

Past, Present, and Future of Postgraduate Nursing Education in Radiology at the National Institute of Radiological Sciences in Japan

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A B S T R A C T

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The National Institute of Radiological Sciences in Japan has offered a postgraduate training course for nurses in radiological medicine since 1994 because radiation protection and radiation effects have not been included as subjects in the official guidelines for nursing schools but are strongly required as important knowledge for nurses. By 2017, the training program had been conducted 102 times, and 3230 trainees had participated. To examine if participants thought there was a need for training, a questionnaire survey was carried out after the course, targeting 397 trainees who participated in the course from 2015 to 2017. Their average age was 39.2 years. Among them, 81.9% were general nurses, 17.6% held an administrative position, 44.8% had 1–5 years of experience in radiation medicine, and 83.7% had received training in radiation in the workplace or elsewhere before participating in the course. Of all, 91.7% participated to obtain knowledge of radiation basics and 65.2% participated to acquire the capability to respond to patients' questions. The average evaluation score of the training course was 90.2 out of 100. These findings indicate that presently, there is still a high demand for postgraduate training of nurses in radiological medicine and that an advanced course needs to be offered in the future.

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Introduction

The National Institute of Radiological Sciences (NIRS) in Japan has offered radiological education for technical experts, medical personnel, students, and others, from basics to radiologic medical care and radiological emergency medicine, since 1959 (Hachiya and Akashi, 2016; Shimizu et al., 2017a, 2017b). One of these training courses is to provide opportunities for nurses to learn nursing relating to radiologic medical care and radiation protection, and it was started in 1994.

In recent years, the use of radiation in medical examinations and treatment has increased, and nurses have an increasingly important role in helping with this medical practice. In addition, nurses are required to protect themselves from radiation and to relieve patients' uneasiness about radiation exposure in radiation medicine. However, until 2018, basic knowledge on radiation had not been taught as an independent subject in nursing schools in Japan for

50 years. Instead, only technical knowledge on radiation use in therapy and diagnostics was taught. Thus, continued nursing education in radiation is strongly required, especially for nurses to protect themselves from radiation hazards and to explain radiation to patients (Kusama et al., 2013).

Under such circumstances, NIRS planned to provide postgraduate nursing training in radiology. Before its launch, a questionnaire survey, as a pilot study, was conducted at nursing schools and hospitals to evaluate the demand for postgraduate nursing education in radiation (Joshima, 1997). Of the 519 participants, who were all medical personnel, 84% showed a positive desire for a new course in radiological nursing education to be set up. Subjects required for radiological nursing education were radiation basics, radiological effects on the human body, radiation protection, drills, and nursing in radiologic medical care. In addition to the questionnaire survey, NIRS asked several specialists, who are leaders in nursing and/or in radiation protection in medical field, to advise on a new training course. On the basis of the results of the pilot study and this specialist advice, NIRS started a 3-day basic training course in radiation medicine for nurses in 1994.

Currently, in 2018, this course has been extended to a 5-day training course in radiation medicine for nurses, which is held four times per year. Here, we review the past trends in postgraduate radiation-related nursing education and analyze the results of a

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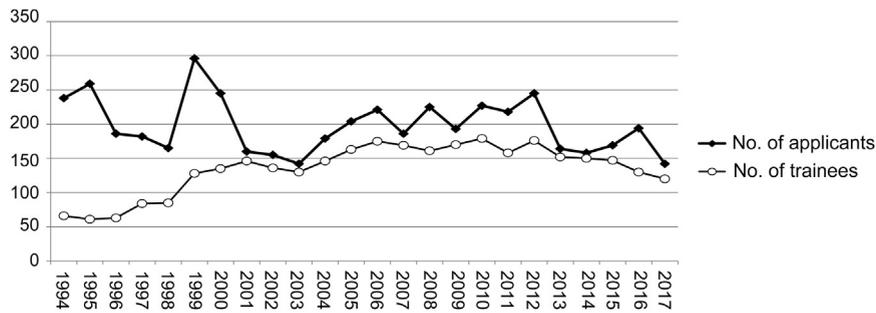


Figure 1. Changes in the number of applicants and trainees in the training course for nurses in radiation medicine at NIRS from the fiscal year 1994 to 2017.

questionnaire given to participants in the three most recent years to investigate the current demands of nurses in hospitals in Japan.

Methods

The questionnaire was given to 397 trainees who participated in the training courses for nurses from fiscal year 2015 to 2017. The questionnaire consisted of the following closed questions: How old are you? What is your position? How long have you worked in radiation medicine? Which department do you belong to? Have you undertaken postgraduate training in radiation before? What is your purpose in participating in this training course? How good is this training course on a scale of 1 to 100?

Results

NIRS started a training course in radiation medicine for nurses in 1994. By 2017, it had been conducted 102 times, and 3230 trainees had participated. There are a few trainees who repeated participation in the course. [Figure 1](#) shows the changes in the number of applicants and trainees from 1994 to 2017. The number of applicants ($n = 238$) was about four times larger than the actual number of trainees ($n = 60$) taught in the first year. From 1994 to 1996, the course was held twice per year. After that, NIRS gradually increased the number of offerings to five times per year until 2001 to meet the increasing demand. After 2001, the capacity to handle trainees in

this course began to match the demand, and NIRS has held this course four times per year since 2013.

[Table 1](#) lists the subjects taught in 1994 versus those taught in 2017. Most of the subjects taught in 1994 have remained in 2017 except for “nursing in brachytherapy”. Corresponding to the current trends in radiological medicine, which have moved away from brachytherapy, “nursing in brachytherapy” was integrated into “nursing in radiotherapy”. In addition, several new subjects (nursing in interventional radiology, mental care of patients in radiological medicine, and nuclear accident response as a nurse and radiation emergency medicine) were added to the course. “Nursing in radiation therapy” and “Nursing in diagnostic imaging” are divided into a medical portion taught by medical specialists (“Radiation therapy” and “Diagnostic imaging by radiation”) and a nursing portion taught by nurses (“Nursing in radiotherapy” and “Nursing in diagnostic imaging”) to enrich their educational content. “Nursing in diagnostic imaging” includes computed tomography. “Contamination and decontamination” was added because the importance of the involvement of nurses in radiation emergency medicine has been strongly recognized. Group work was set up to allow the trainees to share and resolve problems that they are actually facing in their workplaces. “Heavy ion therapy” and a site tour were added to show trainees the facilities at NIRS, which is a world-leading radiological research institution with outstanding levels of research and facilities.

Almost half of the trainees were in their forties ([Figure 2A](#)). The average age of the 397 trainees was 39.2 years. Most (81.9%) were

Table 1

List of subjects taught in the training course for nurses at the National Institute of Radiological Sciences (NIRS) in 1994 and in 2017

Subjects in 1994	Subjects in 2017
Basics of radiology	Basics of radiology
Radiological effects	Radiological effects on humans
Demonstration	Demonstration (cloud chamber, various radiation-measuring instruments)
Radiation protection	Radiation protection
	Radiation exposure of patients and medical personnel
Drill (1): Radiation measures	Drill (1): Characteristics of radiation
Drill (2): Characteristics of radiation	Drill (2): Direct and scattered radiation from mobile X-ray apparatus
Drill (3): Direct and scattered radiation from X-rays	
Nursing in brachytherapy	
Nursing in radiation therapy	Nursing in radiotherapy
	Heavy ion therapy
	Site tour at Heavy Ion Medical Accelerator in Chiba (HIMAC), Medical imaging building, Radiation Environment Monitor facilities, and NIRS hospital
Nursing in diagnostic imaging	Nursing in diagnostic imaging
	Diagnostic imaging with radiation
Nursing in nuclear medicine	Radioactive medicines
	Contamination and decontamination
	Nuclear accident response as a nurse and radiation emergency medicine
	Group work
	Nursing in interventional radiology
	Mental care of patients in radiological medicine

The course lasted for 3 days in 1994 but has been increased to 5 days since 2001.

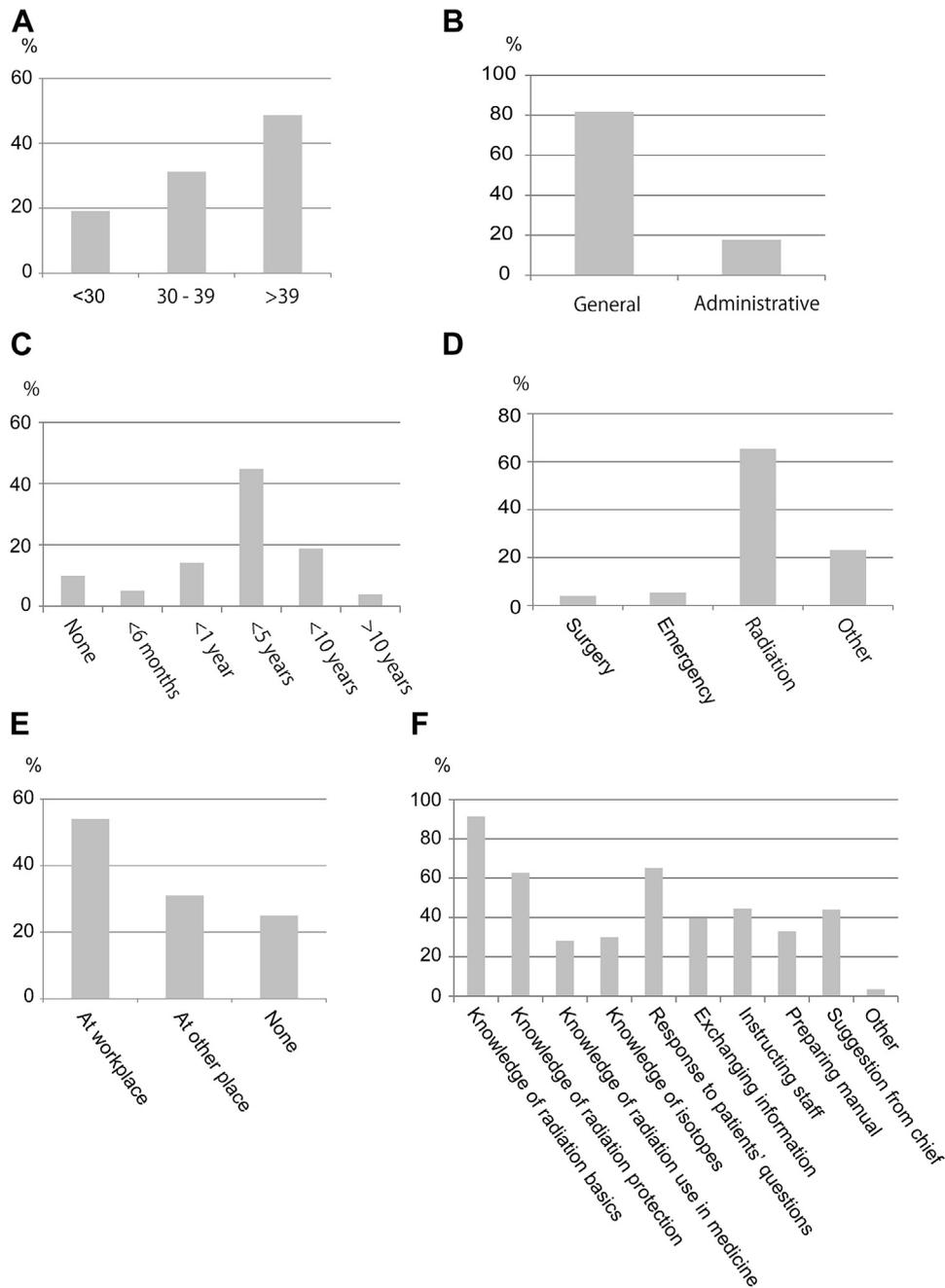


Figure 2. Results of a questionnaire survey of 397 trainees from the fiscal year 2015 to 2017. (A) Age of trainees. (B) Position of trainees. (C) Experience with radiation work. (D) Department to which trainees belonged. (E) Postgraduate education experience in radiation. (F) Reasons for participating (multiple answers were allowed).

general nurses, and 17.6% held an administrative position (Figure 2B). About half (44.8%) of them had 1-5 years of experience in radiation medicine (Figure 2C), and 65.5% belonged to a radiology department (Figure 2D). Of the trainees, 54.2% received training in radiation in the workplace, 29.5% received it elsewhere (Figure 2E), and 25.9% had no training in radiation at all. Almost all (91.7%) trainees participated in the training course at NIRS to obtain knowledge on radiation basics, whereas 65.2% of them did so to also be able to respond appropriately to patients' questions (Figure 2F). The average evaluation score of the training course was 90.2 out of 100.

From 1990, the number of nursing staff (public health nurses, midwives, registered nurses, and licensed practical nurses) has

been increasing, whereas the number of general hospitals has been decreasing (Figure 3A and B) (Ministry of Health, Labor, and Welfare, Japan, 2005, 2016, 2017). The percentage of general hospitals with a radiology department has remained almost flat at around 45% (Figure 3B).

Discussion

NIRS offers various kinds of training courses to develop human resources in the radiological field. One of the most important courses is that for nurses, which began in 1994. From the beginning, there has been a high demand for postgraduate nursing education in radiation as shown in Figure 1. The course has been held four

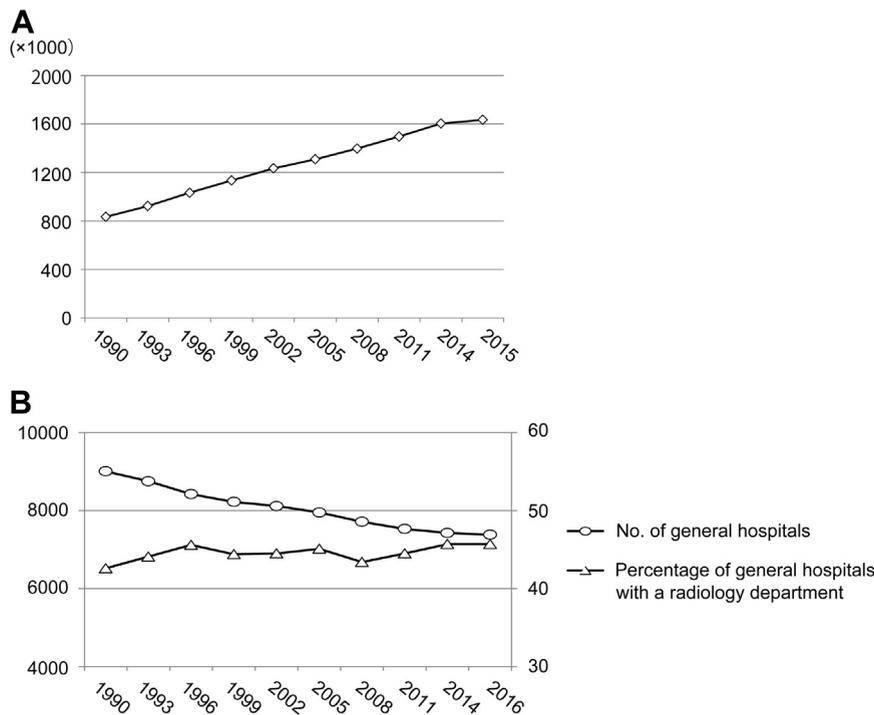


Figure 3. (A) Changes in the number of nursing personnel (public health nurses, midwives, registered nurses, and licensed practical nurses) in Japan from 1990 to 2015. This is edited from references in the Health and Medical Services, Annual Health, Labor, and Welfare report 2017, Ministry of Health, Labour and Welfare, Japan. (B) Changes in the number of general hospitals and percentage of general hospitals with a radiology department in Japan from 1990 to 2016. These data are compiled from Static/Dynamic Survey of Medical Institutions and Hospital Reports 2005 and 2016, Ministry of Health, Labour and Welfare, Japan.

times per year since 2013 and teaches about 120 trainees per year. It is currently appearing to meet the demand for such a course.

In Japan, there were around 1.2 million nurses in 2015 (Ministry of Health, Labour and Welfare, Japan, 2017), which means that only 0.01% of nurses are directly educated at NIRS every year. Most of the trainees are general nurses, but based on their average age, experience, and purpose for attending (Figure 2A–C and F), it seems that they are expected to instruct other nurses after completion of the course. For efficient and effective education, it is reasonable that a trainee would become an instructor in the workplace. This would indicate that in reality, NIRS is directly and indirectly educating more than 0.01% of nurses every year. The number of hospitals with a radiology department was 3387 in 2016 (Ministry of Health, Labour and Welfare, Japan, 2016). Almost all trainees were from general hospitals, and 65.5% of them belonged to a radiology department (Figure 2D). At the time of writing, 3230 trainees have participated in this course, which suggests that the contribution of NIRS to postgraduate education in radiation is not small.

Compared to the curriculum in 1994, that in 2017 includes more subjects in accordance with the changing trends in radiological medicine (Table 1). It appears that this change has satisfied the trainees because of the high approval rating that they gave. Accordingly, the length of the training course, which initially was 3 days, was increased to 4 days in 1995 and then to 5 days in 2001, where it stands today. This course length appears to be appropriate for most of the trainees (data not shown).

Most hospitals are conducting their own training in radiation because 83.7% of the trainees indicated that they have received postgraduate training at their workplace or elsewhere (Figure 2E). However, 91.7% of the trainees participated in the course at NIRS to obtain knowledge on radiation basics and 63% did so to learn about radiation protection (Figure 2F). This indicates that nurses need intensive postgraduate education in radiation in addition to the training received in the workplace. Apparently, the 5-day training

course at NIRS is meeting this demand based on the 90.2% approval rating given by the trainees.

The overall number of nurses has been increasing since 1990 to improve both nursing care and the work environment of nurses (Figure 3A). At the same time, the number of general hospitals has been decreasing (Figure 3B), and medical specialties have become centralized. It is thus necessary for nurses in general hospitals to obtain greater expertise. The training course at NIRS has accepted nurses with both little and much experience in radiation as trainees. Now, it is time to prepare two separate levels by offering general and advanced-level courses.

The new guideline on nursing education at the university was developed for the purpose of quality assurance to develop human resources with practical responsibility, research abilities, and high expertise (Ministry of Education, Culture, Sports, Science and Technology, Japan, 2017). In the guideline, radiation basics covering radiation use in radiological medicine, radiological effects, and radiation protection are included as the necessary basic knowledge to comprehensively understand humans. From now on, basic knowledge on radiation, which has not been taught in nursing school, is supposed to be taught as an independent subject. More than 250 universities are providing nursing education in Japan. Therefore, the proportion of nurses with high knowledge of radiation basics is expected to rise, and in the future, more nurses may demand more advanced knowledge on radiation medicine over and above the basic knowledge they have already acquired. In addition, with the rapid progression of radiological medicine, nurses must update their technical knowledge after graduation. Postgraduate education can play an important role in updating their knowledge and in providing advanced knowledge on nursing in radiation medicine. These indicate that the need for the present course of NIRS, which includes all the content in radiation basics in the guideline, could reduce and should be upgraded to an advanced one that is more practical and more application oriented, with up-to-date information, in a shorter period.

NIRS will react to the change in demand and continue to conduct training courses in future.

Conclusion

Postgraduate nursing education in radiation medicine has been strongly required in Japan because the official guideline for nursing education before 2017 did not include radiation basics as a subject. Thus, NIRS has offered a training course for nurses in radiation medicine since 1994. Trainees can intensively study radiation basics, radiation protection, and nursing in radiation medicine through lectures and drills given by specialists in the course. The evaluation score of the course given by trainees was high. However, it should be noted that trainees were from various backgrounds in respect to their positions and experience in radiation medicine and that the new guideline published in 2017 intends for radiation basics to be taught as an independent subject in university. From now on, it might be necessary to offer advanced postgraduate education in radiation medicine.

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