


An experiential approach to developing radiological content for public health nursing: Lessons from a nuclear disaster

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Funding information

Japan Society for the Promotion of Science, Grant/Award Number: 15H05107

Abstract

Objective: This study identified the radiological content required for PHNs and public health nursing students based on PHNs' experiences caring for people affected by the 2011 Fukushima Daiichi nuclear power plant accident.

Design: We used qualitative research, interviews, and content analysis.

Sample: Participants were eight PHNs employed by local governments in Fukushima and neighboring prefectures.

Results: Six content themes regarding the nuclear disaster were identified: (a) basic knowledge about radiation, (b) public health nursing activities in emergency exposure situations, (c) management in emergency exposure situations, (d) consultation to support residents affected by the nuclear disaster, (e) activities in the existing exposure situations, and (f) disaster preparedness in the planned exposure situations. Necessary content shifted depending on the phase of the nuclear disaster recovery.

Conclusions: The use of the experiences of PHNs after the nuclear power plant accident to inform PHNs and public health nursing students will enable PHNs to respond appropriately and support people without difficulties. Comprehensive radiation content is needed to address the range of situations caused by nuclear disaster.

KEYWORDS

nuclear disaster, nursing education, public health nursing education, qualitative research, radiological content

1 | INTRODUCTION

1.1 | Background

After the March 2011 great East-Japan earthquake the resulting nuclear accident at the Fukushima Daiichi Nuclear Power Plant (FDNPP) became the world's fourth large-scale nuclear disaster and most costly (Oskin, 2017). Thousands of people were suddenly evacuated to nearby locations causing disruptions in lifestyle (Hasagawa, Ohira,

Maeda, Yasumura, & Tanigawa, 2016). PHNs employed by local governments in the affected areas were faced with daunting challenges.

During this early "emergency exposure phase", information on radiation exposure and the subsequent health risks was confusing and conflicting (Leppold, Taminoto, & Tsubokura, 2016). Because PHNs had insufficient knowledge about radiation and radiation protection, they struggled with how to support people in the affected communities. Despite their inexperience and lack of adequate correct information, the PHNs still attempted to address people's concerns about

radiation exposure and provide relief and safety to residents with a sense of strong mission (Kawasaki, Omori, Ono, Konishi, & Asahara, 2015). The uncertainties about radiation contamination during the emergency exposure situation lasted nearly 1 year (International Atomic Energy Agency, 2013).

Through the existing exposure situation, beginning April 2012 to the present, Fukushima PHNs continued to provide care to residents in the neighboring prefectures where they were employed even though they were also anxious about radiation (Yoshida et al., 2016). This involved supporting over 150,000 people (World Nuclear News, 2012), including those who had health problems related to concerns about radiation exposure and had experienced upsetting lifestyle changes due to the evacuation (Asahara, 2014; Leppold et al., 2016). The experiences of the PHNs should prove valuable for disaster education.

There have been concerted efforts to improve aspects of radiological education for PHNs (Goto et al., 2014; Japan Ministry of Education, 2016; Japan Ministry of Education, 2017) because nurses must assume very broad roles, from emergency care to surveillance (International Congress of Nursing & World Health Organization, 2009). The majority of nursing schools did not have an independent radiation program (Asahara et al., 2017; Sasatake, Kitajima, Urushizaka, & Noto, 2017). Less than 30% received radiation education during disaster nursing education (Asahara et al., 2017). Over 80% of the faculties thought radiation and radiation protection should be taught, despite a lack of teaching materials and qualified nursing faculty. Indeed, more research and education are needed (Veenema, Lavin, Bender, Thornton, & Schneider-Firestone, 2019).

Therefore, it is necessary to explore specific radiation and radiation protection content from the vantage of practicing PHNs to inform the education and practice of public health nursing. The purpose of this study was to describe the content of radiological education required for PHNs and public health nursing students based on PHNs' experiences of the 2011 nuclear accident at FDNPP.

2 | METHODS

2.1 | Design

This qualitative research design used purposive sampling. Interviews generated data that were analyzed (Bryman, 2008) to identify the educational content required for PHNs and public health nursing students. We recognized it was important to educate PHNs and students about radiation and radiation protection based on the real-life experiences and the needs of PHNs working in the field after the nuclear disaster.

2.2 | Participants

The participant inclusion criteria were as follows: (a) PHNs employed by a local government, (b) worked in an area that had

evacuees, and (c) had direct experience supporting evacuees. The local governments assisted in locating eight willing PHNs: five were from an adjacent prefecture and three were from the Fukushima prefecture. They were selected based on their previous connections with the researchers and their willingness to participate. Others declined based on time or unwillingness to be interviewed about their painful experiences. Unfortunately reliance on local government officials and the political and emotional tensions precluded an accurate accounting of the number of PHNs who declined. However, we were confident that the PHNs who did agree to participate had many experiences that were typical in serving the disaster victims.

We provided verbal and written explanations of the study objectives, analysis strategy, and the Declaration of Helsinki ethical considerations before obtaining signed informed consent to participate in the study. The Ethics Committee Hirosaki University Graduate School of Medicine approved the study.

In 2011, the participants' occupations included two each: managers, assistant managers, chiefs, and general public health nursing. Their mean duration of employment as public health nurses employed by local government was 32 ± 13.18 years, which included working at a public health center, health and welfare center, or prefectural office.

2.3 | Setting

Fukushima was one of many prefectures that were impacted by the nuclear disaster. Wind and water carried radioactive materials to neighboring prefectures. Evacuees from Fukushima were relocated nationwide. Because the nuclear disaster was still a sensitive subject, our local government contacts advised us as to which prefectures would be most willing to participate provided that we agreed to protect the prefecture anonymity. Thus, agreeing to participate was one prefecture area north of Fukushima (referred to as neighboring prefecture) and Fukushima. Mid-size towns, small villages, farms, and rice fields characterize the areas that also included wooded mountains. Larger towns were accessible by trains and buses. Well-developed roads connected outlying areas but without public transportation.

2.4 | Data collection

The researchers conducted two individual interviews and 2 three-member group interviews in February 2016, each lasting from 60 to 90 min. Individual or group participation was determined by the PHNs' availability. The participants were asked to reflect on their experiences and talk about knowledge, skills, or education they thought were required for PHNs and public health nursing students, to provide adequate care in a nuclear disaster. To maintain anonymity, no attempt was made to link the comments of the participants with their actual or coded name. Given that

assurance, participants provided permission for the interviews to be recorded using a digital voice recorder, followed by content transcription.

2.5 | Data analysis

The interview data were analyzed qualitatively. We coded data relevant to educational content required for PHNs and public health nursing students. We then classified similar codes into subcategories and abstracted the subcategories into categories.

3 | RESULTS

The qualitative analysis provided a rich view of pertinent content. Within the disaster trajectory of (a) emergency exposure, (b) existing exposure, and (c) planned exposure were the following six categories with subcategories (Table 1).

3.1 | Basic knowledge about radiation

This category contained two subcategories: (a) physical and chemical characteristics of radiation and (b) effect of radiation on the human body. The two subjects PHNs needed included:

- physical and chemical characteristics of radiation, radioactive material, natural radiation, radiation exposure in daily life, and
- effects on health, such as thyroid disease or risk of cancers.

The participants recognized that if PHNs acquired adequate knowledge about radiation, they should be able to select correct information from numerous choices, such as the Internet, newspapers, and professional literature and to use this knowledge about radiation to care for people.

I couldn't decide by myself because of a lack of knowledge of the numerous and wide ranges of information.
(PHN from Fukushima)

We have to know that we live in an environment with natural radiation, and are exposed to radiation during daily life.
(PHN from neighboring prefecture)

3.2 | Public health nursing activities in the emergency exposure situations of the nuclear disaster

This category contained one subcategory: basics of activities in the emergency exposure situations of the nuclear disaster. The participants identified the following preparedness and the activities for what PHNs should do during this early phase:

TABLE 1 Radiological content for PHNs and public health nursing students

Categories: Education theme	Subcategories: Content
Basic knowledge about radiation	<ul style="list-style-type: none"> “Physical and chemical characteristics of radiation” “Effects of radiation on the human body”
Public health nursing activities in emergency exposure situations	<ul style="list-style-type: none"> “Basics of activities in emergency exposure situations of the nuclear disaster”
Management in emergency exposure situations	<ul style="list-style-type: none"> “Management of local government departments and related organizations” “Pollution exposure management” “Shelter management”
Consultation to support residents affected by the nuclear disaster	<ul style="list-style-type: none"> “Basics of treatment and support of residents in all situations of a nuclear disaster” “Help people to choose actions after understanding health risk”
Activities in the existing exposure situations	<ul style="list-style-type: none"> “Primary features of long-term support after a nuclear disaster” “Construction of support system for victims” “Support for PHNs and other people who support and respond to victims”
Disaster preparedness in the planned exposure situations	<ul style="list-style-type: none"> “Recognition of the risks of a nuclear disaster” “Preparation of a crisis management system over a wide area”

- figure out what was going on by using social networks they created in the communities during the normal phase,
- remain alert and try to recognize changes in individuals or groups,
- identify the needs of evacuees,
- focus on and respond to people's health problems even when they (PHNs) were so busy that they needed support from other officers,
- clearly tell people the necessary information,
- support people trying to construct new face-to-face relationships, and
- support people's decision making.

It is important to study how to express information to help people understand and feel relieved. In addition, it is essential to study how to communicate specialized information required by the target group [e.g., elderly, children, disabled, pregnant women].

(PHN from Fukushima)

It is important initially to be on the alert about [the situation] and recognize that something has changed [situation, individuals] in the communities.

(PHN from neighboring prefecture)

3.3 | Management in emergency exposure situations of the nuclear disaster

This category contained three subcategories: (a) management of local government departments and related organizations, (b) pollution exposure management, and (c) shelter management. The participants were not expecting evacuees from another prefecture, so they said they were confused. They usually responded to and supported people living in their prefecture. Through this experience, they recognized the need for education on management. Management of the departments and related organizations was required to execute the following activities:

- make a projection of evacuation routes according to the pollution range and geographical conditions,
- clarify the instruction path between departments and organizations by integration of the evacuees' acceptance criteria,
- share information with other local government agencies, and
- manage the information gathered.

Pollution exposure management involved conducting comprehensive health checks and informing people in clear simple terms of the results. Shelter management needs arose during the early phase and involved helping city governments manage the shelters including health needs.

We need to know how to handle complaints, how to lead PHNs and officers who responded to residents, and how to direct PHNs employed by city governments for disaster response.

(PHN from neighboring prefecture)

In order to determine the support needs we have to construct a route to obtain information on the number of shelters and evacuees, and the public health nursing activities in each area. We also have to manage this information.

(PHN from Fukushima)

3.4 | Consultation to support residents affected by the nuclear disaster

This category contained two subcategories: (a) basics of treatment and support of residents in all situations of a nuclear disaster and (b) help people to choose actions after understanding health risks. The participants identified these basic requirements for responding to and supporting residents:

- learn what happened to people in the nuclear disaster and what they felt about not being able to return to their homes or about living separately from their family,
- learn how to respond to people's various reactions from vague uneasiness to fear and anxiety concerning the invisibility of radiation, and

- gain skill required to provide ongoing psychological support to people who could not go home.

In addition, with regard to the comprehensive health check, the participants thought it was necessary to

- understand the purpose of a stable iodide tablet (potassium iodide),
- learn the method for the simple radiation test, and
- learn how to educate the residents about the radiation tests in a way that would allay their fears.

People with anxiety concerning radiation may have a sensitive reaction to a single word, and therefore it is difficult to select the correct words to provide advice and communicate with the residents.

(PHN from neighboring prefecture)

After five years we are inclined to believe that people live without anxiety. However, many people have anxiety and feel burdened about radiation, although they often cannot talk about this with other people.

(PHN from Fukushima)

Participants also recognized that they needed to learn how to support residents' decision making. This required:

- assessing the resident's understanding about radiation effects and health, and then
- offering them choices using evidence-based documents that considered health risks.
- assisting residents to make health behavior decisions, and
- finding ways to help residents to manage their current acute or chronic health conditions.

We have to tell people about the health effects of radiation and other factors, and support them when they are considering what to choose.

(PHN from Fukushima)

3.5 | Activities in existing exposure situations

This category contained three subcategories: (a) primary features of long-term support after a nuclear disaster, (b) construction of support systems for victims, and (c) support for PHNs and other people who support and respond to victims. Once a nuclear disaster has occurred, it takes many years for people in the contaminated area to return to their previous daily life. Even though 8 years have passed there remain "difficult-to-return" zones; there are some areas in which residents are not permitted to live, and support remains for evacuees living temporarily outside of Fukushima.

The participants recognized that the basics of long-term support during a nuclear disaster were as follows:

- the importance of showing interest in the victims and remaining close to them throughout all the phases,
- how to redirect and transform the support for group members in shelters to individuals living in temporary housing,
- the necessity to serve as an intermediary between local governments in their place of refuge and the hometown of Fukushima,
- the necessity to create opportunities for evacuees to freely express their feelings, and
- the necessity to convey the correct information and to disseminate correct knowledge regarding the needs of evacuees after considering the characteristics of the community and the population.

Over the last five years we have been holding group meetings for evacuees from the affected area and supported them. I think these public health nursing activities are still needed. I realize the impact of a nuclear disaster lasts for a long time.

(PHN from Fukushima)

We have to convey the correct basic knowledge about radiation to officers of city governments and companies, residents, and care providers of evacuees.

(PHN from neighboring prefecture)

I realized that we have to provide the correct information repeatedly for several years.

(PHN from neighboring prefecture)

Participants recognized it was necessary to learn how to construct support systems for victims. That activity included establishing a core department of victim support and clearly establishing the roles of each department or organization in the community. In addition, the participants recognized the need to learn how to support people who provided support to victims, and to respond to evacuees such as PHNs, nursery school teachers, social workers, and other professionals and officers of local government to maintain their mental health.

Year by year, the problems of evacuees become more serious. It proved difficult to solve these problems due to the increased psychological burden of the supporters. We identified the need to consult and train the supporters.

(PHN from neighboring prefecture)

We found it impossible to sufficiently understand the pains of the evacuees and this problem hurt us. We need to understand that we have limitations because otherwise we may become psychologically depressed.

(PHN from neighboring prefecture)

3.6 | Disaster preparedness in the planned exposure situations

This category contained two subcategories: (a) recognition of the risks of a nuclear disaster and (b) preparation of a crisis management system over a wide area. The participants recognized that it was necessary to do the following:

- Develop a guidebook about nuclear disasters based on the experiential knowledge of the accident at the FDNPP.
- Regularly review a regional disaster prevention plan.
- Listen to victims' experiences, recognize the usefulness of thinking through various disaster scenarios, and by doing that assist the PHNs to properly recognize risks.

We feel relieved that a regional disaster prevention plan was developed, although it is more important to train and learn regularly.

(PHN from Fukushima)

It is not sufficient to just read the guidebook on nuclear disasters. Someone's real story from their experiences of a nuclear disaster reaches our hearts, and therefore it is worth hearing as part of an education program.

(PHN from neighboring prefecture)

In a nuclear disaster, the radiation effect covers a wide area and people are evacuated to many different municipalities. The participants recognized the need to learn and carry out the necessary preparation. This included the following activities:

- sharing role recognition and how local governments and other organizations responded to evacuees,
- building relationships,
- creating a crisis management system over a wide area, and
- building a training system.

We need to build relationships by face-to-face communication between PHNs and evacuees. This makes good use of the time during a disaster.

(PHN from Fukushima)

4 | DISCUSSION

4.1 | Educational needs about radiation for PHNs and public health nursing students

Based on the day-to-day experiences of PHNs after the accident at the FDNPP, we identified the educational content specific to each of the three periods: emergency exposure situations, existing exposure situations, and planned exposure situations. Each of these periods

had special characteristics and the population had corresponding needs related to the nuclear disaster. Radiation is invisible and may affect people's daily life for many years to come while changing their daily pattern of life (Nukui, Midorikawa, Murakami, Maeda, & Ohtsuru, 2018; Ohki, 2012). There is evidence that the presence of radiation also caused emotional reactions ranging from vague uneasiness to major anxiety (Kawasaki et al., 2015; Kayama et al., 2014). The effect varied depending on the population such as the extent of anxiety, information requirements, and support needs (Kobayashi & Kikuchi, 2014; Mitsumori et al., 2014; Ono, Orita, & Asahara, 2014). The need for PHN education based on the characteristics of the target groups and nuclear disaster was identified in the six categories (Table 1). Nukui et al. (2018) found similar educational needs about radiation for hospital nurses.

Once a massive nuclear disaster has occurred it takes many years for restoration and reconstruction (Hornyak, 2018). Nuclear disasters also have their own specific issues. Some evacuees never go back to the contaminated area of their hometown because of the possibility of legal action. Wives may move far away from the disaster area to reduce radiation exposure to the children, while husbands remain for employment (Nukui et al., 2018). People may not be able to dispel their uneasiness about radiation even after many years (Murakami et al., 2018). Others may not express their anxiety and questions regarding complex feelings on radiation, making it difficult for PHNs to convey the correct information and knowledge. In addition, specific problems such as differences in compensation to victims who were evacuated, and determinations about the extent of damage existed, resulting in jealousy and feuds between the evacuees (Brasor & Tsubuku, 2018; Organisation for Economic Cooperation & Development, 2012).

We found that additional content was needed to address several specific issues based on the PHNs experiences of the nuclear disaster. PHNs and public health nursing students need to learn methods for "risk communication" (Gamhewage, 2014; Goto et al., 2014) and for sharing information and mutual understanding with evacuees, the general population, officers including PHNs of local government, and all other people engaged in disaster responses in the community. PHNs must help people to achieve correct knowledge and rebuild their daily life according to their own choices. In addition, PHNs should assist in building a "radiation protection culture" which means to build lifestyle habits that incorporates knowledge about radiation protection in their daily lives (International Atomic Energy Agency, 2013). This was achieved by correctly using knowledge to maintain peoples' health (Goto et al., 2014; PHNs' Activity & Radiation Group, 2018). Ando (2012) indicated that conversations between residents possibly removed fear of an uncertain future due to radiation exposure and helped residents retain a feeling of self-control of their daily life. Conversations between residents in Fukushima were shown to be an effective way to build a radiation protection culture (Mitsumori et al., 2014). PHNs used their existing strengths and expertise during a nuclear disaster to find opportunities gained from conversations among evacuees and local residents to foster the radiation protection culture.

The management framework that emerged was related to the fact that prior to the FDNPP accident no one expected the shelters to be spread over a wide area (Fairlie, 2018). Before the nuclear disaster happened in 2011, PHN activities for natural disasters were limited to government agencies in their community where disasters, such as earthquakes, had occurred and Japan had an outstanding earthquake disaster preparedness system (Foster, 2011; The World Bank, 2017). However, in a case of nuclear disaster, unlike earthquakes, people seek a place of refuge over a wide area, and it is therefore necessary for many other government agencies to respond to and support them (Fairlie, 2018). Supporters also went to the affected area from other prefectures. This is different from natural disasters because exposure management and contamination control are needed, with evacuation prolonged due to difficulties predicting the return of the disaster (Hasagawa et al., 2016). Education on management and building management systems must assume that the nuclear disaster and the place of refuge would affect a large area and is needed to prevent confusion and delay by providing supportive consultation to those in the refuge bay.

4.2 | Implementation of radiation education in the near future

Eight years after the disaster, PHNs employed by local governments are still in need of education. This is important because about 32,000 people were evacuated nationwide from their hometown of Fukushima (Fukushima Prefecture, 2019). PHNs employed in the local governments that do not have a nuclear facility must provide consultation to assist evacuees based on the specificity of the nuclear disaster. It is therefore important for all PHNs to acquire basic knowledge about radiation (Katsumura, 2019) and obtain other necessary knowledge and methods on the disaster based on the experiences of the FDNPP accident.

In 2018, content regarding radioactivity was incorporated into the Japanese national licensure examination for nurses and PHNs. However, lack of prepared faculty and time limitations in the current curricula may slow implementation of adding this content. PHNs of local governments are also constrained by time and opportunity. We, therefore, suggest choosing new curriculum contents and content reflecting knowledge gaps (see Table 1) and adapting human resources, curriculum year, and time to provide the content.

Training programs conducted for PHNs of local governments reflect the increase in natural disasters in Japan (Goto, 2016; Maeda, Kotera, Matsuda, & Edwards, 2016). Therefore, risk communication for nuclear disasters should become part of the existing disaster nursing training program. Risk communication that can apply to all types of disasters and could be added to the curriculum based on the PHNs' experiences of the FDNPP accident. We also suggest that we build collaborative relationships with experts in radiation and radiation protection or risk communication to advise PHN nursing faculty studying radiological nursing. Collaboration is also important for radiological countermeasures. Radiological education is effective

and feasible to implement, taking into account (a) curriculum content required for target groups, (b) adapting to the circumstances, (c) considering the changes in law and disaster prevention plans of the local governments, (d) referring to the PHNs experiences in the FDNPP accident, and (e) collaboration among PHNs and other specialists.

4.3 | Limitations

Certain limitations of credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985) may be found in this study. While the credibility of data and data analysis were strongly supported by the findings of other researchers, transferability may not be as strong. The nuclear disaster was both complex and influenced by the prior huge earthquake, a tsunami, and cultural and political factors unique to Japan. Even so, certain features such as the need to know about radiation exposure, risk communication, evacuation routes, and shelter management would be common needs regardless of location or culture. It is possible that the particular participants selected for the study had some biases or unique experiences that would not be generally shared. The participants shared experiences that were "etched in their memories" after 5 years. Other experiences therefore may have been omitted in terms of memory decay. The researchers were well acquainted with the PHNs and the events as they unfolded, and therefore could provide some confirmability. Finally, we were unable to document the various ways the prefecture governments managed the phases of the disaster. There was a general consensus that a lack of communication and coordination of care was ubiquitous over an extended time and area. We surmised that most PHNs were facing similar situations in all the prefectures surrounding the nuclear accident.

5 | CONCLUSION

Making use of the experiences of PHNs after the FDNPP accident to educate PHNs and public health nursing students is essential. This would lead to PHNs being able to respond to and to support people without the difficulties that may result from insufficient radiation knowledge and inexperience. It is feasible and effective to select contents that emerged from this research, for inclusion as part of existing courses or training programs. We not only recommend that radiation education be adapted based on the characteristics of the nuclear disaster and the widespread situations in which evacuees live but also include disaster preparedness theories. This approach is necessary to protect people's health and QOL for building a radiation protection culture. Because any country can become at risk from a nuclear disaster; radiological content based on the results of this study should be useful for PHNs and public health nursing students worldwide.

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How to cite this article: Kawasaki C, Kitamiya C, Yoshida K, Omori J, Porter S, Asahara K. An experiential approach to developing radiological content for public health nursing: Lessons from a nuclear disaster. *Public Health Nurs.* 2020;37:295–302. <https://doi.org/10.1111/phn.12700>