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AUTHOR(S):

Okamoto, Reiko; Gouda, Kayoko; Koide, Keiko; Tokimasa, Mai; Kageyama, Masako; Iwamoto, Saori; Shiomi, Misa; ... Kiya, Misaki; Tada, Aoki; Koetaka, Hanayo

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# Effectiveness of simulation learning program for mastering public health nursing skills to enhance strength of community: A quasi-experimental design

Reiko Okamoto[a,*], Kayoko Gouda[b], Keiko Koide[c], Mai Tokimasa[a], Masako Kageyama[a], Saori Iwamoto[d], Misa Shiomi[e], Emiko Kusano[f], Miho Tanaka[a], Misaki Kiya[a], Aoki Tada[a], Hanayo Koetaka[b]

[a] Osaka University, Graduate School of Medicine, Division of Health Sciences, Japan
[b] Faculty of Nursing and Rehabilitation, Konan Women's University, Japan
[c] Faculty of Nursing, Shitennouji University, Japan
[d] Faculty of Nursing, Kobe City College of Nursing, Japan
[e] Graduate School of Medicine, Kyoto University, Japan
[f] Faculty of Nursing, Osaka Medical College, Japan

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ABSTRACT

*Purpose:* The purpose of this study is to develop a simulation learning program for mastering public health nursing skills to enhance strength of community, and to verify its effectiveness.
*Methods:* The program is one-day session to master the skills from three exercises. This study adopts a quasi-experimental design. We selected unbiased 34 participants in intervention group and 30 participants in control group, and conducted self-administered questionnaire surveys at three points in time: pre, post 1 and post 2. Three tools were used to measure the required outcome. For the outcome evaluation, we calculated the changes in the mean value of each tool between pre and post 1 and between pre and post 2, and compared them between the two groups.
*Results:* The change of intervention group in the total score at the post 1 stage from the pre stage was significantly higher than control group regarding each of the scales ($P < .05$).
*Conclusions:* The program was found to be effective in upgrading the skills of less-experienced public health nurses to enhance strength of community.

## 1. Introduction

In recent years, health needs in Japan have become increasingly diverse and complex with the increase of care-related issues and changes in disease structure, driven by the declining birth rate, population aging and changing lifestyles (Ministry of Health and Labour, 2014). These developments, coupled with frequent health crisis events such as disasters and abuse, require more comprehensive action by public health nurses (hereinafter, PHNs) in order to promote sustainable community building (Japan Nursing, 2016).

The Guidelines on Healthcare Activities of PHNs in the Local Community (Ministry of Health and Labour, 2013) provides a basic approach for solving such health issues, namely promoting initiatives by inhabitants and helping to ensure that such initiatives will be sustained by the community. There is an urgent need to promote activities to enhance strength of community as a national government policy, because the Cabinet decision on Japan's Plan for Dynamic Engagement of All Citizens (2016) also emphasizes the transition to "regional cohesive societies."

Based on practical analyses, previous studies identified major skills in essential public health nursing art (hereinafter, PHNA), and their framework to enhance strength of community (hereinafter, SC) (Okamoto et al., 2019b). SC means potential of the community to promote positive health such as mutual aid, partnership building, skills of leveraging resources identified in previous studies (Okamoto et al., 2019a). Even though enhancement of the skills was required, it was difficult to find an effective method of developing them. This was mainly because the skills to enhance SC, to be deployed for not only

* Corresponding author at: Osaka University, Graduate School of Medicine, Division of Health Sciences, Yamadaoka 1-7, Suita-city, Osaka 565-0871, Japan.
*E-mail address:* reiko@sahs.med.osaka-u.ac.jp (R. Okamoto).

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individual but also population and community to develop their capacity and the surrounding environment, guided by the norm of social equity (JAPHN, 2014), can only be understood and put into action with sense of purpose (Asahara et al., 2010) after a long period of experience through practical or on-the-job training.

Nevertheless, it should be noted that PHNs are expected to function on their own from the outset (Takao, 2013). Since PHNs continue learning through practical experience (Matsushita et al., 2012), it is crucial to develop a progressive and repetitive learning method so that they may master the skills from an early stage, including basic education and induction, even if doing so takes time.

Simulation learning is a method to master and improve specific skills through repetitive learning by experiencing relevant activities in an environment which simulates the key situations that PHNs may face in our diverse and complicated real world. The simulation learning method helps the learners integrate their professional knowledge, skills and attitude by reviewing and verifying what they have experienced (Abe, 2013). It is reported that technology-enhanced simulation training in health profession education is correlated with the outcome obtained in terms of knowledge, skills and attitude (Cook et al., 2011).

However, most of the 15 studies conducted overseas covered by a systematic review of simulation-based training for nurses were done in hospitals, and none at the community level (Hegland et al., 2017). The same trend may be observed in Japan. The simulations conducted at the community level were related to disasters and poverty (Pesiridis et al., 2015; Yang et al., 2014; Waller, 2017), and were not intended to develop sustainable community building skills, given their substantial scale.

Thus, we found that skills to enhance SC needed to be learned from early in the career, but an effective method for this learning remains underdeveloped and a challenge to be addressed. The purpose of this study is therefore to develop a simulation learning program for mastering the skills to enhance SC, and to verify its effectiveness. This study is significant in that the developed program is expected to help improve the practical skills of PHNs, and hence public health in local communities in general. It will also contribute to career development through robust active learning, which is an objective being pursued by the national and educational institutions.

## 2. Methods

### 2.1. Study design

This study adopts a quasi-experimental design.

### 2.2. Study participants and selection method

The participants in this study were selected from those PHNs in the induction or early mid-career period (PHN experience of 10 years or less) who were able to participate in all scheduled sessions.

To recruit participants, we sent letters to the lead PHNs working in the sections responsible for PHN education at those prefectural governments and municipal governments authorized to establish health-care centers in five neighboring prefectures, asking for cooperation in the study and recruitment of participants. Potential participants were invited to e-mail the secretariat at their own initiative to apply for the program. The intervention and control groups were assigned by a single blind method to ensure that there is no bias in their experience period and affiliation.

### 2.3. Outline of the simulation learning program

#### 2.3.1. Program development process

The program was developed through the following six stages, comprising face-to-face consultations and frequent exchanges of e-mail. The program was developed between April 2016 and December 2017.

1) Identification of the skills learned in the program: We decided to develop an exercise for each: “Searching,” “Stimulating” and “Facilitating.” We set three kinds of skills in each exercise based on previous studies (Okamoto et al., 2019b) as follows: Searching; “Needs/Potentials Identification”, “Resource Exploration”, “Reality Visualization/Presentation”, Stimulating; “Collective Responsibility Sharing”, “Collective Voluntary Involvement”, “Initiation Assistance”, Facilitating; “Player Amplification”, “Local Dissemination”, “Initiative Support”.
2) Examination of the simulation method to be applied to the program: In order to select the best method possible, we first obtained knowledge from current publications (Abe, 2013, 2015; Orii, 2016) and relevant training sessions. As no simulator was found to be applicable to mastering the skills at the community level, we adopted a simulation using a simulated community and scripts as a method with a higher fidelity and reasonable cost. We also arranged the three exercises into a one-day session for convenience, as the participants would be coming from different prefectures.
3) Examination of the learning methods suited for mastering the skills: Since simulation is a type of empirical learning with reflection, we basically decided to adopt an empirical learning model (Kolb, 1984). As the three exercises had to be implemented in one day and in view of the characteristics of the skills concerned, we also decided to combine the learning transfer and critical learning models (Nakahara, 2013) with the empirical learning model for more effective mastering of the skills. In the framework of empirical learning, we further adopted the techniques of simulated experience (Exercise 1), dramatization (Exercise 2) and gaming (Exercise 3) to bring variation to each of the exercises (Orii, 2016).
4) Prototyping of training materials for the program: In order to secure the fidelity and debriefing quality of the program, we decided to build the materials based on evidence of specific aspects of the cases where PHNs had actually enhanced SC. The cases, covering a period of 10 years from 2005, were outlined in multiple articles and books (Gouda, 2014; Gouda and Okamoto, 2012; Gouda et al., 2011, 2012); their authors were involved in the whole prototyping process as research collaborators.
5) Preparation for implementation: The whole study team took part in a demonstration using the prototype thus developed. Subsequent consultations resulted in some modifications before implementing the program.
6) Evaluation plan: Evaluation was to be conducted on the outcome, process and planning.

#### 2.3.2. Outline of the program (Table 1)

Table 1 shows the exercises thus developed.

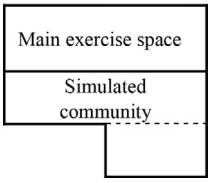
In Exercise 1, the participants visited a simulated area (District C in Town B of City A) to collect information from four informants for community assessment. In Exercise 2, the participants played out the two scripts prepared by the study team to learn from comparisons between good practices and not-so-good practices. In Exercise 3, the participants played the crossroad game prepared by the study group to learn about decision-making in dilemmatic situations by exchanging views.

A facilitator was provided for each group for Exercises 2 and 3. The following goals were set for the exercises: (1) to understand the importance of the skills; (2) to gain confidence in putting them into practice; and (3) to be able to identify the principles of PHN activities. Since the skills to be learned are not technical with “correct answers”, we focused on learning various “possible solution options” through group work, presentation and debriefing.

### 2.4. Survey method (Fig. 1)

We first calculated the average years of experience as PHN and the number of applicants per affiliated entity for unbiased selection of the

**Table 1**
Outline of the simulation learning program for mastering skills in public health nursing art to enhance strength of community.

| ●PHNA Skills to learn<br>■Learning style | Outline of the simulated community and objective of each exercise | ●Outline of the program<br>■Handouts/Materials | Exercise scene<br>(Typical selection) |
|---|---|---|---|
| **Whole program**<br>●To learn skills in PHNA to Enhance SC and to be able to identify the principles of PHN activities.<br>■Apply to each practice after this learning (Learning transfer model) | **Outline:** District C in town B, which was built and developed 40 years ago as a dormitory town of the local city A. At present, the population is declining and aging. Detached housing 170 households, population 416, aging rate 24.8%. Recently, a senior living alone died in a neighboring area with an aging rate of 34.8%. | District C<br>Detached housing estste on the hill<br>Good view<br>Steep slope<br>  | One floor: 327 ㎡<br>3 rooms<br>Main exercise space<br>Simulated community<br>  |
| **Exercise 1** (90 min)<br>●Searching refers to exploring health-related events.<br>■3 person group<br>■Experience to search the simulated community. (Empirical learning model)<br>+ Group work<br>+ Presentation<br>+ Debriefing | **Objective:** To recognize the importance of the searching skills and gain confidence in putting into practice.<br>**Goals (evaluation items):**<br>1.Needs/Potentials Identification: Visit community to detect latent health and livelihood issues as well as community strength.<br>2.Reality Visualization/ Presentation: Prepare documents and cases to visualize the community issues and strength thus detected.<br>3.Resource Exploration: Identify resources to enhance community strength and develop an information network to utilize the resources. | ●Assume the entire floor as District C, and create four key informant booths for the head of a neighborhood association, a health promotion worker, a helper and the head of the health and welfare department (acted by staff).<br>●Acting as PHNs in charge of District C, the participants travel around the district in groups of three to collect information, and to assess the challenge and direction of support for strength of community.<br>■Handouts: 1) Outline of District C and the thoughts of PHN in charge, 2) Photos and a map of the district, 3) Assessment recording sheet, 4) Debriefing recording sheet<br>■Staff materials: 1) Information provided by key informants, 2) Points of debriefing | Informant interview<br>  <br>Group work<br>  <br>Presentation<br>  |
| **Exercise 2** (90 min)<br>●Stimulating refers to energizing community members.<br>■6 person group<br>■Script acting experience, 2 types comparison. (Empirical learning model / dramatization, Critical learning model)<br>+ Group work<br>+ Presentation<br>+ Debriefing | **Objective:** To recognize the importance of the stimulating skills and gain confidence in putting into practice.<br>**Goals (evaluation items):**<br>4.Collective Responsibility Sharing: Promote dialog to build consensus for working toward positive health at the initiative of inhabitants.<br>5.Collective Voluntary Involvement: Help develop the attitude of working together toward positive health while having fun.<br>6.Initiation Assistance: Promote the participation of inhabitants in the effort toward positive health by motivating them. | ●Role-playing practice with two types of script in which re-casting required. In groups of six, the participants set the casts and play the designated roles by reading the script: (4 casts; one PHN, one head of neighborhood association, one health promotion worker, one inhabitant, and one observer/ one recorder.)<br>●A scene in which a PHN, with the support of a health promotion worker, invites inhabitants to discuss and stimulate what they can do to prevent isolated deaths in District C to take advantage of the strength of community. Two types of script with corresponding scenes to allow comparative analysis.<br>■Handouts: 1) Script with recording space,<br>2) Props: Several kinds of material for each script.<br>■Staff materials: 1) Observation recording sheet, 2) Facilitation and debriefing points. | Script acting<br>  <br>Group work<br>  <br>Recording sheet<br>  |
| **Exercise 3** (90 min)<br>●Facilitating refers to promoting the continuation of independent activities.<br>■6 person group<br>■A card game that demands Yes / No selection in a dilemma scene. (Empirical learning model/gaming)<br>+ Group work<br>+ Presentation<br>+ Debriefing | **Objective:** To recognize the importance of the facilitating skills and gain confidence in putting into practice.<br>**Goals (evaluation items):**<br>7.Player Amplification: Help inhabitants leverage their individual strengths to maintain and develop the activities.<br>8.Local Dissemination: Help inhabitants verify the results of their activities and disseminate them to the whole community.<br>9.Initiative Support: Help inhabitants develop their capacity to take the initiative and act toward positive health | ●Play a card game with five dilemmatic cases. In District C, several years have passed since the launch of a community organization to think about the livelihood of inhabitants. However, sometimes there are situations the activities become rut and disagreements.<br>●Group discussion on how to act on such cases, why they should act that way, what is the best solution, and whether there is any other alternative, etc. Share various ideas.<br>■Handouts: 1) Dilemma cards, Yes / No cards and Point cards, 2) Recording sheet.<br>■Staff materials: 1) Facilitating and debriefing points. | Playing the game<br>  <br>Debriefinf<br>  |

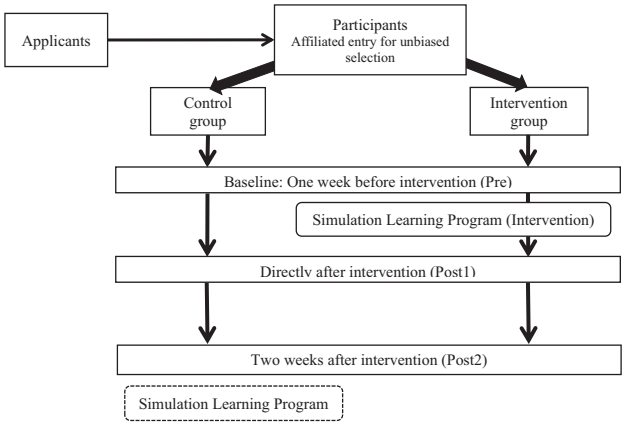



**Fig. 1.** Survey method.

participants. We then conducted self-administered questionnaire surveys at three points in time: baseline (pre), directly after intervention (post 1) and two weeks after intervention (post 2). We intervened in the intervention group one week after the baseline measurement. We provided the same program to the control group after all surveys had been completed to ensure that there was no inequity.

### 2.5. Description of the surveys

Three tools were used to measure the required outcome of the program:

- Recognition of the importance of the skill, and of confidence in applying them (hereinafter "Importance" and "Confidence," respectively). The criteria regarding the skills were determined by the study team through consultations (Table 1). The score for each of the Importance or Confidence criteria ranged from 0 to 10, with 0 indicating "Not important at all" or "Not confident at all," and 10 indicating "Very important" or "Totally confident."
- Scale for Basic Action for Public Health to assess fundamental competency for public health nursing (12 items, with a range of 0 to 60; hereinafter "BAPH"; Iwamoto et al., 2008); and Professional Development Scale for PHNs (16 items, with a range of 0 to 80; hereinafter "PDS"; Okamoto et al., 2010).

The following scale was used for the planning evaluation:

- Simulation Design Scale Japanese Version (hereinafter "SDS"; Ito et al., 2015, the original version; NLN, 2005).
  Composed of 20 items grouped into five elements: Objectives and Information (five items, with a range of 5 to 25), Support (four items, with a range of 4 to 20), Problem Solving (five items, with a range of 5 to 25), Feedback/Guided Reflection (four items, with a range of 4 to 20), and Fidelity (Realism) (two items, with a range of 2 to 8).

One tool was used for the process evaluation:

- Satisfaction with the program (hereinafter "Satisfaction", four items for the whole and each exercise; the score ranged from 0 to 10, with 0 indicating "Not satisfied at all," and 10 indicating "Very satisfied").

The existing scales adopted for the program have been widely accepted as reliable and valid.

### 2.6. Method of analysis

(1) In order to verify that no difference existed between the intervention group and the control group, we conducted a *t*-test on the years of experience as PHN and age of the participants, and a $\chi^2$ test on the affiliation of the participants.
(2) For the outcome evaluation, we calculated the changes in the mean value of each tool (Importance, Confidence, BAPH and PDS) between pre and post 1 and between pre and post 2, and compared them between the two groups (t-test). We verified internal consistency regarding the total score for the nine items for Importance and Confidence, as well as the total store for the three items for each exercise.
(3) Descriptive statistics on SDS and Satisfaction were adopted for planning and process evaluation purposes.

We used the statistics software SPSS ver. 24 for the analysis with a significance level defined as $< 0.05$.

### 2.7. Ethical considerations

The study was conducted with the approval of the Ethics Committee for Intervention Study, Osaka University Hospital (approval No. 17175, November 2017). We provided written explanations to the survey participants, including on the purpose and methods of the study, the protection of personal information, and the freedom to reject, before asking them to sign the letter of consent.

## 3. Results

### 3.1. Overview of the study participants (Table 2)

Seventy-five PHNs applied for the programs. Of those, we selected 64 who met the criteria for study participants, and received consent from all of them. Of the 64 participants, our analysis covers 33 members of the intervention group and 30 members of the control group who responded to all three surveys. The mean period of experience as PHN was 4.2 years for the intervention group and 4.1 years for the control group. In terms of affiliation, three participants of the intervention group (9.1%) belonged to a prefecture, 18 (54.5%) to a government-ordinance-designated city, nine (27.3%) to a city, and three (9.1%) to a town or village, while three participants of the control group (10.0%) belonged to a prefecture, 23 (76.7%) to a government-ordinance-designated city, three (10.0%) to a city, and one (3.3%) to a town or village. The mean age was 29.0 for the intervention group and 28.4 for the control group. No measure indicated any significant difference in demographics between the two groups ($P > .2$).

### 3.2. Outcome evaluation (Table 3)

Prior to the analysis, we calculated Cronbach's α for the total Importance and Confidence score of the 63 participants regarding the nine items in total and each of the three exercises. The coefficient turned out to be 0.92, 0.86, 0.94 and 0.94, respectively for Importance, and 0.96, 0.86, 0.95 and 0.95, respectively for Confidence. In all cases, the coefficient was sufficiently high to allow the total score to be used as a valid measure.

At the pre stage, the mean of total scores and standard deviation of Importance, Confidence, BAPH, and PDS were 77.1 ± 12.46, 33.9 ± 17.41, 30.2 ± 8.88, and 46.8 ± 12.32, respectively for the intervention group, and 78.9 ± 8.92, 36.1 ± 15.26, 30.8 ± 9.94, and 49.1 ± 11.97, respectively for the control group. Thus, no measurement tool indicated any significant difference between the two groups in terms of the total score ($P > .4$).

The change in the mean of total score and standard deviation at the post 1 stage from the pre stage was 4.9 ± 10.43 points in Importance,

**Table 2**
Overview of the study participants.

| | | | | N = 63 |
|---|---|---|---|---|
| | | Intervention group | Control group | *P* value |
| | | *n* = 33 | *n* = 30 | |
| Period of experience as PHN | Mean ± SD | 4.2 ± 2.21 | 4.1 ± 2.66 | 0.937 |
| Affiliation | *n* (%) | | | |
| Prefecture | | 3 (9.1) | 3 (10.0) | 0.214 |
| Government-ordinance-designated city | | 18 (54.5) | 23 (76.7) | |
| City | | 9 (27.3) | 3 (10.0) | |
| Town or village | | 3 (9.1) | 1 (3.3) | |
| Age | Mean ± SD | 29.0 ± 4.77 | 28.4 ± 4.64 | 0.614 |

5.2 ± 12.13 points in Confidence, 3.3 ± 6.77 points in BAPH and 3.5 ± 6.80 points in PDS for the intervention group, and − 4.7 ± 15.82 points, −1.9 ± 9.43 points, −1.1 ± 5.11 points and 0.0 ± 6.64 points, respectively for the control group, thus indicating a significant difference between the two groups regarding each of the scales ($P < .05$). However, the change at the post 2 stage from the pre stage turned out to be 2.9 ± 10.19, 6.6 ± 13.42, 2.2 ± 8.02 and 3.5 ± 8.99 points, respectively for the intervention group, and − 2.2 ± 10.85, 5.5 ± 11.16, 1.5 ± 6.43 and 1.6 ± 7.69 points for the control group, indicating no significant difference between the two groups ($P > .1$), even though the intervention group exceeded the control group in all scores.

### 3.3. Planning and process evaluation (Table 4)

All 63 study participants were included in our analysis of descriptive statistics on planning evaluation. The mean value and standard deviation of SDS among the study participants (percentage in parentheses) was, in descending order, 17.1 ± 2.05 (85.5) for Support, 16.8 ± 2.05 (84.0) for Feedback/Guided Reflection, 20.4 ± 2.30 (81.7) for Objectives and Information, 8.2 ± 1.14 (81.6) for Fidelity (Realism) and 19.4 ± 2.90 (77.6) for Problem Solving (Table 4). For all items, the mode and median values were both 4, as no one gave the value of 1 (Strongly Disagree). The mean value and standard deviation for Satisfaction was 8.0 ± 1.64 for the whole program, 7.7 ± 1.87 for Exercise 1, 8.0 ± 1.71 for Exercise 2 and 7.6 ± 2.00 for Exercise 3. The mode and mean values were 8 in all cases, with no one giving any value ranging from 0 to 2.

**Table 4**
Mean value of simulation design scale.

| | | | | | N = 63 |
|---|---|---|---|---|---|
| Item | Range | Mean | ± | SD | Mean (percentage in parentheses) |
| Support | 4–20 | 17.1 | ± | 2.05 | 85.5 |
| Feedback/Guided Reflection | 4–20 | 16.8 | ± | 2.05 | 84.0 |
| Objectives and Information | 5–25 | 20.4 | ± | 2.30 | 81.7 |
| Fidelity | 2–10 | 8.2 | ± | 1.14 | 81.6 |
| Problem Solving | 5–25 | 19.4 | ± | 2.90 | 77.6 |

## 4. Discussion

### 4.1. Profile of the study participants

Since the demographics and baseline outcome of the study participants did not show any significant difference between the two groups, we determined that a comparison was possible between the intervention group and the control group. Since the study participants had experience of five years or less on average in both groups, we made a comparison with the participants in a preceding study (Iwamoto et al., 2008) with a PHN experience of five years or less. The average total score for the whole BAPH scale in that study (22.8) was exceeded by the scores in this study: 30.2 for the intervention group and 30.8 for the control group. Likewise, the total scores for the PDS measures, 46.8 for the intervention group and 49.1 for the control group, exceeded the score of 41.2 in a previous study (Okamoto et al., 2010). It may be considered that the participants in the present survey were more keen to learn, as they participated in the programs at their own initiative. The higher total score for the BAPH and PDS measures in both groups might be attributed to this greater motivation.

### 4.2. Effectiveness of the program

The average rise in score at post 1 from baseline was significantly higher for the intervention group than for the control group, as far as Importance and Confidence are concerned. This result indicates that the intervention under the program might have been effective in improving

**Table 3**
Mean of the pre stage and the change in the score (post1-pre, post2-pre).

| | | | | | | | | | | | N = 63 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Range | Group | Pre | | | | Post1-Pre | | | | Post2-Pre | | | |
| | | | Mean | ± | SD | *P* value | Mean | ± | SD | *P* value | Mean | ± | SD | *P* value |
| Importance | 0–90 | Intervention | 77.1 | ± | 12.46 | 0.515 | 4.9 | ± | 10.43 | 0.006 | 2.9 | ± | 10.19 | 0.057 |
| | | Control | 78.9 | ± | 8.92 | | −4.7 | ± | 15.82 | | −2.2 | ± | 10.85 | |
| Confidence | 0–90 | Intervention | 33.9 | ± | 17.41 | 0.604 | 5.2 | ± | 12.13 | 0.012 | 6.6 | ± | 13.42 | 0.718 |
| | | Control | 36.1 | ± | 15.26 | | −1.9 | ± | 9.43 | | 5.5 | ± | 11.16 | |
| BAPH | 0–60 | Intervention | 30.2 | ± | 8.88 | 0.826 | 3.3 | ± | 6.77 | 0.005 | 2.2 | ± | 8.02 | 0.701 |
| | | Control | 30.8 | ± | 9.94 | | −1.1 | ± | 5.11 | | 1.5 | ± | 6.43 | |
| PDS | 0–80 | Intervention | 46.8 | ± | 12.32 | 0.448 | 3.5 | ± | 6.80 | 0.042 | 3.5 | ± | 8.99 | 0.370 |
| | | Control | 49.1 | ± | 11.97 | | 0.0 | ± | 6.64 | | 1.6 | ± | 7.69 | |

the skills for enhancing SC, the primary objective of the study. Apparently, this was because the learning models used in each exercise were suited for the learning of the skills concerned. In particular, the empirical learning model, adopted in all exercises, is used for learning activities to obtain implicit knowledge and skills, such as “empirical knowledge” and “case knowledge,” and is designed to extract unique insight from one's own experience, rather than memorizing knowledge in a passive manner (Orii, 2016). The present program was intended to learn from exercises based on narrative cases for the skills built on “empirical knowledge” and “case knowledge,” as well as universally applicable academic knowledge. Also, debriefing in a simulation exercise is reported to improve the effectiveness of simulation learning (Dufrene and Young, 2014). For this reason, our program included group discussions, sharing of the findings, and oral reviews by facilitators. The significant difference in the change of score between the pre stage and the post 1 stage might be explained by those factors.

Likewise, the average change in score between pre and post 1 was also significant for BAPH and PDS. The result indicates that the present program can be effective in verifying and improving the capacity to implement the principles of PHN activities, including the equality of health and well-being among inhabitants, as well as other competencies including intention, attitude, mindset and behavioral pattern, to establish and develop the professionalism of PHNs.

In contrast, no significant difference was observed between the two groups in the average change of the total score from pre to post 2. With regard to individual scales, the score of the intervention group exceeded that of the control group in Importance, Confidence, BAPH and PDS. Dale (1961) showed in his Cone of Experience that 90% of what is learned through the dramatization or simulation of experience is retained for two weeks. In support of his hypothesis, our result indicates that the effectiveness of intervention under the present program was actually retained for two weeks. It has also been argued, however, that a single intervention does not ensure improvement in knowledge or adherence (Jansson et al., 2016). Since PHNs learn from practical experience (Matsushita et al., 2012), we consider that it is necessary to continuously improve the skills learned in the program through self-practice, if the participants are to acquire and upgrade the skills to enhance SC.

### *4.3. Relevance of program planning*

The average score for all five SDS measures exceeded 75%, with the Satisfaction score exceeding 7 in all four items. It may thus be considered that the whole program, as well as individual exercises, was suited to the situations and learning needs of the participants. Since simulation with higher fidelity is said to increase the satisfaction of participants (Baptista et al., 2016), the substantial Satisfaction felt by the participants in our study implies a high fidelity of the simulation program, developed from narrative cases actually experienced by PHNs.

Overall, the result indicates that the planning of the program met the learning needs of the participants and thus was relevant.

## 5. Practical implications and future challenges

We consider that we succeeded in developing a new learning method applicable to the mastering of the skills, because the program was found to raise awareness of the importance of and confidence in the skills to enhance SC, and verify the capacity to implement the principles of public health nursing. That the program was shown to be effective for PHNs with practical experience of 10 years or less indicates its applicability to induction training for PHNs. The results support the previous studies that medium-fidelity simulations are effective for novice learners (Lubbers and Rossman, 2017). Since the effect of learning was found to be maintained after two weeks, it may be possible for the participants to improve their skills through repetitive learning by applying to their own PHN activities the skills learned in the program regarding assessment and engagement with inhabitants. Furthermore, the one-day program, integrating multiple learning theories, might be applicable to exercises in basic education.

However, the insufficient time for each exercise, without enough time for debriefing, is one of the limits of this study. In many cases, simulation learning is said to require a longer time for debriefing than for actual simulation exercises (Dufrene and Young, 2014). In contrast, the present program allocated more time to the simulation exercises than the debriefing, suggesting that the reviewing may have been insufficient. According to Levett-Jones et al.'s systematic review (2012), debriefing is effective not only for improving technical skills but also for non-technical skills such as situational awareness. It was considered that debriefing was also important for improving the skills targeted by the program. Further consideration needs to be given to time allocation in introducing the program to in-service or basic education. Also, the criteria used for evaluating the main outcome were developed by the study team, solely based on internal consistency as far as reliability is concerned. Going forward, it will be necessary to develop tools for more granular measurement of the skills to enhance SC. To disseminate the skills thus learned, we will need to examine the possibility of developing books and web-based e-learning materials for more substantive learning of the skills, as well as programs covering a wider range of support skills required and applicable areas.

## 6. Conclusion

As the program was found to be effective in upgrading the nine skills of less-experienced PHNs to enhance SC, we need to explore its applicability to in-service and basic education. The originality of this study lies in developing, implementing, and verifying the effectiveness of a simulation program based on narrative cases in three different types of exercise. Although the program aimed to improve the nine skills to enhance SC, the development of a similar program applying the three types of simulation methods for other skills required of PHNs would help upgrade their skills. To that end, we must collect information on quality PHN activities as a source of narrative cases, and accumulate basic studies to transform the practical knowledge into program materials as evidence.

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## Ethical approval

The study was conducted with the approval of the Ethics Committee for Intervention Study, Osaka University Hospital (approval No. 17175, 13 November 2017).

## Declaration of competing interest

All authors have declared no conflicts of interest associated with this research.

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