I. Introduction

The globalization in medicine is expanding the role of nurses, thus the university education system for nursing is under review at the Ministry of Education, Culture, Science and Technology (MEXT) and the Ministry of Health, Labour and Welfare (MHLW) in Japan. The review committee of the MEXT on the role of human resource development for nursing at universities explored enhanced critical thinking skill, creativity and research capability further to the conventional education to acquire specialized knowledge and technical skills for nursing. Further advancement of practical nursing competencies was suggested in various fields to cover health, medicine and welfare (practical nursing competencies mean: ① basic competency for human care, ② capability to perform nursing practices systematically based on the evidences, ③ practical competency in terms of health maintenance and promotion, ④ capability to understand diverse care environment and the function of the team medicine for effective resource mobilization, and ⑤ ability to actively keep on learning and seeking for improvements of the professional nursing skills). The report of the review committee at the MHLW concluded that it is necessary to promote awareness of students for the usefulness of the specialized basic class components (the subjects such as “mechanism of human body, diseases and recovery”) in conjunction with the advanced class components for enhancement of practical nursing competencies. Based on those reports, every college of nursing is currently implementing their curriculum reform or its systemic reform in order to enhance practical nursing competencies. Now, many foreign countries have initiated action to foster the qualified nurses who can respond to the highly specialized health care services as expected also in Japan; at the Colorado University in the US, the specialized education was initiated in 1965 for the nurse practitioner (NP) to enable them to independently obtain the patients’ medical history, request medical examinations or prescribe medicines specifically for the patients whose conditions was deemed to be stable. In the developed countries, various educational components such as advanced physical assessments, pathological physiology, clinical pharmacology are provided at the graduate school level for strengthening of practical nursing competencies; education system for the Advanced Practice Nurse (APN) has been facilitated. This educational concept is also based on the idea to emphasize the importance of the basic subjects such as anatomical physiology, pharmacology and pathological therapeutics for effective nursing practices. In Japan, the educational program for NP has just been started at the graduate schools in 2008, and certified system for NP has not yet been introduced so far. It has been pointed out that insufficient training for chemistry and biology in the baccalaureate degree program. Earlier training of these basic subjects could contribute to improvement of nursing education. Then, our hypothesis is as follows; curriculum which aims to foster the practically qualified competent nurses currently required needs to be started from
the bachelor programme, not from the graduate school level. Based on this hypothesis, we conducted the collaborative education with the training practice sessions intended for clinical practice in addition to the lectures of the basic subjects in the bachelor programme. Deep understanding of various knowledge and skills may be expected by collaboration of basic subjects.\textsuperscript{11,12}

\section*{II. Objective}

To develop an education program for improvement of practical nursing competencies in baccalaureate degree.

\section*{III. Method}


\section*{IV. Results}

1. The educational contents at the Department of Biological Science and Nursing

At the College of Nursing of the Yokohama City University School of Medicine, the Department of Biological Science and Nursing has been set up with the aim to develop human resource of practical nursing experts based on understanding of the basic sciences, medical sciences and pharmacy (Fig.1). By the Department staffs, the lectures on pathophysiology, therapeutics and pharmacology were provided in order to deepen understanding mainly of morphology and mechanism of human body, biochemistry, nutritional science, microbiology (Fig.2). We conducted training practice sessions in conjunction with the contents of learning on the above subjects (knowledge acquisition places) so as to facilitate bridging a gap between scientific evidence and nursing techniques. The teaching staffs were consisted of nurses, pharmacists, physicians and basic researchers for various educational approach to integrate specialized knowledge in the area of expertise.

2. Collaborative curriculum arrangement of the lectures on the basic subjects with training practice sessions

We decided to coordinate the nursing education at our department in a collaborative manner to interrelate the teaching components of the lectures and training practices; it was reported that training of basic science and medicine was associated with the improvement of basic skills for professional nursing.\textsuperscript{9,13} Students were engaged in the training practices on osteology, histology, anatomy and bacteriology after their lecture-based learning of morphological dynamics, biochemistry, and microbiology, aiming to enable a deepening of their understanding by practicing after lectures (Fig.3). Moreover, the knowledge acquired through the lectures on morphological dynamics, biochemistry, nursing pharmacology and pathological therapeutics were systematically related to the training practice sessions of clinical, physiological and biochemical examinations in addition to pharmacology and pathology so that the students were expected to be able to smoothly realized the substantial interrelation between the basic subjects and clinical practices as we offered (Fig.3).

Our education system was concretely implemented as indicated below.

[Training practice sessions related to the basic subjects]

\begin{itemize}
  \item Practices on morphological dynamics for nursing (elective
courses: total 15 course-hours for the 2nd grade students, 97 attendees)

Clinical examinations (5), Physiological examinations (2), Biochemical examinations (2), Morphological dynamics (2), Histology (2), Osteology (2)

- Basic medical practices (elective courses: total 15 course-hours for the 3rd grade students, 16 attendees)
  Pathology(4), Histology(4), Pharmacology(4), Microbiology(3)

2-1. Specific efforts in the lectures (nursing pharmacology)

At the College of Nursing of the Yokohama City University School of Medicine, the designated teaching nurses provided the lectures of pharmacology with the specialized contents for nursing (in the 1st semester for the 2nd grade students, total 15 course-hours). On the 1st hour, the lecture was provided on the necessity of pharmacology for nursing with reference to the clinical practice examples. For instance, the many case examples of the error in drug administration were introduced as an important evidence to seek preventive measures because the number of such error cases by nurses was remarkably increasing. According to our aim set for nurses to need pharmacology, the categorization of the particulars was disease-based, not sectionalized by specific pharmaceutical effects, because we intended for better comprehensive understanding of their expected or adverse effects primarily for treatment of diseases. Since the lectures were provided in the first semester for the 2nd grade students who had not yet experienced sufficient clinical practices, we provided supplemental explanations of the Pharmaceuticals with reference to the case studies of popular over-the-counter (OTC) products. Meanwhile, it was necessary for students to gain knowledge of beneficial and harmful drug effects in order to understand how nurses could support patients' daily lives. In that regard, we explained about the similarly active compounds contained in our food products or the environment in the lectures so as to bridge the gap between scientific knowledge and practical nursing. We set the theme on “nursing and Pharmaceuticals” for the last 1 course-hour lecture and offered the systematic education for development of multidirectional viewpoint to understand drugs; that is, the education was given through the lectures in order to facilitate interrelation with nursing practices. The last 1 course-hour lecture was conducted with reference to the case study of one pharmaceutical to explain the issues related to clinical pharmacy services and quality of life (QOL) control, the differences between the commercially available products and prescription drugs containing the same major active components, or the newly obtained knowledge from research on drugs.

2-2. Specific efforts in the training practices

The training practices play an important role for nurses to build multidirectional store of knowledge and develop capability to capture clear image of clinical practices. Here, we introduced our efforts geared toward practical nursing competencies development with reference to the training practice examples on morphological dynamics for nursing.

[Training practice on morphological dynamics: biochemical examinations]

A total of 97 student nurses attended this practice in the 1st semester of their 2nd grade. Two course-hours out of 15 course-hours of the morphological dynamics for nursing were allocated for the biochemical examination practices, which was measuring the concentration of blood sugar. For measurement of the blood glucose level, there are three major methods: (1) testing performed at hospital laboratories or testing centers, (2) rapid and simple bedside testing (point of care testing: POCT), and (3) home-based self monitoring of blood glucose (SMBG). There are several principles for those different methods of measurement for which we need to consider potential influences on measured values according to methodological variation. The SMBG is developed originally for enabling self-monitoring of blood glucose level by patients, but it is used also for inpatients at hospital. Although the package inserts indicate necessary precautions to be observed in using respective...
testing instruments, it is true that such influence on the measured value has not been well recognized in general. Also in Japan, the results to use the simplified blood glucose meter showed false-high value for the patients performing a maltose-contained transfusion and subsequent medical accidents were reported on the case of hypoglycemic attack induced by insulin administration.\textsuperscript{16} \textsuperscript{17} In order to prevent such medical accidents, nurses are also required to have a correct recognition of the characteristics of various medical instruments.\textsuperscript{18} During this training practice, students empirically realized the variability of measured values according to respective measurement principles in using testing samples to which appropriate chemical was added as an influential factor. Students also learned the importance to understand the principles or grounds for application of the instruments by discussing the differences in measurement results due to such variation of measurement principles, which was useful to adopt a positive attitude about understanding of relevant scientific evidences. The guidebooks for the training practice were prepared in the form to perform experiments simultaneously with writing the experimental data in it. Relevant figures and photo images were provided for reference to supplement its descriptive guidance so as to support understanding of difficult operational procedures of the instruments.

- Test reagents for clinical examination

The contents of lecture were expected to become impressive if its learning effect could be visualized. For that regard, the test kit (Glucose C-II Test Wako, Wako Pure Chemical Industries, Osaka, Japan) was used as easily applicable test reagent kit for examination with which we could visually verify the test results by coloring. Because targeted attendees for the practice were students who had not yet been trained for basic experimental techniques, we provided some technical demonstrations appropriately for basic experimental operations required for the instrument with reference to the guidebook.

- The simplified blood glucose meter

Two types of instruments were used: Medisafe-Mini (TERMO Corporation, Tokyo, Japan) and Glutest Neo Super (Sanwa Chemical Co., Ltd., Aichi, Japan), which were used for the patients at our university hospital. By using the instruments frequently used in medicine, students could realized that their knowledge gained through training practices and lectures of the basic sciences were pragmatically interrelated with their own clinical practices.

- Measurement samples

In addition to maltose as the example referred in the above medical accident report, xylose and ascorbic acid with the use of rat plasma, and measured by 3 different methods to compare respective results.

In the experimental reports, almost all students could discuss in terms of the differences in the results based on each measurement principle. However, it was also revealed that there was a lack of rudimentary education in terms of the form of experimental report to structure and record their discussions and results. It is the future issue to consider how we should instruct the procedure to analyze the acquired data scientifically in the limited time available.

V. Discussion

Basic subjects such as anatomical physiology, pharmacology and pathological therapeutics are important for Nursing education.\textsuperscript{7} \textsuperscript{8} It was suggested that training for chemistry and biology was insufficient in baccalaureate nursing education.\textsuperscript{9} Miscalculation of medical drugs by nurses could occur due to the inadequate education for basic subject at high school.\textsuperscript{10} Therefore we decided to start a new curriculum; that could allow students know the significant relationship between basic subject and clinical nursing practices in lower grades. Currently, collaborative education between basic subjects and specialized subjects for nursing have been conducted at small scales\textsuperscript{5} . We have developed a collaborative education system of basic subjects and clinical practices as department-wide strategies for the first time. Characteristics and challenges are shown in this manuscript.

1. Collaboration with the specialized subjects for nursing

At the Department of Biological Science and Nursing, the fostering of practically qualified nurses was set as the educational goal, for which the basic subjects were considered as the platform to be interrelated with the specialized subjects for nursing (Fig.4).

The basic subjects provided at the College of Nursing of the Yokohama City University School of Medicine include: morphological dynamics, microbiology, pharmacology, nutritional science and biochemistry for nursing. We considered that the contents of those subjects should be connected with nursing science by learning of pathological therapeutics or the basic subjects in terms of living conditions of the patient. As introduced here, we believed that the collaborative education of the nursing practice-based lectures and the training practices would serve as the platform to promote interrelation with the specialized subjects for nursing so that scientifically evidence-based nursing practices could be provided to patients.
2. Trial of the retrospective basic education at the upper grade levels

In the nursing education system, the specialized basic subjects are generally learned mostly at the lower grade levels such as for the 1st or 2nd grade students. Refresher training may generate beneficial effects on students. Based on our educational concept to understanding of the interrelation between the basic subjects and clinical practices, we provided the education of clinical pharmacology again for 6 student members of the 4th grade seminar at the Service Management Office for Clinical Trials and the Center of Clinical Pharmacology. Because the number of available drugs is dramatically increasing including the investigational agents, and simultaneously relevant drug information becomes enormous in our current clinical settings. And there are many cases particularly for nurses to provide clinical information of drug characteristics or its adverse effects to patients. Those were remarkably important opportunities to discuss in terms of nursing support to ensure the safety of increasingly complex medication. The collaborative education with specialized subjects for nursing will be continued.

VI. Conclusion and limitation

Based on the educational concept with the purpose to foster practically qualified nurses in the bachelor programme of nursing sciences, we provided the lectures of the basic subjects along with the training practices, as the platform for nursing science, in conjunction with the specialized subjects for nursing. For the future, we plan to verify whether this educational system can guide to a further understanding of the specialized subjects for nursing in reference to the results of: “the essential questions,” “structure and mechanism of human body,” “diseases construction and promotion of recovery” and the questions in certain settings, which are related to the basic subjects of the national nursing examination.

Reference

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