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A Study of the Educational Needs of Clinical Nurses Based on the Experiences in Training Programs for Nursing COVID-19 Patients

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ABSTRACT (ENGLISH)

SummaryPurpose

This study aimed to explore the experience of clinical nurses regarding training programs for critically ill patients with coronavirus disease 2019 (COVID-19) and their educational needs.

Methods

Qualitative data were analyzed using content analysis, and quantitative data were analyzed according to Borich's formula. Data for the study were collected in March 2021 from 16 nurses who had completed a nursing program for critically ill patients with COVID-19 and were working at three hospitals designated for COVID-19.

Results

Participants' experiences were classified into three major categories, namely “Participation experiences and perceptions of the training program,” “Recommendations for improving the training program,” and “Perceptions of working in an infectious environment,” and 10 subcategories. According to Borich's formula, the most pressing educational needs in respiratory and non-respiratory nursing, respectively, were for “nursing care for patients on extracorporeal membrane oxygenation” and “application of continuous renal replacement therapy and caring for patients.”

Conclusion

To prepare for the periodic emergence of communicable infectious diseases throughout the world and cultivate nursing staff to care for critically ill patients, it is necessary to develop nursing education programs with content corresponding to nurses' needs. This study can be used as base data for cultivating nursing staff for critically ill patients with communicable infectious diseases in keeping with clinical nurses’ educational needs and basic educational materials for nursing students.

Trial registration

CRIS, KCT0006359. Registered 20 July 2021 - Retrospectively registered, https://cris.nih.go.kr/cris/

FULL TEXT

Introduction

Coronavirus disease 2019 (COVID-19) is a viral disease that was first reported in Wuhan, Hubei Province, China. On December 1, 2019, the World Health Organization [1] declared COVID-19 a pandemic, prompting countries around the globe to respond to their respective national emergencies; however, the number of confirmed cases has been continuously rising, and the emergence of new and more dangerous COVID-19 variants worldwide is a growing concern. The clinical manifestations of COVID-19 vary from being asymptomatic to having fever, cough, shortness of breath, diarrhea, and many other symptoms. The symptoms are mild in the initial stage, can progress to severe symptoms, and may lead to death [2,3]. COVID-19 is particularly deadly in the case of elderly,

immunocompromized, and comorbid patients, and in some cases, advanced interventions such as extracorporeal membrane oxygenation (ECMO) and mechanical ventilation are required [4]. Therefore, it is necessary to increase the number of healthcare personnel who can manage critically ill COVID-19-related patients [2,3].

The Korean government has designated national hospitals and built more intensive care units (ICUs) to manage critically ill COVID-19-related patients [4,5]. To supply nursing staff for their care, the government has deployed trainees who have completed relevant training courses [6]. However, cultivating nursing staff for critically ill COVID-19-related patients is time consuming, and in-depth educational programs are needed, specifically training programs suited to the novel circumstances including medical personnel movement management, cleaning wards, and wearing protective equipment. Hence, the supply of nurses who can care for critically ill COVID-19-related patients is inadequate [5]. Critically ill COVID-19-related patients should be provided with special nursing care from the basic level of personal hygiene to life-saving treatment for 24 hours [7]; at this point in time, nursing personnel who can provide nursing care for severe COVID-19-related cases are integral.

Since caring for critically ill patients is difficult for nurses experiencing it for the first time, several problems, such as maladjustment and low self-confidence, may arise [8,9]. These may affect the quality of nursing care provided to critically ill patients and lead to excessive work-related stress, as well as increased turnover rates for nurses [10]. A study conducted by the Ministry of Health and Welfare involving experienced nurses caring for COVID-19 patients in Korea reported that nurses viewed themselves as lacking knowledge about COVID-19 patients and that they felt pressured and overwhelmed in response to the demand to provide nursing care for critically ill patients without sufficient nursing experience regarding patients with respiratory communicable infectious diseases, leading to an increase in emotional and psychological stress [11]. The uncertainty that characterizes infectious diseases increases healthcare professionals' stress, anxiety, and depression [12] and decreases sleep quality [13]. In such circumstances, if a sufficient number of nursing staff is secured through systematic educational programs related to the care of critically ill patients with respiratory communicable infectious diseases, healthcare personnel can comply with the regulations for controlling viral spread with regard to infected patients through training involving wearing personal protective equipment (PPE) and nursing practice simulation [14], and they can perform all medical procedures calmly because of the reduced pressure, which may decrease the risk of additional infections. Given these results, it is necessary to address in depth the content of educational programs aimed at training nurses to care for critically ill patients by obtaining sufficient knowledge about COVID-19 and the skills required for managing it.

Nurses' practical education requirement becomes evident when they need to perform nursing practice on a professional level, feel insufficient or face difficulty in nursing, or want to improve their expertize by obtaining up-to-date knowledge and skills [15]. Considering that respiratory infectious diseases, such as Middle East respiratory syndrome (MERS) followed by COVID-19, occur repeatedly, it is important to identify nurses' educational needs to prepare nursing staff to care for critically ill patients.

Therefore, this study explores two aspects of educational needs. First, we will explore subjects' participation experiences with education for nursing critically ill COVID-19-related patients with respiratory infectious diseases based on the study question "What nursing education characteristics and content are required to adequately prepare for nursing critically ill patients?" Second, we confirm the participants' objective educational needs. On this basis, we aim to use the results as base data to improve clinical nurses' competency in nursing critically ill COVID-19-related patients and identify strategies that meet the social requirements of nursing personnel who care for critically ill patients.

Methods Study design

This study used mixed methods research design [16], combining focus group interviews (FGIs) as the qualitative element and a survey as the quantitative element. The qualitative results reflecting the participants' experiences in the existing training programs were supplemented with a quantitative study to identify the participants' objective educational needs.

Study participants

Eighteen study participants were recruited from among nurses who completed a training program for critically ill

patients with COVID-19 who were working at three hospitals designated for COVID-19 in Gyeonggi Province. Two people were excluded from the study because they withdrew due to the side effects of COVID-19 vaccination; thus, 16 people participated in the study. Six participants belonged to A hospital, six to B, and four to C, and FGIs were conducted with them at their respective hospitals. They all received training at government-designated teaching hospitals from September 2020 to February 2021, after which they returned to their hospital where they currently care for confirmed cases of COVID-19. Perspectives on the proper number of focus group participants differ in the literature. This study adopted the opinion [17] that the desirable number is six to ten participants per group. Given practical considerations related to group dynamics and participants' high interference tendency, there were at least three participants per group.

Data collection

Data were collected from March 4 to March 11, 2021. A list of COVID-19-designated hospitals located in Gyeonggi Province was obtained to gather participants, and participant recruitment advertisements were posted on three hospitals' online bulletin boards after obtaining approval from the respective heads of department among those hospitals implementing education programs for critically ill patients with COVID-19. Participants who saw the advertisements and voluntarily expressed their interest in participating in the study were selected, and FGIs were scheduled in advance according to the participants' availability. Considering the risk of COVID-19 infection, three FGIs were conducted using Zoom video conferencing. Each group meeting lasted approximately one hour. FGIs were led by a researcher with extensive FGI and qualitative research interview experience, and other researchers participated as assistant facilitators. Before the interviews, consent to study participation was reconfirmed, and interview guidance was provided. By voluntary agreement, interviews were recorded and transcribed. Group interviews were conducted until content saturation was reached, and it was determined that no new content could be derived through the team meetings. Researchers developed a guide to general interview questions to maintain the flow of the interview in keeping with the clarified purpose. Related ad-hoc interview questions were also used. The main guiding questions were as follows:

- Please describe your experience of participating in the nurse training program for critically ill patients with communicable infectious diseases.
- What did you like about participating in the nurse training program for critically ill patients with communicable infectious diseases?
- What did you dislike about participating in the nurse training program for critically ill patients with communicable infectious diseases?
- What changes did you notice after participating in the nurse training program for critically ill patients with communicable infectious diseases?

At the end of the FGIs, the participants completed a 10–15-minute questionnaire aimed at investigating general characteristics and educational needs related to critically ill patients with communicable infectious diseases. The questionnaire consisted of 16 items about nursing critically ill patients with respiratory diseases, 20 items about nursing critically ill patients with non-respiratory diseases, and six items about infection control. There were 42 items based on guidelines and books about the management of critically ill patients, and a survey was conducted on effective learning methods for each item [7, 18–20].

Data analysis

The qualitative data collected were analyzed using inductive content analysis, following Elo and Kyngas' suggestions [21]. The inductive method is useful when data from previous studies on research phenomena are insufficient or knowledge about phenomena is segmented. The interviews revealed the participants' experiences of

nursing education programs aimed at shaping dedicated personnel to care for critically ill patients with COVID-19. This study aimed to identify and categorize common factors to generalize their experiences. Based on content analysis, words and phrases were chosen as the unit of analysis in the preparation phase. Following the stages of open coding, category formation, and abstraction in the organizing phase, the specific data analysis procedure was as follows: First, transcribed data were read several times to grasp the fundamental content and flow of the interview as a whole; second, the transcript was read and marked up to arrange repeated words and phrases in order to extract codes; third, researchers examined the arranged codes together and categorized them through grouping and comparison according to the characteristics; fourth, the categorized content was confirmed and repeatedly perused and re-classified to grasp the meaning and relevance; and fifth, through deduction of abstract categories reflecting the key categorized interview content and the relevance, a description of a phenomenon in keeping with the purpose of the study was derived. Regarding the rigor of the study, following Lincoln and Guba [22], credibility was established directly with the participants by confirming the meanings derived from the transcribed conversations, and validity was verified through transcripts indicating that our participants had clearly recounted their experiences. Neutrality was ensured through meetings among the researchers to avoid biases and personal judgements; these meetings were held in consultation with a qualitative researcher. In addition to the FGIs, 16 participants were surveyed about their educational needs in nursing programs related to dedicated critical care. Questionnaires were analyzed as follows. Regarding the subjects' general characteristics, frequencies, percentages, and standard deviations were verified. The educational needs related to nursing patients with respiratory infectious diseases were analyzed using the Wilcoxon signed rank test and Borich's formula. According to Borich [23], educational needs can be deduced through a discrepancy analysis of current and desired levels. In this study, using Borich's formula for needs, after subtracting the subject's performative self-confidence from the importance of each item, the difference was multiplied by each item's average importance and then divided by the total number of cases to calculate the needs. Based on this value, the larger the needs coefficient, the higher the demand priority.

Ethics approval and consent to participate

The institutional review board reviewed and approved the study (IRB approval no.). Informed consent was obtained from all the subjects involved in the study. Written informed consent was obtained from the patients for publication of this article.

Results Study participants' general characteristics

All study subjects were women (100.0%), and their mean age was 31.94 ± 6.21. Regarding marital status, there were five (31.3%) married women and 11 (68.8%) unmarried women. Regarding education, three (18.8%) had an associate's degree and 13 (81.3%) had a bachelor's degree. Regarding work, one nurse (6.3%) was working in an emergency room (ER), six nurses worked in an ICU (37.5%), and nine (56.3%) worked in a COVID-19 ward. The total duration of clinical experiences was 8.90 ± 6.21 years, and the duration of experience in the current department was 1.09 ± 1.27 years. The sources of COVID-19-related information were the hospital website's homepage (6 nurses, 37.5%), the Korea Disease Control and Prevention Agency (5 nurses, 31.3%), mass media (2 nurses, 12.5%), and the Internet (7 nurses, 43.8%) (Table 1).

Content analysis for focus group interviews

Participants' experiences regarding nursing programs aimed at shaping dedicated critical care nurses were classified into three major categories and ten subcategories (Table 2).

Category 1. Participation experiences and perceptions of the training program

This category concerns the overall structure and characteristics of training as well as post-training changes in participants.

Disorganized program arrangement in early stage

Due to the onset of the COVID-19 pandemic in early 2020, the nursing personnel shortage was highlighted, and a nursing program aimed at shaping dedicated critical care nurses commenced as an improvement measure at the national level. However, during the initial training period, there were some problems, including indecision regarding the ratio of theoretical education to practical training in the education plan, preceptors' lack of experience with the relevant content, and the absence of a practical training protocol. During the first round of training, practical training was provided exclusively for 4 weeks. This was changed to 1 week of theoretical instruction and 3 weeks of practical training. This was further modified to an even split, consisting of 2 weeks of theoretical instruction and 2 weeks of practical training, and it is this arrangement that has been implemented so far. The nursing staff of tertiary hospital ICUs were deployed in great numbers to COVID-19 nursing departments. As a result, many new personnel were assigned to the ICUs where this study's participants practiced, and the absence of an education protocol made it difficult to administer the program. Many participants expressed their dissatisfaction with practical training and thought that it would be more effective to increase the amount of theoretical instruction. Although the training included scenario-based simulation practice, it seems that the preparation offered was insufficient for the participants to effectively apply the content of the program.*First, there was a lot of trial and error. Those who first participated in the training had clinical practice almost exclusively, and I joined for the second session on clinical practice and theory together. The time dedicated to theory was absolutely adequate, but as for clinical practice, we only observed, and the preceptors were not well prepared, so it was not that helpful. It seems that they had not quite decided what to teach and what to practice.* (1-1).*There were many new nurses. The preceptors were busy teaching them, so there was no one for us to ask* …(1-2).*(For simulation practices), I understand that the intention was for us to practice, like in the actual situation, wearing protective clothing. However, the situation was not clearly set, and it was disorganized. I wish that it had been better organized*. (3-1).

Progressing to systematic arrangement of the training program

Although programs varied by educational institutions, the training program gradually became more organized through trial and error over successive rounds. Nurse educators and doctors delivered theoretical lecturers, and critical care content was included. The theoretical portion of the program gave participants opportunities to practice what they learned through lectures and on site. Participants could familiarize with content by assessing and operating devices first-hand. Participants also received one-on-one training with a preceptor according to their duty roster, and the preceptors made efforts to thoroughly educate participants with the aid of a checklist.*For the first 2 weeks, we had theoretical sessions, and during the following 2 weeks of practice sessions, the preceptor explained how to operate a ventilator, even though I did not get to do it myself and shared various patient cases. I think I understood to some degree.* (2-1).*During 2 weeks of theoretical sessions, we attended a lecture in the hall in the morning and went to the site in the afternoon, where a nurse educator re-explained what we learned in the morning and let us practice it ourselves. As a preceptor taught us for the remaining two weeks, it was very systematic.* (2-2).

Inadequate hands-on clinical practice

Since the participants did not belong to the institutions (hospitals) where the clinical practice sessions were held, they could not perform nursing care directly, and practice was mainly through observation. Moreover, despite the program's aim of cultivating dedicated critical care nurses for COVID-19, the participants expressed dissatisfaction regarding limited opportunities to practice nursing patients with COVID-19. Although they acknowledged that direct contact with COVID-19 patients would entail an infection risk and the need for intensive care, they noted that such contact would be necessary to meaningfully experience the operation of a COVID-19 ward.*It was not helpful*

because I only observed during practice. It was more valuable, and I learned a lot from the ICU where I was first assigned after I returned to the hospital after training. (2-3).*I was assigned to the SICU [surgical intensive care unit], where there were many neurosurgical patients. In fact, patients with COVID-19 have many respiratory problems, but I only cared for neurosurgical patients for 2 weeks. I could provide critical care, but I could not practice the important aspects of caring for patients with COVID-19.* (2-4).

Perceived self-efficacy in critical care after training

Medical equipment such as continuous renal replacement therapy (CRRT) and ECMO were new to nurses without ICU experience; however, training improved their understanding of how to use the equipment, as they were able to practice setting up and preparing it in person, as well as observe how to apply it to various patients. This was also a good opportunity to clarify medications with which they were previously unfamiliar. Consequently, overall nursing competency for critical care improved, including assessment of the nervous system, in addition to the respiratory system. Participants became more communicative with their colleagues as a result, and the quality of patient care improved, leading to increased self-confidence in nursing.*I was unfamiliar with ventilators, but learning about them and operating one by myself during training helped me a gain a clear understanding of how to use them. I was roughly aware of what would happen based on theoretical knowledge" if applicable, but I gained a clearer understanding of what the figures mean when operating the CRRT.* (1-3).*I have worked only in the ward in the hospital, so I did not provide actual care for patients. However, after training, I [now] know how to look after the patients.* (2-5).*I am less fearful than before, and I have a little more self-confidence. My fear of machines dissipated a lot, and now I can interpret their output. In that respect, I think I have changed significantly.* (3-2).

Motivation by nurses with expertize

Participants were motivated by expert nurses, the program educators' expertize and passion, the teamwork spirit between medical staff in emergency situations, and the nurse preceptors' management of material resources in preparation for emergency situations. They reflected on their nursing practice so far and attempted to apply what they had learned after returning to their workplaces.*The nurse educators really looked like professionals, and even though I have been working in the clinical field for a long time, I thought I still had so much to improve [on], so I felt ashamed of myself. I was a lot more motivated.* (1-1).*She was very experienced [from working] at another hospital. After perusing my experience, she skipped content that would have been redundant and explained the theory first, about procedure, with which I was unfamiliar and then, I got the chance to practice it after she gave me a demonstration of how to do it. She is so impressive because she actively taught me in this way.* (3-2).*In the practice session, there was a nurse who was really good at organizing and cleaning up. She organized everything in the ward for use in emergency situations. So, now I am also organizing staff in my ward.* (1-3).

Category 2. Recommendations for improving the training program

The second category concerns participants' post-training opinions regarding the need to improve future training, as well as trainees' perceptions of the actual situation as soon-to-be critical care nurses.

Inclusion of specific institutional practice

Participants were disinterested in medical equipment and practices that had not yet been established at their workplace. In cases where some participants' home institutions were equipped with some of them, product type varied; hence, there was an adjustment period. Participants therefore demanded customized training to reflect their work environment. On the other hand, since the education program was administered by an external institution, there were problems such as having to practice in the pediatric intensive care unit (PICU) even though some participants did not have pediatric intensive patients at their institution. Therefore, regarding education delivery methods, it was suggested that it would be more efficient if nurse educators could visit the institution where the

trainees belong and provide content tailored to their respective work environments, rather than having trainees visit a site other than their institution. In addition, participants also said that when they received training at another institution, it was difficult to care for critically ill patients immediately after returning to their own, and sufficient time should be provided for them to adjust to a preceptor.*My hospital is not equipped with CRRT or ECMO yet, so even though I have learned about these, there is nowhere to apply it. That's a shame. Now, I am aware of it only theoretically. If that equipment is introduced in my hospital later, I think I [will] need to learn to use them from scratch again.* (2-1).*In the practice session, some of us were assigned to the PICU. It is very rare to see pediatric patients in my hospital. We just practiced for no reason because there is almost no opportunity to apply such knowledge after returning.* (2-2).*Because the systems are completely different between the hospital where I received training and the one where I am working, it seems like it would take far more than a month or two to apply what I learned in training in the field. However, as I cannot receive training forever, I think that after practicing in the external institution for about a month as I am doing now, I will need time to adapt to the field again. After grasping the bigger concept, I think we should focus on the finer details after returning*. (2-2).

More hands-on practice and simulation training

Given that critically ill patients' status changes frequently and rapidly, it was found that the current mainly observation-based 4-week theoretical and practical training program was limited in terms of its ability to enhance participants' adaptability and coping skills in the field. Despite their theoretical understanding after training, many participants doubted whether they had acquired the actual practical skills to care for critically ill patients. In addition, the need for simulation training was mentioned as a means to increase the program content's practical applicability. *If participants in training receive content that is applicable in practice, then nurses will know how to take care of critically ill patients. We need to be trained on how to cope with situations according to the test results and the status of patients*. (1-4).*We know the alphabet from A to Z, but it is difficult to speak in English. I know how to turn the machines on and off, but I think it takes more time and effort to apply such things and cope with unexpected situations.* (3-3).*Currently, nursing students' simulation training involves a demonstration with a simulator. It will be helpful for us to repeat such practice and apply it to different situations.* (1-2).

Inclusion criteria for trainee selection

Trainees either participated in training voluntarily or upon recommendation from a manager at their workplace, such as a head nurse. Institutions recommended personnel for training based on their ICU work experience and the trajectory of their nursing career. Voluntary participants felt the need to acquire additional knowledge and more advanced methods when their hospital was designated for patients with COVID-19. Post-training, participants could cope well with emergency situations. They also created ripple effects by educating other nurses when they returned to work. Such personnel should have sufficient (5–10 years or more) experience in nursing practice and be motivated to receive training.*Since the hospital where the practice sessions are held is large and well organized, it would be good if nurses with about five years of nursing experience or those with an intermediate position or higher receive training and can teach junior nurses what they learned upon return.* (2-2).*Motivation seems to be the most important factor. Nurses with no interest have nothing to gain despite [the] opportunities [they are] given, but it will be a good opportunity for motivated nurses to learn a lot if the hospital provides the opportunities.* (3-2).

Category 3. Perceptions of working in an infectious environment

The third category concerns perceptions of caring for critically ill patients that should be considered when developing future training program content.

Anxiety and fear about the work

Participants received training during the relevant period, but even thereafter, they were still not accustomed to caring

for critically ill patients and feared mishandling situations due to the inability to predict changes in patients' condition. *I received training, but I will be under a lot of pressure to save patients' lives under conditions to which I am not fully accustomed. I am anxious about communication, such as knowing what exactly to do as a nurse in charge, giving instructions to acting nurses, and reporting to doctors.* (1-1).*I have no idea when the patient's condition changes. Because I am not good at coping with such situations, I feel anxious in that sense. This is not anxiety about caring for patients. This may be because I am not good at dealing with rapidly changing situations.* (3-4).

Burden of wearing personal protective equipment

Nurses caring for critically ill patients with COVID-19 must wear PPE. However, participants had difficulty working while wearing PPE because the equipment acted as a major physical obstacle. On the other hand, anticipating emergency cases in which there is inadequate time to put on PPE, they expressed their views about ethical dilemmas related to PPE.*I cannot hear well in PPE. During emergencies, I need to move quickly. So, I am afraid that because I [could] mistakenly hear a doctor's prescription, I may give [a patient] an incorrect drug or do something wrong, causing harm to a patient.* (1-2).*Of course, I am afraid of performing cardiopulmonary resuscitation in general, but in the case of COVID-19, we need to do it in Level D PPE. Therefore, it is inevitable that we get slower at doing everything. Because communication is not easy and movement, for example, to get something is slowed down, we need more staff. It is difficult, even for experienced people. Therefore, it will be especially difficult for inexperienced nurses.* (2-2).*When emergencies occur, we run. However, in that situation, if we go there without wearing PPE, we cannot protect ourselves, and if we put on PPE, it takes more than 10 minutes. However, as you know, timing is very important. I am really concerned about what I should do in a situation like that.* (1-3).

Analysis of educational needs using Borich's formula

The results of the analysis of the subjects' educational needs for critical care are presented in [Table 3]. Regarding the subjects' educational needs for respiratory nursing, for all items except application of the prone position (p = .069), the importance and level of the subjects' self-confidence in their current performance showed a statistically significant difference (p = .05). Within the framework of Borich's needs, five items were identified; in descending order, starting with the most urgent, these were: nursing care for patients on ECMO, understanding ECMO, nursing care for patients on artificial ventilators, understanding artificial ventilation, and Aspergillus co-infection. Regarding the educational needs for non-respiratory nursing, for all items except nutrition management (p = .166), the importance and level of subjects' self-confidence in their current performance showed a statistically significant difference (p = .05). Within the framework of Borich's needs, the following five items were the most urgently needed: application of CRRT and nursing care for such patients, understanding CRRT, understanding electrocardiogram (ECG), understanding diagnostic testing for acute coronary syndrome and its treatment, and physical assessment of the circulatory system. Regarding educational needs for infection control, a statistically significant difference (p = .05) was found in the importance and level of current performative self-confidence for the following items: understanding respiratory infectious diseases (p = .001), application of PPE to various nursing situations (p = .012), and aerosol-generating procedures (p = .003), except for the disposal of infectious waste (p = .096), disinfection of medical devices and quarantined patients' hospital rooms (p = .166), and post-mortem patient care (p = .193). In addition, based on Borich's needs, the following items were, in descending order, the most urgently needed: erosol-generating procedures, understanding respiratory infectious diseases, and application of PPE to various nursing situations. The results for the trainees' learning methods are shown in [Table 4].

Discussion

This study aims to explore participation experiences with COVID-19 training program and clinical nurses' educational needs on this area. The findings have a few implications.

First, based on the FGIs, regarding their training experience, the participants thought that the critical care nursing program was initially poorly organized but noted that this improved over time. Moreover, there were educational infrastructural shortcomings, even at the hospitals where the training was conducted, because of the voluminous increase in the number of critically ill patients due to COVID-19 and a shortage of critical care nurses. Accordingly, the participants did not view the early-stage programs as effective. However, with successive training sessions and progressive systematization, the participants eventually expressed satisfaction with the content. A study [9] on nursing experiences with patients with confirmed COVID-19 diagnoses involving Iranian nurses emphasized the importance of supplying trained nursing personnel prepared to cope with pandemic situations. This study also highlighted the importance of systematic education programs and manpower supply-and-demand planning to prepare for medical crizes. In addition, in this study, it was necessary for the participants to practice providing nursing care for patients with confirmed COVID-19 diagnoses; however, the risk of infection and efforts toward strict infection control made it difficult to proceed with such practice. Nevertheless, the ability to cope with various situations involving respiratory infectious diseases is essential for dedicated nursing personnel responsible for caring for critically ill patients with respiratory diseases, unlike other communicable infectious diseases. Therefore, to overcome such situations, it will be necessary to develop diverse simulation training programs using high-fidelity simulation or virtual reality so that trainees can practice providing critical care for confirmed COVID-19 cases in the program setting.

Second, the content of the FGIs conducted as part of this study showed that pre-training, the participants feared caring for confirmed COVID-19 patients, but their fear declined after training, and their competency as dedicated nurses for critically ill patients improved. They were also found to be stimulated by expert nurses. A study conducted in China [24] on nurses caring for confirmed COVID-19 patients reported that nurses without prior experience caring for patients with infectious diseases or critically ill patients feared performance of such nursing care and experienced stress as a result. A study [11] conducted in Korea involving nurses experienced with caring for confirmed COVID-19 patients also reported psychological pressure among the nurses because they were assigned to critical care with insufficient experience caring for infected patients. Similarly, the participants in this study also expressed feelings of fear before training and a decline in self-confidence. However, the study results showed that nursing education for critically ill patients improved the subjects' self-confidence in terms of nursing assessment, drug administration, and use of medical equipment. This indicates that nursing programs for critically ill patients with infectious diseases are an effective method to enhance nursing competency for critical care and the quality of nursing care.

Third, the content of the FGIs conducted in this study revealed the need for customized education to suit participants' clinical settings, education that increases practical applicability, and proper trainee selection. In particular, participants suggested that it would be more effective if nurse educators could visit the institutions where the trainees work and provide education tailored to their respective working environments, rather than having participants attend external institutions for training. As previously mentioned, the Korean government has designated hospitals for COVID-19 and established more ICUs [5], as well as rapidly launching educational programs to secure dedicated nursing personnel to care for critically ill patients [6]. However, it is thought that there is a limit to increasing the supply of dedicated nursing staff for critical care at each hospital through the current critical care nursing programs because every hospital's system and settings are different, and critically ill patient care requires the use of various medical equipment. In addition, there was a demand for simulation of the required educational content. Given that simulation education improves clinical performance and knowledge more than conventional educational methods, the scope of nursing education for students is expanding [25,26]. However, hospitals face challenges acquiring expensive simulation facilities and equipment, and scenario development, training for

educators, and operation and management also present difficulties [20]. Therefore, regarding training programs for nursing critically ill patients with communicable infectious diseases, it is necessary to share and develop simulation equipment to deliver training practice and content through systematic connections between hospitals and schools in the long term. Government support will be needed to establish a simulation center for healthcare personnel through school–work links.

Fourth, the nurses reported that because they were unaccustomed to caring for critically ill patients and could not predict the situations in which they would be placed, they feared providing such care. Previous studies [8,9] have reported that healthcare personnel described caring for confirmed COVID-19 patients as more difficult and stressful than caring for other patients. This study also showed that caring for critically ill patients with infectious diseases is intense and highly stressful, although the subjects received related training. However, a previous study [24] on nurses working in isolation wards revealed a case in which nurses who had worked in another ward were assigned to the isolation ward, indicating that it intensive cases for the acquisition of infection control, self-protection, and communication skills for self-improvement would be helpful as a turning point in career development. In conclusion, nurses are professionals with a sense of duty and a drive for self-improvement. Therefore, if systematic education programs can be provided to regularly and adequately meet subjects' needs amid a national crisis, the burden of nursing care for critically ill patients may lighten, and even when pandemic infectious diseases occur in the future, there will be a sufficient supply of critical care nurses.

Fifth, in this study, the subjects' educational needs for critical care were analyzed using Borich's formula. The results showed that demand was the highest for ECMO and mechanical ventilation among the educational needs for respiratory nursing, while for non-respiratory nursing, there was high demand for CRRT and ECG application. This corresponds to the results of a study [20] in which educational needs were investigated in ICU nurses through analysis of the importance of nursing practice, performance frequency, and level of difficulty. In that study, the subjects' most urgent educational needs were related to high-risk equipment such as ECMO, ventricular assistance devices, artificial pacemakers, and intra-aortic balloon pumps.

To provide such education, educational institutions should be equipped with medical devices at the relevant hospitals, and these devices should be readily available. Since long-term education and experience with a diverse cross-section patients are necessary, the government and nursing educators should contemplate appropriate educational programs. In terms of infection control, the most pressing needs were erosol-generating procedures, understanding respiratory infectious diseases, and situational PPE application. Therefore, it is necessary to organize educational programs that reflect these results. In the case of patients with respiratory infectious diseases in particular, there are various issues, including situational PPE application. Clinical nurses face many challenges in nursing practice. Amid the current COVID-19 pandemic crisis, it will be necessary to standardize guidelines for nursing patients with respiratory infectious diseases across several countries through collaborative efforts, instead of using standardized nursing guidelines limited to one nation. In addition, because this study's subjects wanted training regarding the use of high-risk equipment, training should be delivered mostly as practice or based on high-fidelity simulation or virtual reality, necessitating collaborative efforts to develop appropriate programs.

This mixed-methods study's significance lies in its in-depth investigation of nurses' educational needs for nursing critically ill patients. We have made suggestions based on the results obtained. First, it can be seen that a nursing education program for critically ill patients with infectious diseases is an effective means to enhance nurses' critical care capacity and improve the quality of nursing care. Therefore, various educational programs have been established, and research to verify their effectiveness is suggested. Second, the participants highlighted the merits of educational nurses receiving national-centered education followed by education tailored to their home institution's

specific working environment. Therefore, it is necessary to build a network to nurture nursing education, specifically supporting tailored education at individual hospitals. Third, content that it is difficult to deliver in the nursing education program for patients with infectious diseases needs to be developed as part of a simulation education program.

The limitations of this study are as follows. It is common to calculate the number of samples based on the t-test for the Borish education need assessment equation. In the case of embedded design among mixed methods research, embedded data plays a secondary role and be supplemental to the primary dataset. As a mixed method study was conducted with same 16 nurses, calculation for the minimum sample size, validation of the reliability and validity of the newly developed tool were omitted in this study. In addition, this study involved nurses at government-designated COVID-19 hospitals, it is necessary to also identify the educational needs of nurses who care for confirmed COVID-19 patients in the wider clinical field. Repeated future studies on educational needs should therefore be conducted by expanding the subjects to include various types of hospitals.

Conclusion

Changes in the medical industry due to COVID-19 demand changes in, including the expansion of, nurses' roles, an increase in the quality of nursing care, and a high level of knowledge and skills. Such demands emphasize the need to acquire new knowledge and skills for critical care. A number of participants in this study saw the need for critical care education and noted that training improved critical care nursing competency. Therefore, it is necessary to develop educational programs for nursing critically ill patients to meet learners' needs, enhance the educational effect of nursing programs for critical care, and supply healthcare personnel to satisfy social needs.

Ethical consideration

The institutional review board reviewed and approved the study (GWNUIRB-2021-12).

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Consent for publication

Not applicable.

Availability of data and materials

The data presented in this study are available on request from the corresponding author.

Conflict of interest

The authors have no competing interests to declare.

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	Gender	Age (year)	Marital Status	Education level	work department	Total clinical career (year)
1	Women	34	Single	Bachelor degree	COVID-19 ward	7.02
2	Women	37	Married	Bachelor degree	COVID-19 ward	16.00

3	Women	48	Married	Bachelor degree	COVID-19 ward	25.00
4	Women	34	Single	Bachelor degree	COVID-19 ward	10.00
5	Women	30	Single	Associate degree	ICU	8.00
6	Women	36	Married	Bachelor degree	ICU	13.10
7	Women	35	Married	Associate degree	COVID-19 ward	14.00
8	Women	27	Single	Bachelor degree	COVID-19 ward	3.10
9	Women	27	Single	Bachelor degree	ER	5.00
10	Women	28	Single	Bachelor degree	COVID-19 ward	4.03
11	Women	27	Single	Associate degree	COVID-19 ward	3.00
12	Women	26	Single	Bachelor degree	ICU	5.00
13	Women	29	Single	Bachelor degree	ICU	7.00
14	Women	40	Married	Bachelor degree	ICU	15.00
15	Women	26	Single	Bachelor degree	ICU	3.00
16	Women	27	Single	Bachelor degree	COVID-19 ward	4.09

Category	Subcategory

Participation experiences and perceptions of the training program	Disorganized program arrangement in early stage
Progressing to systematic arrangement of the training program	Inadequate hands-on clinical practice Perceived self-efficacy in critical care after training Motivation by nurses with expertize
Recommendations for improving the training program	Inclusion of specific institutional practice
More hands-on practice and simulation training	Inclusion criteria for trainee selection
Perceptions of working in an infectious environment	Anxiety and fear about the work

Content	Importance M±SD	Confidence M±SD	z	p	Borich score	Borich priority
Respiratory nursing						
Anatomy and physiology of the respiratory system	4.31 ±0.80	3.44 ±0.51	3.27	.001	3.77	13
Physical assessment of the respiratory system	4.31 ±1.01	3.44 ±0.51	2.56	.010	3.77	13
Oxygen therapy (including high-flow oxygen therapy)	4.63 ±0.71	3.88 ±0.61	2.26	.023	3.47	16
Nursing care for the patient with dyspnea	4.69 ±0.79	3.81 ±0.65	2.95	.003	4.10	11
Nursing care of patients on intubation	4.50 ±1.03	3.63 ±0.71	2.37	.017	3.94	12
Understanding a mechanical ventilator	4.75 ±0.57	3.25 ±0.57	3.38	.001	7.13	4
Nursing care of patients on mechanical ventilators	4.75 ±0.68	3.19 ±0.75	3.47	.001	7.42	3
Nursing care of a patients on extubation	4.50 ±0.89	3.31 ±0.79	2.55	.011	5.34	8

Application of the prone positioning	4.00 ±1.26	3.13 ±1.02	1.81	.069	3.50	15
Tracheostomy management	4.31 ±0.87	3.06 ±0.77	2.98	.003	5.39	7
Understanding of a diagnostic test for pneumonitis and its treatment	4.44 ±0.72	3.38 ±0.61	2.98	.003	4.71	10
Understanding of a diagnostic test for ARDS and its treatment	4.38 ±1.08	3.13 ±0.61	2.83	.005	5.47	6
Understanding of Aspergillus co-infections	4.38 ±0.88	2.94 ±0.68	3.23	.001	6.29	5
Understanding of ECMO	4.25 ±1.06	2.44 ±1.15	2.70	.007	7.70	2
Nursing care for patient on ECMO	4.25 ±0.93	2.00 ±0.81	3.24	.001	9.56	1
Understanding of ABGA and acid-base imbalance	4.69 ±0.62	3.56 ±0.62	3.28	.001	5.27	9
Non-respiratory nursing						
Anatomy and physiology of the circulatory system	4.38 ±0.80	3.19 ±0.65	3.09	.002	5.47	7
Physical assessment of the circulatory system	4.44 ±0.89	3.19 ±0.65	3.33	.001	5.82	5
Understanding of ECG	4.50 ±0.81	3.00 ±0.63	3.21	.001	6.75	3
Defibrillator application	4.63 ±0.71	3.50 ±0.89	3.16	.002	5.49	6
Understanding of a diagnostic test for acute coronary syndrome and its treatment	4.38 ±0.88	2.94 ±0.85	3.13	.002	6.29	4
Understanding of CPR	4.50 ±0.96	3.38 ±0.80	3.08	.002	5.34	8
Nursing care of patients with shock	4.44 ±1.03	3.31 ±0.70	2.33	.019	5.27	9

Anatomy and physiology of the digestive system	4.31 ±.060	3.56 ±0.62	2.65	.008	3.50	15
Physical assessment of the digestive system	4.25 ±0.68	3.38 ±0.71	2.81	.005	3.98	14
Understanding of a diagnostic test for digestive system diseases and its treatment	4.13 ±0.88	3.44 ±0.51	2.11	.035	3.09	17
Nutrition management	4.06 ±1.06	3.69 ±0.60	2.38	.166	1.78	20
Anatomy and physiology of the kidney system	4.19 ±0.91	3.13 ±0.71	3.32	.001	4.71	11
Physical assessment of the kidney system	4.13 ±1.08	3.06 ±0.77	2.50	.012	4.64	12
Understanding of CRRT	4.31 ±1.08	2.69 ±0.87	2.83	.005	7.55	2
CRRT application and nursing care	4.38 ±1.07	2.31 ±0.70	3.23	.001	9.30	1
Thrombosis prevention	4.13 ±1.08	3.06 ±0.85	2.47	.013	4.38	13
Anatomy and physiology of the nervous system	4.25 ±0.93	3.13 ±0.71	3.16	.002	5.05	10
Physical and consciousness assessment of the nervous system	4.19 ±1.04	3.44 ±0.72	2.19	.028	3.40	16
Nursing care for stroke patient	4.13 ±1.20	3.44 ±0.72	1.96	.049	3.09	17
Nursing care for delirium patient	4.06 ±1.23	3.38 ±0.71	2.65	.008	2.79	19
Infection control						
Understanding of respiratory infectious diseases	4.69 ±0.60	3.81 ±0.65	3.35	.001	4.10	2
Application of PEE in each nursing situation	4.63 ±0.80	3.75 ±0.68	2.50	.012	4.05	3

Aerosol-generating procedures (AGPs)	4.44 ±0.89	3.31 ±1.01	2.02	.003	4.99	1
Disposal of infectious waste	4.38 ±0.80	4.06 ±0.44	1.66	.096	1.37	6
Disinfection of medical devices and hospital rooms of quarantined patients	4.44 ±0.89	4.13 ±0.34	1.38	.166	1.39	5
Nursing care of a patient after death	4.19 ±1.10	3.81 ±0.75	1.30	.193	1.57	4

Content	Lecture N (%)	Lecture + practice N (%)	HFS N (%)	VR N (%)	Others N (%)
Respiratory Nursing					
Anatomy and physiology of the respiratory system	12 (75.0)	1 (6.3)	1 (6.3)	2 (12.5)	0 (0.0)
Physical assessment of the respiratory system	6 (37.5)	2 (12.5)	6 (37.5)	1 (6.3)	1 (6.3)
Oxygen therapy (including high-flow oxygen therapy)	6 (37.5)	3 (18.8)	5 (31.3)	2 (12.5)	0 (0.0)
Nursing care for the patient with dyspnea	6 (37.5)	1 (6.3)	3 (18.8)	6 (37.5)	0 (0.0)
Nursing care of patients on intubation	3 (18.8)	2 (12.5)	8 (50.0)	3 (18.8)	0 (0.0)
Understanding a mechanical ventilator	8 (50.0)	3 (13.8)	1 (6.3)	4 (25.0)	0 (0.0)
Nursing care of patients on mechanical ventilators	5 (31.3)	2 (12.5)	4 (25.0)	5 (31.3)	0 (0.0)
Nursing care of a patients on extubation	5 (31.3)	3 (13.8)	5 (31.3)	3 (13.8)	0 (0.0)
Application of the prone positioning	3 (13.8)	2 (12.5)	8 (50.0)	3 (13.8)	0 (0.0)

Tracheostomy management	3 (13.8)	2 (12.5)	9 (56.3)	1 (6.3)	0 (0.0)
Understanding of a diagnostic test for pneumonitis and its treatment	14 (87.5)	1 (6.3)	1 (6.3)	0 (0.0)	0 (0.0)
Understanding of a diagnostic test for ARDS and its treatment	14 (87.5)	1 (6.3)	1 (6.3)	0 (0.0)	0 (0.0)
Understanding of Aspergillus co-infections	13 (81.3)	1 (6.3)	1 (6.3)	1 (6.3)	0 (0.0)
Understanding of ECMO	9 (56.3)	3 (13.8)	1 (6.3)	3 (13.8)	0 (0.0)
Nursing care for patient on ECMO	2 (12.5)	5 (31.3)	4 (25.0)	5 (31.3)	0 (0.0)
Understanding of ABGA and acid-base imbalance	12 (75.0)	0 (0.0)	2 (12.5)	2 (12.5)	0 (0.0)
Non-Respiratory Nursing					
Anatomy and physiology of the circulatory system	14 (87.5)	1 (6.3)	1 (6.3)	0 (0.0)	0 (0.0)
Physical assessment of the circulatory system	8 (50.0)	1 (6.3)	6 (37.5)	0 (0.0)	1 (6.3)
Understanding of ECG	8 (50.0)	2 (12.5)	3 (13.8)	3 (13.8)	0 (0.0)
Defibrillator application	0 (0.0)	7 (43.8)	7 (43.8)	2 (12.5)	0 (0.0)
Understanding of a diagnostic test for acute coronary syndrome and its treatment	10 (62.5)	1 (6.3)	2 (12.5)	3 (13.8)	0 (0.0)
Understanding of CPR	1 (6.3)	3 (13.8)	7 (43.8)	5 (31.3)	0 (0.0)
Nursing care of patients with shock	9 (56.3)	1 (6.3)	2 (12.5)	4 (25.0)	0 (0.0)
Anatomy and physiology of the digestive system	13 (81.3)	0 (0.0)	2 (12.5)	1 (6.3)	0 (0.0)

Physical assessment of the digestive system	10 (62.5)	2 (12.5)	2 (12.5)	1 (6.3)	1 (6.3)
Understanding of a diagnostic test for digestive system diseases and its treatment	14 (87.5)	0 (0.0)	2 (12.5)	0 (0.0)	0 (0.0)
Nutrition management	13 (81.3)	2 (12.5)	1 (6.3)	0 (0.0)	0 (0.0)
Anatomy and physiology of the kidney system	14 (87.5)	1 (6.3)	1 (6.3)	0 (0.0)	0 (0.0)
Physical assessment of the kidney system	10 (62.5)	1 (6.3)	3 (13.8)	1 (6.3)	1 (6.3)
Understanding of CRRT	10 (62.5)	3 (13.8)	2 (12.5)	1 (6.3)	0 (0.0)
CRRT application and nursing care	0 (0.0)	7 (43.8)	4 (25.0)	5 (31.3)	0 (0.0)
Thrombosis prevention	14 (87.5)	0 (0.0)	2 (12.5)	0 (0.0)	0 (0.0)
Anatomy and physiology of the nervous system	14 (87.5)	0 (0.0)	2 (12.5)	0 (0.0)	0 (0.0)
Physical and consciousness assessment of the nervous system	7 (43.8)	2 (12.5)	5 (31.3)	1 (6.3)	1 (6.3)
Nursing care for stroke patient	10 (62.5)	1 (6.3)	3 (13.8)	2 (12.5)	0 (0.0)
Nursing care for delirium patient	12 (75.0)	1 (6.3)	1 (6.3)	2 (12.5)	0 (0.0)
Infection control					
Understanding of respiratory infectious diseases	14 (87.5)	1 (6.3)	1 (6.3)	0 (0.0)	0 (0.0)
Application of PEE in each nursing situation	11 (68.8)	1 (6.3)	2 (12.5)	2 (12.5)	0 (0.0)
Aerosol-generating procedures (AGPs)	11 (68.8)	1 (6.3)	2 (12.5)	2 (12.5)	0 (0.0)

Disposal of infectious waste	13 (81.3)	1 (6.3)	1 (6.3)	1 (6.3)	0 (0.0)
Disinfection of medical devices and hospital rooms of quarantined patients	13 (81.3)	1 (6.3)	1 (6.3)	0 (0.0)	1 (6.3)
Nursing care of a patient after death	9 (56.3)	0 (0.0)	5 (31.3)	2 (12.5)	0 (0.0)

DETAILS

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Cross-cultural adaptation and validation of a Chinese Preventive Health Model instrument for measuring the psychosocial factors in hepatocellular carcinoma screening among patients with hepatitis B

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ABSTRACT (ENGLISH)

SummaryPurpose

Screening for hepatocellular carcinoma (HCC) as an effective instrument to reduce the burden of late diagnoses remains underutilized in China, much of the Asian countries, and in a sense all over the world. Modifiable psychosocial factors should be identified to improve screening utilization and reduce the burden of late diagnoses. However, valid psychosocial measures are unavailable. This study aimed to translate, culturally adapt, and validate the preventive health model (PHM) instrument for measuring psychosocial factors of HCC screening among patients with hepatitis B.

Methods

This study was conducted from June 2020 to April 2021 in three rigorous phases: (1) committee-based translation from English to Chinese; (2) cognitive interviews (n = 33) and Delphi expert consultations (n = 7) for cultural adaptation; and (3) a cross-sectional study (n = 305) for validation.

Results

In phase I, two items were reworded, and two retranslated for semantic equivalence. In phase II, issues related to comprehension, sensitive wording, wording clarity, question relevance, and cultural sensitivity were addressed by including pictures, rewording five items, and developing seven items. In phase III, exploratory and confirmatory factor analyses suggested a five-factor 20-item solution: it explained 76.9% of the variance; had adequate factor loading (.60–.91), convergent and discriminant validity; satisfactory model fit indices; and reliability (Cronbach's α, .86−.91). Known-group analysis showed that patients with optimal HCC screening behavior had significantly higher scores on each subscale than those not having such.

Conclusion

The Chinese PHM instrument is culturally sensitive, reliable, and valid to measure the psychosocial factors of HCC screening. It can help nurses and researchers to tailor strategies to improve clinical HCC screening practices in high-risk HCC regions.

FULL TEXT

DETAILS

Subject:	Patients; Behavior; Validity; Quantitative psychology; Mortality; Prevention; Adaptation; Committees; Liver cancer; Colorectal cancer; Medical screening; Psychological aspects; Bilingualism; Interviews; Cognition &reasoning; Hepatitis B; Hepatitis
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Working Conditions and Fatigue in Japanese Shift Work Nurses: A Cross-sectional Survey

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ABSTRACT (ENGLISH)

SummaryPurpose

This study aimed to identify the working conditions (working hours, overtime work, number of night shifts, number of holidays, and work intervals) associated with fatigue, based on the shift patterns, and determine their thresholds.

Methods

From January to February 2020, a web-based questionnaire was sent to 4601 shift work nurses at 47 hospitals in Japan. The multivariate logistic analysis was conducted to predict high- and low-fatigue groups by working conditions, and receiver operating characteristic analysis was performed to clarify the high-fatigue thresholds by shift pattern.

Results

A total of 386 shift work nurses participated in this study. The threshold (fatigue was 3.0 or higher) of the two-shift rotation was 9 hours 50 minutes for daily working hours during day shifts (Odds ratio [OR] = 1.57, $p < .01$), 17 hours 15 minutes for daily working hours during night shifts (OR = 1.20, $p < .01$), and 8.0 days for the number of night shifts (OR = 1.09, $p = .02$). The threshold of the three-shift rotation was 9 hours 45 minutes (OR = 1.59, $p < .01$), 2.9 days for the number of midnight shifts (OR = 1.53, $p < .01$), and 2.0 times for the interval between day-shift and night-shifts within 12 hours (OR = 1.39, $p < .01$).

Conclusion
Working hours and the number of night shifts are important for two-shift rotation, and working hours for the assignment of midnight shift are important for three-shift rotations. Nurse managers should manage shifts according to nurses' shift patterns.

FULL TEXT

Introduction

Fatigue is defined as a condition in which individuals experience a decreased ability to perform activities at the desired level due to mental and/or physical lassitude or exhaustion [1,2]. Fatigue in nurses has a negative impact on them and patient care. According to prior research, fatigue in nurses is related to their performance [3,4], wellness [5], care outcomes related to nurses' satisfaction [6,7], health [8,9], quality of care [10], and patient safety [11,12]. Moreover, long-term fatigue leads to severe physical and mental health problems [2]. Shift work disrupts circadian rhythms and leads to fatigue [13]. Therefore, the prevention of fatigue is important for both health care of the nurses and sustaining high-quality care.

There have been many reports on working conditions that induce fatigue in shift-work nurses. Recent reviews by Gifkins et al. [14] and Min et al. [15] identified shift work arrangement (consecutive and night shifts), length of shifts, overtime, rotating shifts, quick returns, high work demands, and the number of night or evening shifts as work conditions that cause fatigue. It has also been reported that night shifts are associated with sleepiness and that counterclockwise shift rotation lowers sleep quality [16,17]. In other words, working hours per shift, overtime, the number of night shifts, inadequate recovery period, and counterclockwise shift rotation are important factors of fatigue among shift nurses.

Meanwhile, the results of previous studies on the length of shifts are not consistent. Generally, longer working hours are associated with higher fatigue levels [14,15], but there have also been reports of lower fatigue in 12-hour shifts than in 8-hour shifts [17]. A review of studies of Japanese nurses found that the length of working hours was associated with fatigue, but that two-shift workers who worked 16-hour night shifts reported less fatigue than three-shift workers [18]. Thus, the findings on the length of working hours are not consistent. This is because the number of hours worked in each shift varies across countries (e.g. 12 hours in European countries, 8 and 16 hours in Japan) [19–21]. Furthermore, if the number of hours worked per month is held constant, the length of each shift is a trade-off between the number of hours worked and the number of days off or intervals between work [20]. That is, each element of work conditions depends on the rotation type and is interrelated. In addition, factors such as quick return and counterclockwise shift rotation are more characteristic of three-shift rotation than of two-shift rotation [22–24]. Recovery from fatigue requires sufficient holidays, but the factors causing fatigue and their corresponding effects may differ between nurses who work without sufficient holidays and those who are given sufficient holidays. Therefore, the work conditions that lead to fatigue may differ depending on the rotation pattern and the number of holidays. In addition, the threshold values of these factors are unknown.

The Japan Nursing Association has published guidelines for shift work nurses in Japan [25]. The guidelines provide recommendations on appropriate working hours, the number of night shifts per month, and enough holidays, but due to insufficient nurse staffing, it is difficult to implement all of these recommendations. Nonetheless, nurse managers must assign adequate shift work to nurses to protect their health and ensure stable and high-quality care. For more specific and efficient work environment management, evidence for accurate reference points (thresholds) that link shift work to fatigue, which in turn affects nurses' physical and mental health, is needed. Therefore, the purpose of this study was to identify the working conditions (i.e., working hours, overtime work, number of night shifts, and number of holidays) associated with fatigue, based on the shift patterns (two or three rotations) and the number of holidays (more or less groups), and determine the threshold of the associated working conditions.

Methods Study design

This study is a cross-sectional study.

Survey setting and period

To conduct the logistic analysis accurately, the sample size needs to be ten times more than the events [26]. Since we presumed that five independent variables were to be entered this time, at least 50 samples were required. However, to reflect nationwide work conditions and fatigue and minimize sampling bias (e.g., location, bed size, and hospital function), we requested more target hospitals to participate in this study.

Through convenience sampling, 11 hospitals consented to participate; however, due to the bias related to bed size and region, additional hospitals were randomly selected from the list of hospitals nationwide. Using random sampling to include staff nurses working in hospitals of various bed sizes, we categorized the target hospitals as follows: under 99 beds, 100–199 beds, 200–299 beds, 300–399 beds, and over 400 beds. To avoid bias related to the number of nurses included in each bed size category, extractions and requests were repeated until the number of documents distributed in each bed size category reached 1000 shift work nurses. We sent the informed consent documents to the nurse administrators at the selected 338 hospitals, of which, 47 hospitals were ultimately included in this study, as they provided consent. The login information (explanation documents, URL, and QR code for login) for the online survey was distributed to participants via the nurse administrators of these hospitals, and the participants logged in at their discretion and answered the web-based anonymous self-report questionnaire. The survey was conducted from January to February 2020.

Participants

The participants to whom the questionnaires were distributed were 4601 nurses working in the target hospital. The inclusion criteria were full-time or part-time nurses who worked in shifts. The exclusion criteria were nursing managers, schedulers, and newcomers within 6 months.

Measurements Fatigue

Fatigue was assessed by the Brief Job Stress Questionnaire developed by Shimomitsu et al. [27]. It comprehensively measures workplace stressors and stress reactions, and is widely used to conveniently measure job stress among Japanese workers including nurses, because of its use being recommended by the Ministry of Health, Labor and Welfare [28]. In this study, we used the “fatigue” subscale. It comprises three items, assessed on a 4-point Likert scale ranging from 1 = ‘*almost never*’ to 4 = ‘*almost always*’ Item examples include ‘I am very tired,’ ‘I feel exhausted,’ and ‘I feel languid.’ The reliability and validity of the overall scale and its subscales were previously verified by Shimomitsu et al. [27]. The average score of this scale is expressed as a value between 1.0 and 4.0. Those with an average score of 3 or more always perceive at least two items as high fatigue, which suggests that they are in a state of fatigue on a daily basis. The manual for this scale recommends that 3.0 or 4.0 be judged as having a stress reaction as a simple measure of stress response [27]. Therefore, in this study, 3.0 was set as a cutoff and used to divide participants with either high or low fatigue categories. The Cronbach's α of this subscale was 0.912 in this study.

Work conditions

To measure daily working hours, participants were asked their daily start and end time for each shift pattern (day, night, evening, and midnight shifts)—an example of the item regarding this is ‘*At what time did you start/end [day shift] in the past month?*’ In addition to measuring daily overtime working hours, we asked for the start and end times set by their facilities for each shift pattern—an example of an item regarding this is ‘*According to the rules of your hospital, what time does the shift [day shift] have to start/end?*’. In this study, the difference between daily working hours and working hours set by their facilities was considered daily overtime work.

To confirm the number of days of night shifts (including evening and midnight shifts) and holidays (including a day off and requested rest days) per month, participants were asked the number of days of night shifts and holidays in their latest schedule—an example of the item regarding this is ‘*How many days have you been assigned [day shift] in the past month?*’. In Japan, in the two-shift rotation, the night shift is generally from approximately 17:00 to 9:00 the following morning. However, in the three-shift rotation, the evening shift is from 16:00 to 0:00, and the night shift is from 0:00 to 8:00. In other words, the night shift of the two-shift rotation is equivalent to two days when converted to the three-shift rotation. Therefore, for the two-shift rotation, one night shift was counted as two days. We converted them into days per 30 days since the schedule span was different for each participant. A short interval

between work hours hinders recovery from fatigue and leads to a stress response. According to the Japan nursing association's guidelines [25], for two-shift rotations, it is recommended to have an interval of 24 hours or more after the night shift, and for three-shift rotations, it is recommended to have an interval of 12 hours or more for inter-working intervals. Therefore, we asked the number of times of inter-working intervals in the latest schedule that were less than 24 hours for the two-shift rotation or 12 hours for the three-shift rotation—an example of an item regarding this is '*How many quick returns have you experienced within 24/12 hours in the past month?*'
Additionally, we asked participants to provide their age, sex, nursing experience (years), and marital status as demographic characteristics.

Statistical analysis

We calculated descriptive statistics to verify the relationship between work conditions and fatigue. The bivariate logistic analysis was conducted with each work condition variable as the independent variable and the fatigue group (high or low) as the dependent variable. The multivariate logistic regression analysis (stepwise method) was performed to identify the work conditions associated with high-level fatigue in each rotation type (two- or three-shift rotation) and the number of holidays (fewer than 10 holidays per month and 10 or more holidays per month; this is because Japanese nurses are assigned approximately 10 holidays per month [21]). At each step of the analysis, socio-demographic variables (age, sex, and marital status) and work conditions were entered. Variables entered in the two-shift rotation model included daily working hours per day shift, daily working hours per night shift, daily overtime work per day and night shift, number of night shifts and holidays per month, and interval between workdays within 24 hours. Variables entered in the three-shift rotation model included daily working hours during the day, evening, and midnight shifts, daily overtime work during day, evening, and midnight shifts, number of evening and midnight shifts holidays per month, and interval between workdays within 12 hours (evening shift to day shift, and day shift to midnight shift). The variables entered in less than 10 holidays model and 10 or more holidays model included daily working hours during day and night shifts, daily overtime work per day and night shift, and number of night shifts and holidays per month. In the stepwise method, the inclusion criteria were p p > 0.1. After that, to determine the threshold of the working conditions associated with high fatigue, predictive probabilities were calculated for each variable. The points with maximum sensitivity and specificity were searched by a receiver operating characteristics (ROC) analysis for each rotation type or the number of holidays. Missing data were excluded from all analyses.

Ethical considerations

The questionnaire was completed anonymously. Participants were provided with documents that explained the ethical considerations of this survey, and they were informed that participation was voluntary, and nonparticipation would not cause them any disadvantages. After reading the documents, if participants agreed to complete the survey, they logged in to the survey screen on the web and checked a box at the top of the questionnaire to confirm their consent. Those who did not agree were not shown the survey screen and were not asked to respond. This study was approved by the Research Ethics Committee of the Graduate School of Medicine, the University of Tokyo (No. 2019142NI).

Results Participants' characteristics

Table 1 shows participant characteristics. Of the 4601 shift work nurses, 640 logged onto the website for the survey. After excluding those who declined to participate or were managers or schedulers (74 people), 566 nurses were included. Finally, after excluding newcomers (e.g., recently arrived nurses or nurses transferred within six months) and surveys with missing data (180 surveys), the data of 386 nurses were analyzed (Figure 1).
The average age of participants was 36.5 years and approximately 90% were female. The average number of years of nursing experience was 13.1. There were 58, 66, 89, 86, and 87 nurses for under 99 (15.1%), 100–199 (17.1%), 200–299 (23.1%), 300–399 (22.3%), and 400 beds (22.5%), respectively. Approximately half of all the participants were in the high-fatigue group, and the proportion was high in the three-shift rotation group. The start and end times of each shift varied according to the rules of their hospital, but the mode of two-shift rotation was 8:30 (63.2%) for the start time and 17:00 (30.5%) for the end time of the day shift. The mode of the night shift was 16:30 (39.9%) at

the start time and 9:00 (29.8%) at the end time. The mode of the three-shift rotation is 8:30 (98.5%) for the start time of the day shift, 17:15 (64.6%) for the end time, and 16:30 (80.0%) for the start time of the evening shift. The end time was 1:00 (55.4%), the start time of the midnight shift was 0:30 (75.4%), and the end time was 9:15 (43.1%). Daily working hours during day shifts were 9 hours 53 minutes for the two-shift rotation and 9 hours 40 minutes for the three-shift rotation. Daily working hours during the night shifts of the two-shift rotation were 17 hours 08 minutes, and that of the evening and midnight shifts for the three-shift rotation were approximately 9 hours 30 minutes. Overtime hours were approximately one hour for each working shift for both shift rotations. The average number of days of night shifts per 30-day period was 8.5, with two-shift rotations slightly higher. The average number of days of holidays per month was 10.3.

Multivariate logistic analysis

The results of the multivariate logistic analysis have been presented in Table 2. In all models, the variance inflation factor for all variables was less than 2.0; thus, there was no problem of multicollinearity. Variables associated with high fatigue were selected via the inclusion and exclusion criteria for a stepwise method. The controls and socio-demographic variables were excluded from all models.

For the two-shift rotation, daily working hours during day shifts, daily working hours during night shifts, and the number of days of night shifts were significantly associated with high fatigue (OR = 1.57, *p* p p = .02, respectively). For the three-shift rotation, daily working hours during midnight shifts, number of days of midnight shifts, and the interval between workdays within 12 hours (day shift to midnight shift) were significantly associated with high fatigue (OR = 1.59, *p* p p

For the group with fewer than 10 days of holidays per month, daily working hours during day shifts, daily working hours during night shifts, and the number of days of night shifts were significantly associated with high fatigue (OR = 1.41, *p* p p p p

ROC analysis

The ROC analysis was performed for variables that were significant in the logistic regression analysis; the results have been presented in Table 3.

The thresholds of daily working hours for day shifts, daily working hours for night shifts, and the number of night shifts for two-shift rotations were 9 hours 50 minutes, 17 hours 15 minutes, and 8.0 days, respectively. The thresholds of daily working hours for midnight shifts, number of midnight shifts, and the interval between workdays within 12 hours (day shift to midnight shift) for three-shift rotations were 9 hours 45 minutes, 2.9 days, and 2.0 days, respectively.

For the group with less than 10 holidays per month, the daily working hours for day shifts, daily working hours for night shifts, and the number of night shifts were 9 hours 20 minutes, 17 hours, and 8.0 days, respectively. For the group with 10 or more days of holidays per month, the daily working hours during day shifts and daily working hours during night shifts were 9 hours 10 minutes and 17 hours 50 minutes, respectively.

Discussion

Approximately 83.0% of the participants in this study had a two-shift rotation, and their daily working hours were 9 hours 52 minutes during day shifts and 17 hours 08 minutes during night shifts. In a European survey, 12-hour rotations were common [19]; however, in a two-shift rotation, which is mainly used in Japan, day shifts are shorter and night shifts are longer than European countries. Moreover, half of the study samples experienced high fatigue, and the ratio was high in the three-shift rotation group. In three-shift rotations, circadian rhythms are easily disturbed by evening shifts and midnight shifts, and recovery time is often required [13]; thus, this may be a type of shift work in which fatigue tends to accumulate despite the short working hours of the night shift.

This study revealed that the work conditions that are associated with high fatigue differ depending on the rotation pattern. A review article [14,15] showed that overtime and night shifts lead to fatigue. However, our study provides further insight as it identified the different factors that differ based on the shift patterns and influence fatigue in shift work nurses. In addition, our findings provided the threshold for each important work condition.

In the two-shift rotation, the number of night shifts per month and total working hours in the day and night shifts were significantly associated with high fatigue. Although some reports indicate that nurses who work two-shift rotation

shifts are more likely to recover from fatigue [29], the results of this study were consistent with the inferences of review articles [14,15], and indicated that long working hours could cause fatigue and health problems in nurses. In addition, the findings of this study imply that, in the two-shift rotation, day shifts should not exceed 9 hours and 50 minutes and night shifts should not exceed 17 hours and 15 minutes to prevent fatigue. Long day shifts to compensate for night shift hours—for example, 12-hour day shifts—might be inappropriate. Nursing organizations should adopt shift patterns other than the traditional day and night shifts to avoid long working hours. Additionally, nurse managers should monitor the total working hours rather than overtime hours and restrain nurses' night shift to no more than eight per month to prevent fatigue.

In three-shift rotation, the working hours and number of night shifts for midnight shifts were associated with high fatigue. This finding suggests that working hours and frequency of shifts—especially for midnight shifts—are important factors for consideration in three-shift rotations. A three-shift rotation consists of a diverse combination of three patterns: day, evening, and midnight, which is more likely to disrupt nurses' internal rhythm [13]. Working long hours at midnight, when they should be resting, and working frequent midnight shifts can easily cause fatigue, which in turn also affects their recovery. In addition, the number of short intervals from day shift to midnight shift being associated with high fatigue is the characteristic of three-shift rotations. Night shift and quick return negatively affect the circadian rhythm and subsequent recovery from fatigue [29–32], and day shift to midnight shift work involves a counterclockwise shift rotation, which does not follow circadian rhythms [33]. Quick returns from day shift to midnight should be more tightly restricted. Nurse managers in departments with three-shift rotations should pay particular attention to the working hours and frequency of midnight shifts and provide sufficient rest periods before and after midnight shifts to avoid fatigue among nurses.

For both groups with few and many holidays, daily working hours during day and night shifts were associated with fatigue. However, in the group with many holidays, there was no association between the number of days of night shifts and fatigue, but in the group with few holidays, this association was found. Furthermore, daily working hours during night shifts for the group with few holidays were shorter than those for the group with many holidays. It is important that nurses with fewer holidays manage their time by working shorter hours and fewer night shifts. Alternatively, it should be to secure enough personnel for everyone to take a holiday of 10 days or more a month.

Limitations

This study had some limitations. First, in the ROC analysis' results, both the area under the curve (AUC) and discrimination performance were low. The items related to work conditions are single items created for this study and were collected using a self-report questionnaire. Therefore, their reliability and validity are not verified. Real working hours data (e.g., time clock data) should be used to improve the results' accuracy. Second, a multivariate analysis for the other organizational factors was not conducted in this study. Therefore, the results did not consider the effects of other confounding factors associated with fatigue. Other organizational factors (e.g., quantitative/qualitative workload, job control, social support, and leadership) have been shown to influence stress responses, including fatigue. Future research may need to consider these factors. Third, the response rate was low and there were a lot of missing data. This may be because there were many items, many nurses dropped out, and the survey was conducted during the year-end and New Year holidays, which are busy periods.

Conclusion

Our study clarified the relationship between work conditions and fatigue and presented the thresholds for each work condition related to fatigue in shift work nurses. For two-shift rotations, long working hours on both day and night shifts were associated with high fatigue. For three-shift rotations, daily working hours during midnight shifts, the number of days of midnight shifts, and quick returns from day shift to midnight were associated with high fatigue. Additionally, our study identified the difference in threshold between the group with few holidays and the group with many holidays. The results of our study provide specific reference points in labor management when assigning shifts on different wards and when adjusting nursing staff schedules.

Our study showed that each shift rotation pattern has different working conditions necessary to avoid fatigue. In addition, their thresholds were identified. Based on our findings, nurse managers should mainly pay attention to total

working hours in two-shift rotations, protect the health of shift work nurses. In three-shift rotations, they should mainly consider the working hours, frequency, and assignment of midnight shifts. In addition, being aware of these factors and thresholds related to nurses' work life for each shift pattern can help them manage and avoid fatigue.

Author contributions

Study design: Ryohei Kida, Yukie Takemura, Data collection: Ryohei Kida, Yukie Takemura, Data analysis: Ryohei Kida, Manuscript writing: Ryohei Kida, Yukie Takemura.

Conflict of interest

There are no conflicts of interest to declare.

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	Two-shift rotation (n = 321)		Three-shift rotation (n = 65)	
Mean or n	SD or %	Mean or n	SD or %	Age
35.67	10.07	40.35	9.41	Gender
				Women
285	88.8	56	86.2	Men
36	11.2	9	13.8	Nursing experience (years)
12.35	9.45	16.60	9.04	Marital status
				Unmarried
168	52.3	23	35.4	Married
134	41.7	35	53.8	Other

19	5.9	7	10.8	Number of beds at unit
40.99	12.20	40.60	11.70	Fatigue
				Low
178	55.5	26	40	High

	Odds ratio	95% CI	P value
Two-shift rotation			
Daily working hours (per shift)			
Day shift	1.57	1.21–2.04	<.01
Night shift	1.20	1.01–1.40	<.01
Number of night shifts (days per month)	1.09	1.00–1.18	.02
Three-shift rotation			
Daily working hours (per shift)			
Midnight shift	1.59	1.03–2.16	<.01
Number of night shifts (days per month)			
Midnight shift	1.53	1.28–1.78	<.01
Interval between workdays (per month)			
Day shift and midnight shift within 12 hours	1.39	1.05–1.72	<.01
Less than 10 holidays per month			
Daily working hours (per shift)			

Day shift	1.41	1.16–1.72	<.01
Night shift[a]	1.21	1.09–1.47	<.01
Number of day night shifts (per month)[b]	1.11	1.09–1.23	<.01
10 or more holidays per month			
Daily working hours (per shift)			
Day shift	1.49	1.05–2.10	<.01
Night shift[a]	1.25	1.03–1.51	<.01

	AUC	Threshold
Two-shift rotation		
Daily working hours (per shift)		
Day shift	0.63	09:50
Night shift	0.63	17:15
Number of night shifts (days per month)	0.65	8.00
Three-shift rotation		
Daily working hours (per shift)		
Midnight shift	0.60	9:45
Number of night shifts (days per month)		
Midnight shift	0.64	2.90
Interval between workdays (per month)		
Day shift and midnight shift within 12 hours	0.62	2.00
Less than 10 holidays per month		

Daily working hours (per shift)		
Day shift	0.62	09:20
Night shift[a]	0.59	17:00
Number of day night shifts (per month)[b]	0.64	8.00
10 or more holidays per month		
Daily working hours (per shift)		
Day shift	0.63	09:10
Night shift[a]	0.66	17:50

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Effects of a Sociodrama-based Communication Enhancement Program on Mothers of Children with Neurodevelopmental Disorders: A Pilot Study

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ABSTRACT (ENGLISH)

SummaryPurpose

The incidence and prevalence of neurodevelopmental disorders have rapidly increased, indicating an urgent need for assistance through parenting interventions. This study aimed to evaluate the effects of a sociodrama-based communication enhancement program on mothers of children with neurodevelopmental disorders.

Method

A non-randomized controlled experimental study design was employed. The experimental and control groups had 16 and 18 participants, respectively. The once-a-week six-session intervention was conducted from September to November 2017, in South Korea. The effects of group, time, and group-by-time interactions among the groups were

verified using generalized estimating equations with an autoregressive correlation structure.

Results

There was a significant decrease in the parenting burden, alongside a significant improvement in parent-child communication and parenting competence in the experimental group compared to the control group.

Conclusion

The sociodrama-based communication enhancement program was found to positively influence the parenting burden, communication, and parenting competence of mothers of children with neurodevelopmental disorders. These findings suggest that sociodrama-based programs may be an effective intervention strategy for parents of children with neurodevelopmental disorders. The sociodrama-based communication enhancement program can be applied to decrease parenting burden and improve parent-child communication and parenting competence. Through continuous parenting interventions, an improvement in expressive language and an increase in the attachment behaviors of children with neurodevelopmental disabilities could be expected.

FULL TEXT

Introduction

Neurodevelopmental disorder is a broad term for diseases related to physical, learning, verbal, or behavioral impairment and includes autism spectrum disorder (ASD), intellectual disability (ID), and attention deficit hyperactivity disorder (ADHD) [1]. A recent study, based on a nationwide sample, revealed that the incidence and prevalence of developmental disorders have increased two- and four-fold, respectively, in the last 15 years [2], indicating an urgent need for assistance through parenting interventions.

Parents of children with neurodevelopmental disorders experience psychosocial distress and economic burden, difficulties in performing their parental role [3], and severe parenting stress [4]. Children with disabilities require additional sustained and diverse care compared to healthy children, which can result in multidimensional experiences regarding both parenting stress and parenting reward (i.e., feeling indispensable in the family) [5]. According to a recent survey, 90.3% of the primary caregivers for young children with disabilities in Korea were mothers; consequently, the latter are at a greater risk of parenting burden [6]. A previous study defined the parenting burden of children with neurodevelopmental disorders involving psychological distress, anxiety, depression, and a loss of freedom [7]. This is because parents of children with neurodevelopmental disorders experience more significant stress than those of children with other disabilities, due to the lack of services available to meet the needs of their children when they become adults, making them feel that they have a lifelong responsibility as parents [8]. Maladaptive and atypical behaviors frequently seen in children with neurodevelopmental disorders cause parenting stress and depression, both of which are negatively associated with parenting competency [9,10]. Studies on interventions for parents of these children indicated that techniques such as skills training, parenting education, and parenting coaching could provide parents with knowledge, with parent-led interventions enhancing parenting competence and self-efficacy; these interventions were found to help parents' psychological well-being and mitigate their caregiving burden [11,12]. Specifically, parenting interventions for parents of children with neurodevelopmental disorders were effective in lowering caregiving stress and improving parenting competence [13,14]. Since parents of children with neurodevelopmental disorders were found to experience more parenting burden than those of children with other disabilities [15,16], it is crucial to rigorously diagnose childcare problems and provide tailored assistance to meet the specific needs of these families.

Communication is a bidirectional process of building and maintaining relationships among family members through symbolic interactions that create and share meaning [17]. The quality and intimacy of parent-child relationships are developed through communication [18]. Specifically, effective communication can alleviate the parenting burden for parents of children with disabilities, acting as an important factor affecting parent-child relationships [19]. Indeed, a previous study showed that parents of children with neurodevelopmental disorder face difficulties when interacting with their children [20]. Parent–child interaction and communication skills are important factors influencing the outcomes of parent-training programs [21]. Thus, interventions emphasizing parent–child communication may have positive implications for the development of children [20].

Jacob Moreno first developed sociodrama, a deep action method using group relationships, in 1953. Alongside research on sociodrama interventions for families in vulnerable situations [22], this method is used as an intervention in other scenarios, for example, as a teaching method to enhance the communication skills of healthcare personnel, including oncologists [23], those caring for terminal patients and intensive care unit doctors [24]. Sociodrama can facilitate the learning of roles, ideas, concepts, and behaviors through socioeducational experiences [25]. In the field of nursing, sociodrama has been applied in two ways. Sociodrama has been used as a psycho-pedagogical method in nursing education [26,27] by facilitating learning engagement [27]. In addition, it has been implemented as a therapeutic method [28,29]. These methods are in line with two types of sociodrama: one for educational purposes in a learning group and one for therapeutic purposes in a client group [25]. The sociodramatist should understand the psychological and pedagogical context when working with individuals [25]; in this regard, a nurse can be the right person to conduct sociodrama as a psycho-pedagogical method in nursing education or as a therapeutic method in clinical settings.

Sociodrama helps participants experience emotional liberation and catharsis by developing a better understanding of themselves, their circumstances, and the roles of others in those circumstances, further encouraging them to express their feelings [30]. When prioritizing the mental health of teen mothers, SmithBattle et al. (2017) emphasized the importance of interventions to alleviate their psychological distress and tested the effects of behavioral group therapy to train them in life skills [31]. Similarly, in one study using sociodrama with mothers of students with special needs [28], sociodrama was effective in lowering parenting stress and improving parenting self-efficacy. In the last 20 years, most intervention studies that have aimed to enhance the interactions of parents, teachers, and caregivers of children with developmental disorders [32], have used didactic instruction, video monitoring/modeling, group debate, feedback, and coaching. Interventions can be more effective when they include realistic scenarios [22,30]; however, in previous studies, reflecting the actual situation was not sufficient, and interventions targeting parents of children with neurodevelopmental disorders were extremely rare.

Comprehensively examining the results of previous studies, parent–child communication can affect the parenting burden and parent-training program's effectiveness [19,21]. In addition, sociodrama is known to alleviate the parenting burden and improve parent–child communication as well as parenting competence by facilitating the learning of roles and behaviors [25,28]. Thus, to mitigate the parenting burden and enhance communication skills and parenting competence among parents of children with neurodevelopmental disorders, there is a need to develop and implement sociodrama-based intervention programs that are tailored to the difficulties experienced by this group, including elements of their personal situations. Therefore, the objective of this study was to develop a sociodrama-based program to enhance communication (SCEP) for parents of children with neurodevelopmental disorders, and investigate the effects of this program on caregiving burden, parent-child communication, and parenting competence. The hypotheses of this study were as follows:**H1**

The parenting burden within the experimental group will be significantly decreased after the SCEP when compared to that in the control group.

H2

The parent–child communication in the experimental group will be significantly improved after the SCEP when compared to that in the control group.

H3

The parenting competence in the experimental group will be significantly improved after the SCEP when compared to that in the control group.

Methods Design

This study used a non-randomized controlled experimental pretest-posttest design. The Transparent Reporting of Evaluations with Non-randomized Designs guidelines were followed throughout the manuscript [33].

Participants and data collection

The participants were the mothers of students with neurodevelopmental disorders (ID, ASD, and ADHD) living in A—City (a major city located to the north of the Korean capital city, with a population of 460,000), South Korea. With the

cooperation of the A— City Office of the Education's Institute for Special Education, the parents of students with special needs were notified of the program's contents, aims, and procedures, and individuals who consented to participate were included in the study. Data collection was performed between September 28 and November 10, 2017. According to the research assistant's instructions, the participants completed self-reported questionnaires both on the first day of the study and after six weeks. The participants were non-randomly allocated to the experimental and control groups. To minimize potential bias induced due to non-randomization, we first matched individuals according to their key general characteristics: (1) for parents: age, level of education, household income; (2) for children: sex, disability type, presence of multiple disabilities, severity of disability. After the process of matching, the two decided groups were randomly assigned to the experimental and control groups, respectively. Participants were selected according to the following inclusion criteria: (1) being primary caregivers of children with neurodevelopmental disorders and (2) being well literate. According to a longitudinal study following up participants from the age of six to adulthood [34], the deep-seated nature of neurodevelopmental disorders persists from childhood into adulthood. Therefore, we did not restrict the age range of the children during recruitment. The exclusion criteria were (1) individuals with restricted movement and (2) primary caregivers of children with impairments other than neurodevelopmental disorders.

Using G*Power 3.1.9.7 with conditions of F-test, analysis of variance, repeated measures, and within-between interaction (effect size f = 0.30, power = 0.90, α = .05) [35], both groups required 32 participants. Considering a potential dropout rate of 20.0%, a total of 40 participants were enrolled, with 20 participants each in the experimental and control groups. Four participants from the experimental group and two from the control group dropped out immediately after registration due to personal scheduling issues, resulting in 16 and 18 participants in the experimental and control groups, respectively, for the final analysis (Figure 1).

The sociodrama-based communication enhancement program

The control group received nursing intervention as usual, consisting of counseling and psycho-education. The experimental group received usual care except for the SCEP, which happened once a week for six weeks. The SCEP was initially based on the nonviolent communication model (NVC) [36] and previous literature that used sociodrama with mothers of students with special educational needs [28]. However, in a previous study, parents of children with physical disability and emotional disturbance were also included as participants [28]. The SCEP was developed specifically to reflect the parent–child communication needs based on interviews with three parents of children with neurodevelopmental disorders. Thus, this pilot study served to develop the most significant tailored nursing intervention for parents raising children with neurodevelopmental disorders and finalize it, confirming the applicability of this program as an effective nursing intervention. To verify the validity of the program, a panel of two experts from the Korean Association for Psychodrama and Sociodrama, two mental health nursing professors, one counseling expert, and one school counselor from an Institute for Special Education reviewed and modified it, after which the content validity of the final program was analyzed.

The study authors have been teaching mental health nursing and communication at a college of nursing for the past few years. Author 2 is particularly an expert in sociodrama as she has received over 500 hours of professional education as a member of the Korean Association for Psychodrama and Sociodrama, having conducted sociodrama programs for over seven years. For intervention adherence and fidelity, one of the researchers (author 2) administered the program for 150 minutes per session, with one session per week, for six sessions in a seminar room. The interventions were delivered through group sessions and the group size comprised 16 participants altogether.

The program composition enabled participants to understand and learn observations, feelings, needs, and requests—the four components of the NVC model [36]. In addition, sociodrama was used to encourage participants to express their emotions, recognize parent-child needs, and practice the communication skills they had learned. The sociodrama process consisted of warming up, enactment, and sharing phases. After determining common topics related to communication difficulties with the participants' children with disabilities, a scenario was chosen. During the enactment phase, participants voluntarily adopted a role and were instructed to express their emotions

and solve the problem through their behaviors. In the sharing phase, participants could share their emotions with each other. The drama process was improvised based on spontaneous interactions among the participants.
The first session focused on building motivation for the program, as well as trust and intimacy among the participants. The second session focused on identifying the needs of the participants and their children in conflicting situations. The third and fourth sessions encouraged participants to differentiate between their thoughts and feelings and understand and empathize with their own needs and those of their children and families. The fifth session encouraged participants to communicate compassionately by reaffirming the meaning of family and value of existence. The sixth session encouraged participants to find true happiness and meaning in life by using the technique of “family sculpting.” Participants were asked to complete a questionnaire before and after the program. Those who attended all six sessions were awarded a certificate and took part in a graduation ceremony. Table 1 illustrates a summary of the themes, goals, and contents of each session in the program.

Measures Parenting burden

The parenting burden scale comprises 28 questions regarding physical burden (five questions), emotional burden (seven questions), social burden (10 questions), and economic burden (six questions) [37]. Participants responded to each question on a scale of 1 (“Never”) to 5 points (“Always”), with higher scores indicating higher parenting burden. In a study that measured the parenting burden of parents of children with neurodevelopmental disorders using the same instrument, the Cronbach's α was .95 [38], and it was .92 in the present study. Six professionals (two psychiatric-mental health advanced practice nurses, two professors in child health nursing, and two professors in mental health nursing) verified the content validity. The scale-level content validity index (S-CVI)/average for each item was .97, and the S-CVI/universal for each item was .82.

Parent–child communication

Communication ability was measured using the Parent–Adolescent Communication Scale [39]. It has two subscales: open communication (10 items) and problematic communication (10 items). Each item was rated on a self-report Likert scale from “Never” (1 point) to “Always” (5 points). While this scale was developed to measure parent-adolescent children communication, it has also been used in measuring parent-child communication [28,29]. Open communication refers to communication that enables family cohesion and adaptability to a functional level (i.e., clear and unambiguous messages, empathy, reflective listening, and supportive speech) [39]. In contrast, problematic communication refers to closed and dysfunctional communication, which does not occur smoothly due to reluctance in parent–child interaction, with an experience of more critical expressions [40]. Higher open communication scores indicate more positive parent-child communication in which the parent and child can interact freely and express their opinions. Higher problematic communication scores indicate more negative parent–child communication. The Cronbach's α was .88 at the time of development of the Korean version of the scale and .78 in the present study. Six professionals verified the content validity. The S-CVI/average for each item was .96, and the S-CVI/universal for each item was .85.

Parenting competence

Parenting competence was measured using the Parenting Sense of Competence scale [41]. It consists of 16 questions on parenting efficiency (nine questions) and parenting satisfaction (seven questions). Each question is scored on a Likert scale from 1 (“Strongly disagree”) to 5 points (“Strongly agree”), with higher scores indicating better parenting competence. In terms of the instrument's reliability, Cronbach's α was .74–.76 in a recent study on the mothers of children with neurodevelopmental disorders [42] and .76 in the present study. Six professionals verified the content validity. The S-CVI/average for each item was .96, and the S-CVI/universal for each item was .81.

Ethical considerations

This study was approved by the institutional review board at the authors’ affiliated institution (No. 1041078-201709-HRSB-175-01). The study protocol was registered at the Clinical Research Information Services (registration number: KCT0006412) and is available online. Before participation in the SCEP, participants who had received the program application and provided prior written consent, voluntarily consenting to participate, were selected. They

were informed that they could withdraw from the study at any time, and that they would not experience any disadvantage as a result. In addition, the participants pledged to protect the privacy of all other participants to ensure that any knowledge gained during the program would remain private.

Data analysis

Data were analyzed using the IBM SPSS/WIN 26.0 Program. Pre-homogeneity between the experimental and control groups was analyzed using the chi-squared test, Fisher's exact test, and t-test. Based on the results of normality testing, parametric tests indicating normal distributions were used for communication ability and parenting self-efficacy, and non-parametric tests indicating non-normal distributions were used for parenting burden. The effects of group, time, and group-by-time interactions among the groups were verified using generalized estimating equations with an autoregressive correlation structure. Generalized estimating equations were used because our data were repeatedly measured, clustered, and correlated, but the generalized estimating equations approach did not assume the independence and homogeneity of variance [43]. To clarify effect size, Cohen's criteria [44,45] was adapted: Cohen's d = 0.2 (small), d = 0.5 (medium), and d = 0.8 (large).

Results Homogeneity test of participants' general characteristics and dependent variables

In this study, all the participants were mothers, and the mean ages of mothers and children were 42.62 (SD 6.29) and 12.38 (4.26) years, respectively. As for the diagnosis of children, 61.8% had ID and the rest had ASD. Table 2 illustrates the results of the homogeneity tests for the general characteristics and dependent variables at pre-intervention between the experimental and control groups. There were no significant differences with respect to age, education level, income, gender of child, age of child, diagnosis of child, or severity of child's disease, and the two groups were comparable in terms of all dependent variables.

Verification of the effects of the SCEP

The effects of the SCEP were tested using generalized estimating equations. Table 3 and Figure 2 compare the parenting burden, parent–child communication, and parenting competence between the experimental and control groups pre-intervention, as well as the changes post-intervention.

Parenting burden

The experimental group that participated in the program exhibited a significant reduction in parenting burden compared to that in the control group, supporting hypothesis 1. As revealed in the generalized estimating equations analysis results in Table 3, the main effects of group and time were not significant, but the group × time interaction effect was significant (Wald's test = 4.90, p = .027). The analysis showed that the parenting burden of the experimental group decreased significantly more (−.25 –.04 = −.29, i.e., a decrease by .29 points) than that of the control group (i.e., an increase by .04 points). This difference in change reflected a small effect size (Cohen's d = .32).

Parent–child communication

The experimental group exhibited a significant increase in open communication scores between the parent and child compared to the scores for the control group. As revealed in the generalized estimating equations analysis results in Table 3, the main effects of group and time were not significant, but the group × time interaction effect was significant (Wald's test = 7.32, p = .007). The analysis showed that open communication of the experimental group improved significantly more [.35 –(−.08) = .43; i.e., an increase of .43 points] than did that of the control group (i.e., a decrease of .08 points). The effect size was .98, indicating a large effect. Although the experimental group exhibited a decrease (−.21 –0.11 = −.32; i.e., a decrease of .32 points) in problematic communication compared to that in the control group, the difference was not significant (Wald's test = 2.58, p = .108); therefore, hypothesis 2 was partially supported in that the SCEP could improve the parent–child communication solely in terms of open communication.

Parenting competence

The experimental group exhibited a significant increase in parenting competence scores compared to the scores for the control group, supporting hypothesis 3. As revealed in the generalized estimating equations analysis results in Table 3, the main effects of group and time were not significant, but the group × time interaction effect was significant (Wald's test = 4.91, p = .027). The analysis showed that the parenting competence of the experimental group

improved significantly more [.21 –(– .06) = .26; i.e., an increase of .26 points) than did that of the control group (i.e., a decrease of .06 points). The effect size was .95, indicating a large effect.

Discussion

In the present study, an SCEP was implemented for the primary caregivers of children with neurodevelopmental disorders, and the effects of the program were analyzed. This sociodrama-based communication enhancement program was tailored to reduce parenting burden and enhance communication and parenting competence, which comprise the biggest problems for parents of children with neurodevelopmental disorders. In the group sociodrama sessions, based on the NVC model of Rosenberg and Eisler (2003) [36], the participants observed each other; expressed their needs, feelings, and requests in the corresponding phases; and learned to understand and express their conflicts as a caregiver.

After the SCEP, participants exhibited a significant decrease in parenting burden (effect size, Cohen's d = .32). Although no previous study has indicated the direct effects of a sociodrama intervention on overall parenting burden, sociodrama was effective in reducing depression in a study on the mothers of students receiving special needs education [28], encouraging participants to perceive, control, and express their own anxiety [46]. Similarly, sociodrama was efficient in alleviating parents' negative emotions, such as anger, anxiety, and sadness, in a study on the parents of patients with schizophrenia [47]. In a study on the mothers of children with neurodevelopmental disorders, an action methods-based program reduced the mothers' anxiety and depression [31], and informal support from people in their surroundings reduced parenting burden for the parents of children with neurodevelopmental disorders [7]. Given that Robinson et al. (2016) claim that psychological distress, such as anxiety and depression, is included in the properties of parenting burden [7], the results of the present study can be considered consistent with those of previous studies. The SCEP was administered as part of a parent-focused planning approach. In line with previous research [48], this program was able to help participants unload their parenting burden by encouraging them to express their emotions and difficulties verbally, thereby sharing their experiences with other parents. The fact that the participants were all caregivers of children with developmental disorders stimulated interactions within the group, providing an outlet for them to share real-life experiences [49], thereby alleviating their parenting burden. These findings were also partially supported by a study in which informal support, rather than formal support from the government, was effective in reducing parenting burden for parents of children with neurodevelopmental disorders [7].

The SCEP was also found to be effective for developing communication ability (in particular, the open communication) in parents of children with neurodevelopmental disorders. Parents of children with developmental disorders have extremely diverse and complex communication needs because they experience many interaction-related difficulties while performing various roles throughout their lives, such as supporting their child's communication development, effectively fulfilling their role as parents, and helping their child form social relationships [18,21]. Since communication education consists more of observation and feedback than lecture-based instruction, it is essential to encourage and assist learners to find their own solutions through interactions within a group [50]. Family-mediated communication programs enhance open communication, and unimpeded communication within the family enhances children's communication development, self-esteem, problem-solving ability, and stress management, reducing behavioral and emotional problems in parents of children with ASD [51,52]. In one prospective longitudinal study [53], an intervention conducted with primary caregivers of children with neurodevelopmental disorders resulted in an improvement in the children's long-term language outcomes through the caregivers being more responsive during their communication with them. Furthermore, parenting interventions have been found to increase maternal synchronization with the child's speech or behavior, improve the child's expressive language [52], and increase attachment behaviors [35].

The upbeat ambience created by interventions using action methods, including sociodrama, assists individuals in achieving self-reflection during group programs, helping them become more aware of problems [49]. Similarly, the SCEP may have been effective since sociodrama was used to develop communication skills by helping parents specifically express needs and recognize their children's needs in situations of conflict, differentiate between

thoughts and feelings, and listen effectively. Therefore, the authors believe that programs using sociodrama can enhance patient–child communication, ultimately helping children with neurodevelopmental disorders adapt to life situations. In terms of future long-term care plans for individuals with neurodevelopmental disorders, one might consider expanding the scope of participants beyond mothers being the only primary caregivers, by including fathers and siblings, to promote cooperation with the primary caregiver's perspective rather than the overseer's perspective [54].

The parenting competence scores of the participants in this study were slightly lower than those reported in previous studies for mothers or both parents of children with developmental disorders [42,55,56] and slightly higher than those reported for parents of typically developing children [54,57]. The SCEP was found to be effective in improving the parenting competence of parents of children with neurodevelopmental disorders. This was because the SCEP was based on sociodrama, which is known to alleviate parenting burden by facilitating the learning of roles and behaviors [25]. This is consistent with the results of a previous study that reported a significant increase in parenting self-efficacy after a sociodrama intervention for the mothers of adolescents receiving special needs education [28].

In a previous study [15], parenting competence was analyzed in parents of children with various disabilities and parents of children with ID showed far lower parenting competence than those of children with other disabilities. Among the participants in the present study, there was a high proportion of parents of children with ID. Thus, if SCEPs are tailored for parents of children with ID and actively utilized in intervention strategies for mental health nursing practice, they could help improve the particularly low parenting competence observed in this population.

Nevertheless, this study had several limitations. Although Nawalana et al. (2020) reported differences in parenting efficiency depending on the extent of the child's disability [15], this could not be incorporated in the current study. In future studies, we propose that participants should be divided into groups based on the severity of their disability to enable enhanced individualized care. In this study, all the participants included mothers as primary caregivers. This reflected the tendency of mothers to be the primary caregivers for children in Korea. In addition, the present study was conducted in a single large city in South Korea and, as it was a non-randomized controlled trial, there was a possibility of selection bias. Besides, there were no participants who were the parents of children with ADHD in this study. Therefore, the generalizability of our results is limited. Finally, owing to the small sample size in our study, it was not feasible to compare effects depending on the children's level of development. In future studies on parents of children with neurodevelopmental disorders, randomized controlled trials and longitudinal studies should be performed to overcome these limitations. We also propose intervention studies that differentiate between participants based on their child's level of development. Through continuous parenting interventions such as SCEPs, an improvement in expressive language and increase in attachment behaviors of children with neurodevelopmental disabilities could be expected. Studies to confirm long-term outcomes are encouraged.

Conclusion

As the number of children diagnosed with neurodevelopmental disorders increases so does the demand for mental health nurses to conduct interventions for these children and their parents. Our findings indicate that SCEPs that alleviate the parenting burden, and enhance parent–child communication and parenting competence, should be applied in mental health nursing environments. These findings suggest that sociodrama-based programs may be an effective intervention strategy for parents of children with neurodevelopmental disorders.

Funding statement

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Ethical approval

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Chung-Ang University (Approval No. 1041078-201709-HRSB-175-01). The study protocol was registered at the Clinical Research Information Services (registration number: KCT0006412) and is available online.

Data availability statement

The data presented in this study are available on request from the corresponding author and with permission of the

Institutional Review Board of Chung-Ang University.

Conflict of interest

The authors had no conflicts of interest to disclose.

Author contributions

Conceptualization, S.J.J., J.H, M.H.B, J.A.; methodology, S.J.J. and J.A; formal analysis, S.J.J. and J.A.; investigation, J.H. and S.J.J.; data curation, S.J.J. and J.A.; writing—original draft preparation, S.J.J., J.H, M.H.B, and J.A.; writing—review and editing, S.J.J. and J.A.; project administration, J.H, M.H.B, and J.A; All authors have read and agreed to the published version of the manuscript.

Session	Themes	Goals	Contents
1	Opening mind	To motivate participation and build intimacy and trust among group members	1.Program orientation and lecture (60 min)2.Sociodrama1)Warming up (20 min)2)Sociodrama enactment (50 min)-Practice in generic scenarios (role reversal)3)Sharing (20 min)
2	Resolving Conflict	To explore each other’s needs	1.Life sharing (20 min)2.Lecture on anger and needs (30 min)3.Sociodrama1)Warming up (15 min)2)Sociodrama enactment (60 min)-Conflict situations with family members (child)(doubling, voices, role reversal, soliloquy)-Finding own and child's needs in a conflict scenario (15 min)3)Sharing feelings and evaluation (15 min)
3	Expressing myself	To distinguish thoughts and feelings	1.Life sharing (20 min)2.Lecture on thoughts and feelings (30 min)3.Sociodrama1)Warming up (15 min)2)Sociodrama enactment (60 min)-Problematic situations with family members (spouse)-Using communication skills to resolve problems (doubling, voices, role reversal, soliloquy)3)Sharing feelings and evaluation (15 min)
4	Enhancing communication I	To practice empathetic listening and speaking	1.Life sharing (20 min)2.Lecture on listening and speaking (30 min)3.Sociodrama1)Warming up (15 min)2)Sociodrama enactment (60 min)-Child's problematic behavior-Understanding and empathizing with the needs of child/spouse/oneself (doubling, voices, role reversal, monologue)3)Sharing feelings and evaluation (15 min)

5	Enhancing communication II	To practice sympathetic communication	1.Life sharing (20 min)2.Lecture on sympathetic communication (30 min)3.Sociodrama1)Warming up (15 min)2)Sociodrama enactment (60 min)-Connecting one's own needs and feelings with those of child-Applying empathic listening-Sculpting and reconstituting of the family3)Sharing feelings and evaluation (15 min)
6	Building a happy family	To find the meaning of life and happiness	1.Life sharing (20 min)2.Lecture on the meanings of life and happiness (30 min)3.Sociodrama1)Warming up (15 min)2)Sociodrama enactment (60 min)-Family photo3)Sharing feelings and evaluation (15 min)

Characteristics	Categories		Exp. (n = 16)	Cont. (n = 18)	χ^2 or t
p	n (%) or M ± SD	n (%) or M ± SD	Age (years)		
42.56 ± 5.10	42.67 ± 7.34	0.05	.962	Level of education	≤ High school
10 (62.5)	13 (72.2)	3.66	.545	≥ College	
6 (37.5)	5 (27.8)	Income of household[a]	Low		8 (50.0)
9 (50.0)	0.17	>.999	Average		5 (31.3)
6 (33.3)	High		3 (18.7)	3 (16.7)	Gender of child
Men		11 (68.8)	9 (50.0)	1.23	.268

Women		5 (31.2)	9 (50.0)	Age of child (years)	
12.31 ± 4.25	13.00 ± 3.38	0.53	.603	Type of disability	Autism spectrum disorder
7 (43.8)	6 (33.3)	0.39	.725	Intellectual disability	
9 (56.2)	12 (66.7)	Multiple disabilities[a]	Yes		12 (75.0)
14 (77.8)	0.04	.849	No		4 (25.0)
4 (22.2)	Severity of disabilities[a]	Mild		4 (25.0)	4 (22.2)
0.62	.799	Moderate		10 (62.5)	10 (55.6)
Severe		2 (12.5)	4 (22.2)	Number of children without disabilities[a]	0
5 (31.2)	2 (11.1)	2.10	.349	1	
9 (56.2)	13 (72.2)	2		2 (12.6)	3 (16.7)
Parenting burden			2.69 ± 0.57	2.71 ± 0.66	0.07
.945	Communication		Open communication	3.38 ± 0.64	3.18 ± 0.53

1.19	.233	Problematic communication	2.66 ± 0.70	2.45 ± 0.63	1.07
.284	Parenting competence[b]			3.24 ± 0.35	3.03 ± 0.49

95% Wald CI							
	B	SE	Lower	Upper	Wald χ^2	p	ES (d)
Parenting burden							0.32
Group[a]							
Exp	−0.02	0.20	−0.42	0.38	0.01	.930	
Time[a]							
Baseline	0	0					
Post intervention	0.04	0.08	−0.13	0.20	0.22	.637	
Interaction of group and time[a]							
Baseline	0	0					
Post intervention	−0.25	0.11	−0.48	−0.03	4.90	.027	
Open communication							0.98
Group[a]							
Exp	0.20	0.20	−0.18	0.59	1.06	.302	
Time[a]							
Baseline	0	0					
Post intervention	−0.08	0.06	−0.21	0.04	1.81	.179	

Interaction of group and time[a]							
Baseline	0	0					
Post intervention	0.35	0.13	0.10	0.61	7.32	.007	
Problematic communication							0.01
Group[a]							
Exp	0.21	0.22	−0.22	0.65	-.92	.337	
Time[†]							
Baseline	0	0					
Post intervention	0.11	0.08	−0.05	0.27	1.80	.179	
Interaction of group and time[a]							
Baseline	0	0					
Post intervention	−0.21	0.13	−0.46	0.05	2.58	.108	
Parenting competence							0.95
Group[a]							
Exp	0.21	0.14	−0.07	0.48	2.18	.140	
Time[a]							
Baseline	0	0					
Post intervention	−0.06	0.05	−0.15	0.03	1.80	.180	
Interaction of group and time[a]							
Baseline	0	0					
Post intervention	0.21	0.09	0.02	0.39	4.91	.027	

DETAILS

Subject:	Parent-child relations; Parents &parenting; Pedagogy; Behavior; Students; Nursing education; Stress; Communication; Intervention; Families &family life; Data collection; Caregivers; Disability; Attention deficit hyperactivity disorder; Children with disabilities
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Development and Validation of an Interprofessional Collaboration Scale for Home Health Care for the Frail Elderly

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ABSTRACT (ENGLISH)

S U M M A R YPurpose

The purpose of this study was to develop an interprofessional collaboration (IPC) scale for home health care for frail elderly.

Methods

The first items of the IPC scale included collaboration members' attitudes, awareness, motivation, team strength, communication, relationships, information, care recipients' interests, effects, development, utilization of social resources, contributions to the community, and crisis management. The subjects were 512 care managers who work in home care support offices across Japan. They manage interprofessional collaboration in home health care for frail elderly who need care at 65 years old and above. The scale's construct validity, internal consistency, the validity of known groups, concurrent validity, and test-retest reliability (193 subjects) were examined.

Results

The final IPC scale's items consisted of four factors (37 items): the strength of interprofessional teams (16), the management of collaborative systems (7), effects of collaboration (8), and communication (6). Four factors explained 58.6% of the total explained variance. The modified model fit of the scale achieved acceptable levels. The Cronbach's α coefficient for all items was .97. The sum of communication factor in the cities/wards group was lower than those in the towns/villages group. There were differences between the sum and each factor with different levels of ease to collaborate. The intraclass correlation coefficient for all items in the first and second assessments was .875.

Conclusions

The validity and reliability of the IPC scale have been verified. This scale can be used to assess the IPC for home health care for frail elderly.

FULL TEXT

Introduction

Many developed countries are presently facing the challenges of an aging population, leading to an increase in the number of elderly people who require support and nursing care for health management every day. Japan has become a super-aging society in which the elderly account for more than 21.0% of the population, and the number of frail elderly people with impaired mental, physical, and cognitive functions has been rising [1]. Therefore, Japan has the urgent task of recruiting a variety of health professionals from medical, nursing, and welfare fields, among others, to develop efficient collaborative systems across the nation that can provide the elderly with high-quality support.

The World Health Organization declared 'action on interprofessional education and collaborative practice' to be an important strategy that is required to address the issue of the serious shortage of health professionals around the world [2]. Many countries have emphasized the importance of interprofessional collaboration and its promotion, as well as the implementation of education to help health professionals improve their collaboration skills [3,4].

In Japan, care managers are in charge of coordinating interprofessional collaboration for frail elderly people in the community who require health care. Care managers coordinate interprofessional collaboration among health professionals working in medical, nursing, and welfare facilities according to the healthcare insurance system and develop home care plans for each recipient to provide frail elderly the required home and nursing care services. Community-based integrated care systems for the elderly that provide health/nursing care and daily support are being developed in many areas across Japan to create a society in which the elderly hoping to continue their community lives will be able to do so. Care managers are expected to serve as coordinators who facilitate collaboration among a variety of health professionals in such care systems. Therefore, they are aware of the obstacles of relationships with physicians, professional competency, relationships among other professionals, environmental constraints, and relationships with non-professionals [5]. These obstacles must overcome to strengthen interprofessional collaboration in their community.

Although previous studies conducted in many different countries have indicated the need for interprofessional collaboration to support the elderly living in the community, research that examines the effects of the collaborative activities has focused on limited areas [6]. In addition, no previous studies have presented sufficient evidence of the cost-effectiveness of collaborative activities [7].

Although it is necessary to conduct longitudinal assessments to examine the effects of collaborative activities [8], comparing collaborative effects is difficult. Because the elderly increasingly requires greater support as they become older, and systems and environments required to promote collaboration vary depending on the country, area, and era. However, if there is assessment scale of the functions of interprofessional teams, the functions of interprofessional teams in different systems, supportive environments, countries, and areas can be assessed and/or compared longitudinally and continuously.

Several scales have been developed to assess the functions of interprofessional teams that provide health care at different health levels in general hospitals, communities, and other such places. These scales include the assessment of inter-professional team collaboration scale (AITCS) [9], collaborative practice assessment tool (CPAT) [10], partnership self-assessment tool [11], and other scales with an emphasis on 'team climate' [12], 'the quality of team meetings' [13], and the sharing of decision making [14].

The concept of interprofessional collaboration to support the elderly with chronic diseases living in the community is evolving antecedent, attribute, and consequence but does not get consensus [15]. The functions of interprofessional collaboration required to provide home care for the elderly living in the community must be discussed in order to develop the criteria for their assessment.

This study aimed to define the concept and examine the functions of interprofessional collaboration required to support the health and lives of frail elderly people living in the community, in order to develop an interprofessional collaboration (IPC) scale for home health care for frail elderly. The IPC scale, developed in Japan, a super-aging society, will also be useful in many other countries that are facing the consequences of an aging population.

'Frail elderly' in this study refers to people aged 65 years and above who have been certified as requiring long-term care (people who need others to care for them) because of physical or mental problems or because aging interferes with their daily activities. In Japan, a long-term care insurance system allows those certified as needing long-term care, regardless of whether they live with their family, to receive public services. These include nursing care or home-visit nursing care from various organizations while living in their own home.

People who use such services need a home healthcare plan. Nevertheless, home care support offices are private organizations. These offices have staff members certified as care managers. They plan home health care regarding the necessary services for the frail elderly living at home. They also manage home health care so that various professionals from several organizations can collaborate to provide support.

Methods Scale development Conceptual framework

The definition of the concept of interprofessional collaboration required to provide home care for the frail elderly living in the community, and the development of the plans for the assessment index are described below.

To define this concept, reports pertaining to interprofessional collaboration were examined [3,4], and the differences between collaboration and similar concepts, including cooperation and liaisons, were analyzed. Interprofessional collaboration for providing home care is thus defined as 'collaboration among multiple professionals from different organizations who have expertise in each field, including mutual communication, the development of trusting relationships, and setting common goals to help the elderly users of home care services and their families live a high-quality life or fulfil their hopes.'

Preliminary items

Based on the definition above, personal and group interviews with nine health, medical, and welfare professionals were conducted. These professionals included care managers, home-visit nurses, nursing care workers, pharmacists, and physicians involved in activities that support the elderly in the community. They were asked about their experience regarding interprofessional collaboration as defined by the authors, including what they thought were important in promoting interprofessional collaboration. Based on their response, 58 items were identified as important elements for promoting interprofessional collaboration. These were divided into 10 areas, such as members' attitude, strength of teams, and communication.

Subsequently, a pilot survey with 24 care managers was conducted to examine the validity of the prototype, including its face validity, and a draft assessment index consisting of eight fields and 55 items was created.

Evaluation of the IPC scale Setting and samples

The subjects were care managers working in home care support offices located in Japan's 47 prefectures. Of the 39,124 centers in the 47 prefectures (as of June 2016) [16], 1,962 centers were selected. A representative from each center was asked to participate in the study; the care manager from each center who most frequently collaborated with other health professionals responded to the originally developed questionnaire. The 1,962 centers were selected based on a stratified random sampling method, taking into consideration the ratio of the number of special administrative regions, ordinance-designated cities, core cities, and municipalities (1,761 as of October 2016). All 47 prefectures had at least one of these 1,962 centers.

Survey methods

Anonymous, self-completion questionnaire forms were sent to the subjects by mail, and they returned the completed forms to the researcher.

Survey period

The survey period was between July and August 2017.

Survey items

•(1)Characteristics and ease of collaboration of subjects

The survey items included the names of the prefectures in which the healthcare institutions were located, administrative classification, sex, age, certificates other than care manager, period of working as a care manager, the number of care recipients for whom they are responsible, frequency of meeting professionals from other healthcare institutions per month, frequency of participating in workshops on interprofessional collaboration per year, and ease of collaboration with other healthcare institutions and professionals (using a three-point scale).

•(2)Items for the assessment of the functions of interprofessional collaboration

The following eight fields and 55 items of the draft were adopted: Field I: six items (Questions 1 to 6) related to attitudes toward and awareness of collaboration (understanding of/respect for the specialties of others and the recognition of the need for interprofessional collaboration); Field II: 11 items (Questions 7 to 17) related to the strength of teams (same goals for the activities of teams and roles within teams); Field III: nine items (Questions 18

to 26) related to communication and relationships (exchange of opinions and interaction with respect for other people's positions); Field IV: nine items (Questions 27 to 35) related to information (sharing/management of information and responsibility); Field V: six items (Questions 36 to 41) related to care recipients' interests (support centered on care recipients, satisfaction of care recipients and their families, and the status of their participation); Field VI: 10 items (Questions 42 to 51) related to the effects of collaboration (identification of problems to address and improve them through collaboration); Field VII: two items (Questions 52 and 53) related to the utilization of social resources and contributions to the community (status of the effective utilization of social resources and the level of contribution to the community through collaboration); and Field VIII: two crisis management-related items (Questions 54 and 55) pertaining to early identification of problems and responses in emergency situations. Responses to each question were based on a seven-point Likert scale: ‘Definitely yes’ (7 points) to ‘Definitely no’ (1 point); the higher the collaborative function, the higher was the score.

Data analysis

Correlations between the scores for each question item to assess collaboration and the sum of these scores were analyzed and inter-item analyses were conducted. Question items were then selected based on the analysis results. Exploratory factor analyses using the maximum-likelihood method and promax rotation were performed, and the obtained factor structure was matched to the eight fields of the assessment index draft to examine the validity of the construct. Subsequently, Cronbach's α for each factor related to interprofessional collaboration and the question items was calculated to examine internal consistency.

Since there are differences in the social structures and resources of cities/wards and towns/villages because of their varying population sizes, the functions of collaboration in cities and wards may differ from those in smaller municipalities. The factors related to collaboration and the sum of the assessment scores for ‘cities/wards’ and ‘towns/villages’ groups were compared using χ^2 and t-tests.

High-level collaborative functions are considered to be associated with the ease of collaboration with other healthcare institutions and professionals. Therefore, the factors related to collaboration and the sum of the assessment scores were compared with different levels of ease using one-way analysis of variance and multiple comparison to examine the concurrent validity.

The second survey was conducted approximately 10 days after the first to calculate the intraclass correlation coefficient (ICC) for the first and second assessments.

SPSS Statistics Ver.22 and AMOS Ver.22 (IBM Corp., Armonk, NY, USA) and G*Power 3.1.9.1 (The G*Power Team, Heinrich-Heine-Universität, Düsseldorf, Germany) were used for the analyses. The significance level was 5.0%.

Ethical considerations

This study was approved by an Institutional Review Board of the institution to which the researchers belong. The participation of subjects was voluntary, and their submission of a completed questionnaire form was regarded as their consent to participate in the study. The subjects provided written consent to participate in the interviews and pilot surveys.

Results

A total of 564 care managers responded (response rate: 28.7%), and the 512 respondents who answered all of the questions contained in the assessment index draft were selected as the subjects for analysis (valid response rate: 90.8%). Of the 512 subjects, 194 responded to the re-test (response rate: 37.9%), and 193 valid responses were collected (valid response rate: 99.5%).

Subjects’ characteristics

Of the 512 subjects, 43.8% and 56.3% worked in centers located in cities/wards and towns/villages, respectively. The majority of the participants were female (76.6%) and were in their 50s (39.1%). Furthermore, most were former qualified healthcare workers (56.8%). The mean period of working as a care manager was 9.4 years. The mean care ratio was one care manager to 30.9 elderly people. The care managers met health professionals from other institutions 4.4 times a month (mean) and participated in workshops on interprofessional collaboration 4.6 times a year (mean) ([Table 1]).

Construct validity

Correlation coefficients between each assessment score and the sum were 0.4 or higher. The correlation coefficient between one assessment score and the sum was 0.81 as a result of the inter-item correlation analysis and that question item was excluded to simplify the index.

Exploratory factor analysis was conducted based on the maximum-likelihood method and promax rotation; the number of factors was five, decided by using a scree plot. Factor analyses were conducted seven times until assessment items with a factor loading of 0.4 or lower (a total of 15 items) were excluded. As the eigenvalue of the fifth factor was lower than 1, an analysis involving four factors was conducted excluding two items (Field VIII) included in the fifth factor. There were no items with a factor loading of 0.4 or lower as a result of the analysis, and the four factors (37 items) were adopted. The contribution rates of the four factors were between 3.7% and 46.5%, and the cumulative contribution rate was 58.6%. Correlation coefficients among the factors were between 0.59 and 0.73, which suggest significant correlations ([Table 2]).

The first factor consisting of Fields I and II (16 items) included in the assessment index draft was titled ‘Team strength.’ The second factor consisting of Fields IV, VI, and VII (seven items) was titled ‘Management of collaborative systems.’ The third factor consisting of Fields V and VI (eight items) was titled ‘Effects of collaboration.’ The fourth factor consisting of Fields III and IV (six items) was titled ‘Communication.’

Internal consistency

The Cronbach's α coefficient for all 37 items was 0.97, and those for each factor were between 0.88 and 0.95 ([Table 2]).

Validity of known groups

The mean of the sum of assessment scores for the six ‘communication’-related items in the cities/wards group (n = 224) was 31.5 ± 5.7, which was lower than the mean of the sum in the towns/villages group (n = 288, 32.6 ± 5.0) ($t = -2.33$, $p = .02$, ES = 0.205, $1-\beta = 0.633$). There were no significant differences between the other three factors and the sum of all items.

Concurrent validity

We used levels of ease in collaboration with other healthcare institutions and professionals to examine concurrent validity.

There were significant differences between the score for each factor and the sum of the three groups with different levels of ease to collaborate with other healthcare institutions. The results of the multiple comparisons indicated that scores for ‘Definitely yes’ were significantly higher than those for ‘Yes’ and ‘No’ ([Table 3]).

There were also significant differences between the score for each factor and the sum of the three groups with different levels of ease to collaborate with other healthcare professionals. Multiple comparisons of scores for each factor and the sum of scores for all items indicated that scores for ‘Definitely yes’ were the highest, followed by those for ‘Yes’ and ‘No’ ([Table 4]).

Test-retest reliability

The retest target was the 512 people who participated in the initial survey. It was conducted approximately 10 days after the initial survey. It was thought that the health conditions of the frail elderly or the content of interprofessional

collaboration would not change significantly within 10 days. Further, participants needed to be given at least 10 days following the initial survey so that they would not feel overburdened. A total of 193 people responded to the retest and became the subject of analysis.

A re-test involving 193 subjects was conducted, and the ICC for all items in the first and second assessments was .875 [95.0% C I: .835–.906](p **Discussion**

This study aimed to develop the IPC scale consisting of four factors: “strength of teams,” “management of collaborative systems,” “effects of collaboration,” and “communication.” The study included care managers who coordinate interprofessional collaboration for the frail elderly living in the community and in need of health care from each prefecture in Japan. The construct validity, internal consistency, validity of known groups, concurrent validity, and test-retest reliability of the IPC scale were examined.

The contribution rate of the first factor (strength of teams) of the IPC scale was the highest (46.5%), which suggests that this factor is important in assessing the functions of collaboration. The first factor consisted of fields related to attitudes toward/awareness of interprofessional collaboration (having an understanding of/respect for the specialties of others and the recognition of the need for interprofessional collaboration) and the strength of teams (same goals for the activities of teams and roles within teams). As examples of previously developed indices to assess the functions of interprofessional collaboration, the AITCS, developed by Orchard et al. [9], consists of “cooperation” and “coordination,” and the CPAT, developed by Schroder et al. [10], consists of “mission,” “meaningful purpose,” “goals,” “general relationship,” “team leadership,” “general role responsibilities,” and “autonomy.” These items are similar to those that fall under the “strength of teams” factor in the present study. Even though the CPAT [10] consists of 56 items, the IPC scale developed in this study can intensively and simply assess the functions of interprofessional collaboration, including the “strength of teams” in home health care for the frail elderly in the community.

It has been pointed out that common interests among members of interprofessional teams promote collaboration [17] and that both “role clarification” and “collaborative leadership” are “competencies” required for collaboration [3]. Therefore, “common interests among members,” “role clarification,” and “collaborative leadership” were included under “strength of teams” in the present study. The results of our study also suggest that “strength of teams” is an important element to enhance interprofessional collaboration.

The second factor, “management of collaborative systems,” consisted of fields related to information (measures to cope with information leakage), the effects of collaboration (establishment of interprofessional teams, procedures for collaboration, and methods for the assessment of collaboration), utilization of social resources, and contribution to the community. Some of these items are similar to “community linkages and coordination of care,” the assessment item adopted by the CPAT [10]. To improve the quality of the functions of collaboration, it is necessary to reflect on what has been learned from collaboration in the community through cooperation with community residents and effectively utilize the community's social resources.

The third factor, “effects of collaboration,” consisted of the fields related to the interests of care recipients (most appropriate support centered on care recipients and their satisfaction) and the effects of collaboration (including appropriate support, addressing problems experienced by professionals, and self-reflection by professionals and their improvement). The field of care recipients’ interests is considered to be one aspect of “patient involvement,” item included in the CPAT [10]. Certain features of “the effects of the improvement of members of interprofessional teams” have been adopted by the partnership self-assessment tool developed by Weiss et al. [11]. This suggests that the IPC scale developed in this study can assess the effects of interprofessional collaboration on both the users of healthcare services and health professionals.

The fourth factor, “communication,” consisted of the fields of communication and relationships (including the

exchange of opinions and efforts to maintain communication) and information (including information sharing). "Communication" is a core competency for interprofessional collaboration [4]. The importance of team climates or interactions among team members and communication for interprofessional collaboration has also been pointed out [12]. Moreover, "communication" has been suggested to be an important aspect for the assessment of collaborative functions in home health care for the frail elderly in the community by the IPC scale developed in the present study. Assessment items "partnership" from AITCS [9] and "communication and information exchange" from CPAT [10] are similar to "communication" factor in the assessment index developed in the present study. However, the AITCS [9] consists of a large number of items, whereas the IPC scale developed in the present study can intensively and simply assess the functions of interprofessional collaboration.

The sum of scores for the six items of the communication factor in the cities/wards group was significantly smaller than that in the towns/villages. This suggests that it is necessary to promote communication among health professionals to improve collaboration among those living in large cities. Healthcare and educational institutions have paid attention to methods for the improvement of skills to communicate with other professionals [18, 19]. Although meeting people in person is important as a communication method, it is often difficult for all members of an interprofessional team working in a large city to meet to discuss matters face to face. Therefore, it is necessary to develop effective communication methods using information and communication technology.

Enhancing interprofessional collaboration is an important issue facing many countries today. Various nations seek to develop indices to assess interprofessional collaboration and its competency. Since the necessary collaboration would vary depending on the supply and demand of health care or on each country's healthcare system, it is essential to create indices that reflect such differences. The attitudes and values required of team members may also differ depending on each occupation's role, education, and culture.

The Norwegian version of the interprofessional collaborative competency attainment survey (ICCAS) [20] was developed, and its validity was confirmed [21]. Thus, ICCAS has been translated and used in many countries. ICCAS comprises five areas: communication, collaboration, roles and responsibilities, a patient-centered approach, and conflict management and team functioning [21]. In addition, the Italian version of the Chiba Inter-professional Competency Scale (CICS29) [22] was created, and its validity was confirmed [23]. CICS29 consists of six areas: attitude and belief, team management, actions, respect for patients, improved team cohesion, and role [22].

The IPC scale is similar to ICCAS and CICS29 concerning evaluating the organizational strength as a collaborative team, members' roles, and communication. However, the IPC scale differs from them in that it emphasizes whether collaboration is conducive to providing support to the elderly so that they would be able to maintain their preferred ways of community life. Thus, rather than solving immediate problems that are the subjects' primary concerns, it evaluates the attitudes of team members as they work with the subject to consider countermeasures jointly. In addition, the IPC scale emphasizes the process of collaboration in conducting the evaluation. This is because collaborative teams seek to support the frail elderly and become a new resource for the local community.

The IPC scale was developed with the cooperation of Japanese care managers. Thus, its validity must be confirmed before using it in other countries. However, the authors believe that it will also be helpful to evaluate the collaboration of care teams outside Japan as they help the frail elderly maintain their home life.

Most of the previous indices for the assessment of interprofessional collaboration were designed to assess general collaborative teams, and they often include items unnecessary for the assessment of collaborative functions required to provide home health care to the elderly. Furthermore, they have an excessive number of items or can only assess limited fields. The IPC scale developed in this study, which is specialized for the assessment of the functions of interprofessional teams that provide home health care for the frail elderly living in the community, only has a small

number of items and can comprehensively assess collaborative functions required for home health care.

Study limitations and challenges

The response rate to the present survey was 28.7%, and the subjects may have only included those who were interested in professional collaboration. Furthermore, as the reliability and validity of the assessment index were supported by care managers, it is necessary to examine whether or not the index can be used by other professionals. This survey was conducted in 2017. Thus, it is necessary to conduct another survey to validate the results of this survey and confirm the factor structure.

A longitudinal assessment of collaborative functions using the IPC scale in the homes of the frail elderly living in the community in need of health care will be conducted. A comparison of the functions of interprofessional teams in Japan and other countries will also help improve the quality of interprofessional collaboration in many different countries.

Conclusions

The new IPC scale for the assessment of the functions of interprofessional collaboration to provide home health care for the frail elderly living in the community consists of four factors: “strength of teams,” “management of collaborative systems,” “effects of collaboration,” and “communication,” comprising 37 items in total. This scale indicated that the reliability and validity were good. It is easy to implement the factors of IPC. This scale can be used to assess the IPC for home health care for frail elderly.

Consent for publication

The authors and participants all consent to the publication of the article.

Ethics approval and consent to participate

This study was approved by Medical Ethics Committee of Kanazawa University (No. 751). Participation was voluntary, and submission of a completed questionnaire form was regarded as consent to participate in the study. The subjects consented to participate in the interviews and pilot surveys in written form. The data of the participants were kept confidential and used for the academic research only.

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Conflict of interest

The authors declare no conflict of interest.

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Items	Categories	Number (%)/M±SD
Administrative classification of areas in which the institutions were located N = 512	Cities/wards	224 (43.8)
	Towns/villages	288 (56.3)

Gender N = 508[a]	Men	119 (23.4)
	Women	389 (76.6)
Age N = 506[a]	In their 30s	53 (10.5)
	In their 40s	182 (36.0)
	In their 50s	198 (39.1)
	In their 60s	73 (14.4)
Certificates (multiple answers allowed) N = 512	Health care workers	291 (56.8)
	Participants who had completed training for new health care providers	114 (22.3)
	Nurses	89 (17.4)
	Social workers	76 (14.8)
	Other professionals (pharmacists, dietitians, etc.)	75 (14.7)
Time working as a care manager (years) N = 510[a]		9.41 ± 4.76
Number of care recipients under the care of the care managers (Number of recipients per care manager) N = 502[a]		30.86 ± 9.16
Frequency of meeting professionals from other institutions (per month) N = 509[a]		4.36 ± 3.34
Frequency of participating in workshops related to collaboration (per year) N = 492[a]		4.62 ± 6.38

Question items	Factor loading	Cronbach α coefficients

Factor 1	Factor 2	Factor 3	Factor 4	Each factor	All items	Q 12	All members understand the effects of interprofessional collaboration and problems.

.922	.109	-.015	-.167	.954	.967	Q10	All members discuss how to set common goals, and cooperate with each other to fulfill them.

.889	.058	-.098	-.039	Q9	All members discuss problems that have been identified in relation to the daily lives of care recipients.	.852	-.068

.002	-.008	Q6	All members understand that interprofessional collaboration aims to improve the quality of support provided to care recipients.	.808	-.100	-.023	.020

Q7	All members hope to support the lives of care recipients in collaboration with each other.	.776	-.127	.055	.034	Q11	Roles for each member of the team have been clearly defined.

.765	-.106	.128	.020	Q8	All members share a common understanding of the problems related to the daily lives of care recipients.	.746	-.126
.071	.091	Q14	Members of the team, led by the leader, fulfill their roles.	.738	.101	.082	-.047

Q5	All members recognize that it is necessary to collaborate with other professionals to solve problems.	.734	-.162	-.035	.101	Q15	Members of the team support the leader.
.662	.214	-.036	-.037	Q17	All members are learning about how to support provided for care recipients.	.640	.306

-.108	-.050	Q16	All professionals in the team are allowed to dedicate themselves to provide support using their expertise and specialized skills.	.631	.051	.167	-.052

Q2	All professionals in the team respect and trust the specialties of others.	.580	.075	-.116	.106	Q 13	The roles of the leader (coordinator) have been clearly defined.

.551	-.002	.158	.088	Q4	All professionals in the team understand the types of support provided by others in the team and their effects.	.517	.111

-.048	.214	Q1	All professionals in the team understand each others' expertise and specialized skills, and their functions are independent of each other.	.464	.097	-.093	.232
Q49	The process for collaboration and methods for the assessment of results have been clearly defined.	.062	.806	-.035	-.010	.880	Q53

Interprofessional collaboration is a community resource.	-.078	.777	-.009	-.020	Q51	Members of the team exchange information, including what has been learned from interprofessional collaboratio	-.030

						n.	
.747	.06	.000	Q52	All professionals in the team effectively utilize social resources in the community.	-.083	.727	.095
-.011	Q48	Procedures for collaboration are neither difficult nor a burden to perform.	.000	.681	-.037	.063	Q50

Interprofessional teams can be organized by the professionals required to provide care for recipients on an as-required basis.	-.092	.669	.119	.123	Q34	Members of the team discuss the measures required to address information leakage.	.088

.619	-.101	-.025	Q37	Members of the team provide care recipients with the most appropriate care within a limited period of time.	-.105	.023	.871
-.035	.904	Q36	Support to the life that the care recipients expect is provided.	-.052	-.063	.821	-.073

Q42	Appropriate support is provided to respond to a variety of needs of the care recipients.	.016	.090	.769	-.014	Q38	Explanations of the support provided to care recipients and their families are consistent.

.048	-.132	.715	.092	Q39	Most care recipients and their families are satisfied with the support.	.018	.086
.709	-.088	Q47	Interprofessional collaboration has the advantage of helping members of the team improve their knowledge and support skills.	.156	.122	.440	.084

Q46	Collaboration helps members of the team reflect on their support activities and improve them.	.212	.075	.437	.113	Q44	Collaboration helps professionals in the team address problems that need to be solved.

.192	.226	.413	.048	Q22	Information about support can be shared even when conferences are not held by healthcare professionals.	-.017	-.006
-.048	.921	.921	Q23	Members of the team keep in touch with each other.	.072	-.033	-.021
.876	Q24	Members of the team can talk with each other to respond to changes in situations.	.012	-.001	.028	.825	Q21

Members of the team exchange opinions on the types of support required by the care recipients.	.065	.130	-.016	.687	Q20	Members of the team are acquainted with each other and understand the differences in their views.	.179

.096	-.102	.587	Q27	Members of the team share necessary information regarding the daily lives of the care recipients.	.178	-.105	.268
.491		Contribution rate of factors (%)	46.5	4.8	3.7	3.7	
Cumulative contribution rate of factors (%)		58.6			Factor correlation matrix 1	—	.664
.682	.731	2		—	.638	.586	3
		—	.618	4			

	Is it easy to collaborate with other institutions?			One-way analysis of variance F value	Multiple comparison
1 Definitely yes (n = 362) M±SD	2 Yes (n = 128) M±SD	3 No (n = 20) M±SD	First factor: strength of teams (16 items; 112 points)	84.53 ± 12.74	74.55 ± 12.77
66.95 ± 11.98	42.47***	1 > 2,3	Second factor: management of collaborative systems (7 items; 49 points)	30.60 ± 7.21	26.54 ± 5.60
23.95 ± 5.44	23.48***	1 > 2,3	Third factor: effects of collaboration (8 items; 56 points)	42.00 ± 5.95	38.73 ± 6.16
34.85 ± 6.34	24.42***	1 > 2,3	Fourth factor: communication (6 items; 42 points)	33.28 ± 4.85	29.77 ± 5.20

26.45 ± 5.52	37.3***	1 > 2,3	All items (37 items; 259 points)	190.41 ± 26.69	169.59 ± 24.42

	Is it easy to collaborate with other health professionals?			One-way analysis of variance F value	Multiple comparison
1 Definitely yes (n = 328) M±SD	2 Yes (n = 156) M±SD	3 No (n = 26) M±SD	First factor: strength of teams (16 items; 112 points)	84.71 ± 12.79	76.74 ± 12.68
65.19 ± 12.07	42.63***	1 > 2,3 2 > 3	Second factor: management of collaborative systems (7 items; 49 points)	30.68 ± 7.24	27.31 ± 5.96
23.38 ± 5.15	23.39***	1 > 2,3 2 > 3	Third factor: effects of collaboration (8 items; 56 points)	42.05 ± 5.89	39.38 ± 6.17

35.04 ± 7.05	23.09***	1 > 2,3 2 > 3	Fourth factor: communication (6 items; 42 points)	33.48 ± 4.76	30.18 ± 5.14
26.35 ± 5.75	42.43***	1 > 2,3 2 > 3	All items (37 items; 259 points)	190.92 ± 26.51	173.62 ± 25.22

DETAILS

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Effects of Heating Therapy on Pain, Anxiety, Physiologic Measures, and Satisfaction in Patients Undergoing Cystoscopy

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ABSTRACT (ENGLISH)

SUMMARYPurpose

Cystoscopy is the most common procedure used to diagnose urological diseases; however, it is invasive and can be associated with pain and anxiety. Although pain relieving medications, such as lidocaine lubricants, are used during cystoscopy, the procedure still causes discomfort. Therefore, non-medical intervention is needed to reduce pain and anxiety during the procedure and increase patient satisfaction. The aim of this study was to evaluate the effect of heating therapy on pain, anxiety, physiologic measures, and satisfaction during cystoscopy.

Methods

This was a single-blinded, single-center, randomized controlled trial. A total of 145 participants who underwent cystoscopy between August 2017 and October 2017 were recruited and randomly assigned to an experimental or control group. Before and after cystoscopy, all the participants self-reported the degree of pain they felt, while pain was objectively assessed by trained nurses. Anxiety was evaluated using the validated Korean version of the State-Trait Anxiety Inventory. Blood pressure and pulse rate were also recorded as physiologic measures. After

cystoscopy, satisfaction was measured in the experimental group only using the Korean version of the Client Satisfaction Questionnaire.

Results

Heating therapy reduced both subjective and objective pain and anxiety in the experimental group compared to the control group. Heating therapy also decreased the systolic and diastolic blood pressure and pulse rate in the experimental group compared to the control group. Women reported significantly greater satisfaction than men.

Conclusion

Heating therapy during cystoscopy is a convenient and effective nursing intervention that decreases pain and anxiety and enhances patient satisfaction.

The study has been registered with the Clinical Research Information Service Registry, and the trial registration number is [12616000803493].

FULL TEXT

Introduction

Cystoscopy is now preferentially recommended over invasive testing for the evaluation of asymptomatic microscopic hematuria and thus the identification of bladder cancer or other urological diseases [1–3]. However, even though cystoscopy is the most common procedure in daily urology practice, it is invasive and can be associated with pain and discomfort [4]. In particular, conscious patients are directly exposed to various stimuli during cystoscopy, which increases anxiety [5]. The pain and anxiety associated with cystoscopy can activate the sympathetic nervous system [6], resulting in various physiological responses, such as increased cardiac output, elevated blood sugar level, peripheral vascular contraction, and elevated blood pressure (BP) [7].

A variety of medical interventions, such as intra-urethral injection of lidocaine lubricant [8] or flexible cystoscopy [9], have been used to alleviate pain and anxiety during cystoscopy. Flexible cystoscopy is generally less painful than rigid cystoscopy; however, it is expensive, visualizes a smaller area, and requires more skill from urologists, and is therefore not favored [10,11]. In addition, some studies have reported that lidocaine lubricants can relieve pain and discomfort during cystoscopy [12]. However, some other authors have described self-reports of discomfort from patients who were administered lidocaine lubricants during cystoscopy [13]. Thus, despite the use of these medical interventions, patients undergoing cystoscopy still complain of post-procedural pain and anxiety [2].

Heating therapy involves the use of heat to relax the muscles [14], facilitate blood circulation [15,16], and promote metabolism [17], thus relieving pain [18–20]. It is inexpensive, saves time, and requires no special training or skill [16,20]. Furthermore, heating therapy elicits a sympathetic reaction that increases blood circulation in areas other than those directly in contact with heat [21,22]. Heating therapy can also relieve pain by temporarily increasing the threshold of pain delivery fibers [18].

Generally, acute pain causes anxiety, which increases the fear of pain, depression [23], sleep disturbances [24], and interferes with concentration and cognition [25]. Anxiety is triggered by a threat stimulus or an anticipated threat. As such, it increases attention to the trigger stimulus, leading to physiological arousal and avoidance actions [26]. Anxiety around pain causes individuals to avoid the stimulus and over-react to the body sensations that accompany it.

According to previous studies on the use of non-pharmacological interventions during cystoscopy, music therapy is an effective intervention that lowers pain and anxiety in patients during cystoscopy [27–29]. In another study, playing a video appeared to be the best distraction method during cystoscopy [30]. Hand-holding during cystoscopy has also been shown to reduce patients' anxiety, pain, and dissatisfaction [31]. Recently, two studies demonstrated that heating therapy is an effective intervention; however, only females were evaluated in those studies [32,33].

Therefore, the aim of the present study was to measure the effects of heating therapy on pain, anxiety, physiological measures that are affected by pain and anxiety, and satisfaction in patients undergoing cystoscopy in South Korea. The objectives were to determine: (1) whether the experimental group experienced more pain relief than the control group; (2) whether the experimental group experienced lower anxiety than the control group; and (3) whether the satisfaction differed between men and women in the experimental group.

Methods Study design

This was a single-blinded, single-center, randomized controlled trial (RCT). It was conducted for 3 months, from August 2017 to October 2017.

Setting and sample

We included patients who were to undergo cystoscopy for the diagnosis and treatment. The inclusion criteria were as follows: (1) patients older than 18 years; (2) had sufficient intellectual capacity to communicate and comprehend the details of the study; (3) understood the purpose of the study; (4) provided informed consent; and (5) had urinary problems such as blood in the urine, urinary tract infections, overactive bladder, pelvic pain, etc. We excluded patients diagnosed with bladder cancer as their diagnoses may induce anxiety. Patients who were already in pain were excluded because their pain could not be differentiated from pain due to cystoscopy.

Initially, 166 eligible patients were assessed for possible inclusion in the trial during their scheduled visit for cystoscopy at the urology outpatient clinic of [masked for blinded review]. Of these, seven patients did not meet the inclusion criteria, five patients declined to participate, and eight patients had other reasons for not participating in the study. A total of 146 patients were randomized at a 1:1 ratio into two groups using computer-generated random numbers. Seventy-three patients each were allocated to the control and experimental groups. However, only 72 patients were enrolled in the control group because one patient refused to complete the post-intervention survey and dropped out. Figure 1 shows the Consolidated Standards of Reporting Trial diagram of the procedure of patient enrollment, randomization, and analyses in this study.

The sample size for the RCT was calculated using G*power 3.1.5 freeware [34], based on an effect size of 0.7 for pain intensity according to the methods used in a previous study on the effect of music therapy during cystoscopy [35] since there was no study on heating therapy for cystoscopy in urology when we planned our study. With a statistical power of 0.95, a two-tailed significance level of 0.05, and an allocation ratio of 1 (control vs. experiment), we estimated a sample size of 110 patients in total. We set the attrition rate at 33.0% considering high dropout rates in human health RCT [36]. Thus, the recruitment target was 146 patients.

Ethical considerations

Ethical approval for this study was provided by the Gil Hospital Institutional Review Board [No, (GCIRB2017-242)]. The study has been registered with the Clinical Research Information Service Registry, and the trial registration number is [12616000803493]. Patients were informed that their participation was voluntary and that they could withdraw from the study at any time. They were reassured that their withdrawal would not prevent them from receiving the care that they would normally receive. The participants were identified using research codes, and the research information remained confidential.

Measurements Pain

The patients' subjective pain was assessed immediately after the procedure using a combined numeric rating scale and face rating scale to maximize our understanding of the self-reported pain associated with cystoscopy. Patients were asked to indicate how much pain they felt from 0 (no pain) to 10 (the worst pain).

Before beginning the study, one male and one female nurse were trained to assess pain and check pain monitoring. After training, they consistently measured pain values to assess the patients undergoing cystoscopy. Using the same methods described by Suh in 1990, they observed the patients' pain objectively during the cystoscopy procedure, monitoring four areas: (1) sweating; (2) changes in facial expressions; (3) changes in posture; and (4) changes in the voice [37]. A five-point Likert scale (1–5) was used to score each area, with the total score ranging from 4 (least pain) to 20 (most pain). In the present study, Cronbach's alpha for pain was 0.82.

Anxiety

We measured the anxiety level using the validated Korean version of the State-Trait Anxiety Inventory (STAI), which comprises two subscales of 20 multiple-choice questions each. The STAI was developed by Spielberger, Gorsuch and Lushene in 1970 [38] and was translated into Korean by Kim and Shin in 1978 [39]. Each subscale of the STAI, a 5-point scale (1–5), is summed up to obtain a total score between 20 and 80 points, with larger scores indicating greater anxiety levels [38, 39]. In the present study, we measured STAI trait anxiety, which can affect state

anxiety. Cronbach's alpha for STAI trait anxiety was 0.82, whereas that for STAI state anxiety was 0.88.

Physiological measures

The physiological measures we recorded included BP and pulse rate (PR), both of which could be affected by pain and anxiety [6]. BP and PR were measured thrice on each patient's left brachial artery using an electronic OMRON M3 Comfort® HEM –7134-E BP monitor (Omron Healthcare Co., Ltd. Kyoto, Japan), with 30 seconds between each measurement. An interval of no less than 1 minute was allowed between measurements, and the total measuring time was within 5 minutes. The measurements were taken within 10 min before and after the cystoscopy procedure. We used the average BP and PR values for analysis.

Satisfaction

Patient satisfaction was assessed using the Korean version of the Client Satisfaction Questionnaire (CSQ-8 Korean). The CSQ-8 was developed by Attkisson and Greenfield in 1994, and they permitted the use of the CSQ-8 Korean through a confirmation e-mail [40]. The questionnaire consisted of eight questions, each answered on a four-point scale (score range of 1–4) with the total score ranging from 8–32; higher values indicate higher satisfaction. In the present study, Cronbach's alpha for satisfaction was 0.90.

Procedure

Cystoscopy was performed in a 1-day outpatient clinic by eight qualified urologists following a standard protocol. All cystoscopies were performed with the patients placed in the dorsal lithotomy position; no additional manipulations, such as stent removal or bladder biopsy, were performed. Before each cystoscopy procedure, the external genital area was disinfected using povidone-iodine, and 10 mL of 2.0% lidocaine jelly was instilled in the intra-urethral area. Cystoscopy was performed using s rigid cystoscope (Karl Stortz, Tuttlingen, Germany) connected to a digital video monitor, which was used for all procedures.

In the experimental group, the electric heating pad therapy was initiated before disinfection and lidocaine gel injection and continued throughout the rigid cystoscopy procedure. The pad was warmed to a temperature between 40°C and 45°C and applied to the lower abdomen or sacrum area of the patient. The control group underwent cystoscopy with the electric heating pad therapy turned off. All patients viewed their procedures on a video monitor while they were being performed, and the urologist briefly mentioned each step of the procedure (i.e., instillation of analgesic, insertion of the scope, and intravesical scoping). The duration of the entire procedure was 20 minutes per patient. The urologist performing the treatment and the two nurses assessing objective pain, BP, and PR were blinded to the allocation; therefore, variables other than the experimental treatment were not affected.

Data collection

Data were collected after all participants provided informed consent. Most patients provided self-reported consent; however, we helped some elderly patients who had difficulty in reading the small letters on the survey. Before cystoscopy, a pre-test was carried out. Sociodemographic and clinical characteristics were recorded, and the state and trait anxiety levels were measured within 10–15 min. BP and PR were measured 10 min before cystoscopy. During the procedure, one male and one female nurse who assisted with the cystoscopy observed the patients' pain objectively. The post-test assessment, which included the evaluation of subjective pain, state anxiety, and BP and PR measurements 10 min after cystoscopy, was then carried out. Satisfaction was measured only in the experimental group.

Data analysis

We used IBM SPSS 25.0 for data analysis (IBM Corp, Armonk, NY, USA). Nominal variables were expressed as numbers and percentages (%) and compared using the Chi-squared test, whereas continuous variables were presented as means with standard deviations. First, the Kolmogorov–Smirnov test was conducted to assess the normal distribution of all continuous variables. Since STAI-S anxiety, subjective and objective pain, and satisfaction scores were not normally distributed, they were compared between groups using the Mann–Whitney U test. STAI-S anxiety, subjective and objective pain scores, and satisfaction were compared between the two groups using the Student's t-test for normally distributed data. Additionally, systolic and diastolic BP and PR were analyzed using an analysis of covariance (ANCOVA) model to control the covariates (history of cystoscopy and the basic values of

dependent variables) and identify the effects of heating therapy on the experimental group. Anxiety (STAI-S) and subjective and objective pain were analyzed using ranked ANCOVA after rank transformation to correct the covariates. All *p* **Results Baseline characteristics and homogeneity test**

The demographic data and clinical variables are presented in [Table 1]. The average ages of the experimental and control groups were 63.05 and 65.50 years, respectively, and most of the participants in both groups were men. There were no statistically significant differences between the two groups in terms of age, sex, education level, reason for cystoscopy, history of bladder surgery, and STAI-T. However, the control group showed a significantly higher frequency of history of cystoscopy than the experimental group (χ^2 = 10.15, *p* = .001).

Homogeneity test for the outcome variables of the two groups pre-intervention

We assessed STAI-S anxiety and physiological measures such as BP and PR pre-intervention ([Table 2]). Pain was not measured pre-intervention because none of the participants had pain before cystoscopy. Systolic (*t* = 2.30, *p* = .023) and diastolic (*t* = 2.73, *p* = .007) BP were significantly higher in the experimental group than in the control group. However, PR and STAI-S anxiety were not significantly different between the two groups.

Effect of heating therapy on the outcome variables of the two groups

The effects of heating therapy on pain, STAI-S anxiety, systolic and diastolic BP, and PR in the two groups are presented in [Table 3]. In this study, ANCOVA or ranked ANCOVA was used to control the covariates (history of cystoscopy and the basic values of dependent variables). Post-intervention, subjective (*F* = 25.25, *p* F = 35.55, *p* p p = .010) and diastolic (F = 10.57, *p* = .001) BP, and PR (F = 33.97, *p* **Satisfaction**

Satisfaction of the participants in the experimental group was measured after cystoscopy ([Table 4]). The mean total satisfaction score was 27.86. Total satisfaction reported by women after heating therapy was significantly greater than that reported by men (Z = −2.25, *p* = .024). In particular, women felt more satisfied than men in terms of the following: (1) “anxiety reduction” (Z = −1.99, *p* = .046); (2) “deal more effectively with problems through heating therapy” (Z = −2.08, *p* = .037); and (3) “intention of coming back to heating therapy” (Z = −2.07, *p* = .038).

Discussion

Heating therapy has been used for decades to relieve muscle pain, such as back pain and dysmenorrhea [41, 42]. Nevertheless, in the nursing clinical area, the scientific evidence for the analgesic effectiveness of heating therapy is limited because well-designed research studies are lacking [18]. The results of this RCT provide important nursing evidence on pain and anxiety in patients undergoing cystoscopy. In the present study, we evaluated the use of heating therapy as a non-medical nursing intervention for the management and relief of pain, reduction of anxiety, and increase of satisfaction in patients undergoing cystoscopy. Although many medical intervention studies have been conducted to evaluate the ideal therapy for the reduction of pain and discomfort during cystoscopy, only a few nursing intervention studies are available.

Heating therapy showed an effective reduction in the score for subjective and objective pain. The results demonstrating relieved pain in the present study are consistent with those of the other two studies on women who underwent cystoscopy in which the experimental group experienced less pain when compared with the control group [32, 33]. This pain reduction may have occurred because heating therapy increases blood flow [14, 19] and temporarily increases the threshold of pain delivery fibers [43]. According to review articles, heating therapy, by increasing the temperature of the skin and muscle has the following physiological effects: (1) pain relief, (2) increased blood flow and metabolism, and (3) increased elasticity of the connective tissue [44]. An increase in tissue temperature stimulates vasodilation and increases tissue blood flow, which promotes healing by increasing the supply of nutrients and oxygen to the site of injury [18]. As a result, the rate of local tissue metabolism is also increased by warming, which may further promotes healing and relieve pain [44].

Heating therapy also resulted in significantly lower anxiety in patients undergoing cystoscopy. These results were consistent with those reported by the cystoscopy [32] and urodynamic studies [33] conducted on women. They reported that heating therapy significantly lowered the state anxiety scores of the study subjects compared to those of the control subjects. Heating therapy relieves tension and stress and helps relieve feeling [45]. Heating treatments such as spa or balneotherapy also have anxiolytic effects and have previously been applied to ameliorate stressful

interventions [46,47].

Previous non-pharmacological intervention studies on patients who were undergoing urological procedures involved music therapy [29,35,48], hand-holding or use of a stress ball [30,31], viewing of the cystoscopy video with explanation [49], virtual reality distraction [50], and heating therapy [32,33]. The authors of one study that involved music therapy suggested that music therapy was the most effective intervention for the reduction of pain and anxiety [51]. Although very few studies have investigated heating therapy compared to music therapy, previous studies on heating therapy demonstrated excellent effects in terms of reduction of pain and anxiety [32,33]. To identify the effects of heating therapy in patients undergoing cystoscopy in the future, more studies of heating therapy as a non-pharmacological nursing intervention are needed.

We tried to identify the effects of heating therapy on the regulation of BP and PR. Before the initiation of treatment in the present study, the systolic and diastolic BPs of the participants in the experimental group were higher than those of the participants in the control group; thus, there was no homogeneity between the two groups. To solve this problem, we used ANCOVA to compare the effect of heating therapy. As the results show, the decrease in systolic BP, diastolic BP, and PR after the procedure were significantly higher in the experimental group than in the control group. According to previous studies, heating therapy could reduce the resting heart rate and noradrenaline release [52] and also decrease the BP by improving the endothelium-dependent dilatation [37], arterial stiffness, and intima media thickness [53]. In addition, heating therapy showed positive effects on the cardiovascular system according to a review article that consisted of articles published over a period of 25 years [45]. Therefore, heating therapy is a useful nursing intervention for patients undergoing cystoscopy.

Unlike our results, a previous study indicated that although heating therapy decreased the anxiety, pain, and distress of women undergoing cystoscopy, their systolic BP, diastolic BP, and PR were increased [32]. In another urodynamic study, heating therapy was used by Kim et al in 2018 to treat women with stress urinary incontinence, and their results showed no significant difference in the BP and PR measurements between the experimental and control groups [33]. In both of these studies, a small sample of 37 individuals each was assigned to the experimental and control groups; therefore, objective physiological BP and PR may not have had a significant effect. In the future, various strict randomized studies might be needed to investigate whether heating therapy mitigates the changes in physiologic measures induced by cystoscopy.

Finally, patient satisfaction is a commonly used indicator of the quality of medical services and the effectiveness of nursing interventions [54]. In the present study, the satisfaction survey regarding heating therapy was only administered to the experimental group because it addressed satisfaction with heating therapy during cystoscopy and thus could not be administered to the control group. To identify patient satisfaction with the nursing intervention, we compared the responses of the participants who received heating therapy. When the score of total satisfaction was converted into 100%, women reported 90% satisfaction and men reported 84% satisfaction. Specifically, women were more satisfied in terms of the following survey items: “anxiety reduction by heating therapy,” “deal more effectively with problems through heating therapy,” and “intention of coming back to heating therapy.” Therefore, heating therapy can be considered an effective nursing intervention for women undergoing cystoscopy as it may provide psychological stability and physical relaxation, thus reducing anxiety and discomfort. A plausible reason for these results may be that women tend to favor heating therapy more than men in Korean culture [55].

There were some limitations to the present study. First, measurement of patients' subjective pain and anxiety during the cystoscopy examination was done by memory immediately after the examination because it is difficult to measure pain and anxiety levels during cystoscopy. This should be considered when interpreting the relationship between BP/PR and pain/anxiety during the test. Second, despite using a single-blinded, RCT, participants might have known those who were in the control or experimental group depending on whether the warm heating pad was applied after cystoscopy. Therefore, we suggest the use of three test groups, including a control group with the application of a heating pad which is turned off, the experimental group with the application of a heating pad which is set to a low level of heating, and other experimental group with the application of a warm heating pad. Third, although the same cystoscopy protocol was used for each patient, the procedure was not conducted by the same

urologist. In future studies, it is necessary to have the same urologist perform the cystoscopy procedure to reduce confounding factors. Moreover, the outcomes should be interpreted with caution because we included men with benign prostatic hypertrophy, which can cause pain during cystoscopy. Lastly, post-cystoscopy pain tends to persist in some patients and may occasionally last up to 2–3 days after the procedure; therefore, we suggest that in future studies, [4].

Conclusion

Heating therapy reduces the pain and anxiety in patients undergoing cystoscopy and decreases their BP and PR, which are physiological indicators of pain and anxiety. Considering the high satisfaction score recorded in the present study, we believe that heating therapy is a useful independent nursing intervention. Moreover, as heating therapy using an electric heating pad is simple, convenient, and cost-effective, it may be considered an effective non-pharmacological nursing intervention.

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Conflict of interest

The authors declare no conflicts of interest.

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		Exp. (n = 73)	Con. (n = 72)	χ^2/t	p
Mean (SD)/N (%)		Age, years		63.05 (11.04)	65.50 (11.34)
−1.32	.190	Gender	Men	39 (53.4)	48 (66.7)
2.64	.104	Women	34 (46.6)	24 (33.3)	Educati on level
Below middle school	33 (45.2)	42 (58.3)	2.50	.114	Above high school
40 (54.8)	30 (41.7)	Reason for cystoscopy	Diagnosis	57 (78.1)	48 (66.7)
2.36	.124	Treatment	16 (21.9)	24 (33.3)	History of cystosc opy
Yes	36 (49.3)	54 (75.0)	10.15	.001	No

37 (50.7)	18 (25.0)	History of bladder surgery	Yes	33 (45.2)	39 (54.2)
1.16	.281	No	40 (54.8)	33 (45.8)	STAI-T

		Exp. (n = 73)	Con. (n = 72)	t/Z	p
Mean (SD)		Anxiety (STAI-S)[a]		56.26 (6.74)	57.27 (5.52)
−0.76	.450	BP, mmHg	Systolic	137.55 (19.41)	130.79 (15.78)
2.30	.023	Diastolic	81.49 (10.28)	76.89 (9.99)	2.73
.007	PR, beats/min		77.64 (12.54)	75.65 (10.83)	1.02

Variables		Group	Pre-intervention	Post-intervention	F	p
Mean (SD)	Mean (SD)	Pain*	Subjective	Exp.(n = 73)	-	4.10 (1.30)
25.25	<.001	Con.(n = 72)	-	5.15 (1.17)	Objective	Exp.(n = 73)
-	6.96 (2.30)	35.55	<.001	Con.(n = 72)	-	9.18 (2.42)
Anxiety (STAI-S)*		Exp.(n = 73)	56.26 (6.74)	43.78 (5.48)	55.74	<.001
Con.(n = 72)	57.27 (5.52)	50.87 (5.70)	BP, mmHg	Systolic	Exp.(n = 73)	137.55 (19.41)
132.30 (20.32)	6.91	.010	Con.(n = 72)	130.79 (15.78)	133.61 (17.77)	Diastolic

Exp.(n = 73)	81.49 (10.28)	77.32 (8.88)	10.57	.001	Con.(n = 72)	76.89 (9.99)
78.93 (11.82)	PR, beats/min		Exp.(n = 73)	77.64 (12.54)	74.07 (11.77)	33.97

	Total (n = 73)	Male (n = 39)	Female (n = 34)	Z	p
Mean (SD)			Total score of satisfaction with heating therapy (range: 8–32 score)	27.86 (3.60)	26.95 (3.80)
28.91 (3.08)	−2.25	.024	1.Quality of heating therapy	3.55 (0.50)	3.49 (0.51)
3.62 (0.49)	−1.11	.267	2.Pain relief conferred by heating therapy	3.27 (0.71)	3.13 (0.73)
3.44 (0.66)	−1.87	.062	3.Anxiety reduction by heating therapy	3.41 (0.74)	3.23 (0.84)
3.62 (0.55)	−1.99	.046	4.Recommend heating therapy to a friend	3.47 (0.50)	3.36 (0.49)
3.59 (0.50)	−1.95	.052	5.Satisfaction with application time of heating therapy	3.38 (0.57)	3.33 (0.48)

3.44 (0.66)	−1.25	.210	6.Deal more effectively with problems through heating therapy	3.52 (0.65)	3.36 (0.63)
3.71 (0.63)	−2.08	.037	7.Overall satisfaction with heating therapy	3.59 (0.49)	3.49 (0.51)
3.71 (0.46)	−1.88	.060	8.Intention of coming back to heating therapy	3.67 (0.47)	3.56 (0.50)

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Effectiveness of Virtual Reality Interactive Play for Children During Intravenous Placement: A Randomized Controlled Trial

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ProQuest document link

ABSTRACT (ENGLISH)

SummaryPurpose

This study aimed to evaluate the effectiveness of an interactive virtual reality (VR) play intervention including instructional play and emotional catharsis play sessions in reducing children's pain and fear during intravenous placement.

Methods

A randomized controlled trial with parallel groups was conducted. The sample consisted of 134 hospitalized children

aged 6–12 years (intervention group: *n* = 69; comparison group: *n* = 65). The intervention involved one immersive intravenous scene in VR before the actual intravenous placement and one emotional catharsis VR play after injection. The comparison group received an educational photo book about intravenous placement before receiving intravenous placement. The children and their caregivers rated their pain and fear by using the Wong–Baker FACES Pain Rating Scale and the Children's Fear Scale. The time required for successful intravenous insertion was also compared between the two groups.

Results

Children's pain (*p* = .028) and fear scores (*p* = .004) were significantly lower in the intervention group than in the comparison group. Their caregivers' pain and fear scores (both *p* < .001) were significantly lower in the intervention group. The time required for successful intravenous insertion did not differ significantly between the intervention and comparison groups.

Conclusions

The interactive play intervention with VR effectively reduced children's levels of pain and fear during the intravenous placement procedure. The results of this study can serve as a reference for the implementation of a feasible, child-friendly care practice for clinical intravenous placement in school-aged children.

FULL TEXT

Introduction

Invasive treatment is a stressful process for hospitalized children. An intravenous injection is a common invasive treatment [1]. Although school-aged children can communicate the location and intensity of pain verbally, they often exhibit muscle tightening, body stiffness, fist clenching, painful stimulus avoidance, and procrastination during injection processes. They worry about displaying uncontrolled behaviors and attempt to appear brave to maintain control. If the child is not provided with an initial explanation of procedures or is provided with deceptive information, they can fear and distrust their medical care and medical caregivers and may not cooperate [2,3]. If a child's behavioral reaction during the injection process is intense, achieving a successful injection becomes difficult. Negative experiences with this medical process or unfamiliarity with the environment increases pain caused by intravenous injections and affects children's attitude toward future medical care, physical discomfort, and mental trauma [3].

Therapeutic play is a treatment in which games are designed with plans, goals, and skills in mind to understand the development, threatening life events, and internal conflicts of children who are ill, as an interventional care activity [4,5]. In therapeutic play, children inhabit the role of a third party to express their inner feelings; understand their inner worries, fears, and defense mechanisms; and deal with their concerns and anxieties. Medical staff members gain insight into children's needs and feelings in order to effectively implement health education about nursing interventions, medical treatment, and procedures [6]. Therapeutic play has three main forms, namely instructional, emotional outlet, and physiologically enhancing play [7].

Virtual reality (VR) is a computer-generated simulation that provides an immersive, multisensory, and three-dimensional environment in which a child can experience a changed sense of reality and concentrate on immersing themselves in it [8]. An immersive therapeutic play strategy that can be easily implemented can help alleviate the pain and fear of school-aged children receiving intravenous placement. Most studies on VR have applied the distraction principle to assist in reducing children's pain, fear, and anxiety by providing a comfortable environment for video watching [9–11] and interactive gaming [12,13]. Various VR programs have been extensively used for children and adolescents in intravenous placement or venipuncture [9–12,14,15]. In addition to distraction strategies, Wong et al. [15] used a hospital-based adventure story with cartoon characters for informative purposes. Eijlers et al. [16] asserted the need for further research on the effects of VR exposure as a preparation approach for medical procedures. This approach could be especially effective for children at a concrete operational stage who have the capacity for logical thinking [17]. In addition to providing instructional play before treatment, VR can minimize children's pain, fear, and anxiety during intravenous placement; improve their psychological construction, interpretation, and communication; and enhance their sense of control and participation in treatment. Following intravenous placement, immersive

cathartic play can guide children in expressing their emotional feelings of the medical care process. Therefore, this study aimed to develop a VR play intervention, including instructional and emotional catharsis play sessions for hospitalized school-aged children undergoing intravenous placement, and examine the effectiveness of this strategy compared with an educational photo book about intravenous placement in reducing children's pain and fear during the procedure.

Specifically, we determined the effectiveness of the intervention on the basis of the following items:**Hypothesis 1**

The intervention group with VR play intervention will have a lower pain score than the comparison group with educational book.

Hypothesis 2

The intervention group with VR play intervention will have a lower fear score than the comparison group with educational book.

Hypothesis 3

The intervention group with VR play intervention will take less time required than the comparison group with educational book.

Methods Design and setting

A parallel, two-arm, multicenter, randomized controlled trial was conducted at the pediatric wards of two medical centers in northern and central Taiwan between June and September 2020. The study was registered with the ClinicalTrials.gov (NCT04558086).

Participants

We included children aged 6–12 years who were recommended to receive intravenous placement by a physician. We excluded children who had developmental delay, epilepsy, visual or hearing impairment, nearsightedness with more than 8.0 diopters or farsightedness with more than 5.0 diopters, or head trauma sustained in the past month; required blood transfusion and blood preparation; received two or more intravenous injections; were undergoing chemotherapy; had experienced VR-induced dizziness; or had a history of vertigo.

The G*Power 3.1.2 program was used to calculate the required sample size; the calculation revealed that for analysis of covariance (ANCOVA) with two groups, a minimum sample size of 128 was required to achieve a power level of 80.0%, an alpha level of 0.05, a medium Cohen's f effect size of 0.25, and a total of 8 covariates, including the children's age, gender, frequency of past intravenous injections, prior use or nonuse of VR, fear scores in pretest, caregiver's age and gender, and registered nurses' years of work experience. Assuming a 5.0% dropout rate, we recruited a total of 134 participants in this study.

Randomization

Allocation concealment was used to randomly assign the enrolled participants into two groups. A staff member not involved in the study used Random Allocation Software 2.0 for the block randomization of the two medical centers; the allocation results were placed in opaque, sealed envelopes, which the participants opened after they and their primary caregivers signed the consent forms.

Interventional instrument

The VR headset HTC Vive was used in this study. The head-mounted display device of the VR Cosmos helmet presented a multiangle view of the virtual world, allowing for a fully immersive experience for the participants. A detector captured the movement of the participants and interacted with the virtual environment. In addition, the wireless hand controller mirrored the participants' hand actions (e.g., grasp or aim) in the virtual world. A light sensor was affixed to the helmet and front end of the controller to locate the position of the controller in the three-dimensional space. The scenes and scripts of the interactive VR play were designed on the basis of clinical implementations of intravenous placement and a literature review ([Table 1]). We cooperated with the research team of the third author to develop the VR play entities.

Participants allocated to the intervention group underwent instructional and emotional catharsis play sessions executed in the VR environment. The instructional play consisted of one immersive intravenous scene in VR to inform the participants about the purpose and process of injection and what must be done prior to receiving actual

intravenous placement. The interactive scene lasted approximately 5 min. The scene started from opening the treatment room, where the child could look around the setting with the handheld controller while listening to the purpose and explanation of intravenous placement procedures along with soft background music. Each participant was asked to stretch out their arm on a red pillow. They then watched the sequence of procedures that followed, namely the trying of a blue rubber band around their arm, disinfection and injection of the intravenous area, deposition of blood in a test tube, placement of a sticker on the needle, and connection of the needle with the long fluid tube. Finally, a rabbit and two figures representing bacteria entered into the room and announced that a game in which participants must eradicate the bacteria after completing the intravenous placement. The instructional play scene is illustrated in Figure 1.

The postinjection emotional catharsis play session began with an interactive VR scene in which figures representing bacteria were running and jumping in the treatment room, with brisk but relaxing rhythmical music. The rabbit said the following: “Welcome back, little warrior! You were really brave just now. There are a lot of bad bacteria here making our body sick; let's destroy them!” Each participant held a hand controller with the non-injected hand to play for 5 min. Finally, the rabbit clapped its hands and said the following: “You are really amazing. You can make us healthy by stopping the bacteria!” The scene of the emotional catharsis play is also illustrated in Figure 1.

Participants allocated to the comparison group were provided with an educational photo book on intravenous placement entitled *Detective Conan: The Truth about Needles* developed by Hsieh et al. [18] before receiving intravenous placement. The main content of the book outlines the aim of intravenous placement, sensory and procedural information, and care considerations for hospitalized school-aged children.

Tools Wong–Baker FACES pain rating scale

One of the primary tools in this study was pain. The degrees of pain experienced by the children and reported by their primary caregivers were measured using the Wong–Baker FACES pain rating scale (WBFPS) [1]. The scale contains six cartoon faces with pain ratings of 0–10, with 0 representing ‘no pain’ and 10 representing ‘excruciating pain’. The internal reliability coefficients for the WBFPS were determined to be 0.82–0.92, and the test–retest reliability was 0.90 [19]. The children and primary caregivers were asked to select the faces that best described the pain levels experienced by the children who received intravenous injections; the pain levels were subsequently converted into numerical values [1,19,20].

Children's fear scale

Similarly, the degrees of fear experienced by the children and their primary caregivers were measured using the Children's Fear Scale (CFS) [21]. The scale consists of five cartoon faces with fear ratings of 0–4, with 0 representing ‘no fear’ and 4 representing ‘extreme fear’. The CFS was also determined to have satisfactory reliability and validity. The children and their primary caregivers were asked to select the faces that best described the fear levels of the children who received intravenous injection; the fear levels were subsequently converted into numerical values [21–23].

The time required for successful intravenous insertion

The time required for successful intravenous insertion in this study was defined that began the moment the participants were fitted with the tourniquets and the injection sites determined and ended when the venous catheters (No. 24) were inserted and blood returned to the return blood cavities.

Data collection

All participants and their primary caregivers were provided with an explanation of the study's objectives and their questions were answered by the first author. After signing a consent form, they completed demographic information form. The participants completed the CFS, and a NT$ 200 voucher was gifted to their primary caregiver. After opening the sealed envelopes, the participants were assigned to either the intervention group or the comparison group. The intervention group received VR interactive play, and the comparison group received the educational photo book about intravenous placement. During intravenous injections by the primary care nurses, the time required for successful intravenous insertion was calculated by the first author. After the completion of intravenous placement in the comparison group or after the emotional catharsis play in the intervention group, the participants

and their primary caregivers were requested to complete the WBFPS and CFS. The participants in the comparison group were then invited to play the emotional catharsis game.

The study design, procedure, and reporting followed the CONSORT recommendations on randomized controlled trials [[24]]. All instruments used for data collection were demonstrated to have psychometric adequacy. We further examined the content validity to verify the relevance, accuracy, and suitability of the VR play scenes and scripts. As part of the two-round content verification, five experts were invited to rate the play content from 1 ('the content is very inappropriate and must be deleted') to 5 ('the content is very appropriate and must be retained'). Next, we invited two students from each of the following grades to experience the use and operation of the VR play: 1–2, 3–4, and 5–6. Based on the purpose and process of the intravenous placement in the VR play, the students were requested to rate the content from 1 ('do not understand at all') to 4 ('fully understand'). The content validity index in the second round was 0.90 for the experts and 0.96 for the students.

Ethical considerations

Ethical approval for this trial was obtained from the institutional review boards of two participating medical centers in Taiwan (108163-F &200129). All included patients and their caregivers provided signed informed consent. The participants were permitted to withdraw from the study at any time without prejudice.

Data analysis

Descriptive statistics are presented as mean and standard deviation or as number and percentage for categorical variables. The significance of differences between the intervention and comparison groups at baseline and the time required for successful intravenous insertion were analyzed using the Student's *t* test for continuous variables or Fisher's exact test for categorical variables. ANCOVA was used to compare the levels of pain and fear between the two groups, after adjustment for the covariates. All analyses were performed using the Statistical Package for Social Science (version 22.0; IBM, Armonk, NY, USA). For all participants, a *p* value of **Results**

The flowchart of participant recruitment is illustrated in [Figure 2]. We initially assessed 179 participants for eligibility and randomized 134 (74.9%) of them. Of the randomized participants, 69 participants were allocated to the intervention group and 65 participants were allocated to the comparison group, and all of them completed the clinical trial. As presented in [Table 2], before the interventions, the two groups were comparable in terms of baseline characteristics. The average age of the participants was 10.01 years (±1.71), and over half of the participants were girls (80; 59.7%). The majority were hospitalized for endocrine examination (116; 86.6%). Moreover, a quarter of the participants (34; 25.4%) had never received intravenous injection before. Over half of the participants (73; 54.5%) had no previous VR experience. The average age of the primary caregivers was 43.57 years (±5.72), and most of these caregivers were mothers (104; 77.6%). The average age of the nurses who executed the intravenous injections was 28.62 years (±5.61), and their average work experience was 6.58 (±5.41) years. The two groups did not differ significantly in demographic or clinical characteristics, except for prior use or nonuse of VR and caregivers' age. The intervention group had significantly fewer participants who had used VR than did the comparison group (34.8% vs. 56.9%, $p = .015$). The average age of the caregivers in the intervention group was significantly younger than that of those in the comparison group (42.28 ± 4.61 vs. 44.94 ± 6.45 years, $p = .007$). No adverse events occurred during the trial. Moreover, no patient experienced VR sickness, seizures, discomfort, or infection-related events related to the VR experience.

Analysis of pain intensity

As presented in [Table 3], the degrees of pain (1.33 ± 1.60 vs. 2.06 ± 2.00, $p = .028$) experienced by the children who received intravenous injections were significantly lower in the intervention group than the comparison group, after adjustment for the children's age, gender, frequency of past intravenous injections, prior use or nonuse of VR, fear scores in pretest, caregiver's age and gender, and registered nurses' years of work experience. Additionally, the degrees of pain (1.13 ± 1.51 vs. 2.68 ± 1.74, *p* **Analysis of fear intensity**

As to the prior needle-related fear intensity in the pretest, the mean score of fear intensity in the intervention group (1.58 ± 1.27) was higher than that in the comparison group (1.38 ± 1.33). However, the fear perceived in the pretest by the two groups children differed non-significantly ($t = 0.870$) ([Table 3]). Similarly, the degrees of fear (0.36 ± 0.64 vs.

0.95 ± 0.96, *p* Table 3). The degrees of fear experienced by the children who received intravenous injections were significantly lower in the intervention group compared with the comparison group, after adjustment for the children's age, sex, frequency of past intravenous injections, prior use or nonuse of VR, fear scores in pretest, caregiver's age and sex, and registered nurses' years of work experience (0.28 ± 0.54 vs 0.65 ± 0.94, $p = .004$).

Analysis of time required for successful intravenous insertion

The average seconds required for successful intravenous insertions were taken in the intervention group (51.89 ± 21.51) and in the comparison group (50.91 ± 16.29). Of all participants, five were excluded due to the external factors, including disinfecting for multiple times or finding blood vessels for a long time due to dirty or cold hands. The time required for successful intravenous insertion did not differ significantly between the two groups ([Table 3]).

Discussion

The main findings of the present study are that interactive play with VR intervention was effective and reduced children's pain and fear during intravenous placement. According to our review of the literature, this is the first randomized controlled trial to investigate the effects of both VR exposure and distraction in children during intravenous placement. The lack of other similar protocol studies means that comparing our results with those of other studies would be difficult. However, these results are consistent with those of studies that have examined the effects of similar concepts of therapeutic play, such as dramatic, instructional, or role-play sessions, on the pain, anxiety, and fear of school-aged children during needle-related procedures [25–29]. Silva et al. [3] employed the dramatic therapeutic play technique and evaluated the corresponding outcomes by using the Child Drawing: Hospital instrument; they did not observe a significant difference in the degree of anxiety between the intervention and control groups. Hsieh et al. [18] provided children with an educational photo book (the book used in our comparison group) about intravenous placement before the procedure, and patients watched their favorite music video during the procedure; they observed that fear intensity was significantly and effectively reduced but pain was not. This may reflect that a variety of VR devices have been developed rapidly in these years. The intervention process in this present study was highly accepted by the participants. The findings still revealed significant effects on children's pain and fear that we controlled for the prior use or nonuse of VR as one of covariates.

Previous interventional studies using VR for health education have mostly been executed in the context of children's surgical [30–35] and radiological exam preparations [36,37]. Koo et al. [38] conducted a meta-analysis of five studies and demonstrated the significant benefit of VR in reducing preoperative anxiety in children. Similar findings were reported for the preparation of school-aged children before chest X-ray and magnetic resonance imaging examinations: their anxiety was alleviated, and the use of general anesthetics was reduced [36,37]. Eijlers et al. [16] concluded that further research must be conducted on additional VR exposure strategies, apart from VR distraction strategies. Notably, in previous VR exposure designs, in addition to the first-person role designed by Ryu [34], third-person roles or cartoon characters as instructors were favored [30,31,35]. In the present study, we employed an interactive strategy for children to be completely immersed, from experiencing the treatment room settings to the process of intravenous placement. In addition, the immersive game of eradicating bacteria effectively reduced the degrees of pain and fear.

The time required for successful intravenous insertion did not differ significantly between the intervention and comparison groups. This finding is consistent with those of other studies on VR distraction strategies during intravenous placement, such as the use of a snow world [39], optional games [40], a rollercoaster application [41], and an under-the-ocean game [42]. However, Chen et al. [11] used four virtual environments (i.e., rollercoasters, space exploration, a wildlife park, and travel destinations) selected by school-aged children in an emergency department and revealed that the time required for successful intravenous insertion was significantly shorter in the VR group (53.50 ± 19.01 vs. 61.32 ± 25.78, $p = .046$). Many factors affect the time required for nurses to successfully achieve an intravenous injection, such as the preparation standards, the time it takes to search for a vein, and the cooperative state of the child. Because of the diversity of standard care groups, the preparation standards vary across hospitals and may include the participation of a child life specialist and the use of analgesics or local anesthesia. The VR intervention did not reduce or extend the time required for successful intravenous insertion and

can still be used as a reference for clinical practice.

However, this study has some limitations. First, only 134 participants were recruited from two medical centers in northern and central Taiwan. Because of the Covid-19 pandemic, the rate of inpatient hospitalization for children has decreased. Most participants diagnosed in this study were hospitalized for endocrine examinations. Therefore, the results obtained from this small sample may not be generalizable to all hospitalized children or children with chronic illness. Second, this study used HTC Vive VR equipment with a high-end laptop, which provided an excellent immersive effect but must be set up in a fixed place. Wireless VR headsets may be more convenient to operate in future studies. Third, the interactive VR play intervention in our study included instructional and emotional catharsis play sessions; therefore, a comparison of the effects of these two play sessions on the pain and fear of school-aged children could not be performed. Future studies could compare the effects of a VR play intervention implemented at different time points, such as before, during, and after intravenous placement. Finally, we used only the WBFPS and CFS as subjective assessment tools; we did not perform an objective monitoring process to examine participants' pain and fear responses. Thus, future studies could include heart rate, respiratory rate, blood pressure, salivary cortisol, and other monitoring instruments to assess children's pain and fear during intravenous placement.

Conclusion

The VR interactive play intervention including instructional play and emotional catharsis play sessions is an effective method to decrease school-aged children's levels of pain and fear during intravenous placement procedure. In addition, the VR intervention does not extend the time required for successful intravenous insertion and could be used as a reference for clinical practice. This study validates VR interactive play as an age-appropriate, safe, and feasible intervention strategy that allows children to quickly immerse into a virtual environment from experiencing the treatment room settings to the process of intravenous placement. The results of this study can serve as a clinical reference for the implementation of a child-friendly care practice for intravenous placement in school-aged children.

Author contributions

All authors made substantial contributions. MFH, ICL, CYL, and CWC were responsible for the study conception and design. All authors participated in the data collection and analysis. MFH, YWW and CWC wrote the article with the input from all authors. YWW, ICL, CYL, FCL, PCL, and CWC supervised the study. All authors approved the final version for submission.

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Conflict of interest

The authors declare no potential conflicts of interest, real or perceived.

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Virtual reality interactive play	Instructional play	Emotional catharsis play
Purpose	To inform the participants about the purpose and process of injection and what must be done prior to receiving actual intravenous placement	To forger the feeling of pain and fear of intravenous placement, and relaxation

Content	Immersive intravenous scene	Interactive play
Intervention timing	Before injection	Post injection
Time taken	5 min	5 min
Background music	Soft music	Brisk and relaxing rhythmical music

Variable	Intervention group (n = 69) Mean ± SD/n (%)	Comparison group (n = 65) Mean ± SD/n (%)	p
Child			
Age	9.81 ± 1.70	10.22 ± 1.70	.172
Male	32 (46.4)	22 (33.8)	.139
Reason for admission, endocrine examination	56 (81.2)	60 (92.3)	.077
Times of past intravenous injection received	1.55 ± 1.33	1.71 ± 1.65	.544
Have used virtual reality	24 (34.8)	37 (56.9)	.015
Caregiver			
Age	42.28 ± 4.61	44.94 ± 6.45	.007
Relationship, mother	55 (79.7)	49 (75.4)	.679
Nurse			
Age	29.04 ± 6.28	28.17 ± 4.79	.365
Registered nurse working years	6.79 ± 5.83	6.37 ± 4.95	.657

Variable	Before IV placementMean ± SD	After IV placementMean ± SD	F	p

Pain score by child			5.00	.028
Intervention group (n = 69)		1.33 ± 1.60		
Comparison group (n = 65)		2.06 ± 2.00		
Pain score by caregiver			28.51	<.001
Intervention group (n = 69)		1.13 ± 1.51		
Comparison group (n = 65)		2.68 ± 1.74		
Fear score by child			8.53	.004
Intervention group (n = 69)	1.58 ± 1.27	0.28 ± 0.54		
Comparison group (n = 65)	1.38 ± 1.33	0.65 ± 0.94		
Fear score by caregiver			20.30	<.001
Intervention group (n = 69)		0.36 ± 0.64		
Comparison group (n = 65)		0.95 ± 0.96		
	Intervention group (n = 66) Mean ± SD	Comparison group (n = 63) Mean ± SD	t	
Time required for successful intravenous insertion, seconds (n = 129)[a]	51.89 ± 21.51	50.91 ± 16.29	0.29	.772

DETAILS

Subject:	Clinical trials; Pain; Fear &phobias; Children &youth; Cooperation; Caregivers; Hypotheses; Childrens picture books; Virtual reality; Intervention; Hospitalization; Bacteria
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Development of a Health Promotion Application on Cancer Survivorship as an Educational Content for

Nursing Students

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ABSTRACT (ENGLISH)

SummaryPurpose

This study aimed to develop a health promotion application for cancer survivorship (CS app) based on the adult learning and self-efficacy theories and evaluated its usability as an educational tool for nursing students.

Methods

The CS app was developed according to ADDIE (analysis, design, development, implementation, and evaluation) model. It consisted of interventions involving medication, diet, exercise, stress management, symptom management, and regular medical checkup for cancer survivors on three different levels in terms of difficulty and complexity. It was designed to teach nursing students how to provide tailored care to cancer survivors as well as help survivors with their repetitive and regular health management. The Mobile App Rating Scale and the user version of the Mobile App Rating Scale were used for a heuristic evaluation of the CS app by the experts and student users.

Results

The CS app was developed based on literature reviews and cancer survivorship guidelines. It was evaluated by 20 student users and five experts based on a 5-point scale and obtained a score of 3.97 and 3.66, respectively. Nursing students rated the CS app positively, mentioning that they were able to “learn about appropriate nursing interventions for patients in various cases” and that they became interested in caring cancer survivors’ health using the CS app.

Conclusions

The CS app is an effective and user-friendly educational tool to increase the motivation of nursing students in learning cancer survivorship care. This highlights the potential of CS app as a useful learning tool for nursing students.

FULL TEXT

Introduction

The World Health Organization has estimated the number of 5-year cancer survivors to be 43.80 million worldwide [1]. The US Centers for Disease Control and Prevention has forecast the number of cancer survivors to reach 22 million by 2030 [2]. An increased cancer survivor rate means that there are more cancer survivors in need of continuous lifetime management. Cancer survivors who complete their treatment regimen and begin the long-term management phase of their life face an array of potential physical, mental, and practical problems [3]. To solve and prevent these problems, cancer survivors need lifelong management of chronic diseases, nutrition, lifestyle, and psychological well-being [4]. Failure to prevent and manage cancer survivors’ health problems can result in escalated medical costs for treating these problems, as well as diminished productivity [5].

Nurses play a key role in helping cancer survivors manage and improve their health. Therefore, educating nursing students on how to take care of cancer survivors is important for them to develop their nursing competencies. During nursing practicum, students generally learn about the care provided to patients hospitalized with an acute disease or for diagnostic testing. Teaching nursing students to care for cancer survivors in a hospital setting is difficult not only because of differences in health care services but also because of patient safety and risk of infection [6]. This suggests that during their clinical practicum, students face limitations in learning about nursing care for cancer

survivors who require continuous management and care mostly within the context of living. To address such issues, various educational contents beyond clinical practicum courses need to be developed to boost nursing students' competency in caring for cancer survivors.

The accelerated digitalization of the world and consequent technological advances have led to the development of various teaching modalities that enhance learning outcomes among students. Thus, instructors now face demands to be creative and formulate various educational methods by incorporating information communication technology into learning. In particular, mobile applications have the benefit of engaging students and enhancing their clinical competence [7].

Computer-based learning, online learning, and educational apps are widely used in nursing education as well, and their effectiveness has been validated in many studies [8,9]. However, previous studies that developed nursing educational apps simply focused on a single skill, such as high-risk drug dosage calculation, basic nursing skills (vital signs, intravenous insertion, tube feeding, and tracheal suction), and tracheostomy care [10–12]. For example, Kang and Suh reported that using an app for hypertension and diabetes mellitus care increased the nursing students' knowledge and self-efficacy for chronic disease management [13]. However, the developed app was limited in that it only enabled unidirectional implementation of nursing intervention, as opposed to allowing interactions with patients.

Nurses evaluate, diagnose, intervene, and assess patients by communicating and interacting with them, which are active decision-making processes that change in accordance with patients' needs and values. To our knowledge, no study to date has attempted to develop an educational app for nursing students that boosts their nursing competencies while enabling appropriate patient interactions by specific cases involved.

This study was aimed to develop a cancer survival application (CS app) for nursing students and to evaluate its usability. Furthermore, it was to enable nursing students to acquire knowledge and nursing competency to improve the health of cancer survivors through the CS app.

Methods

Theoretical framework for the development of the CS App

The CS app for nursing students was developed based on Knowles' adult learning theory [14] and Bandura's self-efficacy theory [15] to increase students' knowledge and nursing self-efficacy. Cancer survivors were categorized based on the conceptual framework for three-dimensional nursing simulation education (3D Simulation Framework) [16].

We applied the six principles of Knowles' adult learning theory to boost the effectiveness of education as follows: (1) Need to know: The participants of this study, nursing students, strive to enhance their competence as nursing professionals. (2) Experience: It is important to design a program tailored to nursing students' knowledge and competence. As such, in the analysis stage, we analyzed the nursing curriculum and developed a program with three levels based on basic knowledge about cancer survivorship to an advanced level. (3) Self-concept: The program was developed as a mobile application such that students could access the program without temporal and spatial limitations. They were allowed to choose from levels 1 to 3 at the program design stage. (4) Readiness: Nursing students have or are scheduled to undergo clinical practicum; they have high enthusiasm and are ready for clinical practice. (5) Problem oriented: In the symptom management tab, students can acquire problem-oriented thinking through conversations about health-related information for cancer survivors. (6) Intrinsic motivation: The program encompasses both extrinsic learning motivation, such as feedback, leaderboard, and heart rewards, and intrinsic learning motivation, such as quality of life score among cancer survivors. In the CS app, the patient's quality of life score must be 70 or higher to move to the next level, making nursing students more motivated to improve the patient's quality of life.

Bandura's self-efficacy theory was applied as follows: (1) As a strategy to help students obtain an enactive mastery experience, the program was divided into levels 1–3 such that students gain mastery experience as they advance to the next level. Furthermore, as patients' quality of life score increased or decreased based on the outcome of nursing interventions performed within the CS app, the CS app background also changed to provide visual stimulation. In addition, words of encouragement and challenge quizzes were given through pop-ups to help

students accumulate mastery experiences. (2) To provide a vicarious experience, the latest knowledge and information were provided through videos and other educational materials prepared based on health guidelines for cancer survivors [17]. (3) For verbal persuasion, the patient icon in the CS app provided positive feedback, such as “I like it that I'm controlling my weight” and “I feel like I'm getting healthier with balanced meals” when the nursing student performed appropriate interventions. (4) Regarding physiological and affective status, nursing students' psychological anxiety was minimized, as they were able to access the CS app at a time and place of their convenience.

The CS app consisted of three levels. Each level was developed based on the 3D simulation framework [16]: the X-axis represented the scope of practice, the Y-axis represented the complexity of simulation, and the Z-axis represented the student competency (determining which competency should be assessed based on which level). The game elements of the program were the storyline (nursing storyboard), choice of level (three levels), feedback (visual and verbal feedback for care, including patient's comments and changes in quality of life score and app background), point system (heart reward), and leaderboard (scoreboard) [18].

CS app development

The CS app was developed based on the ADDIE (analysis, design, development, implementation, and evaluation) model [19] and the gamification principle [20]. In the analysis stage, we reviewed existing cancer survivorship care guidelines and studies, as well as the current nursing curriculum. In the design stage, we established learning objectives and incorporated learning content and game design elements. In the development stage, we collaborated with an IT company (TGRAM: AR/VR content studio) for CS app development. We also used an administrator server (www.lvyro.net) for data management. Through the server, administrators can check users' app usage time and consultation answers. In the application and evaluation stage, expert and user evaluations were performed, and the CS app was modified and updated accordingly. A plot and algorithm were created, and the details of the digital algorithm to calculate the students’ final scores were also written (Figure 1, Appendix 1).

CS app usability evaluation Sample

Based on previous studies that evaluated usability after recent app development, the expert evaluation ranged from 2 to 69 people, and the user evaluation ranged from 5 to 35. In this study, five experts and 20 users were obtained in consideration of previous studies [13,21].

A panel of experts comprising two oncology nurse specialists, one nursing informatics expert, one professional app developer, and one nurse with more than 5 years of clinical experience evaluated the usability of the CS app. The CS app developer was different from the app developer in the panel of experts. We provided an explanation of the developed CS app and Mobile App Rating Scale (MARS) to the expert panel and asked them to use the CS app and evaluate it from March 15 to March 19, 2021. Five experts participated in the evaluation.

For user evaluation, 20 third-year and fourth-year nursing students who owned Android smartphones and had completed basic nursing and therapeutic communication were recruited. The recruitment announcement was posted on the school bulletin board and in an undergraduate group chat room from March 15 to March 19, 2021. After they were introduced to the CS app and user version of the MARS (uMARS), the nursing students were asked to use the CS app for 1 day (try out levels 1–3) and evaluate it.

After installing the CS app on their Android mobile phones, experts and nursing students directly ran the CS app to give patients in levels 1–3 appropriate nursing interventions according to the patient's condition; these interventions involved medication, diet, exercise, stress management, symptom management, and regular medical checkup.

Instruments

The expert usability evaluation was measured using the MARS tool after permission was obtained from the original developers and translator [21,22]. The MARS consists of 23 items for engagement (five items), functionality (four items), aesthetics (three items), information (seven items), and subjective quality of the app (four items). It was evaluated on a 5-point Likert scale. A higher score indicated a higher perceived quality of the app. Cronbach α was 0.90 at the time of development and 0.93 in this study.

The user usability evaluation was measured using the uMARS tool after permission was obtained from the original

developers and translator [21,23]. The uMARS comprises 20 items for engagement (five items), functionality (four items), aesthetics (three items), information (four items), and app subjective quality (four items), and each item is rated on a 5-point Likert scale. A higher score indicated a higher perceived quality of the app. Cronbach α was 0.90 at the time of development and 0.82 in this study.

In addition, the participants were asked the following open-ended questions about their experiences with the CS app.

•**1)**Tell me about the problems you experienced while using the CS app (experts and users)

•**2)**What do you think are the pros and cons of the CS app? (Experts and users)

•**3)**Which aspect would the CS app be most helpful for among nursing students? (Experts)

•**4)**Do you think the CS app is useful for learning? Why or why not? (Users)

•**5)**What do you think needs to be corrected or supplemented in the CS app? (Experts and users)

Ethical considerations

Approval was first received from the institutional review board (Approval no.2007/001-013) at the university with which the authors were affiliated, and then the data collection for user evaluation began. The author who conducted the data collection is a doctoral student who does not have direct authority over the students who participated in the data collection. Students who voluntarily expressed willingness to participate in the study after reading the recruitment announcement were provided the consent form containing the study purpose, procedure, anticipated effects, potential risks, data management, and researchers' contact information. They also signed a written consent form. As a token of gratitude, the participants were given a coffee voucher worth 20,000 KRW. The participants were informed that they had the freedom to withdraw from the study at any time without being disadvantaged. Furthermore, they were informed that the collected data would only be used for research purposes, would be anonymously processed during analysis, and would be stored in a locked cabinet with restricted access until disposal after study completion.

Results

The development and usability evaluation results of the CS app for nursing student education are discussed in this section.

Description and installation of developed items Analysis

We reviewed cancer survival management guidelines using the keywords "cancer survival" and "guidelines" to check cancer survival management items. In addition to searching foreign literature such as PubMed, EMBASE, and CINAHL, Korean data were reviewed from DBpia, RISS, and the National Cancer Information Center (Appendix 2, 3). Based on a manual for cancer survivorship, NCCN (National Comprehesive Cancer Network) clinical practice guidelines, the Cancer Experience Health Care Guide, and a literature review (activity, diet, health management), medication (anti-hormone therapy, drugs for chronic conditions), diet, exercise, stress management, symptom management, and regular medical checkup were chosen as the items for the CS app. A counseling tab, where students provide counseling for cancer survivors, was added to level 3 (see Figure 2).

Design

Students could download the CS app using a file provided by researchers. Figure 2 shows screenshots of levels 1–3 in the CS app. The patient's case, information, care history, and medication history can be accessed at the top of the screen. Nursing intervention, medication, diet, exercise, stress management, symptom management, and regular medical checkup tabs are shown at the bottom of the screen.

Development

The storyboard for developing the CS app included the login screen, initial screen (intro), main screen (main), and setting screen, and efficiency of presentation and the functionality for technical implementation were considered. To log in, users entered individual numbers in the login screen. The intro screen explained the learning goals of the CS app, whereas tabs for breast cancer, gastric cancer, colon cancer, and quizzes were shown on the main screen. The setting screen contained tabs for inquiry, educational materials, videos, FAQs (frequently asked questions), scoreboards, and sound effect settings for the CS app (Appendix 4).

The patient at level 1 is a breast cancer survivor. The objective of this level is to acquire knowledge about disease-specific medication, diet, exercise, symptom management, and health checkup. The patient at level 2 is a gastric cancer survivor. The tasks in this level include more complex, individual-specific medication administration, calculation of proper calorie intake, encouragement of the patient during exercise, a high-stress stage, and symptom management. The level 3 patient is a colorectal cancer survivor who requires more complex, situation-specific nursing interventions than level 2, such as counseling about marital relations, family, and social life.

Each level of the CS app was designed, so users could move from one level to the next after the first level is completed. The initial quality of life score of each patient is 50, and the score changes the next day based on the sum of the scores for medication, diet, exercise, stress management, symptom management, and regular medical checkup. If appropriate nursing intervention is implemented, the patient's quality of life score increases, and in the opposite case, the quality of life score decreases. Symptom management, one of the nursing interventions, was presented in a dialog format where the patient makes a complaint about his/her symptoms and the nursing student selects and provides an appropriate nursing intervention. The counseling tab in level 3 was designed in a way that the nursing student can directly write content that provides emotional support to the actual patient. As the background screen and narration of the patient change according to the patient's quality of life score, the nursing student strives to further improve the patient's situation. Appendix 4 explains how the quality of the score is calculated.

The CS app was developed for the Android operating system and will be registered on the Google Play Console. The system requirements are Android 8.0 (Oreo) or higher, and the programming languages used were C# (Microsoft, Redmond, WA) and PHP (Zend Technologies, Cupertino, CA). Unity (Unity Technologies, San Francisco, CA) 2020.1.15 was used as a platform for development. MySQL (Oracle Corporation, Redwood City, CA) was used as the application database, and eight tables were created.

CS app implementation and usability evaluation General characteristics of the participants to evaluate usability

Five experts participated in the evaluation of the CS app: one nursing informatics expert with PhDs, three oncology nurse specialists with master's degrees, and one app developer with more than 5 years of experience. Table 1 lists the general characteristics of the experts.

A total of 20 nursing students, 10 from the third year and 10 from the fourth year, participated in the user evaluation. Of these, 17 were female, and three were male. Four students had prior experience using an educational app (Table 1).

Survey analysis after CS app usability

The experts gave the highest rating (4.05) for functionality and the lowest (3.40) for engagement. The mean quality score given by experts was 3.66 out of 5. Nursing students gave the highest rating (4.35) for information and the lowest (3.45) for engagement. The mean quality score given by students was 3.97 out of 5 (Table 2).

Experts gave the question of whether the CS app has an achievable goal (part of the “information” subcategory) their highest rating (4.25 points). Conversely, nursing students gave the question of whether the CS app has visual information (part of the “information” subcategory) their highest rating (4.50 points). Both groups’ lowest scores were given in the subjective quality subcategory: experts gave their lowest score (2.40) for how many times they thought

they would use the CS app (none: two people; 3–10 times: two people; 10–50 times: one person), whereas nursing students gave their lowest score (2.65) for whether they were willing to pay to use the CS app (Table 2).

Comments from experts and nursing students

To the question, “Which aspect would the CS app be most helpful for nursing students,” the expert panel answered that students could obtain information about each level and acquire an understanding of patients’ situations and basic knowledge about health management of cancer survivors. Furthermore, the experts believed that the CS app would help students approach patients more easily.

To the question, “Do you think the CS app is useful for learning,” students affirmed that they were able to learn about cancer survivorship care. They also said that the symptom management tab was particularly easy to use and memorable because it allowed them to talk to the patient in the case. Moreover, the students mentioned that the CS app would be helpful for them to be prepared for clinical practicum courses and that it would help them develop an interest in nursing care and health management for cancer survivors. Regarding areas where the CS app needed revision, they said there was not enough space for students and instructors to interact and that it would be beneficial to have more timely feedback to allow them to check the intervention score and the patient's quality of life score immediately after the intervention (Table 3).

Total app usage time by expert and nursing students

After surveying the usage time to determine the utilization of and interest in the CS app, it was found that five experts spent an average of 8.92 minutes and nursing students 7.18 minutes on the CS app. The most recent nursing intervention of the day was reflected in the patient's quality of life score the next day. Only the latest quality of life score was reflected, and the number of daily logins was not checked (Appendix 5).

Discussion

This study was aimed to develop a CS app for nursing students and evaluate it by experts and users (nursing students) for its usability. The CS app allowed the students to experience nursing interventions for cancer patients in mobile setting. In particular, the symptom management feature in the CS app was designed to enable a virtual conversation between the students and the patients for them to learn how to interact with the patients. In addition, by differentiating patients’ conditions in three levels, the CS app was designed to enable the students to learn the complexity of various patients cases step by step.

Through the CS app, students were given the opportunity to perform nursing interventions on patients in a virtual setting, which is often difficult in clinical training due to patient safety concerns. In contrast to other chronic illness care smartphone apps for nursing students, we developed a scoring system in which a patient's condition changed according to the user's performance in the CS app [13]. In this study, the change in the patient's quality of life intrinsically motivated the students to modify their inputs (nursing interventions). Furthermore, the results of nursing interventions conducted by the students were expressed as the quality of life in a comprehensive way.

Considering that MARS scores for an online educational app providing COVID-19 information ranged from 2.4–4.8 [24], the CS app developed in this study can be regarded as having a good quality rating overall, as its MARS scores surpassed 3.0 [25]. The expert ratings for each domain ranged from 3.40 to 4.05, with the highest rating for functionality and lowest rating for engagement. The user (nursing students) ratings for each domain ranged from 3.45 to 4.35, with the highest rating for information and lowest for engagement. The aforementioned COVID-19 educational app was also given a good rating for functionality and a low rating for engagement. It was speculated that the low rating for engagement could be due to the lack of eye-catching colors, graphics, and entertainment [24]. The low rating for engagement in the CS app may also be attributable to the absence of a channel for communication between the administrator and nursing student, apart from the researchers’ contact information

being missing. In a previous study, the expert usability evaluation for an emotional education mobile app for middle school students was 4.00 points, whereas the user evaluation was 3.96 points. The expert evaluation was higher than that in the present study, but the user evaluation was similar [26].

This study has several theoretical implications. We applied Knowles' adult learning theory and the three aspects of Bandura's self-efficacy theory: enactive mastery experience (use of three levels), vicarious experience of success (educational materials), and verbal persuasion (feedback provided within the CS app). In addition, we implemented three levels of cancer survivor scenarios using the 3D simulation framework to provide an opportunity for students to experience different patient cases. Also, we incorporated the gamification theory to motivate students to participate [19]. Thus, the key significance of this study is that several theoretical principles were applied to develop the CS app for nursing student [7].

The analysis of the content evaluations in this study revealed that the participants used star ratings as a means of expressing their interest. However, a previous study that examined the usefulness of reviews and star ratings for online products found that star ratings had no relation to products or subjects; rather, text reviews were highly related to product selection [27]. In another study that evaluated an app developed for hyperlipidemia management, the lowest ratings in the subjective quality category were given to the item assessing whether experts and users were willing to pay to use the app (3.00 and 2.7, respectively) [21]. Furthermore, in a study evaluating an emotional education, mobile app developed to promote the mental health of middle school students, experts, and users both gave willingness to pay for the app 3.6 points [26]. In the present study, experts and student users gave 3.0 and 2.65 points for willingness to pay, respectively.

This is a notable result because it contradicts the high star rating of 3.70 given by students. Thus, it seems that students do not want to use the app if they need to pay for it because, despite gamification, these apps still differ from normal games developed purely for entertainment. In other words, even if educational apps feature high usability and practicability, student users may not actively purchase them. To address this issue, educational apps for professional study should be developed in collaboration with schools, industries, and developers, with funding from public institutions or industry–university foundations, so that the apps can be available for students at no cost to encourage active utilization.

In this study, nursing students positively rated the CS app, mentioning that they developed an interest in nursing care and management of cancer survivors, which highlights the potential of the CS app as a useful learning medium for nursing students. In the usability evaluation, patients' quality of life scores increased for all nursing students with the exception of one, and all students strived to increase their patients’ quality of life scores.

In the past, many attempts have been made to apply gamification to educational apps. After medical students used medical knowledge software based on gamification, they participated more actively when solving problems, and their correct answer rate significantly increased in the competitive team–based and individual quizzes and retests. Furthermore, the leaderboard was identified as the game-playing element that motivated users to participate [28]. In the present study, we intended to motivate participation by creating a “scoreboard” tab. However, in the CS app, the notification for competitions was not implemented. Subsequent studies should apply notifications for competitions or current performance to further motivate participation.

Finally, in the study of developing a virtual hypertension and diabetes management app for nursing student education [13], researchers could not reflect changes in the patient's blood sugar or sodium level in the app as precisely as the intervention of nursing students gave due to technical barriers. However, in this study, an algorithm to increase or decrease the quality of life score based on the nursing intervention performed by the student was developed. Thus, the changes in the patient's state stimulated the students' caregiving instinct. Using advances in

information communication technology and establishing a technological foundation to develop an array of patient cases that are not commonly encountered during clinical training would be beneficial for nursing education.

This study contributes to the nursing academia at large in several ways. First, to our knowledge, this is the first study to develop an app for nursing students to learn about the promotion of cancer survivors' health. This is relevant in today's world where the number of cancer survivors is increasing; thus, nursing students must learn about the amount and quality of cancer survivorship care. Second, the students participated in this study became interested in and understood the importance of the care for cancer survivors. Third, through the CS app, knowledge of cancer symptom management and conversation skills with cancer patients was cultivated before clinical practice in advance what they should learn in clinical practice. Fourth, details of nursing care for cancer survivors in terms of their medication, diet, exercise, stress management, symptom management, and regular medical checkup to improve the quality of life were implemented through the CS app. Fifth, the intrinsic motivation of students was promoted by developing an algorithm in which each patient's quality of life score increased and decreased according to the nursing care they provided.

However, this study also has a number of limitations. First, it did not implement a system of competition to increase participation in the app, nor did it implement a user interface that allowed interaction between the administrator and nursing students and among nursing students. Second, convenience samples were used for usability evaluation, and only the Android platform was used in consideration of the cost in the development process. Third, we attempted to create a question-and-answer tab to enable interactions between the administrator and the students and among the students after the usability evaluation but could not proceed with the update due to cost restrictions and lack of data storage. Thus, establishing a question-and-answer feature in the early design stage is important in future studies. Finally, the effect evaluation after CS app development has not yet been conducted; thus, further research is needed.

Conclusion

The CS app is expected to be an effective and user-friendly educational tool to increase the knowledge and self-efficacy of nursing students in learning cancer survivorship care. Nursing students stated that they were able to comprehensively learn about cancer survivor care and that the conversational feature in the symptom management tab allowed for easy and memorable learning. In particular, incorporating common patient symptoms through conversational interaction that enabled students to learn about them consistently was a valuable element of learning for nursing students preparing for clinical practicum.

A key component of the CS app, developed based on gamification, was feedback, and it was the most mentioned feature among users. The CS app was modified by reflecting quick feedback, which appeared after the usability evaluation by the CS app users. We confirmed that proper feedback is an essential motivator and component of the instructor–user interaction. Developing additional apps containing more patient cases that enable interaction with nursing students and patients would contribute to the establishment of mobile apps as a complementary learning tool to clinical practicum. Subsequent studies should also implement and evaluate the CS app developed in this study.

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Conflict of interest

The authors declare no conflict of interest.

Quality of life score	Medication (20) + diet (20) + exercise (20) + stress management (20) symptom management (20) + regular medical checkup (20) = 120 points
0–120 points	1. 110–120: Patient's quality of life score increased by 10 points
2. 90–109: Patient's quality of life score increased by 8 points	3. 70–79: Patient's quality of life score increased by 6 points
4. 50–69: Patient's quality of life score decreased by 2 points.	5. Fewer than 50: Patient's quality of life score decreased by 4 points

No	Reference/website	Title	Journal
1	Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H, Bozzetti F, et al (2017)	ESPEN guidelines on nutrition in cancer patients	Clin Nutr, 36(1), 11-48.
2	Birken SA, Ellis SD, Walker JS, DiMartino LD, Check DK, Gerstel AA, &Mayer DK. (2015)	Guidelines for the use of survivorship care plans: a systematic quality appraisal using the AGREE II instrument	Implement Sci, 10, 63.
3	Coletta AM, Marquez G, Thomas P, Thoman W, Bevers T, Brewster AM, et al (2019)	Clinical factors associated with adherence to aerobic and resistance physical activity guidelines among cancer prevention patients and survivors	PLoS One, 14(8) e0220814.
4	Denlinger CS, Sanft T, Baker KS, Baxi S, Broderick G, Demark-Wahnefried W, et al (2017)	Survivorship, Version 2.2017, NCCN Clinical Practice Guidelines in Oncology	J Natl Compr Canc Netw, 15(9), 1140-1163.
5	Okubo R, Wada S, Shimizu Y, Tsuji K, Hanai A, Imai K, et al (2019)	Expectations of and recommendations for a cancer survivorship guideline in Japan: a literature review of guidelines for cancer survivorship	Jpn J Clin Oncol, 49(9), 812-822.
6	Yun YH, et al (2013)	Manual for cancer survivorship	Koonja.co.kr

7	www.cancer.go.kr	National Cancer Information Center	
Cancer Experience Health Care Guide	Cancer Patient Life Guide (life management, diet, symptom management)	8	https://www.macmillan.org.uk
Macmillan Cancer Support		9	https://www.nccn.org (National Comprehensive Cancer Network)
NCCN Clinical practice guidelines in oncology (NCCN Guidelines) Survivorship Version 1. 2020-March 17.2020		10	https://www.cancercare.org
Cancer care		11	https://www.cancer.gov
National Cancer Institute (NCI)		12	https://www.canceradvocacy.org
National Coalition for Cancer Survivorship (NCCS)		13	https://www.cancer.org
American Cancer Society		14	https://www.acsm.org
American College of Sports Medicine		15	https://www.cancernetwork.com
The Cancer Information Network		16	https://preventcancer.aicr.org
American Institute for Cancer Research		17	https://www.asco.org

No	Author	Title	Content	Journal

1	Park JH, Shin DW (2012)	Cancer Survivor 1 Million Era, Cancer Survivor Health Management	Prevention and screening for secondary cancer, chronic disease management and vaccinations, health habit management (smoking, obesity, nutrition, physical activity), psychosocial problem management	Research Institute for Healthcare Policy Korean Medical Association, 10(4), 66-72.
2	Lee JE. Shin DW, Cho BL (2014)	The current status of cancer survivorship care and a consideration of appropriate care model in Korea	Secondary cancer prevention and screening, management of accompanying diseases, lifestyle management, psychosocial problems	Korean Journal of Clinical Oncology, 10(2), 58-62.
3	Song CE (2018)	Integrative review of guidelines related symptom management and physical activity for developing of self-care management program for cancer survivors	Symptom management: fatigue, sleep disturbance, pain, depression, and anxiety Physical activity management: exercise (flexibility, strength, aerobic exercise recommended)	Journal of the Korean Contents Association, 18(4), 586-600.
4	Lee Y (2013)	Cancer Survivor's Health Management	Prevention and screening for secondary cancer, chronic disease management (hypertension, diabetes, hyperlipidemia, osteoporosis, anemia), diet, exercise, proper weight management	Korean Society for Health Promotion and Disease Prevention. Paper presented at 2013 spring conference. Seoul.
5	Park JH, Bae SH (2017)	Effects of psychoeducational intervention for cancer survivors: a systematic review and meta analysis	Among 41 papers, counseling and behavioral therapy were significant for psychological education intervention	Journal of Korean Academy of Nursing, 47(2), 143-163.

6	Viscuse PV, Price K, Millstine D, Bhagra A, Bauer B, Ruddy KJ (2017)	Integrative medicine in cancer	Role in the management of physical and emotional issues: physical activity, diet, dietary supplement, mind-body modalities, acupuncture, massage therapy	Curr Opin Oncol, 29(4), 235-242.
7	Sisler J, Chaput G, Sussman J, Ozokwelu E (2016)	Follow-up after treatment for breast cancer: practical guide to survivorship care for family physicians	Four main tasks: Survivorship care 1) surveillance (annual mammography) 2) management of long-term effects (pain, fatigue, lymphedema, distress, cardiac and bone health) 3) health promotion (physical activity) 4) care coordination	Can Fam Physician, 62 (10), 805-811.
8	De Lorenzo F, Apostolidis K, Florindi F, Makaroff LE (2018)	Improving European policy to support cancer survivors	Key priorities for action 1) timing and content of follow-up, rehabilitation 2) raising awareness of both short-term and long-term treatment-related effects 3) health maintenance 4) information regarding legal protections 5) psychological support.	Journal of Cancer Policy, 15, 72-75.

Appendix 4 Screen Capture in the CS App and Background Changes According to Quality of Life.Appendix 4

Category	Experts (n = 5)	Nursing students (n = 20)
Mean ± SD	Mean ± SD	Usage time (minutes)

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Variable	Category	Experts (n = 5)	Nursing students (n = 20)

n (%) or mean ± SD	n (%) or mean ± SD	Gender	Women
4 (80.0)	17 (85.0)	Men	1 (20.0)
3 (15.0)	Major	Nursing informatics	1 (20.0)
	Nursing oncology	3 (60.0)	
App developers	(20.0)		Degree of education
PhD candidate	2 (40.0)		Master degree
2 (40.0)		Bachelor degree	1 (40.0)
	Duration of career		9.60 ± 4.72
	Grade	Junior	
10 (50.0)	Senior		10 (50.0)
Age			22.05 ± 1.97
Experience of using of educational apps	Yes		4 (25.0)

Subcategory	Item	Expert (n = 5)		Nursing students (n = 20)	
Mean ± SD		Mean ± SD		Engagement	1. Entertainment
3.20 ± 0.84	3.40 ± 0.85	3.35 ± 0.88	3.45 ± 0.59	2. Interest	3.40 ± 1.14
	3.75 ± 0.91		3. Customization	3.40 ± 1.14	

2.95 ± 0.60		4. Interactivity	3.00 ± 1.22		3.10 ± 1.22
	5. Target group	4.00 ± 0.70		4.10 ± 0.79	
Functionality	6. Performance	4.20 ± 0.84	4.05 ± 1.16	4.10 ± 1.02	4.08 ± 0.63
7. Ease of use	4.00 ± 1.73		3.90 ± 1.02		8. Navigation
3.80 ± 1.79		3.85 ± 0.88		9. Gestural design	4.20 ± 0.84
	4.45 ± 0.69		Aesthetics	10. Layout	3.60 ± 1.14
3.53 ± 1.17	3.85 ± 0.75	4.00 ± 0.51	11. Graphics	3.40 ± 1.14	
4.00 ± 0.79		12. Visual appeal	3.60 ± 1.34		4.15 ± 0.59
	Information	13. Accuracy of app description	4.00 ± 0.71	3.64 ± 1.02	-
4.35 ± 0.38	14. Goals	4.25 ± 2.07		-	

15. Quality of information	3.75 ± 1.87		4.45 ± 0.60		16. Quantity of information
3.25 ± 1.52		4.15 ± 0.88		17. Visual information	4.00 ± 0.71
	4.50 ± 0.61		18. Credibility	3.80 ± 1.10	
4.30 ± 0.47		19. Evidence base	2.50 ± 1.41		-
	Total		3.66 ± 0.90		3.97 ± 0.41
App subjective quality	20. Would you recommend the app to people who might benefit from it?	3.40 ± 1.14	3.10 ± 0.72	3.30 ± 0.80	3.13 ± 0.73
21. How many times do you think you would use this app in the next 12 months if it was relevant to you?[a]	2.40 ± 1.34		2.85 ± 0.81		22. Would you pay for this app?[b]

3.00 ± 0.00		2.65 ± 1.46		23. What is yours overa ll star rating of the app?	3.60 ± 0.8 9

Category		CS app's Advantages
Expert	Information	1.Helpful for gaining knowledge about each disease
2.Enables students to engage in experiential thinking by determining the need for a specific intervention for a particular disease and performing the intervention	3.Provides information about each level	4.Provides an opportunity to gain an understanding of the patient's situation
5.Will make it easier for students to approach patients	Correction	6.Priority intervention by disease is required
7.Add more game elements to arouse interest	Nursing student	Education
1.Can experience an educational method for health management of cancer survivors	2.The conversation-style design of the symptom management tab makes learning easy and memorable	3.Can comprehensively learn about the appropriate nursing interventions for patients in various cases
4.The quizzes were extremely helpful in retaining the learned contents, and taking the quizzes repeatedly allowed for repetitive learning	5.Was able to learn more clearly about the things that nurses should pay close attention to and provide care for, compared with other types of learning	Information
6.Provides credible information and case-based scenarios that are effective for learning	7.Will be helpful in preparing for clinical procedures	Engagement

8.Helped develop an interest about health management and health improvement for cancer survivors	Correction	9.Lack of space for interaction between instructors and students10.The app needs quick feedback to check the intervention score and the patient's quality of life score.

DETAILS

Subject:	Cancer; Teaching; Patients; Quality of life; Simulation; Motivation; Students; Usability; Nursing education; Curricula; Disease; Knowledge; Nursing care; Chronic illnesses; Ostomy; Educational software; Feedback; Distance learning; Survivor
Identifier / keyword:	education; mobile applications; nursing; student
Publication title:	Asian Nursing Research; Seoul
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Influencing Factors on Nursing Students’ Learning Flow during the COVID-19 Pandemic: A Mixed Method Research

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ABSTRACT (ENGLISH)

SummaryPurpose

This study aimed to investigate the factors affecting nursing students' learning flow in COVID-19 pandemic situations through mixed-method research.

Method

Of the 245 nursing students participating in the survey, 20 participated in a focus group interview. Quantitative data were analyzed using stepwise multiple regression analysis. Qualitative data were analyzed using content analysis.

Results

The factors affecting the learning flow of nursing students during the COVID-19 pandemic were their self-regulated learning ability (β = .24, *p* = .001); learning motivation (β = .23, *p* = .001); self-efficacy in clinical practice (β = .14, *p* = .014); and lecture type, or a mixture of recorded and real-time video lectures (β = .13, *p* = .022). As a result of the qualitative study, eight categories and 22 subcategories were derived. The eight categories are: a lack of preparation in the starting of virtual classes, adapting and growing in a new learning environment, enhancing nursing knowledge and skills through virtual clinical training, self-regulation difficulties when studying alone due to social distancing, difficulty concentrating when learning online, disadvantages of virtual learning, concerns about academic performance, and missing opportunities to enjoy college life.

Conclusion

Students attempted to discover their own learning expertise through virtual learning while concerned that they would be unable to fully establish their competence to work as actual hospital nurses due to a lack of clinical practice. In such a learning environment, systematic support and strategies are needed to increase the learning flow of nursing students.

FULL TEXT

DETAILS

Subject:	Research methodology; Active learning; Nursing education; Public speaking; Adult students; Clinical medicine; Academic achievement; Focus groups; Pandemics; Online instruction; Ability tests; Likert scale; Qualitative research; Coronaviruses; Distance learning; Disease transmission; COVID-19; Mixed methods research
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Psychological Processes of Postpartum Mothers with Newborns Admitted to the Intensive Care Unit

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ABSTRACT (ENGLISH)

SummaryPurpose

This research aims to explore the psychological processes of postpartum mothers during the admission of their newborns to the intensive care unit. It is hoped that the findings from this study will serve as a reference for clinical medical staff in providing individual and holistic patient care.

Methods

Using grounded theory methodology, we collected data through semistructured, one-to-one in-depth interviews. When data saturation occurred, 12 participants were involved through the constant comparative analysis process.

Results

The psychological processes consisted of a core category and three main categories. The core category was “worrying about the baby and striving to fulfill maternal responsibilities.” The three main categories were as follows: “impact on the maternal role,” “recognition of the maternal identity,” and “exhibition of maternal role.” The entire process may be affected by intrinsic and extrinsic factors, such as breast milk supply, timing of skin-to-skin contact, seriousness of the newborn's health conditions, the support system, and the style of postpartum confinement care.

Conclusion

It is recommended that the neonatal intensive care unit should adopt family-centered care, taking an initiative to empathize and care for the mother, assisting skin-to-skin contact for the mother and baby as soon as possible, maintaining established breastfeeding, providing the correct concept of postpartum care, and encouraging participation in support groups. These activities can reduce the impact of the situation on the maternal role and improve maternal identity recognition.

FULL TEXT

Introduction

Globally, there are at least 15 million preterm births every year, and the number of premature babies and preterm babies with very low birth weight is increasing year by year [[1]]. In 2018, the number of neonates born in Taiwan was

181,601 [2], among which premature babies accounted for approximately 8–10% and preterm babies with very low birth weight accounted for about 0.9%. The vital signs of babies born preterm and newborns with congenital abnormalities or diseases need to be monitored at all times in case of an emergency where they may need immediate attention to maintain physiological stability. They are often admitted to the intensive care unit at birth. Approximately 80–90% of babies born prematurely are directly admitted to the neonatal intensive care unit after birth [3]. It is a joy for parents to give birth to a healthy newborn, but if the newborn needs to be treated in the intensive care unit due to premature delivery or disease, parents may experience tremendous psychological and societal stress, thus affecting their adaptation to the parent role [4]. In addition to worrying about the health conditions, sequelae, and future developmental issues of preterm infants, these parents face constant pain from the threat of potentially losing their babies. Such stresses often cause emotional shocks, lead to changes in the family system, and affect the quality of life. Moreover, parents' mental health may be affected because they are often stuck in self-blame because of their inability to fulfill their responsibilities as a result of separation from their babies [5–7].

The results of previous studies in Taiwan related to experience of mothers with newborns admitted to the intensive care unit include grief reactions due to a newborn baby that were different from what they expected, including shock, fear, self-blame, crying, sleep disturbance, betraying the expectations of her in-laws, and worrying about the newborn's illness and prognostic, uncertainty, and striving to become a true mother [8]. Based on the principal investigator's 20-year clinical experience, the principal investigator has observed that medical staff and family members often focus on the newborns and overlook the mothers' emotional response and needs, inadvertently leaving the mothers in danger of experiencing emotional distress. Some medical staff may not even know how to respond to a mother's emotional breakdown. Past research has indicated that mothers with newborns in the intensive care unit often do not receive adequate mental and spiritual support, especially for their inner needs [4]. For example, there may be a lack of empathetic communication from medical staff, limited parent–child contact due to the separation from the infants, fear of getting close to the babies when visiting, self-blaming, and emotional crying. These mothers rarely receive proper assistance and timely support from the medical team [7].

The establishment of an early parent–child relationship is crucial for mothers and newborns and helps nurture the physical, psychological, and emotional development of newborns. Mother–child separation has a long-term impact on the parent–child relationship, which may continue into the child's school age [6]. Therefore, how to address the early separation between mothers and preterm babies in intensive care units effectively in a timely manner is an important topic that cannot be overlooked.

Other studies have pointed out that medical personnel is not only the primary caregivers of newborns but also the supporters of family adaptations [4]. If the medical team can actively support and assist mothers during their hospitalization, try to understand postpartum mothers' psychological processes, and put themselves in the shoes of these mothers, also help through the stressful [4]. Psychological processes are the mother's subjective description of the inner psychological process through memory, review, and experience [9]. Other helpful measures include keeping mothers apprised of newborns' conditions and treatment procedures, establishing a good doctor–patient relationship, actively listening to patients, assisting patients in coping with difficult situations and crises, helping patients avoid fear and insecurity, adopting a family-centered holistic care plan, elevating the mothers' and families' learning ability, strengthening the skills of mothers and families in baby care, providing useful channels of information, and caring for the mothers' life and emotional needs. These win–win measures can reduce mothers' depression, help mothers practice maternal roles, establish parent–child relationships, reduce patients' sense of loss from their separation from newborns, improve family functions, and reduce the negative impact on the family and infants [7,10,11].

In Taiwan, most studies on mothers' experience and adjustment process for experiencing premature birth did not really focus on the mother to systematically understand the psychological processes of postpartum mothers with newborns admitted to the intensive care unit. Furthermore, as research in Taiwan and abroad has rarely adopted qualitative grounded theory research methods to explore the psychological processes of postpartum mothers during their newborns' admission to the intensive care unit, the current research sought to address this gap. This article

focuses on psychological processes of postpartum mothers with newborns admitted to the intensive care unit. The reason for choosing the grounded theory methodology for my study is that the psychological processes are a characteristic of time history, and it is suitable to use grounded theory to conduct research [12]. The aim is to explore psychological processes of postpartum mothers with newborns admitted to the intensive care unit. It is hoped that the findings from this study will serve as a reference for clinical medical staff in providing individual and holistic patient care.

Methods Study design

This study used grounded theory methodology to explore Taiwanese postpartum mothers' psychological processes during their newborns' admission to the intensive care unit. Grounded theory emphasizes the importance of field data collection and analysis, mainly focusing on understanding human interactions and social processes [12].

Settings and participants

In this study, data from 12 mothers were collected in the neonatal intensive care unit or pediatric outpatient clinic through purposive sampling at a medical center in northern Taiwan. Inclusion criteria included mothers who had newborn infants admitted to the intensive care unit within 6 months, a willingness to participate, provided informed consent, and the ability to communicate in Mandarin or the Taiwanese dialect. Mothers whose newborns passed away after being treated in the neonatal intensive care unit were excluded from this study. Table 1 presents the demographics of the study participants.

Data collection

Data were collected from 2018 to 2019. After obtaining consent from the participants, interviews of all 12 subjects were conducted by the first author (C-K Lee) in the hospital's neonatal intensive care unit or pediatric outpatient consultation room. Following the semistructured interview guidelines, the researcher guided the participants in talking about key issues, including the following questions: “What did you experience during your baby's stay in the intensive care unit?”, “How did you face or deal with what you experienced?”, “What psychological shocks did you experience?”, “How did you deal with them?”, and “What else do you want to say?”

Each interview lasted about 50 to 60 minutes. To ensure that the participants could share their thoughts freely, they were assured that the contents would be deemed valuable and kept confidential. Each interview was recorded with the participant's prior approval. The recording was later transcribed into verbatim manuscripts by research staff and verified by the interviewees. To increase the richness and depth of the data being collected, the principal interviewer received qualitative research interview training and completed graduate-level courses to improve interviewing skills. The interview contents, wording, and questioning techniques were adjusted accordingly in consultation with qualitative research experts. Data collection continued until data saturation was reached in all categories, that is, until no new categories of information appeared.

Data analysis

Data analysis consisted of three stages: open, axial, and selective coding. The first stage involved open coding and the development of substantive codes from a line-by-line examination of the data. Words, groups of words, or phrases were then categorized under a conceptual label. Subsequently, the categories and subcategories were connected according to their properties and dimensions in the axial coding process. Finally, the categories and subcategories were integrated and refined through a process of selective coding Table 2. Example of the audit trials used for one category and subcategories in the study.

During the data analysis process, the data collection, sampling, and analysis of data involved constant comparative analysis. For example, inductive data helped to identify the category of events and feelings experienced by postpartum mothers during their newborn's admission to the intensive care unit. Researchers then applied deductive reasoning during the data analysis process to identify the factors affecting the degree of data saturation relating to postpartum mothers' psychological processes during the newborn's admission to the intensive care unit. Thus, findings were obtained inductively from the data collected and were confirmed deductively by a further theoretical sampling of the data.

Research trustworthiness

The rigor was determined using four criteria: credibility, transferability, dependability, and confirmability [13]. In this study, credibility was ensured by a series of methods, including audit trial and member check. The researcher was flexible and open minded in the process of obtaining information from the participants. During the process of data collection, the researcher tried to avoid becoming deeply involved with the participants and tried to avoid being subjective in accepting or rejecting data. The researcher also selected a natural and comfortable setting for the interviews. For example, the interviews were conducted in a private conference room to allow the participants to behave naturally. Objectively analyze the interview data, coupled with the researcher's own reflection, and constantly discuss with the instructor whether the text analysis is correct, to reduce the impact of research bias. In addition, to enhance the generalizability of the data, the participants' age, level of education, and occupation were not a part of the exclusion criteria. Therefore, the content described by the interviewees was rich, and the results of the study can be applied to cases with similar postpartum experiences.

Ethical considerations

The research proposal was approved by the ethics committee of the Institutional Review Board (Approval no. FEMH-2018-C-071) of the northern medical center. The researcher ensured that the participants completely understood the informed consent form and that confidentiality was guaranteed. Personal details were changed to protect the mothers' anonymity. When the participants experienced psychological issues and were in need of support, the research team would refer them to social workers or psychologists.

Results Participant characteristics

When data saturation was reached, a total of 12 mothers, aged 25 to 35 years, were interviewed. All of them were college graduates and married. Among them, eight mothers had their preterm newborns admitted to the intensive care unit (two were twins), and four mothers had their newborns admitted because of rapid breathing caused by neonatal meconium aspiration. In the following narratives, the participant of mother is abbreviated as P.

The result gave a core category and three main categories. The core category was "worrying about the baby and striving to fulfill maternal responsibilities." The three main categories were as follows: "impact on the maternal role," "recognition of the maternal identity," and "exhibition of maternal role." The entire process may have been affected by intrinsic and extrinsic factors, such as breast milk supply, skin-to-skin contact opportunities for mother and baby, seriousness of the newborn's health conditions, the support system, and the style of the traditional postpartum confinement care. The results are shown in Figure 1.

Core category: worrying about the baby and striving to fulfill maternal responsibilities

According to the findings of this study, the psychological process of postpartum mothers during their newborn's admission to the intensive care unit revolved around worrying about the baby and striving to fulfill maternal duties. The participants reported that during the newborn's stay in the intensive care unit, they were constantly worried about the changes in the baby's condition, fearing that they might lose the babies at any time, worrying about baby care issues after returning home, and feeling uncertain about the future.*…I am afraid of losing him… [P2] …Whenever I received a call from the hospital…I was afraid of receiving bad news. I felt a great deal of ambivalence. [P3]I worry about how to take care of my baby when discharged from the hospital. [P5]*

In addition, in terms of striving to fulfill maternal responsibilities, this study found that although it was impossible for them to care for and feed their newborns, such as other mothers whose newborns were not in intensive care, the interviewees generally expressed that when they realized that they were mothers, and they felt that they would do their best to overcome all challenges. They would adjust to place their focus on the newborns, give the babies the best treatments possible, and hope that they would get better and better.*Pumping breast milk is something I can do for my baby; I would do my best to provide him the best nutrition possible. [P3]Nothing else is more important than my baby; I don't care about anything else. [P12]*

First categories: impact on the maternal role

The impact on the maternal role included two subcategories: The negative feelings and the inability to perform a mother's responsibilities.

The negative feelings

The negative feelings consisted of disbelief, self-blame, and melancholy.

Most mothers were shocked and were unable to accept the facts when faced with a newborn baby that was different from what they expected. They felt disbelief.*I imagined that he would be a baby with bright and lucent skin color…How could he be so tiny, and his skin color was dull, with tubes all over him…I felt completely different from what I anticipated…I really cannot accept that. [P3]*

This study found that the participants believed that the newborns' conditions might have resulted from their negligence during pregnancy. They self-blamed and felt that they let their family members down.*I kept telling her that I was sorry because of my stupidity. I let her suffer from premature birth. I blamed myself. [P5]I disappointed my husband and parents-in-law. When I saw them, I apologized, and I cried. [P6]*

The mothers experienced deep feelings of sadness and frequent and inexplicable daily crying, which resulted from worries about their newborns, uncertainty about the newborns' status, and inability to care for and feed the babies. They felt melancholy.*I felt a little depressed, and I cried inexplicably. I struggled with anxiety…I could not sleep. [P6] I felt that life was hopeless…I was struggling with having a low mood…[P7]*

Inability to perform a mother's responsibilities

Most participants expressed that they could not hold, care for, and feed their newborns as other mothers could.*I dared not hold my baby…I did not want to touch him because I feared he would have some kind of infection. I dared not touch premature babies in the past, not to mention how tiny he was, that made it harder for me to touch him. (P6).*

Second categories: recognition of the maternal identity

Recognition of the maternal identity involved three subcategories: Truly feeling like a mother, mothers are strong, and undertaking the maternal responsibilities. The mothers in this study said that they felt distant when they first saw their newborns, but they experienced subtle feelings after their first skin-to-skin contact with the newborns. They recognized their maternal identity and wanted to be strong for the babies. They wanted to fulfill their responsibilities as a mother and were willing to adjust their expectations and accept reality.

Truly feeling like a mother

The participants said felt distant when they first saw their newborns. They feared to touch the newborns at first because they were afraid of the tubes and equipment connected to the newborns; after their first skin-to-skin contact with the baby, they recognized that the precious newborns were outcomes of their efforts during their pregnancies. *After more than a month, I finally had my first contact with my baby. It was a wonderful feeling. I finally felt that she was really my baby, and I was a real mother. [P4]When I first saw him, I doubted if he really was my child…I felt a little strange and unfamiliar…but after I touched him for the first time…I was deeply moved…He was born after the efforts of my eight months of pregnancy!… He is my heart…" [P12]*

Mothers are strong

In this study, the mothers expressed that having a newborn naturally stimulated their motherly love. To protect the babies and ensure that they grew up safely, mothers must become stronger to be able to face everything in life.*I'm already a mother…If I feel sad, who is going to take care of my baby?… If I don't toughen up, who will take care of the kid for me. [P1]The moment I touched him for the first time, I suddenly thought of the words 'All mothers are strong.' No matter what lies ahead, he is my child…I will take care of him for the rest of my life. [P9]*

Undertaking the maternal responsibilities

In this study, the participants indicated that despite the gap between expectations and reality in terms of their baby, no matter what the future held, they would accept reality by adjusting to the situation and undertaking the parenting responsibilities of raising the baby.*If the baby cannot fully develop, or if the baby has a mental deficiency, I will accommodate and accompany him…I would discuss with my husband, adjust my work and family situation, and deal with whatever happens. [P3]I would go with the flow; no matter what the future is for the child, I must take care of him. [P10]*

Third categories: exhibition of maternal role

Maternal role attainment consisted of two subcategories: Doing their best to fulfill their maternal responsibilities and

self-adjustment in facing the future. Most mothers in this study said that their focus was on the newborns and that they did not care much about everything else. They would do everything in their power to fulfill their duties. In terms of the future, they would adjust themselves to face the challenge of uncertainties.

Doing their best to fulfill their maternal responsibilities

In this study, all mothers expressed that their lives were centered around their babies. They pumped milk for the newborns, learned new skills in caring for the newborns, gave the babies the utmost love, and hoped that the babies would grow up safely.*I eat any food that helps to produce more milk…I dared not eat pig's feet in the past…but now I swallow them…I want to give my baby the best food… [P3]I can also take the opportunity to learn how to take care of the baby once the baby can go home…When I have questions, I ask the nursing staff or search the internet. [P6]*

Self-adjustment in facing the future

Most mothers expressed that they experienced a sense of uncertainty about their newborns' health conditions and the future. They took various initiatives, such as keeping in shape, having a positive attitude, managing their emotions, balancing family and work, and actively seeking assistance, to prepare themselves and the newborns for future challenges.*I went to see a Chinese medicine practitioner…because I needed to take good care of my body to face future challenges… [P1]After praying, I feel a lot better... Prayers give me the strength to keep going… [P5]I gave up my job…so I could take care of the baby… [P7]There is a social media group for mothers with premature babies…I received a lot of relevant information and support that helped me… [P11]*

The entire process has been affected by intrinsic and extrinsic factors

This study found that the main intrinsic factors that affected the mothers' psychological processes included breast milk supply and the timing of skin-to-skin contact with the babies. The extrinsic factors included the newborns' conditions, support systems, and the traditional postpartum confinement customs.

Breast milk supply

A small number of mothers in this study could not provide breast milk to their newborns because they were not able to pump enough breast milk. Their depression worsened because they could not perform their duties as a mother, which significantly impacted their maternal identity and maternal role attainment. However, when there was sufficient breast milk, the mothers could pump and feed the newborns. They felt that they were mothers, fulfilling their basic responsibilities for their babies. Thus, the impact of breast milk supply on their maternal identity was small.*I really didn't have breast milk. I started crying. I was really depressed at the time and couldn't do anything for the baby… [P3]I pumped quite a lot, and the amount is sufficient… I just want to stock as much as I can to help my baby…this is the least I can do for her. [P7]*

Timing of skin-to-skin contact

This study found that the timing of skin-to-skin contact between the mother and the newborn was an important factor affecting the mothers' psychological processes. It also affected the timing of the mothers' recognition of their maternal identity.*It was more than a month before I felt the first contact…I finally felt that I was really a mother…very subtle feeling…[P2]The first time I touched my baby was about one week after he was born…I felt his vitality when I touched him. [P7]*

Seriousness of the newborns' health conditions

In this study, most mothers self-blamed or had negative feelings about their newborns' unstable conditions. Many of the babies had numerous tubes and equipment attached to their bodies. The negativity, self-blame, and increased depression impacted the mothers' maternal role. A small number of babies deteriorated suddenly after their conditions stabilized. The mothers could not adjust their emotions to accept the change and continued to blame themselves for not taking good care of their newborns. This sudden change of the babies' status impacted the mothers' psychological processes, moving them away from fulfilling their maternal role. However, when the newborns were stable, the mothers' psychological processes and maternal identity were less affected.*It caught my heart…seeing so many needles inserted into her body…so many machines were connected to her body. I blamed myself… [P7]I may lose my baby at any time…I couldn't stop my negative thoughts, and I was really depressed… [P3]*

Support system

In this study, the support and encouragement from some participants' spouses and family members helped reduce the mothers' self-blame and depression. The situation thus had a smaller impact on the maternal role. However, when there was a lack of spousal and family support, the impact was much greater. This study also found that empathy from the medical staff and their assistance with skin-to-skin contact between the mother and the baby reduced the mothers' self-blame and melancholy, lessened the negative impact on the maternal role, and enhanced the recognition of their maternal identity.*My husband encouraged me constantly…My biggest supporter was my husband. [P3]The doctor…told me not to blame myself because he knew that I blamed myself very much. Hearing what the doctor said…I felt at ease, a bit relaxed. [P12]The nurse in the room…opened the incubator and taught me how to touch my baby appropriately, so I finally dared to touch her… [P8]*

Traditional postpartum confinement customs

In this study, mothers were restricted by traditional postpartum confinement customs and were not allowed to go outside of the house to visit their newborns or come into contact with their newborns. This caused the mothers to become more depressed, as they were unable to perform and fulfill any maternal responsibilities. The confinement had a great and profound effect on the maternal role. On the other hand, in this study, the participants had their own ideas about confinement and were not subject to all confinement rules. They visited the newborns daily, had a better understanding of the status of the newborn, and even had opportunities to feed the newborn and fulfill maternal duties. This revised postpartum confinement had less of an impact on maternal role attainment.*My parents-in-law would not let me go out of the house because they were afraid that I would be affected by the wind…I was home waiting for them to tell me about the baby's condition…I felt that I had depression. [P4]During the confinement period…I didn't have any breast milk. I couldn't feed my baby with breast milk…I couldn't fulfill my responsibility. I was so sad. [P11]I put a lot of effort into pumping…I personally delivered it to the hospital every day for my baby…I had no time to be depressed. [P2]*

Discussion

This study described the psychological processes and factors influencing postpartum mothers whose newborns were admitted to the intensive care unit. The results showed that the core category of "worrying about the baby and striving to fulfill maternal responsibilities" throughout the entire psychological process was similar to what was documented in past literature. Mothers often worry about their newborns' health conditions, fear the loss of their babies, and do not have the help of the medical team after discharge, among other things. When a mother recognizes her maternal identity, she will begin to rebalance her life, attempt to overcome all challenges, and seek assistance from external resources. In addition, mothers will familiarize themselves with the needs of the newborns, strive to carry out their maternal duties, and develop a positive perspective toward their experiences [4, 14, 15]. If the medical staff supports the mothers empathetically and actively provides information related to newborns and baby care skills, the mothers would be satisfied with their medical experiences. Even if their needs and expectations associated with the newborns cannot be met, their stresses could be reduced, and their ability to cope with stress positively could be improved [4].

This study reported that postpartum mothers whose preterm or sick newborns needed treatments in the intensive care unit after birth often experienced many negative feelings, mismatched expectations, self-blaming, and depression. These findings are consistent with what has been reported in the literature. To date, many Taiwanese women still cannot escape from the stereotypical gender roles created in traditional Chinese society. They still strive to meet the spouse's and senior family members' expectations to have a son carry on the family name. If the family line cannot continue, these women bear considerable pressure, thereby resulting in negative feelings [14]. In addition, in both domestic and foreign societies, mothers are the main caregiver of newborns. Taiwan's current health insurance adopts the Diagnosis-Related Group system for hospitalizations related to childbirth. If a newborn continues to be hospitalized due to illness, the mother must be discharged first. Traditional postpartum confinement customs strongly discourage mothers from leaving the house, which prevents them from visiting their newborns at the hospital. The mother–child separation has a great impact on the fulfillment of maternal duties. In addition, family

dysfunction, lack of support, or individual depressive tendencies may lead to postpartum depression, which may in turn affect parent–child interactions and create similar impacts on the maternal role [14,15]. During the study period, it was found that the support and encouragement from spouses were extremely important for the mothers. It is recommended that healthcare professionals take the initiative to encourage the patients' spouses, as part of the patient care instructions for families, to be caring and empathetic towards the mothers' emotional responses. This action can reduce the negative impact of the situation on the maternal role, which has also been suggested by previous literature [15]. Most mothers mentioned that empathy and assistance from the medical staff helped reduce their self-blame and depression. The opportunities offered by the medical staff for the mothers to carry out their maternal duties and establish parent–child relationships helped the mothers to reduce the sense of loss in their maternal identity. This finding is also consistent with the results of past literature [4].

A new finding from this study was that the mothers felt distant when they first saw their newborns. The mothers feared to touch the newborns at first because they were afraid of the tubes and equipment connected to the newborns. They were hesitant and feared that they would interfere with any procedures or cause infections to the babies, so they refrained from any physical contact. Some mothers even said that when they saw the newborns, they questioned, "Is she my child?" They felt that everything was unrealistic. However, as soon as the medical staff arranged for them to have skin-to-skin contact with the newborns, the mothers immediately felt that "she is really my child" and that they were mothers. The mentality that "mothers are strong" emerged spontaneously. Regarding the gap between reality and expectations relating to the newborns, the mothers were able to adjust their mindset, accept the newborns' conditions, and move forward with assuming the maternal responsibilities. Previous studies have pointed out that parent–child skin contact could enhance parent–child connection. Mothers' participation in caring for newborns and breastfeeding can help mothers feel capable and confident about fulfilling maternal responsibilities [7]. In this study, new finding an in-depth investigation further showed that the timing of the skin-to-skin contact was the turning point in recognizing their maternal identity. It was also the critical moment when the mothers began taking an initiative to carry out their maternal responsibilities. Thus, early skin-to-skin contact can help mothers develop their maternal identity and turn their negative feelings into positive thinking. Recognition of the maternal identity is crucial in that it reduces the duration and extent of the impact of the newborns' admission to the intensive care unit on the mothers' maternal role.

Mothers said that their baby was the center of their life and that they did not care much about anything else. They strove to fulfill their maternal responsibilities and adjusted themselves to face the challenges of the uncertain future. Some mothers also mentioned that they benefited greatly from the suggestions shared by mothers who had similar experiences. Therefore, it is recommended that medical staff proactively provide referral resources to help mothers improve their learning ability and strengthen their caregiving skills. Furthermore, if hospital staff members are empathetic towards mothers' emotions as well as the challenges that they face in their lives, the stresses that mothers experience would be reduced. Empathy would also help mothers greatly in their attainment of the maternal role [15,16].

Findings from this study showed that the psychological processes could be affected by intrinsic and extrinsic factors, including (1) breast milk supply, (2) timing of skin-to-skin contact, (3) seriousness of the newborn's health conditions, (4) support system, and (5) traditional postpartum confinement customs.

- **(1)** Breast milk supply affects the impact of newborns' admission to the intensive care unit on mothers' maternal role attainment. As documented in past literature, mothers' participation in feeding babies is considered the only thing that they can do for the baby. Breast milk is beneficial for newborns, and more importantly, this feeding method can only be provided by the mother. Therefore, mothers feel that they are capable of taking care of the baby, and the impact on the maternal role is reduced [17]. Therefore, it is crucial to teach mothers how to breastfeed babies and maintain breast milk production.

- (2)Timing of skin-to-skin contact can potentially reduce the impact of the newborn's conditions on the maternal role. It is the turning point of maternal role attainment. This is an important new finding of this study. Therefore, when the mother first visits the baby, medical staff should assist mothers in establishing skin-to-skin contact with the baby, thus shortening the impact of the situation on the maternal role.

- (3)The increase in the mother's negative feelings as a result of the seriousness of the newborn's health conditions can greatly impact the maternal role. This finding is consistent with what has been reported in past research: the uncertainties of the newborns' survival, coupled with mothers' insufficient caregiving knowledge and concerns about the child's subsequent disability, developmental delays, and baby care challenges, can increase the mothers' stress [14,15]. But participants in this study were classified only as preterm newborns and rapid breathing babies (in Table 1). This is the limitation of this study.

- (4)In this study, the mothers expressed that empathy and support from family members (spouses in particular) and healthcare professionals can help the mother overcome the depression period. Other research has also reported that healthcare professionals, the internet, support groups, and mutual support from mothers or friends with the same experience are of great help to the establishment of parental roles [17]. In domestic societies and abroad, mothers often play the role of the main caregiver; therefore, more attention should be paid to mothers' emotions compared with those of other family members. When mothers cannot receive adequate support and empathy from a dysfunctional family or medical staff, they often experience postpartum depression, which, in turn, affects parent–child interactions, as mentioned in the literature [15]. Therefore, the healthcare professionals' empathy towards the mother's feelings, appropriate support, and encouragement of parent–child skin-to-skin contact are critical factors affecting the maternal role and identity attainment.

- (5)Traditional postpartum confinement customs have many rules and restrictions with the goal of restoring the mothers' health to the status before pregnancy. Previous literature has documented that Taiwanese women cannot go to the hospital to visit their babies because of the restrictions imposed by traditional postpartum confinement customs. Such customs affect the fulfillment of maternal responsibilities and impact maternal role development [14]. Different from the findings of previous research, this study found that modern women have independent ideas. The traditional norms of confinement are no longer suitable. Most mothers are concerned about confinement, but they have different ideas. They are not subject to a specific pattern, and they use their own method of confinement to restore health. For example, they stay indoors as much as they can. When they have to go out, they bundle up to avoid catching a cold. They may also use Chinese medicine to help restore their strength. They order special confinement meals so that they can have a balanced diet to restore their body to the condition before pregnancy without any help from their mother or mother-in-law. They visit the babies at the hospital every day without restrictions. They stay updated on the newborn's status and even have opportunities to feed the newborns to fulfill their maternity responsibilities. This showed that traditional confinement customs may have minimal impact on maternal role attainment. However, the study also found that a small number of mothers were still affected by the traditional confinement customs because they lived with their mother or mother-in-law. They were pressured by their mother-in-law or mother to follow the rules, which were not to leave the house or visit their newborn babies. This caused the mothers to become more depressed and to feel incapable of performing and fulfilling their maternal duties. This situation caused a negative impact on maternal role attainment and maternal identity recognition. Because mothers' different views and ways of confinement can affect their psychological processes, it is recommended that healthcare professionals give the mothers and family members the correct concept and suggest

methods of confinement so that the mothers can choose the most suitable way of confinement, reduce the impact of newborns' admission to the intensive care unit on the maternal role, and improve the fulfillment of the maternal role.

Conclusions

The strengths of the study different from the findings of previous research, first using grounded theory to analyze the mother's psychological processes in the neonatal intensive care unit. The results may also help to reduce the impact of newborns' admission to the intensive care unit on mothers' maternal role and enhance mothers' self-confidence towards carrying out their maternal duties. The limitations of the study adopted. Because the mothers interviewed in this study were all married, the results from this study are not generalizable to teenage or single mothers.

The recommendations of this research for healthcare professionals include adopting a "family-centered" neonatal intensive care unit care model, being empathetic, and implementing active listening when helping patients deal with the life challenges and emotional difficulties faced by mothers and their families. Other recommendations include setting up support groups to encourage sharing experiences and arranging for the mother and the baby to have skin-to-skin contact as early as possible to allow mothers to recognize their maternal identity early and turn their negative feelings into positive thinking. In addition, immediately after childbirth, mothers should be taught how to pump breast milk and maintain lactation to enhance their self-confidence towards their maternity roles. Using video systems to allow mothers to see their babies virtually can enhance the parent–child connection. Actively providing the correct concept and methods of postpartum confinement and helping mothers choose a method best suited for them can reduce the impact of the newborn's conditions on the maternal role and enhance the fulfillment of maternal responsibilities. It is also suggested that future research can further explore and construct a practical care theory for mothers with newborns admitted to the intensive care unit and provide a reference to clinical staff aiming to offer individualized and unique patient care.

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Institutional review board

The institutional review board of the medical center in North Taiwan (Research Ethics Review Committee Far Eastern Memorial Hospital) approved the study (IRB No.: FEMH-106128-E).

Conflict of interest

All authors declare that there are no conflicts of interest.

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Characteristics	n	(%)
Age (years)		
25–30	6	50

31–35	6	50
Levels of education		
College	12	100
Marital status		
Married	12	100
Birth parity		
First born	10	83.3
Second child	2	16.7
Delivery mode		
Normal spontaneous delivery	7	58.3
Caesarean Section	5	41.7
Occupation		
Business	6	50
Medical industry	3	25
Housewife	3	25
Postpartum confinement customs		
Confinement by oneself	4	33.3
Confinement by husband's family	8	66.7
Reasons for admission to intensive care unit		
Preterm newborns	8	66.7
Rapid breathing caused by neonatal meconium aspiration	4	33.3

Significant statements	Concept	Subcategory	Category
"… I felt completely different from what I anticipated…I really cannot accept that." [P3] "…Why has this happened to me only…" [P5]	Consisted of disbelief	The negative feelings	Impact on the maternal role
"I was sorry because of my stupidity …I blamed myself." [P5] "When I saw them, I feel guilty." [P6]	Self-blame		
"II felt a little depressed, and I cried inexplicably. I struggled with anxiety… I could not sleep." [P6] "I felt that life was hopeless, and I lacked confidence about the future… I was having a low mood…" [P7]	Melancholy		
"I dared not hold my baby… I did not want to touch him because I feared he would have some kind of infection." [P6]	Could not hold newborns	Inability to perform a mother's responsibilities	

DETAILS

Subject:	Parents &parenting; Patients; Research methodology; Premature birth; Premature babies; Medical research; Families &family life; Data collection; Data analysis; Newborn babies; Birth weight; Qualitative research; Intensive care; Mothers; Pediatrics; Interviews; Grounded theory
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Using an Early Warning Score for Nurse Shift Patient Handover: Before-and-after Study

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ABSTRACT (ENGLISH)

Purpose

This study aimed to examine the impact of using an early warning score for shift patient handover on nurse and patient outcomes.

Methods

A before-and-after study was conducted with nurses and patients in three general wards in a tertiary teaching hospital. A short-time nurse education on the National Early Warning Score 2 and the use of a checklist for score calculation were performed from June 4, 2019 to June 30, 2019. Outcomes of nurse response (safety competency, handover quality, teamwork, safety climate, and documentation of vital signs and clinical concerns), patient response (deterioration occurrence postadmission, hospitalization length, and discharge status), and adverse events (mortality, cardiopulmonary arrest, and unplanned intensive care unit admission) were measured using questionnaires and medical record reviews. Data from 89 nurses and 388 patients were analyzed.

Results

Regarding nurse outcomes, handover quality ($p < .001$), teamwork ($p = .004$), safety climate ($p = .018$), and recordings of vital signs ($p = .047$) and clinical concerns ($p = .008$) increased after early warning score use. However, no significant change in the safety competency scores was observed. Regarding patient outcomes, there were no significant changes in the occurrence of deterioration, hospitalization length, discharge status, and occurrence of adverse events between preintervention and postintervention.

Conclusion

Despite no significant changes in patient outcomes, using a simple, evidence-based early warning score for patient handover enhanced socio-cultural factors for patient safety, with improved patient monitoring. The findings provide evidence that supports the active implementation of an early warning score to improve patient safety.

FULL TEXT

DETAILS

Subject:	Hospitals; Workforce planning; Medical records; Patient safety; Teams; Mortality; Vital signs; Education; Nurses; Nursing care; Clinical outcomes; Continuity of care
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Effect of Website-based Learning on Improved Monitoring of Adverse Drug Reactions by Clinical Nurses

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ProQuest document link

ABSTRACT (ENGLISH)

SUMMARYPurpose

The purpose of this study was to develop website-based learning contents to activate voluntary monitoring and reporting of adverse drug reactions (ADRs) for clinical nurses and to verify their effectiveness.

Method
Using a quasi-experimental control group pretest-posttest design with random allocation, a total of 60 nurses with more than 1 year of clinical experience were recruited from a university hospital in Seoul, Korea. A website was developed that provides learning contents including real cases and the latest drug-related knowledge, as well as video lectures. Knowledge on ADR monitoring, self-efficacy, ADR practice behavior, and medication performance ability were measured at 2 weeks after intervention. A small notebook for monitoring ADRs of nurses was given to the control group. Data were analyzed using descriptive statistics, the chi-squared test, and the independent *t* test using SPSS Statistics Software Version 21.0.
Results
The scores of ADR monitoring knowledge, self-efficacy, and ADR monitoring practice in the experimental group significantly increased after the intervention compared with the control group ($p < .05$). However, there was no significant difference between the two groups in medication performance ability related to ADR monitoring.
Conclusion
To spread a safety culture in which voluntary ADR monitoring and reporting is activated, it is necessary for clinical nurses to share and communicate ADR-related information and real cases through an open website.

FULL TEXT

Introduction

Adverse drug reactions (ADRs) are unintended negative reactions that occur when drugs are used in appropriate doses and dosages for treatment, diagnosis, and prevention of diseases and refers to all cases in which a causal relationship with drugs cannot be excluded [1]. The expansion of the market due to the development of new drugs in polypharmacy in response to an aging population and complex chronic diseases increases the importance of preventing related side effects [2,3]. Pharmacovigilance activities related to the detection, evaluation, interpretation, and prevention of drug-related problems, including ADRs [1], are an important factor in the safe administration of medication by healthcare providers [4].

Statistical data on ADRs by country revealed that, in Canada, side effects of outpatient medications resulted in more than two million emergency room visits and 700,000 hospital admissions, resulting in more than $1 billion annually in healthcare costs [5]. The United States has reported the loss of $30 billion in medical expenses each year [6]. In addition, preventive activities through monitoring of ADRs are essential for not only economic reasons but also patient safety and reduction of re-hospitalization rates [7]. Therefore, nurses must provide safe and effective medication, and continuous nursing education is required to prevent ADRs and encourage reports when they do occur [8,9].

Healthcare providers, such as doctors and nurses, recognize that drug administration is very important for patient safety in a hospital. In particular, nurses, who provide care closest to patients, are critical healthcare workers who can perform pharmacovigilance activities to monitor, recognize, and report ADRs [10,11]. However, in the clinical field, reports are often delayed due to busy work and are often ignored in the case of common side effects, sidelined in routing to others, or hidden in the case of serious side effects [12]. According to a study conducted with 300 nurses in Iran, after 4 months of training on ADR reporting, nurses' knowledge and attitudes were significantly improved, and the ADR reporting rate was increased [13]. In consideration of this reality, a randomized experimental study emphasized the need for continuous individual education to change nurses' behavior toward ADRs and mentioned web-based educational content as the most appropriate method [14]. To improve nurses' voluntary monitoring and reporting of ADRs, it is necessary to increase their sense of reality in the clinical field as to drug side effects, coping methods, and patient education contents. To establish a drug safety culture, it is essential to develop a program that allows educational institutions and nurses to share and communicate information, rather than a one-time education [15,16]. For the medium of education, nurses were found to prefer online e-learning due to conditions such as shift work [17,18]. In addition, to create a safe medication culture for patient safety, the education should be of a type that induces voluntary reporting and practice through web-based interactive communication such as a website, rather than a one-time presentation [19]. Development of website-based learning content can establish a system that plays

an important role in the economic aspect by providing educational materials and information necessary to create a safe medication culture.

Therefore, the purpose of this study was to develop a communication-enabled website that includes error cases and learning content to enhance nurses' awareness of ADRs, to improve their voluntary reporting, and to verify the effect of website-based learning.

Methods Study design

This study was a quasi-experimental control group pretest–posttest design with random allocation for developing website-based learning content and verifying its effectiveness on voluntary reporting of ADRs in nurses with more than 1 year of clinical experience.

Development of website-based learning contents

The website, including the learning content, was developed according to the web-based learning design model with five steps: analysis, design, development, application, and evaluation. In the analysis stage, in July 2017, 210 clinical nurses were surveyed about their preferred educational form and content for ADR reporting. Among them, 10 individual interviews were conducted to explore the reasons for the difficulty of voluntary reporting. The survey revealed that they desired education mainly in four areas: side effects by organ system (20%), patient condition observation methods prior to and after administration (17.0%), ADRs (16.7%), and side effects reporting procedures (15.7%). In addition, the scope and contents of the learning contained in the website were checked through a literature review on ADRs and a search of the Korean Ministry of Food and Drug Safety website.

In the design stage, the information to be delivered was developed. On the main screen, the menu was divided into four headings: Online lectures, ADR evaluation cases, information on individual drugs provided, and frequently asked questions (FAQs) about ADRs; notice boards were composed of newsletters (Table 1). In addition, questions and answers, posters, slogan contest campaigns and information on prizes were made on the website to facilitate mutual communication with learners and to strengthen motivation for learning. The “How in this case?” banner part is structured so that information necessary for patient safety can be shared by two-way communication through questions and prompt feedback from the manager and by sharing clinical cases. After a participant watched the video lecture, questions were answered when asked. By clicking on the banner of “Knowing it is medicine” on the website, learners can take five online lectures, totaling about 2 hours of learning (Table 2). To provide information, this researcher, a nurse at a local drug safety center, took an online lecture on procedures for reporting ADRs, drug side effects and allergic reactions, symptoms and their management, high-risk drugs that require monitoring, and patient cases with side reactions.

In the development stage, after selecting a developer, the purpose, target, and contents of the site were explained, and development was carried out through technical support for security policies, characteristics of each screen, and individual menu management. As an administrator, this researcher has the authority to organize and provide information on the website and allows learners to write questions and opinions on the notice board. Finally, in the application stage, the final website-based education program that was revised and completed after validation by the expert group was applied to the experimental group. A group of experts consisting of two pharmacists from local drug safety centers, one internal medicine professor, two nursing professors, and ten clinical nurses with more than 10 years of clinical experience, evaluated the website's properties and its learning content using a health information website evaluation criteria tool consisting of 13 questions [20]. The validity of the developed website after use by 10 nurses showed a content validity index (CVI) of 0.9 or higher in all questions. Some learning contents and parts that need to be supplemented in terms of continuity and ease of use were modified, and finally website-based learning contents were developed (Figure 1). A domain (www.drugsafe.Kr) was purchased, and the website was named “Drug Safety for Nurses.”

This research design was applied for the evaluation of the developed website-based education program. In the experimental group, consent was obtained for the use of personal information (e-mail, contact information, affiliation) for website membership registration and learning contents. Learning contents were developed to be linked to the Smart Teaching and Learning Center of the affiliated university and the experimental group was registered as

students and connected with personal identifications (ID) and passwords through this link to take courses. Through the website manager page, we checked the number of accesses for learners to use the website.

Setting and participants

The number of samples in this study was calculated based on the evidence of the educational effect with a large effect size in several previous studies on ADR reporting for clinical nurses [12]. Using G*Power program 3.1.9.2, the number of samples that fit the *t* test with an effect size of .80, significance level of .05 for the two-tailed test, and power of 80% was at least 26 in each group.

The criteria for selection of participants were nurses working at a university hospital in Seoul and general ward nurses with clinical experience of 1 to 25 years, excluding new nurses and chief nurses. New nurses were excluded from the participants because they had little experience with drug side effects and lacked drug-related clinical judgment skills that required critical thinking [21]. To secure the homogeneity of clinical experience among a total of 266 participants who met the criteria, 60 participants were selected through a randomization program (Microsoft Excel 2010), divided into 5 years and less than 5 years, and assigned to an experimental group and a control group. All 60 participants agreed to participate in the study, and there were no dropouts; 30 in the experimental group and 30 in the control group were used for the final analysis.

Procedures and data collection

The experimental group and the control group were collected from the same hospital. To prevent the contamination of the experiment, after collecting control group data, we proceeded to the parallax design in which data for the experimental group were collected.

Control group data were collected from February to March 2018, and experimental group data were collected from March to April.

Considering the characteristics of nurses working in shifts, intervention activities of the experimental group asked participants to attend online lectures and upload new drug information and newsletters through the website for 14 days. The researcher monitored the learning history after registering as a course system administrator to check the learning history of the experimental group. To manage the learning history, it was registered as a course in the H university smart teaching and learning center system so that the researcher could check the learning history through the learning management system through the individual ID/PW of each experimental group. To protect the personal information of the test participants, when a member registered on the site, the administrator allowed access after approval, and security was maintained so that personal information and contents were not exposed.

The two groups' pretest general characteristics, knowledge about ADR monitoring, self-efficacy, practice behavior, and medication performance ability were assessed prior to the intervention, using self-administered questionnaires. In the control group, a small notebook for nurse monitoring of ADRs was created and distributed, and a follow-up survey was conducted 2 weeks after the intervention. Based on previous literature showing that the period of transition to a behavioral change after individual learning was 2 weeks [22], the follow-up survey in this study was also conducted two weeks after completion of the 2 weeks learning access period. After that, learners were no longer allowed to access the website. The learners in the experimental group were able to access the website at any time, listen to lecture videos when needed, and browse materials at any time during a two-week period.

Data collection instrument

- **(1)** Knowledge on ADRs

Questions related to the level of knowledge on ADRs were developed by a researcher with 6 years of experience in ADRs work at a local pharmacovigilance center and drug error management work in the Quality Improvement department. This tool consists of 20 questions with 1 point for a correct answer and 0 points for an incorrect answer, for a total of 20 points. This tool measured the CVI for each item from professional experts of 6 doctors and 4 nursing professors. Initially, there were 25 items, but 5 items with a S-CVI (scale-level content validity index) of .80 or less were removed through agreement with the experts. Item validity was in the range of .85-1.00, and the S-CVI

was .94. The reliability of the KR-20 (Kuder-Richardson Formula 20) in this study was .60.

•(2)Self-efficacy on ADR monitoring

The Korean version of the original tool developed by Sherer et al. [23] was used with the permission of the original author as an evaluation tool for the level of confidence in adapting to the ADR monitoring task. This tool consists of 10 questions on a 4-point Likert scale (1-4 points), and each item has an S-CVI value ranging from .85 to .97. The higher the sum of each score, the higher the sense of self-efficacy. The validity was adequate, and the reliability of the tool was verified, with a Cronbach's α of .89.

•(3)ADR monitoring practice

This tool developed by Kim and Lee [24] was used for the early detection of ADRs, establishment of rapid countermeasures and monitoring to prevent adverse reactions. It was developed based on the educational materials of the local pharmacovigilance center and consists of 10 questions such as checking and sharing patient information on ADRs, reporting adverse reactions, confirming drugs, and using the reporting system. This tool consists of a total 10 items on a 5-point Likert scale (1-5 points). A higher sum of each score indicates a higher sense of ADR monitoring practice. The reliability test in a Kim and Lee [24] study revealed a Cronbach's α of .86; that in the current study was .78.

•(4)Medication performance ability related to ADR monitoring

The level of medication performance ability of the participants was examined using a tool modified by Kim and Lee [24] based on the perceived medication ability developed by Lee [25]. The tool consists of six questions related to understanding of the drug actions, necessary precautions, potential allergies, assessment of patient records, understanding the patient situation prior to and after administration, and drug education. On a 6-item, Likert-type 5-point scale (1-5 points), for each item, the higher was the score, the higher was the medication performance ability. Permission of the original author was obtained for use of this tool, which showed reliability through a Cronbach's α of .81.

Data analysis

The data were analyzed using IBM SPSS Statistics Software Version 21.0 (IBM, Armonk, NY, USA). General characteristics of the participants were analyzed as real numbers, percentages, and mean and standard deviations. The prior homogeneity of the two groups was verified by the Chi-square test, Fisher's exact and *t* tests, and the Kolmogorov–Smirnov test for normality, and the Levene's test for equality of variance. To verify the effect of the intervention, the differences prior to and after the intervention were identified between the experimental group and the control group by independent *t* test.

Ethical considerations

Ethics approval and consent to participate This study was Institutional Bioethics Committee (Approval no. HYUH 2017-06-014-002) of Hanyang University Hospital in Seoul, Korea. Prior to data collection, researchers explained to all respondents that all data acquired would not be used for other purposes than research, and respondents could refuse a survey at anytime. Participants in this survey provided their informed consent with written paper.

Results Verification of the effectiveness of the website-based learning interventions

•1)Homogeneity test of participant's general characteristics and variables

As a result of the analysis to verify the homogeneity of the general characteristics and dependent variables of the two groups, there was no statistically significant difference, and the two groups were homogeneous (Table 3). In this study, participants visited the website an average of 7.03 times, but mainly used learning content rather than

commenting or posting, and mainly asked questions about how to use the program. This appears to be the result of the short mediation period and lack of publicity.

•**2)**Effects of website-based learning on research-dependent variables

The difference in ADR knowledge score of 2.93 ± 2.80 in the experimental group was significantly higher than the 1.20 ± 1.92 found in the control group (t = −2.80, *p* = .007). The score difference of self-efficacy on ADR monitoring in the experimental group was 3.50 ± 4.99 points, which was significantly higher than the −0.13 ± 5.18 points of the control group (t = −2.77, *p* = .008). The difference in scores of monitoring ADRs in the experimental group (5.07 ± 6.28) was higher than the 1.27 ± 6.19 found in the control group, and the difference was statistically significant (t = −2.36, *p* = .022). The difference in post-pre scores of medication performance ability related to ADR monitoring in the experimental group was 1.93 ± 3.29, which was higher than the 0.53 ± 3.19 evident in the control group, but the difference was not statistically significant (t = −1.67, *p* = .100) ([Table 4]).

Discussion

The current study developed website-based learning content to establish a culture of information sharing and two-way communication by focusing on the behavior change of voluntary ADR monitoring by nurses in busy clinical settings [15, 16]. For two-way communication with learners, the researcher gave responses to the learners' questions after listening to video lectures or through FAQs and notice board banners. In addition, efforts were made to strengthen learners' motivation to learn by posting a slogan contest campaign and prize information. However, considering that there were few inquiries related to nursing practice other than lecture-related inquiries, it is believed that this was because the focus was on learning due to the limited study period of two weeks. It is necessary to analyze the contents of the question through long-term application in the future.

Whereas information about drugs was previously shared through e-mail, oral, and written media, it was possible in this study to implement a positive environment in which open discussion about drug-related knowledge and opinions can be achieved by using a website. A similar system was shown to be an effective means of communication [26, 27] that avoids time and space restrictions through the design and development of learning content using a website.

In this study, the knowledge on ADRs was significantly increased in the experimental group than in the control group, which supports the result that seven out of 13 studies in a systematic literature review on the effect of web-based education were more effective than traditional face-to-face education [28]. However, there was no significant difference between two methods in five studies [28]. Therefore, it is necessary to consider when designing an educational method that variables such as participant characteristics and educational topics can affect the effectiveness of the educational method.

Self-efficacy on ADR monitoring showed a statistically significant increase in the scores of the experimental group compared with the control group. This result supports the finding that web-based self-learning significantly increased self-efficacy in ventilator management education compared with face-to-face training [29]. However, it is contrary to the finding that there was no significant difference in self-efficacy in web-based anticancer chemotherapy nursing education compared with face-to-face education [30]. Repeated and continuous efforts are required to increase self-efficacy in complex clinical settings [27, 30]. Since the developed website-based learning content can be continuously updated and allows repeated review and learning, it is expected to be used for nursing education management in the future.

In the monitoring practice of ADRs, the experimental group showed a significantly greater difference in scores prior to and after the intervention than did the control group. This result, although a single group study design, partially support the finding that after receiving in-hospital education on ADR monitoring for hospital nurses, their knowledge

and attitudes were significantly improved compared with prior to education, and there were 26 voluntary reports after 4 months [13]. But, in this study, there seems to be some difference in that it was measured as a questionnaire asking the will to change behavior toward practice rather than as a measurement of the reporting rate. Since some nurses and other medical staff are not aware of their duty to report ADRs, it is necessary to produce a network that can provide feedback and promote the necessity, purpose, and method of reporting with a wide range of customized educational activities [18]. Since a structured format for ADR monitoring is required for a safe medication culture for nurses [31], it is necessary to continuously apply the website-based learning developed in this study to nurses in practice as a practical method.

In terms of medication performance ability related to ADRs, there was no statistically significant difference in the increased scores between the experimental and control groups prior to and after the intervention. It is thought that the evaluation could not be done generously because only six items were extensively asked about their medication nursing capacity, and the difference in responses could not be confirmed with a short study period.

The strength of this study is that it was intended to contribute to the creation of a safety culture in hospitals by developing website-based learning contents that allow repeated learning and interaction of the latest information and case-oriented education to activate ADR reporting by clinical nurses. In particular, the study is significant in that it confirmed the importance of voluntary ADR monitoring and reporting by clinical nurses by verifying the effect through the experimental design of randomized subject assignment. In addition, it has established an educational platform for clinical nurses, and it is also suggested to verify the effectiveness of ADR after educational application for nursing students in the future [32].

However, it also had some limitations. First, the study sample was small and involved participants from one university hospital in Korea. In addition, as a self-report questionnaire, there is a limitation that posttest measurement was performed 2 weeks after the intervention. In the future, it is necessary to verify the effect of the intervention through more objective measurement and to confirm whether the effect of the experiment lasts for a longer period of time. The second limitation was that the study period was short, but as a result of the activation of ADR monitoring and reporting, the actual number of self-reports of the participants could not be confirmed. In this study, participants visited the website an average of 7.03 times, but mainly used learning content rather than commenting or posting, and mainly asked questions about how to use the program. This appears to be the result of the short mediation period and lack of publicity. Finally, there is a limitation in that the number of ADR-related nursing behaviors or reports of participants in the study could not be actually measured. Third, there is a limitation in that the number of ADR-related monitoring or reports of the study participants was not actually measured, so it is necessary to confirm this in future studies.

Conclusion

The website content developed in this study included video lectures, case studies about ADRs, information on individual drugs, and FAQs about ADRs. In addition, various notice board functions were used to enable two-way communication such as sharing cases and providing feedback, providing drug safety information issued monthly by the local product safety center, and posting reports related to ADRs. Nurses who learned through the website significantly increased their knowledge of ADRs, self-efficacy, and monitoring practices compared with the control group. Sharing and communication through such an open website induces clinical nurses to practice monitoring for ADRs and activates voluntary reporting, leading to a safer medication culture in hospital settings.

Availability of data and material

The data sets generated and analyzed during the current study are not publicly available due to participant's privacy and decision of IRB but are available from the corresponding author on reasonable request.

Authors' contributions

HJK designed this study, performed data analysis, and drafted the manuscript. SYH designed this study, performed data collection, and drafted the manuscript. All the authors reviewed and approved the final version of the manuscript.

Conflict of interest

The authors have no conflict of interest to disclose.

Site map		Contents	Content classification
Online lecture	Knowing it is medicine!	Online lecture	•Display format: Link to www.selc.or.kr via banner- Under the management of the arbitration participant's list, email, andcontact informationIndividual identification/password provided- E-learning progress management and encouragement, Q&A, etc.- Communication possible
Cases by drug system	What happened?	ADR evaluation case	•Widely used in case data from the Korea Pharmaceutical Safety Administration is drug-oriented data and evaluation provided by the Ministry of Pharmacy Provide data on cases
Drug informati on	Aha like that!	Drug information update	•Provides a list of recently stocked drugs and precautions•Provides information on drugs that have been changed due to safety issues•Lists drugs that require caution when administering (high-risk drugs, etc.)•Suggestion of error points and solutions
FAQ	How in this case	FAQ information	•FAQ provided•Comment function: general member- If you have any questions, you can communicate through comments
Notice board uses	Newsletter	Provide information	•Newsletter provided by local drug safety center•Trends and events on ADRs inside and outside the hospital

Great reporter	Motivation	•Excellent reporter and department selected by the regional drug safety committeeCenter motivation by uploading photos and lists	Notice board
Reference room, through notices, user guides, etc. Provide information	•Information on events and usage through notices•Data can be downloaded and written by members in the data room	Campaign	Motivation

List	Content	Running time
1. ADR terminology and how to report (basic)	•What is an ADR?•The importance of ADRs in nurses•ADR reporting system•ADR evaluation method	35 min
2. Clinical features of ADRs by system (basic)	•Drug-induced skin/liver/renal/gastrointestinal/cardiovascular disease	26 min
3. Prevention and management of ADRs (advanced)	•Contrast adverse reaction management, computer program, symptoms, pretreatment, prevention	17 min
4. Anaphylaxis symptoms and management (advanced)	•Underlying diseases and causes•Symptoms•Examination and diagnosis•Treatment	18 min
5. Drugs requiring monitoring (advanced)	•High-risk and cause serious adverse reactions drugs•Management of side effects of anticancer drugs•Drugs need to be monitored by the Ministry of Food and Drug Safety in case of occurrence	35 min

Variables	Categories	Exp (n = 30)	Cont. (n = 30)	χ^2 or t	p
n (%) or M±SD	n (%) or M±SD	Gender	Men	3(10.0)	0(0.0)

3.16	.237[b]	Women	27(90.0)	30(100.0)	Age (years)
	31.83 ± 6.68	30.87 ± 5.57	−0.59	.559	Education
College	6(20.0)	5(16.7)	0.51	.774[b]	Bachelor's
22(73.3)	24(80.0)	Master's	2(6.7)	1(3.3)	Marital status
Married	10(33.0)	8(26.7)	0.32	.573	Single
20(67.0)	22(73.3)	Total clinical Experience (month)		99.10 ± 82.55	88.8 ± 71.81
0.54	.911	12~<36	7(23.3)	9(30.0)	36 ≤~<60
8(26.7)	6(20.0)	60 ≤~<120	7(23.3)	7(23.3)	≥120
8(26.7)	8(26.7)	Working department	Medical ward	14(46.7)	15(50.0)
0.33	.849	Surgical ward	12(40.0)	10(33.3)	Others[a]
4(13.3)	5(16.7)	Reporting experience	Yes	16(53.3)	21(70.0)
1.76	.184	No	14(46.7)	9(30.0)	Education experience
Yes	18(60.0)	22(73.3)	−1.20	.273	No
12(40.0)	8(26.7)	Knowledge		14.57 ± 2.42	14.00 ± 2.27
−0.94	.354	Self-efficacy		35.90 ± 4.31	37.27 ± 5.63
1.06	.296	Monitoring practice		32.83 ± 4.54	33.50 ± 4.29

0.58	.561	Medication performance ability		21.27 ± 3.15	20.60 ± 2.46

Variables	Group	Pre	Post	Difference	t	p
M±SD	M±SD	M±SD	Knowledge on ADR	Exp.(n = 30)	14.57 ± 2.42	17.50 ± 1.22
2.93 ± 2.80	−2.80	.007	Cont.(n = 30)	14.00 ± 2.27	15.20 ± 1.85	1.20 ± 1.92
		Self-efficacy on ADR	Exp.(n = 30)	35.90 ± 4.30	39.40 ± 5.06	3.50 ± 4.99
−2.77	.008	Cont.(n = 30)	37.27 ± 5.63	37.13 ± 6.70	−0.13 ± 5.18	
	ADR monitoring practice	Exp.(n = 30)	32.83 ± 4.54	37.90 ± 5.36	5.07 ± 6.28	−2.36
.022	Cont.(n = 30)	33.50 ± 4.30	34.77 ± 4.91	1.27 ± 6.19		
Medication performance ability	Exp.(n = 30)	21.27 ± 3.15	23.20 ± 3.33	1.93 ± 3.29	−1.67	.100

DETAILS

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The Effects of Aroma Essential Oil Inhalation on Stress, Pain, and Sleep Quality in Laparoscopic Cholecystectomy Patients: A Randomized Controlled Trial

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ABSTRACT (ENGLISH)

SummaryPurpose

Patients undergoing cholecystectomy report experiencing stress related to the surgery, complaining of pain and poor sleep quality. Aromatherapy is known to have positive effects on these complaints. However, the effect of aromatherapy on cholecystectomy patients has yet to be determined. The aim of this study, therefore, was to investigate the effects of aromatherapy on laparoscopic cholecystectomy patients' stress, pain, and sleep quality.

Methods

This study was a randomized controlled trial involving 69 adults who underwent laparoscopic cholecystectomy. Essential oil therapy was given to an intervention group, and almond oil was given to a placebo group. The outcome variables were stress, pain, and sleep quality.

Results

There were no differences between the groups in terms of demographic and clinical characteristics and pretreatment dependent variables. After the intervention, subjective stress ($F = 7.43$, $p < .001$), objective stress ($F = 2.70$, $p = .034$), parasympathetic nerve activity ($F = 2.65$, $p = .036$), pain ($F = 8.74$, $p < .001$), analgesics administration ($F = 22.43$, $p < .001$), and sleep quality ($F = 5.23$, $p < .001$) were significantly different between the intervention, placebo, and control groups. Sympathetic nerve activity was not significantly different. The effect sizes regarding the sleep quality of the intervention versus control group and the intervention versus placebo group were 1.92 and 1.52, respectively.

Conclusion

Postoperative aromatherapy received by cholecystectomy patients was effective in reducing stress and pain and improving sleep quality. No side effects of aromatherapy were reported during the experimental treatment.

FULL TEXT

DETAILS

Subject:	Physiology; Patients; Stress; Surgery; Cholecystectomy; General anesthesia; Postoperative period; Gallbladder diseases; Laparoscopy; Pain; Nervous system; Aromatherapy; Sleep disorders; Oils &fats; Hospitalization; Gallbladder; Analgesics
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Effects of a Neonatal Supportive Positioning Training Video Program for Preterm Infants on the Knowledge and Performance of Nurses in Neonatal Intensive Care Units

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ABSTRACT (ENGLISH)

SummaryPurpose

The purpose of this study is to develop and apply a neonatal supportive positioning (NSP) training video program for premature infants, using a position support mat for nurses in neonatal intensive care units (NICUs), and to verify its effect on nurses' performance.

Methods

Thirty-five NICU nurses were included in the study. For the pre-test, preliminary check-ups were conducted, questionnaires about NSP knowledge on preterm infants were distributed, and NSP performance using neonatal dolls were video recorded for each participant. PowerPoint presentations and videos were used to educate participants on NSP. Furthermore, a 20-minute one-on-one training session was conducted using an NPS kit. Two weeks after the training, we repeated the process of distributing questionnaires about NSP knowledge and recording nurses' performance videos using neonatal dolls. Questionnaires and videos collected before and after the training were compared.

Results

After NSP training, the mean knowledge score of the participants improved significantly from 23.71 ± 3.62 to 29.51 ± 2.29 ($Z = -5.09$, $p < .001$). The performance score for postural supportive positioning was 38.03 ± 7.46 before training and 80.06 ± 9.85 after receiving training, indicating a high-performance score after NSP training ($Z = -5.16$, $p < .001$).

Conclusion

Our NSP training video program increased nurses' NSP knowledge and performance. Continuous training NICU nurses on NSP, using a standardized training video program, can help improve the care of premature infants.

FULL TEXT

Introduction

Globally, owing to the increase in maternal age and multiple pregnancies, 11.1% of childbirths occur prematurely, and this number continues to increase [1]. In Korea, the birth rate of premature infants under 37 weeks of age in 2019 was 8.1%, a 1.4-fold increase when compared to 2009 [2]. Although the advancement of medical technology has increased the survival rate of extremely low birth-weight infants, it has also increased the risk of long-term problems, such as behavioral status, growth, and development, occurring along with short-term issues, such as medical and surgical problems related to short gestational periods and delays in behavioral status, growth, and development [3].

Generally, premature infants can survive after receiving essential medical treatment such as ventilator support and venous tube insertion in the neonatal intensive care unit (NICU) [4]. For premature infants, perinatal nerve damage and long-term prognosis are very important issues [5]. The risk of neurodevelopmental disorders in premature infants is higher than that in full-term infants [6]. The causes of neurodevelopmental disorders in premature infants include inadequate sensory stimulation exposure in NICUs, painful medical treatments [6], lack of routine care such as touching or handling babies, and bathing or weighing them [7,8]. Stress adversely affects the development of premature infants by affecting physiological processes and central nervous system organization [7,8]. Recognizing these factors led to the development of developmental supportive care (DSC) [9,10], which is a form of nursing that promotes neurosensory and emotional development, while reducing stress in premature infants during admission to the NICU [11]. It includes a space that provides clinical practices such as environmental management, sensory stimulation, interaction, and cooperation with family and medical staff related to the individual characteristics and needs of premature infants [9,10].

During developmental supportive care, the maintenance of an appropriate position for premature infants is an important factor [7]. Unlike full-term infants, premature infants develop from the tail to the head [7]. In addition, due to the limited experience of flexion in the uterus, the tension of the flexor muscles is not well developed, and thus there

is no adequate strength and elasticity [7,11]. As a result, premature infants maintain their body in an outstretched position [12] and their developmental processes such as normal head control, hand and eye control, and normal standing are disturbed [7].

Furthermore, studies have also reported that the lack of appropriate neonatal supportive positioning (NSP) leads to deformation of the skeleton and muscles and affects brain development, leading to abnormal neurological signs [13]. In fact, motor development is delayed in premature infants compared to full-term infants [14], or self-regulation ability and oral feeding skills are poor [15]. For this reason, the neonatal intensive care unit recommends using various methods such as wrapping the premature infant in a blanket or making a border or nest to maintain the proper position of the premature infant [12]. Wrapping the baby in a swaddling bag is the easiest and safest way to support the position [16]. Posture support nursing, including wrapping with swaddling, is effective in maintaining the flexion of the extremities, not only in the development of muscles and nerve roots, but also in promoting self-regulation, improving motor skills, and reducing pain and hospitalization in premature infants [6,17,18].

NSP has a positive effect on the developmental process of premature infants; as such, position support care is very important for the optimal growth of premature infants [19]. One of the factors affecting the development of premature infants is their interaction with the environment and care providers [9]. Therefore, NSP is an essential practical skill for nurses in NICUs [9]. In order to provide effective NSP in nursing practice to premature infants, nurses must acquire knowledge and understanding of the necessity and precise methods involved [19]. However, it was found that nurses in NICUs lack knowledge about the purpose of NSP, the timing and principle of NSP provision, the development of muscle tone, and the ability to perform position support nursing [10,19]. Furthermore, nurses perceive the lack of nursing performance and lack of support for training as obstacles to developmental NSP [10,11]. Overseas, developmental assessment tools and NSP guidelines for premature infants are widely used in nursing practice [19,20]. However, in Korea, it is operated as a one-time educational program through job training at academic societies or hospitals [19]. In addition, standardized training programs are not yet utilized [19]. These circumstances may prevent nurses from applying NSPs to premature infants.

The purpose of this study was to develop and apply an NSP training video program for nurses in NICUs who care for premature infants, and to verify its effect on nurses' knowledge and performance. Our research hypotheses were 1) Nurses' NSP knowledge scores will be higher after receiving NSP training than before receiving training, 2) Nurses' NSP performance scores will be higher after receiving NSP training than before receiving training.

Methods Design

This study employed a one group, pre- and post-test experimental design to evaluate the effectiveness of the NSP training video program for nurses in NICUs who care for premature infants.

Participants

The participants were nurses who directly participate in nursing care for premature infants in the NICU of a tertiary hospital in Incheon, Korea. Nurses who received the NSP training for premature infants before, and who did not directly participate in nursing care for premature infants were excluded.

A commonly used indicator of effect size is Cohen's median effect size, which is suitable when the power is 0.8 or higher [21]. To identify the number of participants required for this study, G*Power 3.1 program was used. For paired t-test analysis, when the median effect size was 0.5, significance level α was 0.05, and power (1-β) was 0.80, 28 individuals was calculated as the minimum sample size. Based on this, and considering the dropout rate, 40 nurses were recruited. The final sample comprised 35 nurses, after excluding four nurses who transferred to another ward and one nurse who resigned.

Research tools Knowledge of NSP for premature infants

The NICU nurses' knowledge of NSP for premature infants was assessed using the knowledge of NSP assessment tool developed by Kim [22]. The tool consists of 33 items, with the five items pertaining to NSP methods and nine items pertaining to NSP theory. Regarding NSP method and its advantages and disadvantages for each position, there were nine items in the supine position, six items in the prone position, three items in the lateral position, and one item in the sitting position. For each question, correct answers were scored as 1 point, and incorrect answers

and those marked “do not know” were scored 0. The total score ranged from 0 to 33, and the higher the score, the higher the knowledge about NSP. The Kuder–Richardson 20 (KR20) value was .75 at the time of scale development [22], and .59 in this study.

Performance of NSP for premature infants

To measure nurses’ performance of NSP for premature infants, we used the assessment tool developed by Kim [22]. In order to increase the objectivity of the evaluation tool, Kim [22]'s scale was modified and supplemented as a checklist with reference to the guidelines for supporting the position of premature infants [23]. To verify the content validity and item reliability of the revised checklist, nine experts (five nurses with more than 10 years of clinical experience in the NICU, two neonatal physicians, and two nurses specializing in newborns) were consulted to verify whether the contents are appropriate, received, corrected, and supplemented. In accordance with the opinion of the experts, 17 items (1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 17, 19, 20) regarding the impact of not introducing the importance of holding and physical support were modified to the same extent as in the NSP Knowledge Educational materials. Item 3, 20, and 22 were kept the same as the contents of the position support education using the position support mat. Five items (16, 21, 23, 24, 25) that were different from the position support education developed in this study were deleted. The final tool consisted of 20 items, including items on diaper change (1), holding (5), supine position (4), prone position (5), lateral position (4), and other (1). Each item was evaluated on a 5-point scale ranging from 5 (strongly agree) to 1 (strongly disagree), where a higher score indicated higher NSP performance. At the time of scale development, Cronbach's α was .77 [22]; in this study, the pre-test Cronbach's α was .83 and post-test Cronbach's α was .85.

Developmental support mat

The NSP mat was (Positioning mat SSS/SS/S/M/L, AKACHANNO SHIRO CORP, Fukuoka, Japan) developed at Nagoya Metropolitan Children's Hospital in Japan to promote the development of premature infants through position support. In developmental nursing, nesting or swaddling babies to maintain a posture that resembles the fetal position is referred to as developmental support [24]. A developmental support mat can be used in both methods of nesting and swaddling, and it can be opened and closed in such a manner that it does not have to be removed during treatment or care. The mat helps in NSP performance, and the soft material helps to stabilize premature infants. Nakano et al. [25] observed that using the development support mat enabled proper posture in premature infants, which facilitates flexion posture and movement pattern toward the center of the body, similar to that of the fetus.

Intervention: NSP training video program

The NSP training video program for premature infants was developed based on the five steps of analysis, design, development, implementation, and evaluation of the ADDIE model [26], which is a teaching design model for systematically planning education (Figure 1).

Analysis

In order to confirm the details of the contents of the NSP training video program for premature infants, domestic and foreign literature [9,17,19,24,27] and postural support guidelines for premature infants [23] were reviewed. Through a literature review, the concept and components of nursing care for premature infants and developmental support were identified, and the contents, knowledge, and performance of positional support nursing for premature infants were derived. Through previous studies, it was found that nurses lacked accurate knowledge about supportive positioning, and that supportive positioning care was performed inappropriately [17,19].

Design

Based on the results derived from the analysis stage, the goal of the NSP training video program for premature infants was established. Accordingly, a training program suitable for achieving that goal was designed, and an operation method was determined. The NSP training video program for premature infants was 62 minutes long and comprised three-stages (lecture, video education, and one-on-one pilot training).

Development

Lecture materials for NSP Knowledge Education were developed. To improve NSP performance ability, performance

training materials using videos were developed.

•(a)Lectures (NSP Knowledge Educational materials)

Knowledge-related information on positional support nursing for premature infants was developed based on a literature review. Educational materials were prepared in lecture format based on the definition of premature infants, the advantages of developmental nursing, positional support nursing, and positional supportive care. Information regarding symptoms that may appear when proper positional support is not provided and the ideal posture in supportive positioning care were also included. To verify and consequently improve the content validity of the training program, ten experts (five nurses with more than 10 years of clinical experience in the NICU, two nurses specializing in neonatal care, and three nurses specializing in newborns) were invited. In accordance with the opinions of the experts, all terms explained in the educational materials were corrected to textbook expressions. For instance, “low weight infants” was corrected to “low-birth-weight infants.” In the performance-related training materials, the importance of holding and the effect of not introducing positional support were corrected and supplemented. The content validity of the training program was .90.

•(b)Video Education

Educational videos can help improve nurses’ clinical skills and knowledge [28,29]. Therefore, video training materials were produced for performance-related educational content. The educational video used involved a diaper changing method that involved supine positioning using a position support nursing mat and a doll that was researched and developed at Nagoya Metropolitan Children's Hospital in Japan (Positioning mat SSS/SS/S/M/L, AKACHANNO SHIRO CORP, Fukuoka, Japan). To verify and consequently increase the content validity of the training program, ten experts (five nurses with more than 10 years of clinical experience in the NICU, two nurses specializing in neonatal care, and three nurses specializing in newborns) were consulted. In accordance with the opinions of experts, the content relating to the diaper change in the training video was revised and the video was re-filmed. The content validity of the training program was .78.

•(c)One-on-one demonstration and performance training

A 20-minute-long one-on-one pilot training was conducted with participants who had completed the knowledge education involving a lecture and video. As premature infants are a vulnerable group and involving them in the study can cause ethical concerns, we conducted one-on-one pilot training and performance evaluation using a premature infant doll. The researcher performed one-on-one training demonstrations using a developmental support mat and a doll of a similar proportion to that of a premature infant. After the demonstration, the participants were asked to perform what they had learned on the preterm infant doll using a developmental support mat. The researcher corrected the participants’ mistakes, if any.

Implementation

In the implementation stage, the NSP training video program for premature infants, completed through the stages of analysis, design, and development, was applied in the following phases: lecture, video, and one-on-one pilot training program.

To increase the evaluation credibility of the reviewers of the NSP performance checklist, the researcher (a nurse) and one neonatal medical doctor in the NICU compared the video training data with the NSP performance checklist. At this time, the evaluations for the item 1 and item 11 were different, so after sharing opinions, the standards were revised in the same as the contents of the position support education.

The video was evaluated by a researcher (nurse) and a neonatal medical doctor at a NICU. Before evaluating the

video, the researcher (nurse) and the doctor checked the video in light of the training data and the postural support nursing performance checklist to define criteria for the evaluation system.

To confirm the reliability of the researcher's performance observation, one neonatal medical doctor at the NICU and the researcher observed five cases of the same performance video and evaluated it using the NSP performance checklist to determine the intra-class correlation coefficient. The agreement between the two was .91.

Procedure

This study was conducted from June 1 to August 28, 2019.

Pre assessment

NSP knowledge was assessed using self-report questionnaires. An incubator equipped with a camcorder (HDR-AS50, SONY, 2018) was set up in an independent room without patients. A doll of a similar size to that of premature infants and the NSP tools were prepared. The participants were asked to enter the room alone and to perform the NSP using the doll and relevant tools, which was recorded. The process of NSP was carried out by reviewing the video recorded using a camcorder installed in the incubator. The performance video was evaluated using the checklist by one researcher (nurse) and a neonatal medical doctor in the NICU.

Intervention

•**(a)**Lecture (NSP knowledge educational materials)

Using the developed NSP training video program, this study utilized a researcher-conducted knowledge training via a lecture for 30 minutes at a time.

•**(b)**Video Education

To increase the continuity of the educational effect, five days after the lecture, video training using educational videos was conducted for 12 minutes at a time.

•**(c)**One-on-one demonstration and performance training

After video training, one-on-one training was provided. This training was conducted for 20 minutes at a time using the premature infant model and the NSP training video program (Table 1).

Post assessment

NSP knowledge was assessed using self-report questionnaires. In order to prevent the learning effect, two weeks after the experimental intervention [30], the participants were surveyed with a questionnaire about their knowledge of NSP. A video was recorded to investigate NSP performance. An incubator equipped with a camcorder (HDR-AS50, SONY, 2018) was set up in an independent room without patients. A doll of a similar size to that of premature infants and the NSP tools were prepared. The participants were asked to enter the room alone and to perform NSP using the doll and relevant tools. The recorded video of the NSP process was reviewed.

The performance videos of the participants were evaluated using the performance of NSP for premature infant checklist. In order to minimize the halo effect, the video was evaluated by two people: one researcher (nurse) and one doctor. The findings of the medical doctor and researcher (nurse) were compared. Further, information on pre- and post-videos was not provided during performance evaluation.

Statistical analysis

The collected data were analyzed using the SPSS 25.0 (IBM Corp., Armonk, NY, USA). statistics program as follows.

•**1)**To present the general characteristics of the participants, frequency, percentage, mean, and standard deviation (SD) were calculated.

•2)To evaluate knowledge and performance of NSP, frequency, percentage, mean, and SD were calculated.

•3)Wilcoxon signed-rank test was performed to analyze the differences between pre-and post-test knowledge and performance of NSP.

Ethical Considerations

To ensure the safety of the participants, this study was approved by the Institutional Review Board of G University (IRB NO: 1044396-201805-HR-122-01). Before collecting data, a consent form for participation in the study was obtained from the nurses who voluntarily agreed to participate.

Results General characteristics of the participants

A total of 35 nurses participated. Among them, 30 (85.7%) graduated with a four-year degree in nursing. Their mean age was 24.89 ± 2.56 years. The mean clinical and NICU experience was 2.10 ± 2.23 and 1.70 ± 1.77 years, respectively, and all participants were general nurses. Thirty-four (97.1%) participants responded that NSP education was necessary and 21 (60.0%) reported excessive workload as the most common cause of its dearth (Table 2).

Knowledge of NSP

To verify the effectiveness of the NSP training video program, the difference in knowledge before and after the intervention was assessed (Table 3). The knowledge score was 23.71 ± 3.62 before NSP education and 29.51 ± 2.29 after NSP education ($Z = -5.09$, p

Among the subcategories, the item “Extremely low birth weight infants are encouraged to take supine position during the first few days of life to prevent elevated cerebral blood flow” had the highest correct response rate with an increase of 54.3% after the program. The item with an increased incorrect answer rate was “Maintaining physiological flexion from around 36 weeks of gestation,” with −5.7%.

Performance of NSP

To verify the effectiveness of the NSP training video program, the difference in performance before and after the intervention was assessed (Table 4). The performance score for NSP was 38.03 ± 7.46 before the training and 80.06 ± 9.85 after training ($Z = -5.16$, p

Among the sub-items, the item with the highest percentage of correct answers after the implementation of the NSP training video program was “Always keep holding at least one hand even when changing posture,” showing a difference of 3.55 points out of 5.

The item with the lowest score after training was 1.00 ± 0.00 for “Place a roll under the front ankle as your baby is in the prone position to keep the feet in a straight line,” which remained the same even after training.

Discussion

We developed an NSP training video program and evaluated its effectiveness in improving NSP knowledge and performance of nurses in NICUs and the results of this study support positive developmental effects in premature infants. In particular, NSP education using lectures was included in the program so that NSP, which could increase the positive effect on the development of premature infants, could be performed. The participants also watched educational videos that were created to supplement and maximize the educational effect. Finally, by conducting a one-on-one demonstration and performance training, the participants' mistakes were corrected. This training program was designed to improve nurses' knowledge and performance by conducting a three-step program consisting of a lecture, video training, and a one-on-one demonstration and performance training.

The nurses who participated in this training program displayed a significant increase in their knowledge of NSP care

for premature infants after training. This finding is similar to that of the study by Mohammed et al. [31], which verified the effects of NSP training in NICU nurses in Egypt and observed a significant increase in the knowledge score from 12.3 ± 4.4 to 18.0 ± 2.4 after NSP training. In addition, the same results as [11,32] showed a significant effect of providing developmental support nursing care on nurses' knowledge and performance before and after training regarding premature infants' sleep. The results of this study suggest that knowledge education improves the knowledge of the participants. Knowledge is acquired through training, and correct nursing is performed based on that knowledge [33]. In this study, the participants' knowledge improving as a consequence of education shows that accurate knowledge was acquired through the NSP training video program, and that correct NSP can be practiced with premature infants based on this knowledge.

In this study, the score for performance of the NSP significantly increased by 42.03 points after receiving training. Through this, it can be seen that the NSP training video program for premature infants is effective in improving the nurse's NSP performance. This finding was consistent with the results of a study by Liaw et al. [34], in which 13 nurses in the NICU had a significantly increased performance score after the NSP training video program, along with positive changes in their nursing behavior. Furthermore, Jeanson [35] conducted a one-on-one on-site program for nurses in a NICU using a standardized infant position assessment tool and observed that the performance score increased from 8.3 before education to 8.7 and 9.2 during and after receiving the training, respectively. This indicates that nurses' performance level of NSP could be increased. Our results are consistent with those of this study.

Additionally, we observed that knowledge and performance scores in terms of NSP increased by the scores increased, respectively, after receiving training. This suggests that our training program had positive effects on both NSP knowledge and performance. In particular, since there were greater differences in the performance scores of NSP, the NSP training video program was considered to be effective More effecting in improving performance ability than increasing knowledge. Education using videos, improves the clinical skills and knowledge of nurses [28,29]. It is thought that the video and one-on-one pilot training of the NSP training video program for premature infants developed in this study were the factors that maximized the educational effect. In addition, to further increase the effect on knowledge, it is necessary to provide and use continuous and standardized NSP training video programs, and not a one-time training program.

NSP in the early stages of life is fundamental in preventing developmental differences between premature and full-term infants, and for the optimal growth and development of premature infants [9]. In addition, it can be seen that systematic education on NSP is necessary for nurses in NICUs to provide appropriate NSP to premature infants. The NSP training video program developed in this study produced positive results on the knowledge and performance of NSP. This implies that the application of this training program can narrow the developmental gap between premature infants and full-term infants in the long-term. In addition, it can help in the proper motor development and growth of premature infants. Hence, it can be said that the NSP training video program for premature infants is a useful program that can improve nurses' NSP knowledge and performance, and support the growth and development of premature infants. Later the development of a systematic NSP training video program based on the theoretical basis and future studies applying NSP training are necessary. In addition, to further increase the effect on knowledge, it is considered that continuous and standardized NSP training, not one-time training, is necessary.

In this study, we observed that the NSP training video program positively affected the knowledge and performance of nurses especially those in the NICU. However, this study has several limitations. First, this study is limited, as the objective results on stress reduction in, and stability of, premature infants could not be assessed. Follow-up studies

assessing whether nurses can provide psychological stability and comfort to premature infants by performing appropriate NSP using an objective indicator will be necessary. Second, in order to prevent the halo effect when evaluating performance, two researchers of this study conducted the evaluation comparing results, and did not provide information on the pre- and post-performance videos, but there is a limitation that suggests that the halo effect could not be completely excluded. In future studies, a follow-up study to prevent the halo effect using a complete double blocking device is needed. Third, the internal consistency of the knowledge measurement tool for NSP was low. Therefore, the score of knowledge may not have been perfectly measured in our sample. Lastly, this study was conducted on participants from a single institution. The researcher did not receive approval from the bioethics committee of other institutions owing to concerns about privacy and confidentiality because of the use of video recording. In order to prevent the testing effect that may occur during the experiment, a pre-test-post-test design was adopted. The post-inspection was conducted after a minimum duration of two weeks had passed since the pre-examination. However, it is possible that the potential exogenous variables were not fully controlled. In the future, follow-up studies are needed to prevent bias by using a control group at various institutions or to observe the actual performance of nurses. In spite of these limitations, this study tried to objectively confirm the change in the performance level by evaluating the performance level after NSP training through video recordings. In addition, it is meaningful that it provides the basis for standardized training materials that can be used in nursing practice using the position support mat created for the development of premature infants.

Based on the results of the study, we propose the following suggestions. First, in order to further solidify the validity of the training program, multidisciplinary experts involved in the nursing of premature infants need to confirm the content validity and carry out follow-up studies. Second, this study was conducted on nurses and, thus, cannot objectively assess stress reduction and stability in premature infants who are directly cared for by the nurses. Therefore, a follow-up study is needed on whether the provision of NSP provides stress reduction and stability for premature infants and can have positive results for development. Third, the target population of this study is nurses in a NICU of a general hospital, therefore, the findings cannot be generalized and must be interpreted with caution owing to the limitations of experience and region. In future, a follow-up study must be conducted to verify the effectiveness of the knowledge and performance of NSP for nurses in NICUs considering various regions and clinical career.

Conclusion

Despite the dearth of prior research on the development of NSP programs in Korea, this study developed a systematic NSP training video program and assessed its effects on nurses' education and performance regarding NSP. The NSP training video program for nurses in the NICU significantly improved the scores for knowledge and performance of NSP. In view of these results, the NSP training video program for premature infants can be said to be an effective nursing education program to improve the NSP knowledge and performance ability of nurses in NICUs. Our findings can help systematize NSP training and improve the knowledge and performance of nurses who provide direct nursing for premature infants.

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Ethics approval and consent to participate

Informed written consent was obtained from all participants in accordance with the Declaration of Helsinki guidelines. The Institutional Review Board of Gachon University approved the study protocol (Approval no.: 1044396-201805-HR-122-01).

Conflict of interest

The author declares no conflicts of interest.

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	Neonatal supportive positioning training video program contents	Methods	Time
Knowledge	Developmental support nursing·Causes of premature birth·Increased premature birth rate·Definition of premature infants·Characteristics of neonatal posture·Neuromuscular maturity assessment·Need for neonatal supportive positioning care·Possible effects of premature infants without proper position support·Efficacy of postural support nursing in the posture and motor development of premature infants	Lecture	15 min
Neonatal supportive positioning care of premature infants·Purpose, principles, and methods of neonatal supportive positioning care·Neonatal supportive positioning care in the acute phase·Neonatal supportive positioning care in the stable phase·Standards of good posture·Preparation of posture·Order of use of the neonatal supportive positioning training video tool·Examples of using the neonatal supportive positioning care tool·How to take care of the neonatal supportive positioning care·Effects and cautions of using the neonatal supportive positioning care tool·Symptoms of incorrect positioning support care·Cautions of handling the care tool	Lecture	15 min	Performance
Neonatal supportive positioning care video·Supportive positioning care using cotton flannel	Video	3 min	·Changing diapers

3 min	·Neonatal supportive positioning care using the tool and holding (supine->lateral->prone position)	6 min	Neonatal supportive positioning care practice·Diaper changing practice:Training and modification of diaper replacement practice and performance

One-on-one practice included using a doll	10 min	·Supportive positioning care :one-on-one demonstration and performance training (supine->lateral->prone position)	10 min

Characteristics	Category	n (%)	M ± SD
Age (years)	23 ~ <26	22 (62.9)	24.89 ± 2.56
≥ 26	13 (37.1)	Education	College
5 (14.3)		University	30 (85.7)
	Total clinical experience (years)	1 ~ <3	25 (71.4)
2.1 ± 2.23	≥ 3	10 (28.6)	NICU experience (years)

1 ~ <3	29 (82.9)	1.71 ± 1.77	≥ 3
6 (17.1)	Position	General nurse	35 (100)
	The need for neonatal supportive positioning care education	No	1 (2.9)
	Yes	34 (97.1)	
Causes of lack of performance in neonatal supportive positioning care	Excessive workload	21 (60)	
Lack of education and knowledge	9 (25.8)		Lack of resources to supportive positioning
3 (8.6)		Lack of awareness of supportive positioning	1 (2.8)
	Risk of extubation and line deviation	1 (2.8)	

Items	Pre-Test n (%)	Post-Test n (%)	Differences in correct answer (%)	Pre	Post	Z	p	Differences M ± SD
M ± SD	M ± SD	Total Knowledge Scores				23.71 ± 3.62	29.51 ± 2.29	−5.09

< .001	5.8 ± 3 .27	1. The uterine walls form a natural boundary for the developing fetus that acts to strengthen the muscle tone and provide resistance to fetal movement	33 (94.3)	34 (97.1)	2.8			
		2. Maintaining physiological flexion from around 36 weeks of gestation	30 (85.7)	28 (80)	−5.7			

		3. Premature infants are stable when maintaining physiological flexion	25 (71.4)	31 (88.6)	17.2			
		4. Normal term infants without medical complications should be provided DP	3 (8.6)	13 (37.1)	28.5			
		5. Before 38 weeks of gestation, the extensor muscle is more dominant than the flexor muscle	15 (42.9)	23 (65.7)	22.8			

		6. Position change should be performed periodically to maintain the skin integrity of premature infants	31 (88.6)	33 (94.3)	5.7			
		7. The skull of preterm infants and can be deformed if left in one position for a long time	34 (97.1)	35 (100)	2.9			

		8. Keeping the baby's head in the midline of the body can reduce the risk of elevated intracranial pressure and intraventricular hemorrhage	20 (57.1)	33 (94.3)	37.2			
		9. The higher the nesting, the more stable it	25 (71.4)	29 (82.9)	11.5			

		10. When applying the nest, all sides of the body should touch the boundary of the nesting	28 (80)	34 (97.1)	17.1			
		11. Nesting is not provided for babies undergoing phototherapy	28 (80)	33 (94.3)	14.3			
		12. When swaddling a baby, wrap it tightly enough to inhibit spontaneous movement of the baby's torso and limbs	28 (80)	33 (94.3)	14.3			

		13. Supine position has lower energy consumption than the prone position	20 (57.1)	24 (68.6)	11.5			
		14. Supine position puts the infant at higher risk of aspiration than prone and lateral positions	31 (88.6)	30 (85.7)	−2.9			

		15. Premature infants show more startle reflexes or disruptive movements in supine position than other positions	31 (88.6)	35 (100)	11.4			
		16. In the supine position, it is difficult to maintain the flexion position because it is influenced by gravity	24 (68.6)	31 (88.6)	20			

		17. If you do not provide supportive positioning in the supine position, premature baby's arms and legs may be externally rotated	27 (77.1)	33 (94.3)	17.2			
		18. For the prevention of sudden infant death syndrome (SIDS), we recommend that you make the baby sleep in supine position	19 (54.3)	26 (74.3)	20			

		19. Extremely low birth weight infants should be in supine position during the first few days of life to prevent elevated cerebral blood flow	13 (37.1)	32 (91.4)	54.3			
		20. Attaching shoulder rolls in the supine position helps prevent excessive flexion of the neck and keep airway open	35 (100)	35 (100)	0			

		21. The supine position increases the hyperextension and muscle tone of the head, neck, and shoulder compared to other positions	18 (51.4)	31 (88.6)	37.2			
		22. When taking a prone position, the height of the pillow or roll under the head and chest should be 1: 2	22 (62.9)	34 (97.1)	34.2			

		23. The baby cries less and sleeps better in the supine position than prone position	30 (85.7)	34 (97.1)	11.4			
		24. It is not easy for the baby to visually explore in the prone position	21 (60)	34 (97.1)	37.1			

		25. Prone position is effective in improving the respiratory function of the baby, increasing the symmetry of the chest wall, and improving the gas exchange	22 (62.9)	32 (91.4)	28.5			
		26. If the baby is placed in the prone position on a flat surface, it can be transformed into a frog-shaped leg by abduction or rotation	25 (71.4)	32 (91.4)	20			

		27. When placing rolls or pillows under the baby's chest in prone position, the shoulders may become excessively extended if the width is wider than the gap between the shoulders	26 (74.3)	35 (100)	25.7			

		28. Babies with inadequate physical activity are advised to take a lateral position to reduce the risk of aspiration	30 (85.7)	35 (100)	14.3			
		29. Lateral position is a position that can minimize abduction and rotation of the hips	22 (62.9)	30 (85.7)	22.8			

		30. When babies take a lateral position, their arms and legs are pulled toward the midline of body by gravity	23 (65.7)	28 (80)	14.3			
		31. The sitting position is the recommended position for babies with severe gastric reflux	26 (74.3)	33 (34.3)	20			

		32. If the width of the diaper placed between the baby's legs is too wide, the baby's hips and legs can be externally rotated	30 (85.7)	35 (100)	14.3			
		33. The supportive positioning provided in the NICU affects the baby's neuro and motor development in the future	35 (100)	35 (100)	0			

Items	Pre-Test M ± SD	Post-Test M ± SD	Difference	Z	p	Differences M ± SD

Total performance scores	38.03 ± 7.46	80.06 ± 9.85		−5.16	< .001	42.03 ± 10.17
1. When changing diapers, hold the baby's thighs and support the abdomen and hips	1.54 ± 0.92	3.89 ± 1.15	2.35			
2. Place the pillow under the shoulders, not head	3.06 ± 0.84	3.97 ± 1.12	0.97			
3. Hold the baby before doing anything that causes stress or pain to provide a sense of security	1.00 ± 0.00	3.54 ± 1.04	2.54			
4. When holding the baby, use the palm of your hand to provide direct touch	1.06 ± 0.24	4.29 ± 1.10	3.23			
5. When holding the baby, do enough over 30 seconds until the baby is stable	1.03 ± 0.17	3.66 ± 0.87	2.63			
6. Always keep holding at least one hand in the process of changing posture	1.11 ± 0.47	4.66 ± 0.94	3.55			
7. When in supine position, keep the baby's head on the center line of the body	2.43 ± 0.74	3.97 ± 0.51	1.54			
8. Put a pillow or roll under your shoulders when in supine position	3.14 ± 0.81	4.40 ± 1.22	1.26			
9. During supine position, bend legs so that the feet and hips are in a straight line and touch the lower wing	1.60 ± 1.06	3.46 ± 1.44	1.86			
10. Before lying in the lateral position, hold the pillow between both arms and legs and hold it sufficiently	1.14 ± 0.49	3.34 ± 1.28	2.2			
11. When turning to the lateral position, roll and pull the baby like a log to avoid excessive stimulation	2.31 ± 0.96	4.37 ± 0.69	2.06			
12. When in lateral position, bend your legs so that your feet and hips are in a straight line and touch the lower wing	2.34 ± 0.87	4.23 ± 0.84	1.89			
13. When taking the lateral position, the baby's nose-neck-sternum-coccyx is maintained in a straight line	2.40 ± 0.88	4.40 ± 0.60	2			
14. When taking the prone position, put a pillow and a prostrate cushion on the baby's head and under the chest	2.77 ± 0.97	4.69 ± 0.83	1.92			

15. The pillow should have a ratio of 1:2 to the prone cushion	1.89 ± 0.83	4.43 ± 1.15	2.54			
16. Keep the prone cushion under the chest equal to the width of the baby's torso when in the prone position	1.86 ± 0.77	4.71 ± 0.79	2.85			
17. When tacking the prone position, roll the baby like a log without lifting the baby	1.91 ± 0.95	4.00 ± 0.87	2.09			
18. Place a roll under the front ankle if your baby is in the prone position, to keep the feet in a straight line	1.00 ± 0.00	1.00 ± 0.00	0			
19. Keep your hands close to your baby's face and around mouth	3.31 ± 1.23	4.66 ± 0.84	1.35			
20. After the posture change is completed, holding the baby for sufficient time and then release the hand.	1.11 ± 0.47	4.40 ± 0.91	3.29			

DETAILS

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Jeong-Won, H., Joung, J., Ji-Soon, K., & Lee, H. (2022). A study of the educational needs of clinical nurses based on the experiences in training programs for nursing COVID-19 patients. Asian Nursing Research, 16(2), 63-72. doi:https://doi.org/10.1016/j.anr.2022.02.001

SummaryPurposeThis study aimed to explore the experience of clinical nurses regarding training programs for critically ill patients with coronavirus disease 2019 (COVID-19) and their educational needs.MethodsQualitative data were analyzed using content analysis, and quantitative data were analyzed according to Borich's formula. Data for the study were collected in March 2021 from 16 nurses who had completed a nursing program for critically ill patients with COVID-19 and were working at three hospitals designated for COVID-19.ResultsParticipants' experiences were classified into three major categories, namely “Participation experiences and perceptions of the training program,” “Recommendations for improving the training program,” and “Perceptions of working in an infectious environment,” and 10 subcategories. According to Borich's formula, the most pressing educational needs in respiratory and non-respiratory nursing, respectively, were for “nursing care for patients on extracorporeal membrane oxygenation” and “application of continuous renal replacement therapy and caring for patients.”ConclusionTo prepare for the periodic emergence of communicable infectious diseases throughout the world and cultivate nursing staff to care for critically ill patients, it is necessary to develop nursing education programs with content corresponding to nurses' needs. This study can be used as base data for cultivating nursing staff for critically ill patients with communicable infectious diseases in keeping with clinical nurses’ educational needs and basic educational materials for nursing students.Trial registrationCRIS, KCT0006359. Registered 20 July 2021 - Retrospectively registered, https://cris.nih.go.kr/cris/

Li, C., Lu, X., Cho, L. W., Gao, F., & Chan, C. W. H. (2022). Cross-cultural adaptation and validation of a chinese preventive health model instrument for measuring the psychosocial factors in hepatocellular carcinoma screening among patients with hepatitis B. Asian Nursing Research, 16(2), 94-105. doi:https://doi.org/10.1016/j.anr.2022.03.003

SummaryPurposeScreening for hepatocellular carcinoma (HCC) as an effective instrument to reduce the burden of late diagnoses remains underutilized in China, much of the Asian countries, and in a sense all over the world. Modifiable psychosocial factors should be identified to improve screening utilization and reduce the burden of late diagnoses. However, valid psychosocial measures are unavailable. This study aimed to translate, culturally adapt, and validate the preventive health model (PHM) instrument for measuring psychosocial factors of HCC screening among patients with hepatitis B.MethodsThis study was conducted from June 2020 to April 2021 in three rigorous phases: (1) committee-based translation from English to Chinese; (2) cognitive interviews (n = 33) and Delphi expert consultations (n = 7) for cultural adaptation; and (3) a cross-sectional study (n = 305) for validation.ResultsIn phase I, two items were reworded, and two retranslated for semantic equivalence. In phase II, issues related to comprehension, sensitive wording, wording clarity, question relevance, and cultural sensitivity were addressed by including pictures, rewording five items, and developing seven items. In phase III, exploratory and confirmatory factor analyses suggested a five-factor 20-item solution: it explained 76.9% of the variance; had adequate factor loading (.60–.91), convergent and discriminant validity; satisfactory model fit indices; and reliability (Cronbach's α, .86−.91). Known-group analysis showed that patients with optimal HCC screening behavior had significantly higher scores on each subscale than those not having such.ConclusionThe Chinese PHM instrument is culturally sensitive, reliable, and valid to measure the psychosocial factors of HCC screening. It can help nurses and researchers to tailor strategies to improve clinical HCC screening practices in high-risk HCC regions.

Kida, R., & Takemura, Y. (2022). Working conditions and fatigue in japanese shift work nurses: A cross-sectional survey. Asian Nursing Research, 16(2), 80-86. doi:https://doi.org/10.1016/j.anr.2022.03.001

SummaryPurposeThis study aimed to identify the working conditions (working hours, overtime work, number of night shifts, number of holidays, and work intervals) associated with fatigue, based on the shift patterns, and determine their thresholds.MethodsFrom January to February 2020, a web-based questionnaire was sent to 4601 shift work

nurses at 47 hospitals in Japan. The multivariate logistic analysis was conducted to predict high- and low-fatigue groups by working conditions, and receiver operating characteristic analysis was performed to clarify the high-fatigue thresholds by shift pattern.ResultsA total of 386 shift work nurses participated in this study. The threshold (fatigue was 3.0 or higher) of the two-shift rotation was 9 hours 50 minutes for daily working hours during day shifts (Odds ratio OR] = 1.57, p < .01), 17 hours 15 minutes for daily working hours during night shifts (OR = 1.20, p < .01), and 8.0 days for the number of night shifts (OR = 1.09, p = .02). The threshold of the three-shift rotation was 9 hours 45 minutes (OR = 1.59, p < .01), 2.9 days for the number of midnight shifts (OR = 1.53, p < .01), and 2.0 times for the interval between day-shift and night-shifts within 12 hours (OR = 1.39, p < .01).ConclusionWorking hours and the number of night shifts are important for two-shift rotation, and working hours for the assignment of midnight shift are important for three-shift rotations. Nurse managers should manage shifts according to nurses' shift patterns.

Jang, S. J., Jong-Sook Han, Bang, M. H., & Jung-Won, A. (2022). Effects of a sociodrama-based communication enhancement program on mothers of children with neurodevelopmental disorders: A pilot study. Asian Nursing Research, 16(2), 114-123. doi:https://doi.org/10.1016/j.anr.2022.03.005

SummaryPurposeThe incidence and prevalence of neurodevelopmental disorders have rapidly increased, indicating an urgent need for assistance through parenting interventions. This study aimed to evaluate the effects of a sociodrama-based communication enhancement program on mothers of children with neurodevelopmental disorders.MethodA non-randomized controlled experimental study design was employed. The experimental and control groups had 16 and 18 participants, respectively. The once-a-week six-session intervention was conducted from September to November 2017, in South Korea. The effects of group, time, and group-by-time interactions among the groups were verified using generalized estimating equations with an autoregressive correlation structure.ResultsThere was a significant decrease in the parenting burden, alongside a significant improvement in parent-child communication and parenting competence in the experimental group compared to the control group.ConclusionThe sociodrama-based communication enhancement program was found to positively influence the parenting burden, communication, and parenting competence of mothers of children with neurodevelopmental disorders. These findings suggest that sociodrama-based programs may be an effective intervention strategy for parents of children with neurodevelopmental disorders. The sociodrama-based communication enhancement program can be applied to decrease parenting burden and improve parent-child communication and parenting competence. Through continuous parenting interventions, an improvement in expressive language and an increase in the attachment behaviors of children with neurodevelopmental disabilities could be expected.

Tsukasaki, K., Kyota, K., & Itatani, T. (2022). Development and validation of an interprofessional collaboration scale for home health care for the frail elderly. Asian Nursing Research, 16(2), 106-113. doi:https://doi.org/10.1016/j.anr.2022.03.004

S U M M A R YPurposeThe purpose of this study was to develop an interprofessional collaboration (IPC) scale for home health care for frail elderly.MethodsThe first items of the IPC scale included collaboration members' attitudes, awareness, motivation, team strength, communication, relationships, information, care recipients' interests, effects, development, utilization of social resources, contributions to the community, and crisis management. The subjects were 512 care managers who work in home care support offices across Japan. They manage interprofessional collaboration in home health care for frail elderly who need care at 65 years old and above. The scale's construct validity, internal consistency, the validity of known groups, concurrent validity, and test-retest reliability (193 subjects) were examined.ResultsThe final IPC scale's items consisted of four factors (37 items): the strength of interprofessional teams (16), the management of collaborative systems (7), effects of collaboration (8), and communication (6). Four factors explained 58.6% of the total explained variance. The modified model fit of the scale achieved acceptable levels. The Cronbach's α coefficient for all items was .97. The sum of communication factor in the cities/wards group was lower than those in the towns/villages group. There were differences between the sum and each factor with different levels of ease to collaborate. The intraclass correlation coefficient for all items in the first and second assessments was .875.ConclusionsThe validity and reliability of the IPC scale have been verified. This scale can be used to assess the IPC for home health care for frail elderly.

Kwon, O. S., Kwon, B., Kim, J., & Bo-Hwan, K. (2022). Effects of heating therapy on pain, anxiety, physiologic measures, and satisfaction in patients undergoing cystoscopy. Asian Nursing Research, 16(2), 73-79. doi:https://doi.org/10.1016/j.anr.2022.02.002

SUMMARYPurposeCystoscopy is the most common procedure used to diagnose urological diseases; however, it is invasive and can be associated with pain and anxiety. Although pain relieving medications, such as lidocaine lubricants, are used during cystoscopy, the procedure still causes discomfort. Therefore, non-medical intervention is needed to reduce pain and anxiety during the procedure and increase patient satisfaction. The aim of this study was to evaluate the effect of heating therapy on pain, anxiety, physiologic measures, and satisfaction during cystoscopy.MethodsThis was a single-blinded, single-center, randomized controlled trial. A total of 145 participants who underwent cystoscopy between August 2017 and October 2017 were recruited and randomly assigned to an experimental or control group. Before and after cystoscopy, all the participants self-reported the degree of pain they felt, while pain was objectively assessed by trained nurses. Anxiety was evaluated using the validated Korean version of the State-Trait Anxiety Inventory. Blood pressure and pulse rate were also recorded as physiologic measures. After cystoscopy, satisfaction was measured in the experimental group only using the Korean version of the Client Satisfaction Questionnaire.ResultsHeating therapy reduced both subjective and objective pain and anxiety in the experimental group compared to the control group. Heating therapy also decreased the systolic and diastolic blood pressure and pulse rate in the experimental group compared to the control group. Women reported significantly greater satisfaction than men.ConclusionHeating therapy during cystoscopy is a convenient and effective nursing intervention that decreases pain and anxiety and enhances patient satisfaction.The study has been registered with the Clinical Research Information Service Registry, and the trial registration number is 12616000803493].

Mei-Feng, H., Yew-Wha Whu, I-Chen, L., Chieh-Yu, L., Fei-Chen, L., Pei-Ching, L., & Chi-Wen, C. (2022). Effectiveness of virtual reality interactive play for children during intravenous placement: A randomized controlled trial. Asian Nursing Research, 16(2), 87-93. doi:https://doi.org/10.1016/j.anr.2022.03.002

SummaryPurposeThis study aimed to evaluate the effectiveness of an interactive virtual reality (VR) play intervention including instructional play and emotional catharsis play sessions in reducing children's pain and fear during intravenous placement.MethodsA randomized controlled trial with parallel groups was conducted. The sample consisted of 134 hospitalized children aged 6–12 years (intervention group: n = 69; comparison group: n = 65). The intervention involved one immersive intravenous scene in VR before the actual intravenous placement and one emotional catharsis VR play after injection. The comparison group received an educational photo book about intravenous placement before receiving intravenous placement. The children and their caregivers rated their pain and fear by using the Wong–Baker FACES Pain Rating Scale and the Children's Fear Scale. The time required for successful intravenous insertion was also compared between the two groups.ResultsChildren's pain ($p = .028$) and fear scores ($p = .004$) were significantly lower in the intervention group than in the comparison group. Their caregivers' pain and fear scores (both $p < .001$) were significantly lower in the intervention group. The time required for successful intravenous insertion did not differ significantly between the intervention and comparison groups.ConclusionsThe interactive play intervention with VR effectively reduced children's levels of pain and fear during the intravenous placement procedure. The results of this study can serve as a reference for the implementation of a feasible, child-friendly care practice for clinical intravenous placement in school-aged children.