2007	More than 52,000 students to the BPharm in 2007 PharmD 1410 students.	N/A	2008	Intensive training 1 year	Pharm D (6 years) B.Pharm (4 years)	It is not required	(Basak & Sathyanarayana, 2010)
10	UK	22 in 2008	3000 per year	N/A	-	1-year workplace Training	Undergrad MPharm (5 years)	Required	(Sosabowski & Gard, 2008)
11	Singapore	6	-	3,201 in 2018	-	12 months training	BS (Pharmay) (a 4-year undergrad and one year pre-registration training and experiential learning) Pharm D (6 years)	Required	(Singapore Pharmacy Council, 2018) (Ministry of Health, Singapore, 2022)
12	Malaysia	21 in 2017	1,200	1:2000 by 2020	-	Complete a one-year internship	B.Pharm (4 years)	Required	(Pharmacy Board Malaysia, 2018) (Kawaguchi-Suzuki et al., 2019a)
13	Philippines	83 in 2017	23,400	N/A	-	600 hours of practicum/intern (200) hours each for C, H, I.	BS Pharmacy (4 years) PharmD (6 years)	Required	(Kawaguchi-Suzuki et al., 2019a) (Tan & Faller, 2022)
14	Vietnam	7 in 2013	1,300	1.2 pharmacist per 10,000 people in 2006 to 2 to 2.5 in 2020)	-	Placement of 140 and 280 hours in generalized pharmacy setting.	B.Pharm (5 years)	Required	(Vo et al., 2013)

Table 2. Basic information about pharmacy education among countries (continued)

No	Countries	Number of pharmacy schools	Pharmacy graduate per year	Number of licensed pharmacists (per 10,000 of population)	Year that transition to an all-PharmD program has been started	Practice training	Academic program, length (years)	National licensing exam	References
15	Indonesia	-	-	Pharmacist ratio of 1 per 7,700 Indonesian residents	No	1 year several mandatory intensive training in H, I and Pharmacy.	B.Pharm (A 4-year undergrad with 1 year several mandatory intensive training)	Required	(Cokro et al., 2021; Widayati et al., 2020)
16	Myanmar	2	About 200	-	No	1 month for H one week for I	B.Pharm (4 years)	It is not required	(University of Pharmacy, Mandalay, 2024b; University of Pharmacy, Yangon, 2024b)

Note: *C = Community pharmacy; H = Hospital pharmacy; I = Industrial pharmacy; O = Others