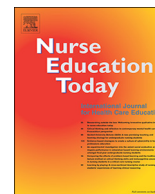




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Effects of pressure ulcer prevention training among nurses in long-term care hospitals

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ABSTRACT

Background: Nurses caring for elderly patients with a high risk of pressure ulcer at long-term care hospitals require the necessary knowledge, behaviors, and attitudes regarding preventing pressure ulcers.

Objectives: To identify the effects of pressure ulcer prevention training on nurses' knowledge, behaviors, and attitudes regarding pressure ulcer prevention.

Design: A comparison group pretest-posttest design.

Settings: Long-term care hospitals in a metropolitan area of the Republic of Korea.

Participants: Participants were conveniently assigned to team-based learning ($n = 30$) or lecture-based learning ($n = 30$) groups.

Methods: We examined pre-post differences in the scores for pressure ulcer prevention knowledge, behaviors, and attitudes in each group using the paired *t*-test. Additionally, pre-post difference scores were compared between the two groups using the independent samples *t*-test.

Results: Both groups exhibited significant increases in scores for pressure ulcer prevention knowledge, behaviors, and attitudes after the intervention as compared before it. However, we found no significant differences in the pre-post difference scores for any of the variables between the two groups.

Conclusions: Pressure ulcer prevention training, regardless of whether it utilizes team-based or lecture-based learning, is useful for enhancing nurses' pressure ulcer prevention knowledge, behaviors, and attitudes. Further study is needed to verify the longitudinal effects of pressure ulcer prevention training on nurses' actual performance and the incidence of pressure ulcers among patients.

1. Introduction

The number of long-term care hospitals in South Korea increased from 593 in 2007 to 1383 in 2016 (Health Insurance Review and Assessment Agency, 2016). Most patients utilizing these hospitals are elderly, whose age-related immunological changes and impairments in their cognitive and physical function put them at risk of pressure ulcers (Kline and Bowdish, 2016). Pressure ulcers are associated with an increased risk of infection on arrival at the emergency room among Korean elderly patients in long-term care hospitals (Kim and Jang, 2018). Both the prevalence and incidence of pressure ulcers were higher in long-term care hospitals in Japan as compared to acute care hospitals (Igarashi et al., 2013).

To prevent elderly from developing pressure ulcers, nurses must possess several competencies (Hommel et al., 2017; Wound Ostomy and Continence Nurses, 2017). However, many nurses may have suboptimal

competency in pressure ulcer prevention (Lawrence et al., 2015; Samuriwo and Dowding, 2014; Tallier et al., 2017; Waugh, 2014). Such nurses may benefit from pressure ulcer prevention training: nurses who participated in such training not only exhibited better prevention nursing (Gul et al., 2017) but had more positive attitudes toward pressure ulcer prevention (Ünver et al., 2017).

Continuing education has traditionally been delivered via the in-service lecture model. However, it is not systematically implemented in long-term care hospitals when compared to general hospitals in Korea. Increasingly, nurse educators are being challenged to develop more learner-centered educational programs based on adult learning principles, which could better facilitate learner engagement (McRae et al., 2017). Currently, we lack sufficient research on pressure ulcer prevention training that uses learner-centered learning methods for nurses in long-term care hospitals.

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2. Background

2.1. Pressure ulcer prevention training

Hospital staff education is a common means of preventing pressure ulcers (Niederhauser et al., 2012). Such education ranges from one-time events (e.g., written materials, in-service training) to more complex, ongoing activities (e.g., monthly rounds, new staff orientation) (Soban et al., 2011). Multiple educational modalities have been used in pressure ulcer prevention training, including lecture- (Lee and Kim, 2016) or case-based learning (Saleh et al., 2009), lectures combined with discussions (Tweed and Tweed, 2008), e-learning (Beeckman et al., 2008; Martin et al., 2017; Morente et al., 2014), and workshops (Ham et al., 2015; Sinclair et al., 2004; Sving et al., 2017).

Lecture-based training improved knowledge of pressure ulcer prevention among 407 nurses (Lee and Kim, 2016), even more so than did a control program (Cox et al., 2011). Intensive care unit nurses who participated in a program comprising lectures and discussions also showed knowledge improvement (Tweed and Tweed, 2008). Sinclair et al. (2004) found that a two-day workshop helped significantly improve nurses' knowledge, while Martin et al. (2017) found the same for a 15-min on-line tutorial for hospital staff. Nursing students participating in adaptive e-learning showed significantly better knowledge acquisition than did those who completed traditional lecture-based classes (Morente et al., 2014). However, among qualified nurses, no difference in knowledge was observed between e-learning and lecture groups (Beeckman et al., 2008). Furthermore, Porter-Armstrong et al. (2018) could not clarify whether health professionals with pressure ulcer prevention education demonstrated any knowledge differences from those without such education.

Training may also improve actual practice of pressure ulcer prevention. Park et al. (2013) found that the pressure ulcer risk assessment rate increased after lecture-based training among 239 ward or intensive care unit nurses, while Beeckman et al. (2008) found that the classification skills of nurses increased after both e-learning and lecture-based training. Pressure ulcer education using lectures and workshops improved the pressure ulcer identification and classification skills of emergency room nurses (Ham et al., 2015). Bredesen et al. (2016) found that nurses who completed a e-learning program showed significantly higher scores on a pressure ulcer classification measure than did those who received classroom lectures, while López et al. (2017) found that nurses showed better completion of electronic pressure ulcer records after 30-min theoretical and practical training sessions.

As is evident, most studies are limited due to their single-group pretest-posttest design or focus on knowledge as an outcome. It is necessary to use a more rigorous experimental design with various training outcomes.

2.2. Team-based learning in nurse education

Team-based learning (TBL) is a small-group instructional strategy involving individual work, teamwork, and immediate feedback (Parmelee et al., 2012). It is a learner-centered, active learning method that requires less time commitments from faculty compared to other active learning methods (Fatmi et al., 2013). However, a systematic review showed that TBL in healthcare education has mixed results in terms of knowledge gains or learners' reactions (Fatmi et al., 2013). Chen et al. (2018) found that TBL significantly increased medical students' theoretical examination scores, learning attitude, and learning skill when compared with lecture-based learning. Another systematic review revealed four themes in TBL studies, including 1) student engagement, 2) student satisfaction, 3) attainment and practice development, and 4) transformational teaching and learning (Dearnley et al., 2018).

Evidence of the effectiveness of TBL for nurses is more robust. It appears to benefit a range of cognitive, affective, and psychomotor

learning outcomes in nursing education. Moore-Davis et al. (2015) found that midwifery students' grades and certification examination pass rates did not change substantially after TBL. Staff nurses showed increased knowledge of open- and closed-chest cardiac surgical resuscitation after TBL (McRae et al., 2017), while critical care master's students showed enhanced deep learning, confidence, and professional and clinical behaviors (Oldland et al., 2017). Critical care nurses perceived TBL as helpful for improving engagement, learning effectiveness, critical thinking, and motivation to participate (Currey et al., 2015). Emergency nurses also outperformed after completing X-ray training using TBL (Considine et al., 2014). Incorporating TBL into a nurse residency program also led to improved team collaboration and positive learner satisfaction (Ouellette and Blount, 2015).

TBL may also be superior to lecture-based education. Hemmati Maslakpak et al. (2015) found that TBL induced greater improvements in nervous system examination knowledge among nursing students compared to lecture-based learning. Furthermore, nursing students' scores on a standardized examination were significantly higher after TBL than after previous lecture-based classes of a fundamental nursing (Della Ratta, 2015) or a psychiatric mental health nursing course (Harmon and Hills, 2015), and they demonstrated greater knowledge of pulmonary nursing care than did students who received lectures (Kim et al., 2016). However, Mennenga (2013) did not find a significant difference in examination scores between a TBL group and a lecture group at any of four assessment points throughout the semester in a community health nursing course.

As shown above, TBL is useful for improving knowledge, critical thinking, and problem-solving ability. Despite this, there is a deficiency of TBL studies for nurses, and most that exist have been qualitative investigations of nurses' learning experiences. Considering its evident pedagogical value, and the importance of pressure ulcer prevention training, TBL should be considered for nursing educators challenged with matching learning objectives to various interactive and innovative learning methods to improve learning outcomes in continuing education.

2.3. Purpose

We examined the effects of pressure ulcer prevention training (using lecture-based learning and TBL) on nurses' pressure ulcer prevention knowledge, behaviors, and attitudes.

3. Methods

3.1. Design

This study used a comparison group pretest-posttest design (Fig. 1).

3.2. Participants

Using G*Power 3.1.9.2 (Faul et al., 2007), we found that 26 participants were required in each group for an effect size of 0.80 with 80% power at a significance level of 0.05 for a *t*-test. The value of effect size was estimated at 0.80 for large effects, based on a meta-analysis (Chen et al., 2018) and a previous study (Cox et al., 2011). Therefore, we invited 60 nurses working at two long-term care hospitals in South Korea to participate. Thirty participants each were conveniently assigned to a TBL or a lecture-based learning group. The required number of participants to make up two groups could not be secured at hospital A. Nurses participating in the TBL group were therefore recruited first from hospital A, and nurses participating in the lecture group were recruited from hospitals A and B.

3.3. Measures

We collected data on the following general characteristics of nurses:

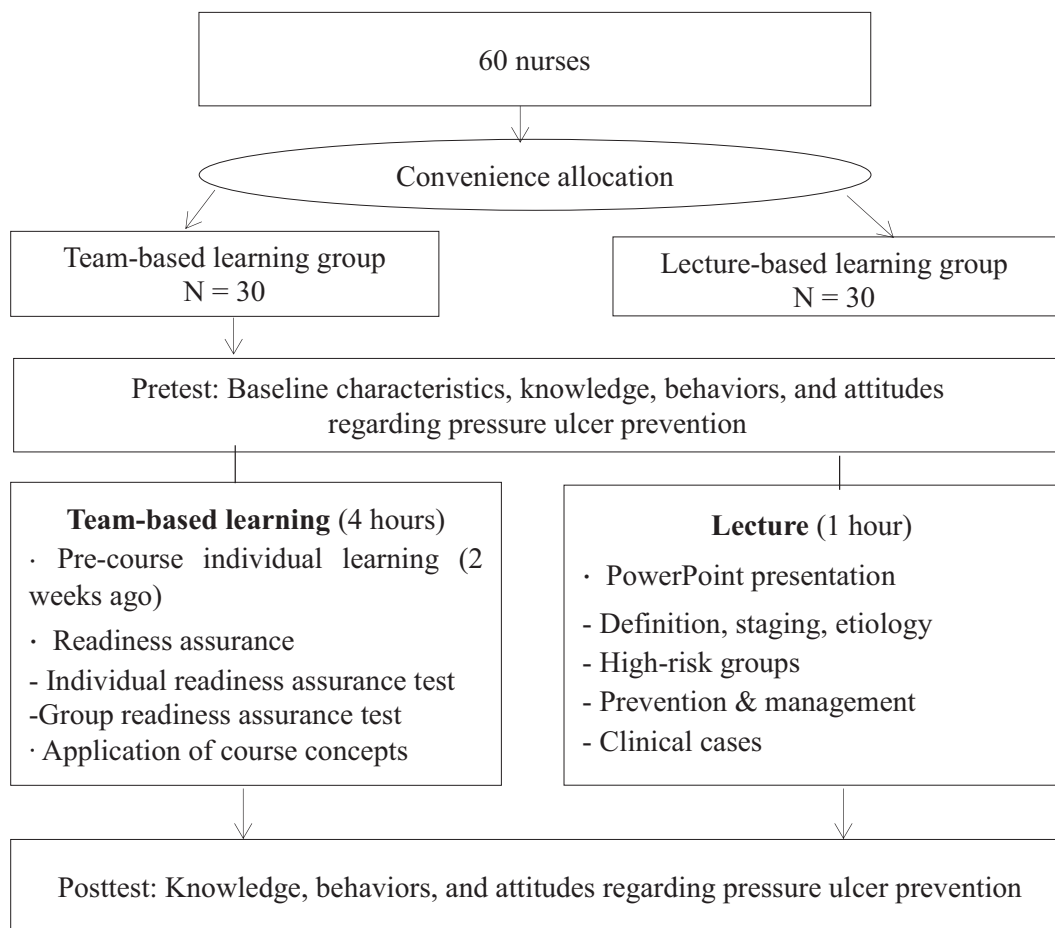


Fig. 1. Research design.

age, gender, academic degree, nursing career length, total work experience at a long-term care hospital, current position, and previous experience of pressure ulcer prevention education.

Pressure ulcer prevention knowledge was measured using the Pressure Ulcer Knowledge Assessment Tool (PUKAT) 2.0 (Manderlier et al., 2017), which contains 26 items. After receiving permission to use the tool from the original author, the researcher first translated it into Korean. Three wound specialist nurses reviewed the appropriateness of the translation for the translation draft. Finally, one professor assessed the measurement tool and confirmed its appropriateness. We divided these into two sets of 13 items, and administered one set each at the pretest and posttest. The questions were split to avoid repeated exposure to the same test questions (individual and group readiness assurance tests) in the TBL group, which could affect their posttest results compared to the lecture group. Higher scores indicated greater knowledge.

To measure behavior, we used the Korean version of the measurement tool for the self-reported clinical behavior regarding pressure ulcers (Moore and Price, 2004; Seo, 2010). This scale contains 8 items in three subscales: risk assessment of pressure ulcer (2 items), pressure ulcer prevention plan (4 items), and pressure ulcer prevention strategy (2 items). One and zero points is given for each correctly and incorrectly answered item, respectively; the total score ranges from 0 to 8.

Finally, we measured attitudes toward pressure ulcer prevention using the Korean version of the Attitude toward Pressure Ulcer Prevention Instrument (APuP) (Beeckman et al., 2010). The APuP contains 13 items, each rated on a 4-point Likert scale, in 5 subscales: personal competency to prevent pressure ulcer (3 items), priority of

pressure ulcer prevention (3 items), impact of pressure ulcer (3 items), responsibility for pressure ulcer prevention (2 items), and confidence in the effectiveness of prevention (2 items). Total scores range from 4 to 52. The Cronbach's alpha of the instrument at the time of its development was 0.79 (Beeckman et al., 2010), and in this study it was 0.58 at the pretest and 0.72 at the posttest.

3.4. Procedure

The purpose of the training programs was to improve nurses' knowledge, behaviors, and attitudes regarding the prevention of pressure ulcers. We recruited 30 nurses for each group (TBL and lectured-based learning), and nurses divided into six teams of five in TBL group.

The TBL course was conducted in three phases (Michaelsen et al., 2008): pre-class learning (conducted two weeks before the TBL class), readiness assurance (120 min), and application of course concepts (120 min) (Table 1). The latter two phases were conducted in a 4-h class by a researcher, who also developed the program procedure. Before the class, a researcher participated in 8 h TBL workshop to improve instructor competency.

For the pre-class learning, the researcher sent an e-mail to participating nurses containing learning materials on the study topic (i.e., the mechanism, risk factors, classification system, high-risk patient group, and preventative strategies of pressure ulcers). Nurses studied these materials in the two weeks leading up to the class as self-directed learning.

Next, for readiness assurance, we administered the Individual Readiness Assurance Test (25 min) and Group Readiness Assurance Test (25 min); conducted an appeals and instructor feedback session

Table 1
Timetable of team-based learning course.

Phase	Time (min)	Activity
I: Pre-class learning		
	Two weeks before the TBL class	Self-directed learning with provided study materials
II: Readiness assurance (120 min)		
Beginning	9:00–9:20 (20 min)	Ice breaking Setting the ground rules Session orientation Behavior and attitude assessment
Middle	9:20–9:45 (25 min) 9:45–10:10 (25 min) 10:10–10:40 (30 min)	Individual Readiness Assurance Test Group Readiness Assurance Test Appeals and instructor feedback
End	10:40–10:50 (10 min) 10:50–11:00 (10 min)	Questions and answers, Summary Coffee break
III: Application of course concepts (120 min)		
Beginning	11:00–11:10 (10 min)	Session orientation
Middle	11:10–11:30 (20 min) 11:30–11:40 (10 min) 11:40–12:10 (30 min)	Free discussion: Concept mapping using brainstorming on the risk factors of pressure ulcers Crossover group discussion Group discussion: Preventive strategies for pressure ulcers
	12:10–12:30 (20 min)	Group presentation
End	12:30–12:40 (10 min) 12:40–13:00 (20 min)	Questions and answers, Summary Knowledge assessment

(30 min); and ended with a wrap-up (10 min). Both readiness assurance tests were conducted using the PUKAT 2.0 (Manderlier et al., 2017). After completing the Group Readiness Assurance Test, nurses were asked to confirm their answers and engage in group discussions under a researcher's guidance. The nurses also questioned the researcher about their answers to the readiness assurance test, and the researcher provided feedback. The researcher also answered nurses' questions about the self-study materials and the readiness assurance phase.

Finally, group discussions on the application of the course concepts were conducted for 120 min. These discussions were conducted in teams and centered on a case scenario of a patient with pressure ulcer developed by the researcher based on an actual case at the long-term care hospital. Each team developed a concept map through brainstorming to identify the risk factors of pressure ulcer. A crossover group discussion was then conducted, wherein each team's concept map was presented to the group. Each team then discussed preventive strategies

Table 2
Homogeneity testing of the general characteristics of the two groups.

Variable	Team-based learning group (n = 30)	Lecture group (n = 30)	t or χ^2	p
	Mean \pm SD/N(%)			
Age (year)	35.97 \pm 7.44	37.13 \pm 6.72	-0.637	0.526
Gender			1.071 ^a	0.612
Male	3(10.0)	1(3.3)		
Female	27(90.0)	29(96.7)		
Academic degree			5.247	0.073
Associate	4(13.3)	9(30.0)		
Bachelor	25(83.3)	17(56.7)		
Master	1(3.3)	4(13.3)		
Nursing career length (months)	112.43 \pm 82.63	124.67 \pm 62.51	-0.647	0.520
Total work experience at a long-term care hospital (months)	72.47 \pm 60.09	81.30 \pm 51.32	-0.612	0.543
Present position			2.000	0.368
Staff nurse	24(80.0)	21(70.0)		
Charge nurse	3(10.0)	7(23.3)		
Head nurse	3(10.0)	2(6.7)		
Past experience of pressure ulcer prevention education			0.000	1.000
Yes	23(76.7)	23(76.7)		
No	7(23.3)	7(23.3)		

^a Fisher's exact test.

for pressure ulcers, and presented their discussion outcomes to the group. Before the end of the session, the researcher answered nurses' general questions about the entire phase.

For the lecture-based learning, the researcher conducted a one-hour lecture using PowerPoint for the participating nurses. The researcher who gave the lecture had one year of education experience as a wound specialist nurse at a hospital. The PowerPoint slides were developed by the researcher, and contained information on the mechanism, risk factors, classification system, high-risk patient group, and preventive approaches of pressure ulcers. It also detailed several actual clinical cases. Following the lecture, the researcher answered nurses' questions about the lecture content.

3.5. Ethical considerations

This study was approved by the institutional review board of a university (IRB No: 1041078–201,802-HRSB-027-01). Informed consent was obtained from each participant, all of whom participated voluntarily after learning of the purpose and procedure of the study, as well as their rights to confidentiality and autonomy of withdrawal.

3.6. Data collection

Data were collected using a self-administered questionnaire. The posttest was conducted two weeks after the pretest. More specifically, data were collected from the TBL group on May 4 (pretest) and May 17, 2018 (posttest), while data were collected from the lecture group on May 11 (pretest) and May 24, 2018 (posttest).

3.7. Data analysis

Data were analyzed using IBM SPSS Statistics 23.0 (IBM Corp., Armonk, NY). We evaluated difference in knowledge, behaviors, and attitudes scores between the pretest and posttest in each group using the paired *t*-test. Additionally, we calculated pre-post difference scores and compared them between the two groups using an independent samples *t*-test. The significance level was set at 0.05 for all tests.

Table 3
Homogeneity testing of the dependent variables of the two groups.

Variable	Range	Team-based learning group (n = 30)	Lecture group (n = 30)	t	p
		Mean ± SD			
Knowledge	0–13	7.83 ± 3.40	7.23 ± 2.88	0.736	0.464
Behaviors	0–8	4.27 ± 1.76	3.43 ± 2.37	1.545	0.128
Attitudes	4–52	38.87 ± 3.46	37.57 ± 2.86	1.586	0.118

4. Results

4.1. Homogeneity of general characteristics

Table 2 displays the results of the homogeneity testing of the general characteristics of the groups. We observed no group differences in any general characteristics, including age ($t = -0.637, p = .526$), gender ($\chi^2 = 1.071, p = .612$), academic degree ($\chi^2 = 5.247, p = .073$), nursing career length ($t = -0.647, p = .520$), total work experience at a long-term care hospital ($t = -0.612, p = .543$), present position ($\chi^2 = 2.000, p = .368$), and past experience of pressure ulcer prevention education ($\chi^2 = 0.000, p = 1.000$).

4.2. Homogeneity of dependent variables

Table 3 shows the results of the homogeneity testing of the dependent variables. We observed no difference in knowledge ($t = 0.736, p = .464$), behaviors ($t = 1.545, p = .128$), or attitudes ($t = 1.586, p = .118$) scores between the two groups.

4.3. Comparison of dependent variables between the two groups

Table 4 shows the comparison of the dependent variables between the two groups. Nurses in the TBL group showed improved knowledge ($t = 6.554, p < .001$), behaviors ($t = 7.018, p < .001$), and attitudes ($t = 3.706, p = .001$) scores at posttest compared to pretest. Nurses in the lecture-based learning group also reported improved knowledge ($t = 3.208, p = .003$), behaviors ($t = 5.992, p < .001$), and attitudes ($t = 3.662, p = .001$) scores at posttest compared to pretest. When examining the pre-post difference scores, however, we found no significant differences between the groups for knowledge ($t = 1.115, p = .269$), behaviors ($t = -0.919, p = .362$), or attitudes ($t = 0.685, p = .496$).

5. Discussion

We investigated the effects of TBL and lecture-based learning on nurses' knowledge, behaviors, and attitudes regarding pressure ulcers. We found that all three variables showed significantly higher scores at posttest compared to at pretest in both groups. Furthermore, none of the variables showed group differences in the pretest-posttest difference

Table 4
Comparison of knowledge, behaviors, and attitude scores between the two groups.

Variable	Group	Pre-test	Post-test	t	p	Difference	t	p
		Mean ± SD				Mean ± SD		
Knowledge	TBL	7.83 ± 3.40	10.63 ± 2.33	6.554	< 0.001	2.80 ± 2.34	1.115	0.269
	Lecture	7.23 ± 2.88	9.20 ± 2.27	3.208	0.003	1.97 ± 3.36		
Behaviors	TBL	4.27 ± 1.76	6.73 ± 1.57	7.018	< 0.001	2.47 ± 1.93	-0.919	0.362
	Lecture	3.43 ± 2.37	6.47 ± 2.00	5.992	< 0.001	3.03 ± 2.77		
Attitudes	TBL	38.87 ± 3.46	41.43 ± 3.66	3.706	0.001	2.57 ± 3.79	0.685	0.496
	Lecture	37.57 ± 2.86	39.53 ± 3.42	3.662	0.001	1.97 ± 2.94		

TBL: team-based learning.

scores.

The increase in knowledge score from pretest to posttest was also found in several past studies using lecture-based learning (Lee and Kim, 2016; Tweed and Tweed, 2008) and TBL (Fatmi et al., 2013; McRae et al., 2017). The lack of a between-group difference in knowledge score also aligns with the findings of a previous study, in which neither knowledge score (Mennenga, 2013) nor the passing rate of the qualification certification examination (Moore-Davis et al., 2015) differed between TBL and lecture-based learning groups. Several studies did find contradictory results to ours, however. The TBL groups showed significantly higher knowledge scores than did the lecture-based groups (Chen et al., 2018; Della Ratta, 2015; Hemmati Maslakpak et al., 2015; Kim et al., 2016;). One possible reason for the lack of between-group differences in our study is that the researcher conducted exceedingly efficient lectures as a wound specialist nurse. Traditional lecture-based learning has been shown to reduce training efficacy and lower learners' motivation and interest (Biggs and Tang, 2011). Therefore, TBL might still serve as a more active, learner-centered strategy to improve knowledge of pressure ulcer prevention among nurses.

The improved behaviors scores in both groups supports previous studies showing that clinical performance in nurses improved after both TBL (Oldland et al., 2017) and lectures (Park et al., 2013). The lack of group differences does not align with past studies, however. In those studies, TBL groups had higher performance scores than did the lecture-based groups, both among nursing students (Kim et al., 2016) and emergency nurses (Considine et al., 2014). Notably, our training program lacked any practice sessions in which participants actually assessed and managed pressure ulcers, and there are limitations in measuring actual pressure ulcer prevention behavior using a self-administered questionnaire. Therefore, it is necessary to directly measure changes in pressure ulcer incidence after implementing a training program developed based on nurses' educational needs.

A similar pattern of results was found for attitudes as for knowledge and behaviors. The lack of group differences was similar to the findings of a study reporting that nurses who received pressure ulcer prevention education had more positive attitudes toward the prevention of pressure ulcers than did uneducated nurses (Ünver et al., 2017). Changing attitudes toward the prevention of pressure ulcer is important in the practice of pressure ulcer prevention interventions (Gul et al., 2017). Therefore, it is necessary to reinforce nurses' attitudes through application of prevention training programs.

This study has several limitations. First, the study was conducted without examining the educational needs of nurses in long-term care hospitals for the prevention of pressure ulcers. Therefore, it is necessary to develop another training program based on analyses of nurses' educational needs and identify its effects. Second, since our participants were nurses from two long-term care hospitals in South Korea, we cannot generalize the results to other settings. Third, considering the limitations of the self-administered questionnaire, more objective indicators such as medical record reviews and performance observations should be used in future studies. Fourth, because the usual in-service training time for nurses in a long-term care hospital is a one-hour

lecture, the control group received the usual training. Although there were no significant differences in the pre- and posttest scores for any of the variables between the two groups, the difference in training time between the two groups could affect the training outcomes. Finally, the PUKAT 2.0 was split to avoid repeated exposure to the same test questions in the TBL group. However, this could compromise the validity of the tool.

6. Conclusions

Continuing education for Korean nurses is often dependent on lecture-based learning. Furthermore, it is not systematically implemented in long-term care hospitals when compared to general hospitals. We therefore examined whether TBL, a learner-centered, active learning method, is a beneficial alternative for teaching nurses to prevent pressure ulcers. TBL was found to improve nurses' pressure ulcer prevention knowledge, behaviors, and attitudes to a similar degree as lecture-based learning. Therefore, it is necessary to develop and implement training programs to ensure that nurses can master the skills and knowledge needed for pressure ulcer prevention through active learning engagement. Nurse educators can choose the appropriate training method for achieving the expected learning outcomes from either the TBL or the lecture, taking into consideration the educational context, the teacher factor and the learner factor. Future studies should implement pressure ulcer prevention training programs that incorporate nurses' actual educational needs, and measure the outcomes of such training using multiple objective indicators.

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Ethical approval

Institutional Review Board of the Chung-Ang University (IRB No: 1041078-201802-HRSB-027-01).

Declaration of competing interest

None declared.

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