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Review

Unique perspectives of Pharmacy Education in Japan —Core Curriculum and Some Examples of Advanced Education—

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ABSTRACT

This review aims to introduce the current perspectives of pharmacy education in Japan. In 2006, Japanese pharmacy education system was reformed to have two tracks; the six-year course to produce pharmacists and four-year course to produce researchers, and the model core curriculum was introduced. The current model core curriculum (version 2013) was designed based on the concept of outcome-based education to cover approximately 70% of total classes. Pharmacy students are required to pass two common achievement tests at the end of fourth year - objective structural clinical examination (OSCE) and computer-based testing (CBT) - before pharmacy practice experiences consisting of community pharmacy and hospital rotations. Besides, all the students are required to carry out the research for graduation thesis. While we are facing with a problem of future imbalance between supply and demand of pharmacists, the science-based pharmacy education will expand the role of pharmacists and improve the imbalance.

Key words: core curriculum, Japan, pharmacy education, clinical rotation

1. Current Pharmacy Education System in Japan and Its Historical Background

In Japan, students enter pharmacy school just after their graduation from high school (*i.e.* bachelor course), unlike the case of the United States where most students enter pharmacy school with bachelor's degree. Until 2005, four-year bachelor course had been provided in Japan as the only pharmacy education system. In 2006, the pharmacy education system was split into two tracks; the six-year pharmacy course and four-year pharmaceutical sciences course (Figure 1). One of the major reasons of introducing this quite unique dual-track system would be explained by the historical background of pharmacy and pharmacy education in Japan. The Tokugawa Shogunate, the feudal (samurai) government of Japan lasted for over 250 years, had adopted isolation policy until 19th century. After the end of Shogunate in 1868, one of the urgent concerns for the new (Meiji) government was to introduce advanced technologies from western countries, under the policy advocating economic growth and reinforcement of military power. The government promoted health sciences as well, and focused upon the pharmaceutical industries, public hygiene, and so on. In 1873, the government founded the pharmacy manufacturing class as one of the sections of the National Medical School, which was incorporated into the Imperial University (the predecessor of the University of Tokyo) in 1877. From this beginning, pharmacy education in the Japanese national universities has been focusing upon chemistry-based and material-oriented research and education of researchers (and some public administrators), but not producing pharmacists. A number of private

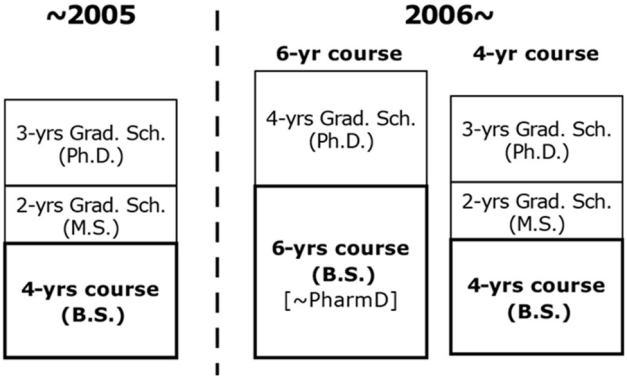

Figure 1. The pharmacy education system in Japan in the past and now. Until 2005, only the four-year bachelor course had been provided. Since 2006, two tracks, *i.e.*, the six-year pharmacy course and four-year pharmaceutical sciences course, have been provided. The four-year courses are followed by two-year master (MS) course and three-year PhD course. The PhD course for graduate from 6-year pharmacy course is four-year course.

pharmacy schools were established thereafter and have been playing the major role in producing pharmacists. Until 1990s all the pharmacy schools had shared same curriculum regardless of their focuses of education, however, several problems in the pharmacy education came up as basic and clinical sciences progressed; overcrowded four-year curriculum, remarkable development and improvement of medicine and drug discovery, insufficient education in the clinical field, and so on. We became aware of the difficulties in educating students with different goals under the same curriculum and decided to introduce two different tracks of pharmacy education; four-year pharmaceutical sciences course for the students who wish to become researchers and six-year pharmacy course for the students who wish to become pharmacists. It should be noted that the graduates from the current four-year pharmaceutical sciences course cannot obtain pharmacist license.

Table 1 shows the current statistics of pharmacy education in Japan (April, 2021). The majority of pharmacy students belong to six-year course with the full quota of 11,795 per year, while the full quota of four-year course is 1,308 per year. Again, you may be noticed that national universities are still focusing upon educating researchers (*i.e.* four-year course).

Table 1. Current statistics of pharmacy education in Japan (April 2021).

(A) The total quota of students (per year)

Category	6-year course (pharmacy)	4-year course (pharmaceutical sciences)	Total
National	604 (5.1%)	523 (40.0%)	1,127
Public†	485 (4.1%)	90 (6.9%)	575
Private	10,706 (90.8%)	695 (53.1%)	11,401
Total	11,795 (100%)	1,308 (100%)	13,103

†prefectural university and city university

(B) The number of pharmacy school

Category	6-year course (pharmacy)	4-year course (pharmaceutical sciences)
National	14	11
Public	5	2
Private†	60	13
Total	79	26

†prefectural university and city university

2. Pharmacy Education in Japan and Model Core Curriculum

The model core curriculum is applied to the six-year course and designed to cover 70% of total education. The first version was enacted along with the introduction of six-year course and revised in 2013 (the current version). The original version was designed based on SBOs (specific behavioral objectives), showing what students should become to be able to do. In 2012, the Ministry of Education, Culture, Sports and Technology (MEXT) enacted the "10 professional competencies for pharmacists" (Table 2), so that the model core curriculum was revised according to these competencies and based on the concept of outcome-based education (OBE) (Ozawa, 2018). The current model core curriculum consists of seven parts (Table 3). One can download the full document of the model core curriculum from the website of MEXT or the Pharmaceutical Society of Japan. The English translation is also available on the PSJ website [https://www.pharm.or.jp/eng/pdf/education/ModelCoreCurriculumforPharmacyEducation_FullText.pdf (accessed on Sep 14, 2021)]. The next version is now under discussion and will be applied from the school year of 2024.

Although the model core curriculum is designed so that students can acquire the competencies required for pharmacists, the contents are still basic-science-oriented. Table 4 shows the comparison of mandatory classes/topics between Japanese model core curriculum and curricula of US pharmacy schools (Figg and Cox, 2003).

From the first to fourth year, pharmacy students learn from the basic sciences such as physics and chemistry to clinical pharmacy. On the fourth year, students are required to train their clinical skills in the laboratory of each university (pre-rotation training).

At the end of fourth year, students are required to pass Pharmaceutical Common Achievement Test (PhCAT) consisting of Objective Structured Clinical Examination (OSCE) to check the skills and attitude, and Computer-Based Testing (CBT) to check the knowledges [Pharmaceutical

Table 2. The ten professional competencies for pharmacists, enacted by the Ministry of Education, Culture, Sports and Technology (MEXT), Japan.

1. Professionalism: Fulfill the legal, ethical, and professional responsibilities of pharmacists.
2. Patient-oriented attitude: Respect the rights of individuals and promote the health and welfare of patients and consumers.
3. Communication skills: Communicate effectively with patients, consumers, and other healthcare professionals to provide necessary information.
4. Interprofessional team-care: Collaborate with healthcare teams in hospitals and regional communities.
5. Basic sciences: Understand the effects of medicines and chemicals on living bodies and the environments.
6. Medication therapy management: Contribute to the optimal use of medicines through pharmaceutical care.
7. Community health and medical care: Contribute to public health and pharmaceutical hygiene and enhance community healthcare and home care.
8. Research: Engage in research on drug development and the appropriate use of medicines to improve the healthcare environment.
9. Lifelong learning: Continue lifelong professional development in response to the advances in healthcare.
10. Education and training: Contribute to the development of the next generation of professional pharmacists.

Translation by PSJ [Pharmaceutical Society of Japan. https://www.pharm.or.jp/eng/pdf/education/ModelCoreCurriculumforPharmacyEducation_FullText.pdf (accessed on Sep 14, 2021)].

Table 3. The overview of model core curriculum for pharmacy education (2015 version), Japan.

A.	Philosophical Principles for the Education of Student Pharmacists
B.	Pharmaceutical Sciences in Society
C.	Fundamentals of Pharmaceutical Sciences
D.	Health and Environmental
E.	Therapeutics: Clinical Pharmacology, Pharmacotherapy, and Pharmacokinetics
F.	Pharmacy Practice
G.	Research

Pharmaceutical Society of Japan. https://www.pharm.or.jp/eng/pdf/education/ModelCoreCurriculumforPharmacyEducation_FullText.pdf (accessed on Sep 14, 2021).

Common Achievement Test Organization, Japan. http://www.phcat.or.jp/en/ (accessed on Sep 14, 2021)]. After passing the PhCAT, students are allowed to join to the pharmacy practice experiences for 22 weeks on the fourth to fifth years. Besides the pharmacy practice experiences, all the students are required to carry out the research for graduation thesis during the fifth and sixth years. During the research, students will learn how to find and solve scientific or clinical problems, as the research is also listed as one of ten professional competencies for pharmacists (Table 2).

3. PhCAT and Pharmacy Practice Experiences

The OSCE consists of five categories; two categories to check the communication skills and three for dispensing skills (Table 5(A)). Students are required to pass six examinations from five categories. Upon evaluation, two evaluators, including skilled pharmacists from outside the university, check the students' skills. Standardized patients (SP) are employed for some examinations such as medication counseling and teaching. All the universities are required to accept external monitor's visit to be checked the fairness of the exam.

As CBT, a set of 310 multiple-choice questions, which is randomly picked up from a number of sets by a computer, is given to each student. Each question set contains 100 questions from zones 1 and 3, and 110 questions from zone 2 (Table 5(B)) and the passing score is 186 (60%).

After passing the PhCAT (both OSCE and CBT), students join to the pharmacy practice experiences, which consists of first (community pharmacy) and second (hospital) rotations with total period of 22 weeks (11 weeks each, in general).

Table 4. Comparison of the Requirement of Basic Sciences between Japanese Model Core Curriculum and Curriculum of US Pharmacy Schools.

	Model Core Curriculum, Jpn	Requirement in US Pharmacy Schools†
Physics	Yes	46/89 (52%)
Biochemistry	Yes	66/89 (74%)
Organic Chemistry	Yes	7/89 (8%)
Microbiology	Yes	69/89 (78%)
Physiology	Yes	68/89 (76%)
Cell Biology	Yes	14/89 (16%)
Molecular Biology	Yes	15/89 (17%)
Immunology	Yes	42/89 (47%)
Medicinal Chemistry	Yes	46/89 (52%)
Quantitative Analysis	Yes	1/89 (1%)

† from Figg and Cox, 2003

Table 5. The overview of Pharmaceutical Common Achievement Test (PhCAT) in Japan.

(A) Overview of Objective Structural Clinical Examination (OSCE) in Japan

Category (Number of Exam)	Contents
1. Interview of patients (1)	- Interview at a community pharmacy - Interview at a hospital
2. Dispensing (2)	- Dispensing powders - Dispensing liquid/syrup - Dispensing ointments/creams - Dispensing tablet, capsule, etc.
3. Checking Medications (1)	- Final checking of filled prescription
4. Aseptic Operation (1)	- IV admixture - Washing hands and wearing glove
5. Providing Drug Information (1)	- Giving medications and providing information to a patient (at a community pharmacy or ward) - Providing information of OTC drugs - Inquiry to physician

(B) Zones, Sections and Number of Questions of Computer Based Testing (CBT) in Japan

Zone 1		Zone 2		Zone 3	
Physical Chemistry	30	Pharmacology	60	Humanism, Communication, Introduction	10
Organic Chemistry	35	Pharmaceutics	35	Hygiene / Environmental Sciences	40
Biological Chemistry	35	Drug Information	15	Social Pharmacy/Laws & Regulations	20
				Preclinical Training	30
	100		110		100

The guideline for pharmacy rotation has been introduced and started to be applied in 2019. The guideline says that two rotations should be planned and coordinated by the university so that each student experiences all the eight major diseases; cancer, hypertension, diabetes mellitus, cardiac disease, cerebrovascular disease, psychiatric/mental disease, immunological disease (including allergy) and infectious disease. Again, the guideline was constructed based on the concept of outcome-based education. The evaluation and grading of students during the rotation are based on the nation-wide scoring rubric.

4. Some Examples of Advanced and Extra-core curriculum Classes at Keio University

Besides the core-curriculum-based classes, each university has developed and provided some unique extra-core-curriculum classes. In Keio University Faculty of Pharmacy, we have been provided various unique classes as follows.

4.1. Interprofessional Development Program

Keio University has three faculties relating to health sciences, *i.e.*, Faculty of Pharmacy, School of Medicine and Faculty of Nursing and Medical Care. Students of these faculties have three opportunities to join to a class for discussion. This interprofessional education was introduced in 2011. The first opportunity is given to the 1st-year students from three faculties. This class aims to let students acquire the attitude needed to perform as a member of medical team. They learn the importance of team play from the group work. The second class is for the fourth-year students of the faculty of pharmacy and school of medicine and second-year students of the faculty of nursing and medical care. They learn how the medical team should be from the group work following a lecture relating a health issue. The third class is for the sixth-year students of the faculty of pharmacy and school of medicine and fourth-year students of the faculty of nursing and medical care. They discuss about the medical plan for a clinical case and make a presentation about their plan. It is useful for understanding their role in a medical team each other.

4.2. Advanced Hospital Rotation

The mandatory clinical rotation in Japan is only eleven weeks and it is too short to acquire wider and advanced knowledge and skills. For pharmacy students who wish to acquire them, Keio University offers advanced hospital rotation class for three months in a hospital as an elective class. They can learn in a general medical center (such as Keio University Hospital) or in a hospital specialized in such as pediatrics, geriatrics, cancer, *etc*.

4.3. Overseas clinical rotation (Ohtani et al., 2017)

Keio University Faculty of Pharmacy has student exchange program with some US and Thai universities. We nominate up to ten students per year based on the academic record, English proficiency, written application, and interview, and send them overseas partner schools on the sixth year, following two preparatory classes given in English language. They stay medical facilities overseas for four to five weeks and learn the pharmacotherapy in foreign countries. The students' feedback of this program is very satisfactory. We also accept foreign students from partner universities as a part of advanced pharmacy practice experiences (APPE).

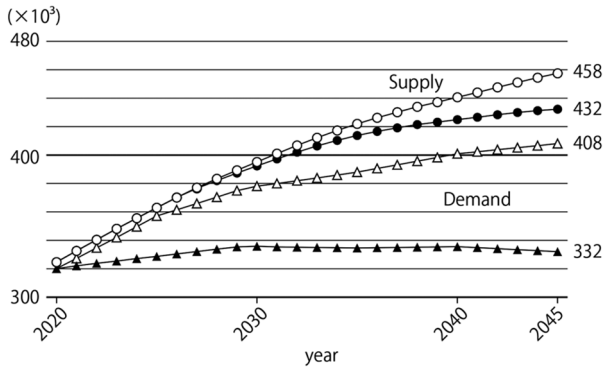

Figure 2. Estimation of the future imbalance of supply and demand of pharmacists in Japan. The lines with circular symbols represent the upper (open symbol) and lower (closed symbol) estimations of the supply of pharmacists. The lines with triangular symbols represent the upper and lower estimation of the demand of pharmacists [Ministry of Health, Labor and Welfare, Japan. https://www.mhlw.go.jp/content/11121000/000772130.pdf (in Japanese) (accessed on Sep 14, 2021)].

5. Future of pharmacy and pharmacy education in Japan

In recent two decades, the number of pharmacy school increased from 46 to 79 in Japan. This raises the problem regarding the imbalance of supply and demand of pharmacists in the near future. Figure 2 shows the estimation of the supply and demand of pharmacists from 2020 to 2045 in Japan (Ohtani et al., 2017). One of the most feasible solutions is to expand the role of pharmacists by strength ening and broadening the scientific background of the graduates, and therefore we need to keep our pharmacy education science-based, as Figg and Cox emphasized in their manuscript (Figg and Cox, 2003). Although we have split the pharmacy education into two tracks, *i.e.*, pharmacy course and pharmaceutical science course, we should never and would never abandon the basic pharmaceutical sciences from pharmacy education in Japan. I believe we need much more pharmacist-scientists with a wide range of competencies.

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