

## ORIGINAL ARTICLE

## Evaluation of a self-efficacy enhancement program to prevent pressure ulcers in patients with a spinal cord injury

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**Aim:** This study developed a self-efficacy enhancement program and evaluated its effects on the self-care behaviors, self-care knowledge, and self-efficacy regarding pressure ulcer prevention in patients with a spinal cord injury.

**Methods:** This was a multicenter randomized controlled trial. Six hospitals were invited to recruit patients with a spinal cord injury who were undergoing rehabilitation after receiving acute treatment. These hospitals were randomly allocated into experimental (three hospitals) or control (three hospitals) groups and 47 patients participated (24 in the experimental group and 23 in the control group). The experimental group was given an 8 week self-efficacy enhancement program for pressure ulcer prevention. The self-efficacy enhancement program consisted of small-group face-to-face intervention (education and skills training), education with computer animation, phone counseling, face-to-face counseling, and self-management records. The control group only received a pressure ulcer prevention information booklet. Self-care knowledge, self-efficacy, self-care behaviors, and pressure ulcer incidence were measured at baseline and after the 8 week self-efficacy enhancement program.

**Results:** The experimental group showed a significantly greater improvement in self-care knowledge, self-efficacy, and self-care behaviors for pressure ulcer prevention than did the control group. One participant in the control group developed a pressure ulcer, while none of the participants in the experimental group developed a pressure ulcer; this difference was not statistically significant.

**Conclusions:** The self-efficacy enhancement program enabled patients with a spinal cord injury to engage in continued self-care behaviors and helped them to improve their knowledge and self-efficacy concerning pressure ulcer prevention.

**Key words:** behavior, pressure ulcer, self-care, self-efficacy, spinal cord injury.

**INTRODUCTION**

Industrialization, urbanization, and leisure activities have contributed to an increasing number of spinal cord injuries. There are approximately 60,000 Korean patients with a spinal cord injury and this number increases by 2000 new cases each year (Cho, Oh, & Kim, 2014).

Spinal cord injuries are highly debilitating because, once damaged, the spinal cord cannot recover or regenerate. Therefore, spinal cord injuries inevitably lead to lifelong physical, psychological, and social burdens for patients and their families (Zinman *et al.*, 2014).

Pressure ulcers are the most commonly experienced complication of a spinal cord injury. Approximately 85% of patients with a spinal cord injury suffer from pressure ulcers throughout their lifetime (Byrne & Salzberg, 1996). Pressure ulcers have a variety of negative effects on patients with a spinal cord injury, such as decreases in body image, self-esteem, social relationships, and social activities and increases in hospital

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readmission. Fortunately, preventive self-care behaviors can contribute to decreasing the incidence of pressure ulcers (Houlihan *et al.*, 2011). Therefore, the most important means of preventing or reducing pressure ulcers is to improve and maintain patients' self-care abilities through skin care, positioning, weight shifting, suitable transfer, and control of the diet and weight.

Providing timely pressure ulcer-related knowledge to patients with a spinal cord injury could help to prevent pressure ulcers, but it is more important to help them put this knowledge into a continual practice of self-care behaviors. Unfortunately, currently there is no pressure ulcer prevention program for patients with a spinal cord injury in Korea. Even studies that have been conducted in other countries have focused solely on improving patient knowledge of pressure ulcers and have failed to design a program to help improve and maintain relevant self-care behaviors (Pellerito, 2003; Schubart, 2012). Most educational programs to prevent pressure ulcers among patients with a spinal cord injury have used traditional instructional methods in order to provide information, such as individualized or classroom instruction using written materials (Garber, Rintala, Holmes, Rodriguez, & Friedman, 2002; Regan *et al.*, 2009). Recently, computer-aided education and e-learning programs have been developed (Pellerito; Schubart).

Self-efficacy in Bandura's social cognitive theory is an important concept that enables individuals to change and maintain their self-care behaviors (Bandura, 1986, 1991). Self-efficacy is an important factor for patients with a spinal cord injury in their continual self-care and rehabilitation behaviors (Pang *et al.*, 2009). Bandura suggested that interventions to improve self-efficacy should consist of (i) skill mastery and performance accomplishments; (ii) vicarious experiences; (iii) verbal and social persuasion by knowledgeable others; and (iv) attention to physiological and emotional states of the individual before and after the desired activity. Interventions based on these four strategies can successfully improve self-care behaviors, as well as self-efficacy, for patients with chronic diseases (Bandura, 1986).

Thus, in this study, a self-efficacy enhancement program was developed and evaluated that uses self-efficacy theory in order to promote self-care behaviors, as well as self-care knowledge and self-efficacy, for preventing pressure ulcers in patients with a spinal cord injury.

## METHODS

### Design

A multicenter randomized controlled trial was conducted in order to evaluate the effectiveness of a

self-efficacy enhancement program in promoting self-care knowledge, self-efficacy, and self-care behaviors for preventing pressure ulcers in patients with a spinal cord injury.

### Participants and setting

For the present study, six hospitals in Korea were invited to serve as centers for recruiting patients with a spinal cord injury (the participants) who were undergoing rehabilitation after finishing acute treatment. These hospitals were randomly allocated into two groups by having their representatives choose a red or a white ball from a container.

The participant inclusion criteria were as follows: (i)  $\geq 20$  years old; (ii) the ability to use a wheelchair and to practice independent self-care, including feeding and grooming (washing face and hands, brushing teeth, and combing hair); (iii)  $> 6$  months postspinal cord injury diagnosis because recovery is drastically delayed after 6 months from a spinal cord injury (Brown, Marino, Herbison, & Ditunno, 1991); (iv) no cognitive impairment, psychiatric history, or pressure ulcer history; (v) Korean-speaking; (vi) Internet access at home (for home access to the computer-animated intervention components); (vii) no previous experience with a pressure ulcer-related education program; and (viii) an understanding of the study's purpose and agreement to participate in the study. The required sample size was determined by using G\*power software (v. 3.1.5; Heinrich Heine Universität Düsseldorf, Düsseldorf, Germany) with power = 80%,  $\alpha = 0.05$ , effect size = 0.25, and repeated measures = 2 (Faul, Erdfelder, Buchner, & Lang, 2009). In order to calculate the sample size, an effect size of 0.25 was used based on a meta-analysis of the self-efficacy of chronic disease self-management programs (Brady *et al.*, 2013), where the overall effect size was  $\sim 0.25$ . A total of 34 patients with a spinal cord injury was required for the whole study; considering a 50% dropout rate, 51 patients were recruited for this study. Although 51 patients with a spinal cord injury initially participated, four patients withdrew after enrollment, resulting in a total sample size of 47 (Fig. 1).

### Procedures

The 8 week self-efficacy enhancement program consisted of the following five components. First, education and skills training was conducted in small groups (three-to-five participants) in each study hospital for 2.25 h in the first week and included education using

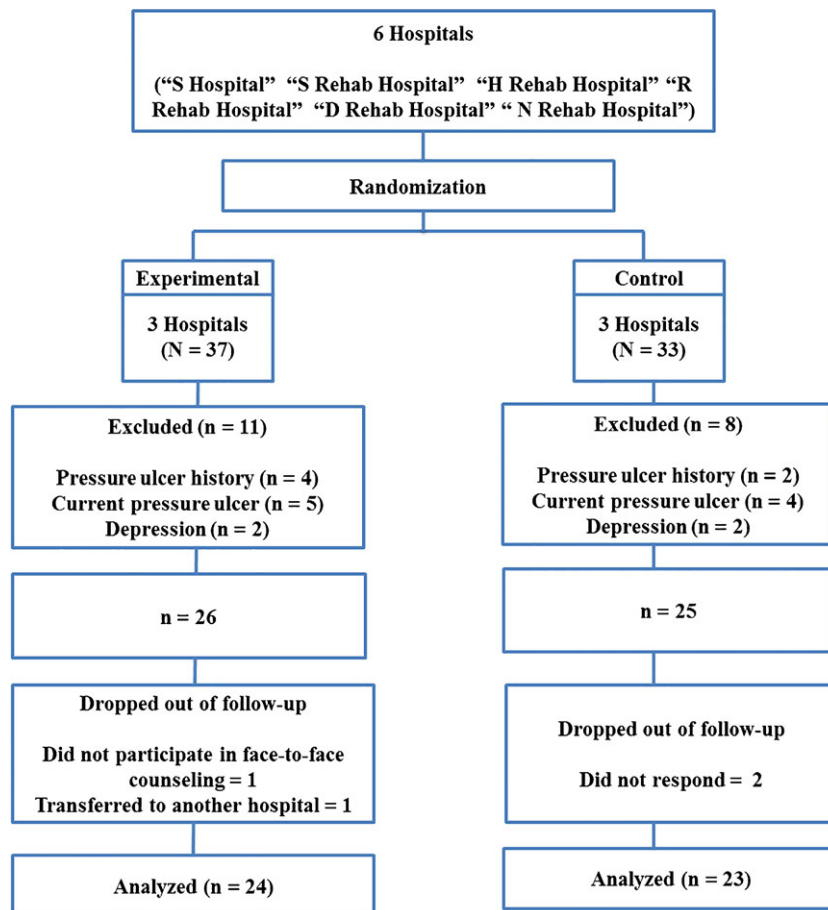


Figure 1 Study flowchart.

booklets, computer slides, and videos, as well as demonstration and performance of the skills that are necessary for self-care behaviors. Second, in order to provide continuous support and advice, the participants received individual face-to-face counseling at each study hospital in the fifth week. Third, telephone counseling was provided for 10–15 min in the third and seventh weeks. Fourth, the participants were given opportunities to watch computer-animated demonstrations of self-care behaviors using a Web-based program in the third, fifth, and seventh weeks to remind them of what they had learned. Fifth, the participants were asked to maintain a self-management record during the self-efficacy enhancement program's implementation in order to confirm whether they had carried out the self-care behaviors. Feedback on their performance was provided during the face-to-face and telephone counseling sessions (Fig. 2).

The self-efficacy enhancement program content was developed from a literature review and existing programs, a focus group interview, and expert group

consultations. MEDLINE/PubMed, CINAHL, and Korean databases (KoreaMed and KMBase) were searched for relevant literature that had been published between 2003 and 2013 by using the following search terms: (i) spinal cord injury, spinal cord trauma, tetraplegia, or paraplegia; (ii) pressure ulcers, decubitus ulcer, ischemic ulcer, skin sores, or bed sores; and (iii) prevention, self-efficacy, self-management, self-care, or knowledge. The existing programs that had been uploaded already on the websites of rehabilitation associations and hospitals also were reviewed. A focus group interview was conducted with six patients with a spinal cord injury in order to assess their needs. Expert group consultations were conducted with a rehabilitation medicine physician, internal medicine physician, plastic surgeon, rehabilitation nurse, smoking clinic educator, dietitian, physical therapist, psychiatrist, and two wound care nurses in order to provide consultation for the content of the self-efficacy enhancement program.

In order to develop intervention strategies for the self-efficacy enhancement program, intervention programs

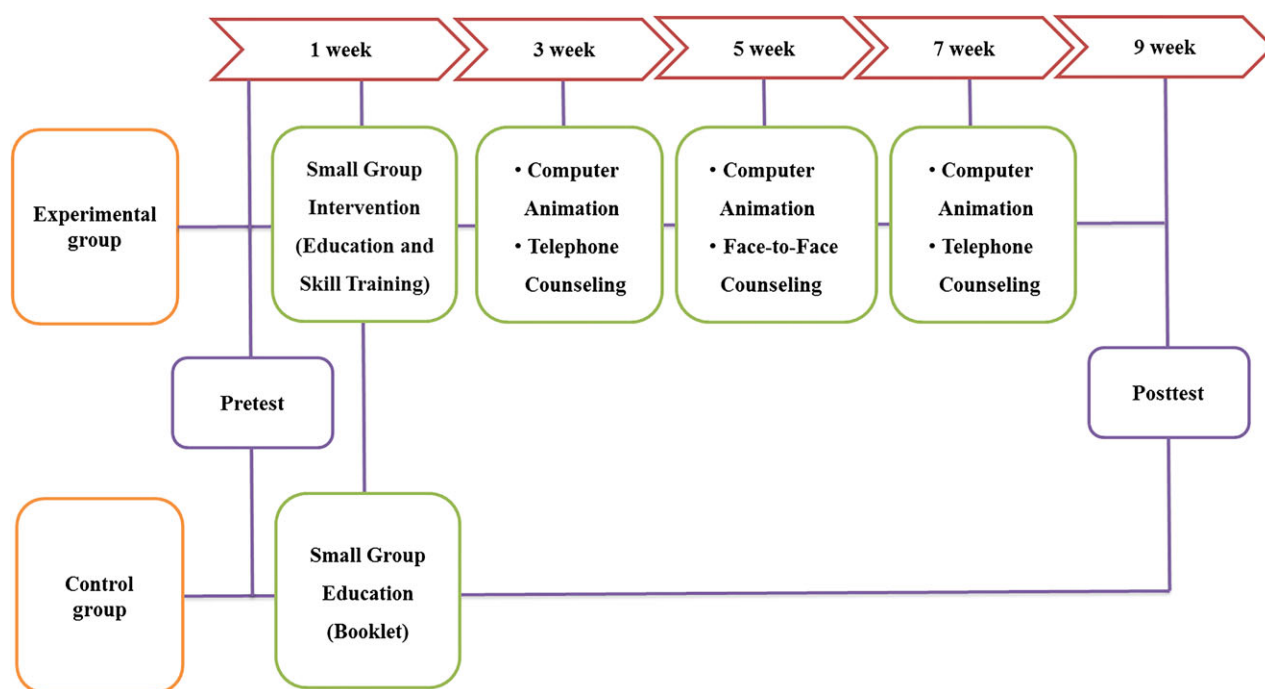


Figure 2 Study procedure.

that were relevant to the prevention of pressure ulcers and self-efficacy were reviewed. The strategies for conducting the self-efficacy enhancement program focused on small groups of three-to-five participants in order to maximize active education participation, first-hand demonstration, and performance (Garber *et al.*, 2002; May, Day, & Warren, 2006; Rintala, Garber, Friedman, & Holmes, 2008). Verbal persuasion, individual attention, and skill mastery strategies were adopted and varied teaching methods (computer slides, video, and booklet) were used (Brace & Schubart, 2010; Garber *et al.*; Pellerito, 2003; Rintala *et al.*; Schubart, 2012). The participants also were provided with the opportunity to observe self-care behaviors through computer animations in order to produce vicarious experiences (Brace & Schubart; Pellerito; Schubart). Individual face-to-face and telephone counseling sessions were conducted for verbal persuasion and to draw attention to an individual's affective state (Garber *et al.*; Rintala *et al.*). These strategies were intended to provide the participants with continued support and advice. Finally, the participants were provided with self-management diaries in order to provide enactive mastery experience and to verify whether they carried out self-care behaviors properly (Arbour-Nicitopoulos, Ginis, & Latimer, 2009). Expert group consultations were conducted with

a rehabilitation medicine physician, plastic surgeon, rehabilitation nurse, and two wound care nurses for the intervention strategies of the self-efficacy enhancement program. The validity of the computer-animated intervention strategies also was evaluated by using an instrument that was modified by Ahn and Kim (1999) from the tool that had been developed by Doll and Torkzadeh (1988). The expert group qualified all items as either “excellent” or “good.” Feasibility was evaluated by four patients with a spinal cord injury. All of them agreed that this program was feasible, but recommended reducing the length of the small-group intervention to 1.5–2 h, which was reflected in the final intervention. The feasibility of the computer animation portion also was evaluated by using an instrument that was modified from the tool that had been developed by Park (2001). All the items garnered responses of “excellent” or “good,” except that the length of the animated videos was described as too long, which was changed for the final intervention.

### Data collection

The data were collected from August 6 to October 13 2013. The pretest data were collected in both the experimental and the control groups, including the

demographic characteristics, clinical characteristics, self-care knowledge, self-efficacy, self-care behaviors, and skin condition (sacrum, coccyx, ischium, trochanter, and heel). The post-test data on self-care knowledge, self-efficacy, self-care behaviors, and skin condition were collected in both the experimental and the control groups after the 8 week program. The experimental group participated in the 8 week self-efficacy enhancement program that consisted of small-group face-to-face intervention (education and skills training), education with computer animation, phone counseling, face-to-face counseling, and self-management records. The control group participants did not receive training in, or demonstrations of, self-care skills and were only given information with a booklet.

### Ethical considerations

This study was granted multicenter approval by the Institutional Review Board at the authors' institution (approval number: B-1304-199-004). The purpose and process of the study were presented to doctors at the study hospitals. When patients with a spinal cord injury met the inclusion criteria, the doctors provided information on the study and asked if the researcher could contact them to discuss the study further. If the patients agreed, the researcher contacted them, provided detailed information regarding the study, and received written informed consent from those who met the inclusion criteria and volunteered to participate in the study. The confidentiality and privacy of all the participants were ensured.

### Measurements

Self-care knowledge was measured by using a Korean version of the self-care knowledge tool, which was modified from the tool that had been developed by Schubart (2012). A Korean version of the self-care knowledge tool was developed through committee translation (Schoua-Glusberg, 1992), a content validity test was developed by a panel of experts, and revision was based on feedback from a focus group of patients with a spinal cord injury. The content validity was tested with a content validity index (CVI). The experts rated all the items as either "3" or "4" on a four-point scale and the CVI was found to be 1.00, which demonstrated complete agreement among the experts. The Korean version of the self-care knowledge tool has 22 items with three subscales: cause of pressure ulcers (10 items), skin problems requiring a visit to a healthcare provider (two

items), and prevention of pressure ulcers (10 items). The items that measure self-care knowledge have two response alternatives ("yes" or "no") and the total score is the number of correct answers. The Cronbach's alpha in this study was 0.658.

Self-efficacy was measured by using a Korean version of the self-efficacy tool that was modified from the self-efficacy subscale of the Skin Care Belief Scale (King *et al.*, 2012). A Korean version of the self-efficacy tool was developed through committee translation (Schoua-Glusberg, 1992) and the content validity was tested by a panel of experts and revised based on feedback from a focus group of patients with a spinal cord injury. The experts rated all the items as either "3" or "4" on a four-point scale and the CVI was 1.00. The self-efficacy tool has 14 items, which are rated on a four-point Likert scale from 1 ("strong disagreement") to 4 ("strong agreement"). High scores indicate high self-efficacy. The Cronbach's alpha of the original tool was 0.940 (King *et al.*) and the Cronbach's alpha of the Korean version of the self-efficacy tool that was used in this study was 0.796.

A self-care behavior assessment tool for pressure ulcer prevention in patients with a spinal cord injury was developed for the present study as no other validated instrument was available. This tool was developed from a literature review and the content validity was assessed by a panel of experts (a plastic surgeon, rehabilitation medicine physician, nursing department professor, and three wound care nurses). The experts rated all the items as either "3" or "4" on a four-point scale and the CVI was 1.00. The tool has 27 items, each with a four-point Likert scale from 1 ("not at all") to 4 ("always") and high scores indicate ample self-care behavior. In this study, the Cronbach's alpha of this tool was 0.891.

In order to verify pressure ulcer occurrence, a wound care nurse assessed the skin discoloration, temperature, edema, and turgor at the sacrum, coccyx, ischium, trochanter, and heel of the participants. The demographic characteristics included their Body Mass Index, sex, age, alcohol intake, smoking, current disease, current living arrangement, educational level, religion, marital status, occupation before injury, occupation after injury, monthly income, main earner status, insurance, and utilization of a pressure ulcer cushion and mattress. Their clinical characteristics included the etiology of the spinal cord injury, level of impairment, American Spinal Injury Association Classification, age at onset, number of months since the injury, Korean Spinal Cord Independence Measure, and depression. The Korean Spinal Cord Independence Measure is the Korean version of

the Spinal Cord Independence Measure that had been developed by Catz, Itzkovich, Agranov, Ring, and Tamir (1997). Na, Seo, Ko, and Kim (2000) translated it into the Korean Spinal Cord Independence Measure, which contains 16 items with three subscales reflecting self-care (four items), respiratory and sphincter management (four items), and mobility (eight items). The total scores range from 0 to 100 and a higher score indicates more independent functioning. The validity of the Spinal Cord Independence Measure and Korean Spinal Cord Independence Measure was demonstrated in previous studies (Catz *et al.*; Na *et al.*). The Cronbach's alpha for the original tool was 0.923 (Berry & Kennedy, 2003) and the Cronbach's alpha for the tool in the present study was 0.693. Depression was assessed by using the Korean version of the Self-Rating Depression Scale. This scale was developed originally by Zung (1965) and Lee (1995) translated it into the Korean version of the Self-Rating Depression Scale. This tool is composed of 20 items reflecting the affective, psychological, and somatic symptoms that are associated with depression. Each item is rated on a four-point Likert scale and the total scores range from 20 to 80. The scores are categorized into four groups: normal (20–44), mild depression (45–59), moderate depression (60–69), and severe depression ( $\geq 70$ ). The validity of the original and Korean versions of the Self-Rating Depression Scale was demonstrated in previous studies (Biggs, Wylie, & Ziegler, 1978; Shin *et al.*, 2000). The Cronbach's alpha for the Korean version was 0.84 (Lee) and the Cronbach's alpha in the present study was 0.78.

### Data analysis

The data analyses were carried out with IBM SPSS v. 18.0 (IBM Corporation, Armonk, NY, USA) and STATA SE13 (StataCorp LP, College Station, TX, USA). The  $\chi^2$ -test, Fisher's exact test, and independent *t*-tests were used in order to examine the baseline differences between the experimental and the control groups. Linear mixed models were used for repeated measurements in order to explore the changes in self-care knowledge, self-efficacy, and self-care behaviors between the pretest and post-test, while adjusting for baseline differences in the experimental and the control groups. Linear mixed models were used to control the cluster effects by hospital. Fisher's exact test was used to examine the differences in pressure ulcer incidence between the experimental and the control groups.

## RESULTS

### Participants' characteristics

The mean age was 42.0 years in the experimental group (ranging from 24 to 62 years) and 36.7 years in the control group (ranging from 20 to 57 years). The majority of the participants was male (experimental group: 70.8%; control group: 87.0%). The mean Body Mass Index of both groups was 22.4. Ten participants in the experimental group (41.7%) and six participants in the control group (26.1%) were found to have current disease in addition to a spinal cord injury. The majority of the participants were living with their family (experimental group: 75.0%; control group: 82.6%). Most of the participants had a job before the injury (experimental group: 83.3%; control group: 82.6%), but only some of them were employed after the injury (experimental group: 8.3%; control group: 34.8%). Most of the participants had public insurance (experimental group: 83.3%; control group: 82.6%) and used a cushion to prevent pressure ulcers (experimental group: 79.2%; control group: 91.3%), but the majority did not use a mattress to prevent pressure ulcers (experimental group: 79.2%; control group: 65.2%). The etiology of a majority of the spinal cord injuries was accident-related (experimental group: 79.2%; control group: 95.7%) and the majority of the impairments were at the thoracic level (experimental group: 62.5%; control group: 60.9%). The American Spinal Injury Association Classification of most of the participants was grade A (experimental group: 50.0%; control group: 65.2%). The mean age at onset of the spinal cord injury was 38.3 years in the experimental group and 31.5 years in the control group, while the amount of time since the spinal cord injury was 49.8 months in the experimental group and 65.8 months in the control group. The Korean Spinal Cord Independence Measure score was 57.8 in the experimental group and 57.9 in the control group, while the depression score was 48.0 in the experimental group and 45.6 in the control group. There was no significant difference between the experimental and the control group with regard to the baseline demographic or clinical characteristics, except for the occupation after injury ( $P = 0.036$ ).

### Self-care knowledge, self-efficacy, and self-care behavior

There was no statistically significant difference in the baseline self-care knowledge ( $t = 1.38$ ,  $P = 0.173$ ), self-efficacy ( $t = -1.70$ ,  $P = 0.097$ ), or self-care behaviors

**Table 1** Homogeneity test of the characteristics between the experimental and the control groups ( $n = 47$ )

Variable	Characteristic	Experimental group ( $n = 24$ ) N (%) or mean $\pm$ SD	Control group ( $n = 23$ ) N (%) or mean $\pm$ SD	$\chi^2$ - or $t$ -value	$P$ -value
Age		42.00 $\pm$ 11.10	36.74 $\pm$ 9.72	1.73	0.091
Sex <sup>†</sup>	Male	17 (70.8)	20 (87.0)		0.286
BMI		22.42 $\pm$ 3.88	22.43 $\pm$ 2.61	-0.02	0.985
Alcohol <sup>†</sup>	Yes	4 (16.7)	10 (43.5)		0.060
Smoking	Yes	7 (29.2)	9 (39.1)	0.52	0.471
Current disease	Yes	10 (41.7)	6 (26.1)	1.27	0.260
Marital status	Married	12 (50.0)	12 (52.2)	0.22	0.882
Current living arrangement <sup>†</sup>	Alone	6 (25.0)	4 (17.4)		0.724
Education level	$\leq$ High school	17 (70.8)	16 (69.6)	0.01	0.924
	$\geq$ College	7 (29.2)	7 (30.4)		
Religion	Yes	11 (45.8)	11 (47.8)	0.02	0.891
Occupation before injury <sup>†</sup>	Yes	20 (83.3)	19 (82.6)		1.000
Occupation after injury <sup>†</sup>	Yes	2 (8.3)	8 (34.8)		0.036
Monthly income (10,000 won)		198.25 $\pm$ 151.36	217.83 $\pm$ 155.80	-0.44	0.664
Main earner	Self	8 (33.3)	12 (52.2)	1.76	0.192
Insurance <sup>†</sup>	Public	20 (83.3)	19 (82.6)		1.000
	Private	4 (16.7)	4 (17.4)		
Pressure ulcer cushion <sup>†</sup>	Yes	19 (79.2)	21 (91.3)		0.416
Pressure ulcer mattress	Yes	5 (20.8)	8 (34.8)	1.14	0.285
Etiology of SCI <sup>†</sup>	Accident	19 (79.2)	22 (95.7)		0.188
	Disease	5 (20.8)	1 (4.3)		
Level of impairment <sup>†</sup>	Cervical	4 (16.7)	3 (13.0)		1.000
	Thoracic	15 (62.5)	14 (60.9)		
	Lumbar	5 (20.8)	6 (26.1)		
ASIA <sup>†</sup>	A	12 (50.0)	15 (65.2)		0.484
	B	4 (16.7)	3 (13.0)		
	C	6 (25.0)	2 (8.7)		
	D	2 (8.3)	3 (13.0)		
Age at onset		38.33 $\pm$ 4.35	31.48 $\pm$ 12.87	1.72	0.092
Months since injury		49.83 $\pm$ 75.56	65.83 $\pm$ 73.23	-0.74	0.465
KSCIM		57.79 $\pm$ 10.58	57.87 $\pm$ 10.42	-0.03	0.980
Depression		48.00 $\pm$ 8.96	45.57 $\pm$ 7.43	1.01	0.317
Self-care knowledge		14.83 $\pm$ 3.51	13.48 $\pm$ 3.20	1.38	0.173
Self-efficacy		37.79 $\pm$ 4.06	39.91 $\pm$ 4.50	-1.70	0.097
Self-care behavior		74.25 $\pm$ 14.41	70.83 $\pm$ 5.31	0.79	0.434

<sup>†</sup> Fisher's exact test.

ASIA, American Spinal Injury Association Classification; BMI, Body Mass Index; KSCIM, Korean Spinal Cord Independence Measure; SCI, spinal cord injury; SD, standard deviation.

( $t = 0.79$ ,  $P = 0.434$ ) between the experimental and the control group (Table 1). The score for baseline self-care knowledge was 14.8 in the experimental group and 13.5 in the control group, while for baseline self-efficacy, it was 37.8 in the experimental group and 39.9 in the control group. The score for baseline self-care behavior was 74.3 in the experimental group and 70.8 in the control group.

Linear mixed models for repeated measurements were conducted with the variable of occupation after injury as a covariate. The results of the linear mixed models

showed statistically significant differences between the experimental and the control groups in terms of changes in self-care knowledge ( $\beta = 1.696$ ,  $P = 0.004$ ), self-efficacy ( $\beta = 5.547$ ,  $P < 0.001$ ), and self-care behaviors ( $\beta = 11.694$ ,  $P < 0.001$ ) after the 8 week program. Self-care knowledge, self-efficacy, and self-care behaviors were improved in both the experimental and the control groups; however, the experimental group showed significantly greater improvement in all three areas after the 8 week program, compared to the control group (Table 2).



**Table 2** Comparison of self-care knowledge, self-efficacy, self-care behavior, and pressure ulcers between groups ( $n = 47$ )

Variable	Time	Experimental group ( $n = 24$ ) N (%) or mean $\pm$ SD	Control group ( $n = 23$ ) N (%) or mean $\pm$ SD	Comparison	$\beta^{\dagger\dagger}$	P-value
Self-care knowledge	Pretest	14.83 $\pm$ 3.51	13.48 $\pm$ 3.20	Group	1.141	0.171
	Post-test	18.83 $\pm$ 1.61	15.78 $\pm$ 2.50	Time	2.304	<0.001
				Group $\times$ time	1.696	0.004
Self-efficacy	Pretest	37.79 $\pm$ 4.06	39.91 $\pm$ 4.50	Group	-2.716	0.026
	Post-test	45.21 $\pm$ 3.37	41.78 $\pm$ 4.58	Time	1.870	<0.001
				Group $\times$ time	5.547	<0.001
Self-care behavior	Pretest	74.25 $\pm$ 14.41	70.83 $\pm$ 15.31	Group	0.833	0.817
	Post-test	92.29 $\pm$ 5.21	77.1 $\pm$ 12.81	Time	6.348	<0.001
				Group $\times$ time	11.694	<0.001
Pressure ulcers <sup>‡‡</sup>	Yes	0 (0.0)	1 (4.3)			0.489
	No	24 (100.0)	22 (95.7)			

<sup>†</sup> Linear mixed models with occupation after injury as the covariate.

<sup>‡</sup> Fisher's exact test.

SD, standard deviation.

### Pressure ulcer occurrence

No participant in the experimental group experienced a pressure ulcer during the 8 week program, while one participant in the control group developed a pressure ulcer on the heel. However, this difference was not statistically significant (Table 2).

## DISCUSSION

The experimental group demonstrated significantly greater improvement in terms of self-care knowledge, compared with the control group. This finding is consistent with previous studies, which reported that individual education programs and e-learning programs for patients with a spinal cord injury significantly improved their knowledge of pressure ulcer prevention (Garber *et al.*, 2002; Schubart, 2012). This improvement might have been attributable to the interaction and feedback that were provided to the participants in the self-efficacy enhancement program through demonstrations. Fulfillment, feedback, and skill reinforcement are important factors in effective self-care education (Morrison, Ross, & Kemp, 2003). The performance-based skills training that was provided in small-group interventions in this study might have been essential in cementing the participants' knowledge. Repeated education through telephone and face-to-face counseling and computer animations also might have played a role in enhancing the participants' knowledge. In addition, the varied teaching methods and modalities that were used in this study could have contributed to reinforcing participants' self-care knowledge. Researchers have reported

that varied media and teaching methods play a major role in ensuring patient understanding and interest (Yeh, Chen, & Liu, 2005).

The experimental group exhibited a significantly greater improvement in self-efficacy, compared to the control group. A few studies have evaluated self-efficacy in patients with a spinal cord injury; however, these studies did not focus on preventing pressure ulcers. These studies reported that a nurse-coached exercise intervention (Sheehy, 2013) and home rehabilitation using a digital video disc (Chen, Wu, & Lin, 2015) were effective in improving self-efficacy in patients with a spinal cord injury. The findings from the present study might have been achieved because the self-efficacy enhancement program was designed using self-efficacy concepts based on Bandura's social cognitive theory (Bandura, 1986, 1991). In this study, all four self-efficacy concepts were used. For verbal and social persuasion, and attention to physiological and emotional states of the individual, a small-group face-to-face intervention (education), telephone counseling, and face-to-face counseling were used. Telephone counseling is particularly valuable in improving participants' confidence in the prevention of pressure ulcers because it enables their concerns and questions to be addressed. The small-group intervention and self-management records for enactive mastery experience provide skills training. Through this process, participants can be convinced that pressure ulcers can be prevented and that their ability to prevent pressure ulcers can be maximized through first-hand performance and continuous skills training. In particular, keeping a record of self-care motivated the patients to conduct self-monitoring and eventually



created a sense of accomplishment. Repeatedly showing computer-animated videos to produce vicarious experience also contributed to improving participant self-efficacy. According to Cook, Billings, Hersch, Back, and Hendrickson (2007), repeated learning is very helpful in improving individual judgment and confidence regarding health-related behaviors (Cook *et al.*).

The experimental group showed a significantly greater improvement in self-care behaviors, compared to the control group. This finding is consistent with previous studies, which reported that a computer-aided education program and an e-learning program for patients with a spinal cord injury significantly improved their self-care behaviors for the prevention of pressure ulcers (Pellerito, 2003; Schubart, 2012). However, all these previous studies were pilot studies and there were limitations in evaluating the self-care behaviors due to the study designs and small sample sizes; specifically, for three participants in Pellerito and 14 participants in Schubart. The present study is a multicenter randomized controlled trial with 47 participants (24 in the experimental group and 23 in the control group). The findings from the present study could have stemmed from continuous teaching and training that focused on self-care behaviors and caution against pressure ulcers. Dryden *et al.* (2004) reported that, over time, patients with a spinal cord injury can become negligent in self-care because they fail to perceive the seriousness and danger of spinal cord injury-related complications once they begin to adapt to daily life. The self-efficacy enhancement program's emphasis on alertness to pressure ulcers might have helped the participants to maintain self-care behaviors. Additionally, skills training, which included first-hand demonstrations and performance, helped the participants to capably and thoroughly carry out self-care activities. During this study, many of the participants noted that they previously had been unaware of proper pressure ulcer prevention behaviors. After witnessing self-care behavior demonstrations first-hand, they had been convinced that the process is not complicated and is easy to carry out. The participant self-management records also might have led to greater self-care compliance. The records were examined regularly during the telephone and face-to-face counseling sessions. Keeping a record of self-care motivates patients to conduct self-monitoring and eventually leads to positive changes in healthcare behaviors (Colkesen *et al.*, 2011). Most of all, improvements in self-efficacy could contribute to enhancements in self-care behaviors, as suggested in Bandura's social cognitive theory (Bandura, 1986, 1991).

One participant in the control group developed a pressure ulcer, while none was observed in the experimental group. This difference is not statistically significant. Notably, the post-test was conducted 8 weeks after the pretest; thus, the amount of time that had been allotted might have been insufficient to evaluate group differences in pressure ulcer incidence. In future studies, the time frame should be lengthened in order to better observe the effectiveness of the self-efficacy enhancement program in reducing pressure ulcer occurrence.

### Limitations of the study

This is the first study to systematically develop and evaluate a self-efficacy enhancement program to prevent pressure ulcers in patients with a spinal cord injury in Korea. Despite these strengths, there are some limitations of the present study. Some measurement instruments that were used in this study must be tested further to verify their reliability and validity. Furthermore, the follow-up period in this study might have been insufficient to accurately evaluate the effectiveness of a self-efficacy enhancement program on pressure ulcer incidence.

## CONCLUSIONS

A self-efficacy enhancement program was systematically developed based on a sound theoretical foundation. Its use facilitated the continued self-care behaviors of patients with a spinal cord injury and also helped them to improve their knowledge and self-efficacy concerning the prevention of pressure ulcers.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## AUTHOR CONTRIBUTIONS

J. K. and E. C. contributed to the study design; J. K. carried out the data collection; J. K. and E. C. carried out

the data analysis; J. K. and E. C. contributed to the writing of the article.

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