ORIGINAL ARTICLE

ISSN (Print) 2005-3673
ISSN (Online) 2093-758X

대한간호학회지 제46권 제3호, 2016년 6월

J Korean Acad Nurs Vol.46 No.3, 463-474
http://dx.doi.org/10.4040/jkan.2016.46.3.463

The Effect of Patient-centered CPR Education for Family Caregivers of Patients with Cardiovascular Diseases

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Purpose: For cardiovascular patients, family caregivers play a vital role in daily nursing and cardiac emergencies. This study aimed to evaluate the effect of patient-centered CPR education (PCE) for family caregivers of patients with cardiovascular diseases. **Methods:** Fifty-four participants were randomly assigned to the PCE or control group. The PCE group received tailored counseling on overall cardiovascular disease information and CPR followed by interactive instructor-guided CPR training and re-education follow-up by telephone 2 weeks later. The control group received only video-based CPR self-education and booklets. Cardiovascular disease and CPR knowledge and self-efficacy were measured before (pre-test), immediately after (post-test 1), and 4 weeks after the PCE (post-test 2). CPR skills and performance were measured pre-test and at post-test1. **Results:** The PCE group demonstrated significant improvements in knowledge (F=91.09, p<.001), self-efficacy (F=15.19, p<.001) and CPR skills and performance (F=8.10, p=.008), as well as significant differences over time (knowledge: F=364.25, p<.001; self-efficacy: F=1162.28, p<.001; CPR skills and performance: F=1798.81, p<.001). There were significant group-by-time interactions for knowledge (F=8.10, p=.001), self-efficacy (F=4.30, p=.019) and CPR skills and performance (F=4.81, p=.036) by repeated measures ANOVA. **Conclusion:** This is the first study to demonstrate the effects of a patient-centered intervention with CPR education tailored for patients' and family caregivers' preferences, needs, and lifestyles. The results of this study encourage the use of tailored, patient-centered interventions in cardiovascular nursing practice.

Key words: Patient-centered care; Cardiopulmonary resuscitation; Caregivers; Cardiovascular diseases

INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is a leading cause of death among adults, and approximately 92% of victims die. The majority (70~85%) of OHCAs have a cardiac cause, and the incidence of cardiac arrest is higher in patients with coronary artery disease, hypertension, diabetes mellitus, and hyperlipidemia [1]. Because about 70% of such events take place at patients' homes and immediate cardiopulmonary resuscitation (CPR) and activation of emergency medical services (EMS) are critical in survival from OHCA, family caregivers of cardiac patients should be considered high priority groups for CPR training [1-3]. Previous studies have demonstrated the effects of CPR training for family caregivers of patients with high risk of sudden death [4] and previous history of cardiac arrest [5]. However, according to Swor et al.[6], 33.6% of bystanders and only 16.3% of family caregivers could perform CPR before EMS arrival. Family caregivers could not perform CPR because they were panicked, wor-

*이 논문은 2013년도 정부(미래창조과학부)의 재원으로 한국연구재단의 지원을 받아 수행된 연구임(과제번호 NRF-2013R1A2A2A01006176)
*This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (Ministry of Science, ICT, and Future Planning) (NRF-2013R1A2A2A01006176).

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Received: January 26, 2016 Revised: May 23, 2016 Accepted: May 23, 2016

ried about performing CPR incorrectly, or concerned about hurting the patient [4,6,7].

Because most CPR training for non-healthcare providers is offered in schools or workplaces, family caregivers of patients with cardiovascular diseases have relatively few opportunities for CPR training [2]. In South Korea, educational opportunities for CPR have historically been limited, and there have been no direct training or coaching for family caregivers of cardiovascular patients, despite the low CPR response rate after OHCA. However, recently, systematic CPR training has begun in South Korea. In 2012, there were only about 1,000 domestic CPR training graduates. This number increased to approximately 60,000 by 2013 and 70,000 by 2014 [8].

Previous articles have shown the effect of CPR training for healthcare providers and non-healthcare providers in major hospitals in South Korea [9,10]. However, there has been no previous report on CPR training for family caregivers of patients with cardiovascular diseases in South Korea. Additionally, the contents of CPR training have focused only on CPR after cardiac arrest. Training on emergencies other than cardiac arrest, warning signs before a heart attack, overall information on cardiovascular disease, and patient-centered lifestyle modifications such as diet and exercise planning would be helpful for family caregivers.

Therefore, we incorporated the "patient-centered intervention" concept with CPR training. The recently developed concept of patient-centered intervention emphasizes: 1) the individual patient's preferences, needs, and values; 2) the interaction between patients, family caregivers, and healthcare providers; and 3) patient-participation in treatment plan and lifestyle modification [11,12]. Recently, patient- and family-centered intervention studies have been conducted, demonstrating the effects of improving things such as patients' and family caregivers' quality of life, efficiency, knowledge, and satisfaction [13,14].

Combining CPR training and patient-centered intervention, family caregivers would learn how to manage the patient's cardiovascular disease in daily life and how to respond to a cardiovascular emergency. This would increase the knowledge, motivation, and confidence of family caregivers.

This study was conducted to investigate the effects of patient-centered CPR education (PCE) on knowledge, self-efficacy, and performance in a cardiac emergency of family caregivers of cardiovascular patients. The concept of patient-centered intervention was applied via counseling and interactive CPR education provided by a nurse. We hypothesized that participants in PCE would demonstrate 1) improved knowledge about cardiovascular disease, and 2) increased CPR knowledge, self-efficacy, and performance compared with participants receiving the usual education.

METHODS

1. Study Design

This study was a prospective randomized controlled trial in which participants were randomly assigned to receive (PCE group) or not receive (control group) PCE. In the PCE group, a nurse guided and trained the participants through individualized PCE; participants in the control group received the usual education. CPR skills and performance were measured before (pre-test) and after the education (post-test1), both on the first day of the study. Knowledge of CPR and disease and self-efficacy in CPR were measured before (pre-test) and after the education (post-test1) and after 4 weeks (post-test2).

2. Setting and Samples

Participants were the family caregivers of outpatient cardiology patients who visited M hospital in Gyeonggi-do, South Korea, from July to September 2015. Potential participants were eligible for study participation in the study when they came for reserved cardiology outpatient care with their family. Interested participants were assessed by the researcher based on the following inclusion/ exclusion criteria: All participants were older than 18, voluntarily chose to participate, and did not have disabilities in cognitive function or physical activity that would prevent understanding or performing the PCE contents. Also, those who previously experienced cardiac arrest of their ill family member were excluded because the former experience might influence the treatment fidelity. The sample size was calculated to achieve 80% power with an α of .05 and an effect size of 0.4 for Cohen's table [15]. Given the effect size was identified in a previous study that suggested significantly clinical and educational implications

 http://dx.doi.org/10.4040/jkan.2016.46.3.463

[16], the priori sample size was calculated at 26 participants per group. Assuming an attrition rate of 14%, we planned to recruit 30 participants per group. Of the 60 participants, 2 in the PCE group and 4 in the control group withdrew from study involvement, 2 because they did not complete the intervention for business related reasons, 1 for giving up for physical fatigue, and 3 because they did not have a phone connection. Therefore, a total of 54 participants, 28 in the PCE group and 26 in the control group, completed the study.

3. Intervention

The PCE program was developed by nurse researchers, based on the concepts of patient-centered care, which concentrates on the individual preferences, needs, and values of the patient and their family [17]. The PCE program was composed of counseling with a booklet and interactive CPR training on manikins (one hour) and telephone follow-up after 2 weeks (10 minutes) in which family caregivers directly participated. One of the researchers provided support as a professional partner, as well as providing information to the participants on cardiovascular disease and how to cope with a cardiac emergency. The adequacy of contents, suitability of the training materials, and procedure of the intervention of the PCE program were assessed and discussed by an expert group that consisted of a professional cardiologist, a professor of nursing, and basic life support (BLS) instructors (American Heart Association certification). The specific configuration of the PCE program is shown in Table 1.

1) PCE Group

Participants in the PCE group received a 30-minute one-on-one counseling session with a booklet about CPR, dietary and

Table 1. Summary of the Patient-centered CPR Education (PCE)

Session	Topic	Specific activity	
		PCE group	Control group
1	Pre-test	·Knowledge of CPR and cardiovascular disease ·Self-efficacy of CPR ·Skills and performance of CPR	·Knowledge of CPR and cardiovascular disease ·Self-efficacy of CPR ·Skills and performance of CPR
2	Understanding cardiovascular disease and coping with emergency	Customized intervention ·Education on cardiac arrest, importance of first-responder, fundamentals of BLS, warning signs ·Individual counseling about patient-centered diet and exercise plan according to specific cardiovascular disease and each family's preference and feasibility	
3	CPR practice	Instructor-guided video-based CPR practice ·Instructor check the participants' performance and correct position ·Give real time feedback to enhance the skills and performance ·Make tailored CPR strategy for each family	Self-instruction video-based CPR practice ·The instructor observe during CPR practice
4	Post-test1	·Knowledge of CPR and cardiovascular disease ·Self-efficacy of CPR ·Skills and performance of CPR	·Knowledge of CPR and cardiovascular disease ·Self-efficacy of CPR ·Skills and performance of CPR
5 (2 weeks)	Telephone counseling and individual booster session	Individualized telephone-based counseling to consolidate the knowledge and increase family's self-efficacy	
6 (4 weeks)	Post-test2	·Knowledge of CPR and cardiovascular disease ·Self-efficacy of CPR	·Knowledge of CPR and cardiovascular disease ·Self-efficacy of CPR

exercise recommendations, and warning signs of cardiovascular disease. In this face-to-face counseling session, the researcher taught overall knowledge of cardiovascular nursing and made a patient-centered diet and exercise plan according to the specific cardiovascular disease, each family's preferences, and feasibility. An overview of cardiac arrest, the importance of the first-responder, and the fundamentals of BLS were also reviewed.

Instructor-guided video-based CPR education was provided with direct real-time feedback during this 30-minute session. The BLS video content for lay rescuers used in the education was made by the Korean Association of CPR (KACPR) and based on the American Heart Association's 2010 CPR guideline [18]. The researcher demonstrated the overall process of BLS using Laerdal Little Anne and participated in the video-based CPR education along with the participants. During the practice, the researcher checked whether the participants performed BLS (establish unresponsiveness, call for help, chest compression, ventilation, and recovery position) in the correct position and manner and gave real-time feedback to enhance skills and performance.

Patient-centered education was applied by developing a tailored CPR strategy for the participants' own family. For example, participants 1) practiced the activation of EMS using their own address, 2) determined the role of each family member during a cardiac arrest, and 3) found the nearest location of automated external defibrillator.

Telephone follow-up to provide re-education on lessons learned during the PCE program was conducted 2 weeks after the baseline by the researcher who provided the CPR education. Based on a knowledge checklist, open-ended questions about the PCE were asked. Participants giving incorrect answers received re-education from the instructor.

2) Control Group

Participants in the control group individually received self-instruction video-based CPR education without counseling and booklet. The instructor played a minimal role as an observer during CPR practice. The same booklet used in the counseling session of the PCE group was provided to the control group after the CPR education. There was no telephone follow-up at 2 weeks after the baseline.

4. Measurements/Instruments

The overall scheme of measurements is shown in Figure 1. The pre-test and post-test 1 were performed before and after the CPR education on the first day of the study and the post-test 2 was conducted by telephone at the 4th week.

CPR skills and performance were measured at pre-test and post-test 1 using Laerdal Little Anne® (Laerdal Medical AS, Stavanger, Norway). These measurements used an essential BLS checklist for non-healthcare providers, developed by the Korean Association of CPR (KACPR) based on the American Heart Association's 2010 CPR guidelines [18]. The checklist consisted of nine questions assessing whether CPR was performed in the correct position. The items included checking for a response and for no breathing or gasping, activating EMS, and giving high-quality CPR.

Knowledge of cardiovascular disease and CPR was measured at pre-test, post-test 1, and post-test 2. Park [19] made a CPR knowledge instrument based on AHA guideline and Lee at al.[9] made modification after expert review and used it. Therefore, we made our own knowledge instrument based on American Heart Association (AHA) 2010 CPR guideline and the text books of adult nursing [20]. The contents included knowledge of cardiovascular nursing, and dietary and exercise plan for the specific cardiovascular diseases. Content validity of the knowledge instrument was established by an expert group consisting of a professional cardiologist, a professor of nursing, and basic life support (BLS) instructors (AHA certification). The experts assessed the instrument for the percentage of total items rate for content validity index (CVI) that is being measured as either 3 or 4 on a 4-point scale. The CVI was reported as 0.90. The knowledge instrument consisted of 10 questions in two areas (five questions about coping with a cardiac emergency and CPR, and five questions about dietary and exercise planning for cardiovascular disease). This knowledge instrument comprised 2 OX quizzes, and 8 multiple-choice questions. Higher scores meant a higher level of knowledge.

CPR self-efficacy was measured at pre-test, post-test 1, and post-test 2. Self-efficacy of participants regarding emergencies was defined as confidence in one's own ability to deal with a patient's cardiac emergency. An instrument developed by Schlessel

 http://dx.doi.org/10.4040/jkan.2016.46.3.463

et al.[21] and modified by Park [19] was used to measure the level of self-efficacy regarding coping with a cardiac emergency. The measurement includes a total of 12 questions measured with a 10-point Likert scale from 0 (strongly not confident) to 10 (strongly confident). The second and third items were reverse scored; higher numbers indicated higher the self-efficacy. Cronbach's α of this instrument was .89 [19], and its value in this study was .95.

Demographic information such as gender, age, marital status, religion, education level, occupation and relationship with patient was collected. Disease-related information including the patient's age and diagnosis about heart disease was also collected.

5. Data Collection/Procedure

Randomization was accomplished using the table of random sampling digits ahead of the participant enrolment. The assignments were concealed in opaque envelopes. A research assistant, who was responsible for participant recruitment and blinded to the random assignment, enrolled the participants. Upon their participation agreement, the research assistant obtained a written consent from each participant and opened the envelope for group allocation. According to the result of group assignment, the participants were allocated into either PCE treatment or usual CPR education. The education and test sessions were performed by a single researcher to standardize the quality of the intervention. The participants did not know each other in person, thus, the possibility for contamination of the PCE treatment seemed minimal.

The data were collected via questionnaires on knowledge and self-efficacy and a checklist on CPR skills and performance completed by a researcher with American Heart Association BLS instructor certification, who provided PCE education. Demographic data were collected before the intervention. CPR skills and performance, knowledge, and self-efficacy were measured before the intervention (pre-test) and after the intervention (post-test 1) both done on the first day of the study. The participants in the PCE group were re-educated 2 weeks after the first session by telephone follow-up. Knowledge of cardiovascular disease and CPR and self-efficacy were measured again 4 weeks after the baseline (post-test 2) by telephone at the participants' convenience (Figure 1).

6. Data Analysis

Data analysis was performed using SPSS, version 22.0 (IBM, Somers, NY, USA). All dependent variables that were not normally distributed ($0.51<W<0.87$, $p<.013$) were analyzed using the Shapiro-Wilk test except for self-efficacy ($0.95<W<0.98$, $.260<p<.945$) on the pre- and two post-tests for both groups,

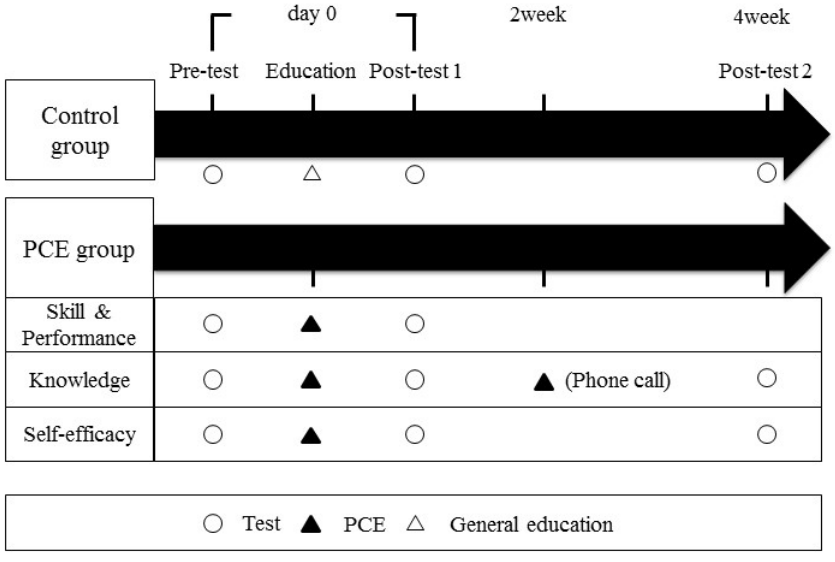

Figure 1. Research design for the study.

so the skewed values were log transformed to meet the assumption of normality. Specifically the following were calculated: (a) Frequencies and percentages, means, and standard deviations per item were used to describe participant characteristics; (b) t-tests, χ^2 tests, Fisher's exact tests and analysis of covariance (ANCOVA) tests were used to compare participant characteristics between the two groups; (c) repeated measures ANOVA (RM ANOVA) was used to compare differences in knowledge, self-efficacy, CPR skills and performance between the two groups during the research period. Levene test for homogeneity of variance ($0.78<F<12.26$, $.019<p<.734$) and Mauchly test for sphericity ($0.06<W<0.28$, $p<.001$) were performed to assess each assumption and used the Greenhouse-Geisser epsilon correction for the variables that violated the sphericity assumption.

7. Ethical Considerations

The study was approved by the institutional review board (IRB) at M hospital (IRB no. MJH-15-056). Participation in the study was voluntary, and, although family caregivers were asked to attend the education and complete all follow-up tests, participants were free to withdraw from the study at any time without incurring penalty or limitation from their later cardiology outpatient treatment. This study was conducted in accordance with the principles of ethical clinical research described in the Declaration of Helsinki.

RESULTS

1. Participant Characteristics

The M±SD age of the 54 family caregivers was 56.80±10.43 years, and 55.6% (30 persons) were men. More than 90% were married at the time of data collection. Fewer than 25% (12 participants) reported that they had no religious beliefs, and about 80% (44 participants) had completed more than a high school education. Most participants in both the PCE group and the control group were the wives or husbands of patients (78.6% and 92.3%, respectively). There were no statistically significant differences in the family caregivers' characteristics in the two groups.

In the patient's characteristics, there was no significant difference in the age of patients in the two groups ($p=.764$). Of these variables, only patient's diagnosis differed significantly between the PCE group and the control group at baseline (Table 2). There were more caregivers of patients with hyperlipidemia in the control group than in the PCE group (32.1% vs. 65.4%, $\chi^2=5.97$, $p=.015$), and more caregivers of patients with angina in the PCE group than in the control group (25.0% vs. 0%, $\chi^2=7.47$, $p=.006$). However, there were no statistically significant differences between the two groups in the outcome variables (knowledge, self-efficacy, and skills and performance) at baseline considering angina to use ANCOVA (Table 2). There were no significant differences between the two groups in the prevalence of hypertension, arrhythmia, coronary artery disease, or other diseases ($p=.050$, $p=.331$, $p=.910$, and $p=.086$, respectively).

All of the outcome variables (knowledge, self-efficacy, and skills and performance) were evaluated at baseline for their homogeneity in the PCE and control groups. There were no significant differences in the outcome variables between the two groups (Table 2).

2. Knowledge and Self-efficacy

The mean initial knowledge score (total score=10) in the PCE group was 3.18±0.95, and this increased to 9.25±0.80 at post-test 1 and then declined to 9.07±0.72 at post-test 2. In the control group, the mean initial knowledge score was 1.92±0.85, and this increased to 6.92±0.74 at post-test 1 and then declined to 6.27±0.92 at post-test 2 (Figure 2, left).

Likewise, the mean initial self-efficacy score (total score=120) in the PCE group was 17.29±5.54 and increased to 98.93±6.19 at post-test 1 and to 100.96±3.73 at post-test 2. The mean initial self-efficacy score in the control group was 16.35±3.88, and this increased to 86.54±5.67 at post-test 1 and declined to 85.77±4.57 at post-test 2 (Figure 2, right). Repeated measures ANOVA demonstrated significant differences in improvements between the two groups in knowledge ($F=91.09$, $p<.001$) and self-efficacy ($F=15.19$, $p<.001$), as well as statistically significant differences over time (knowledge: $F=364.25$, $p<.001$; self-efficacy: $F=1162.28$, $p<.001$). There were significant group-by-time interactions in knowledge ($F=8.10$, $p=.001$) and self-efficacy ($F=4.30$, $p=.019$) (Table 3).

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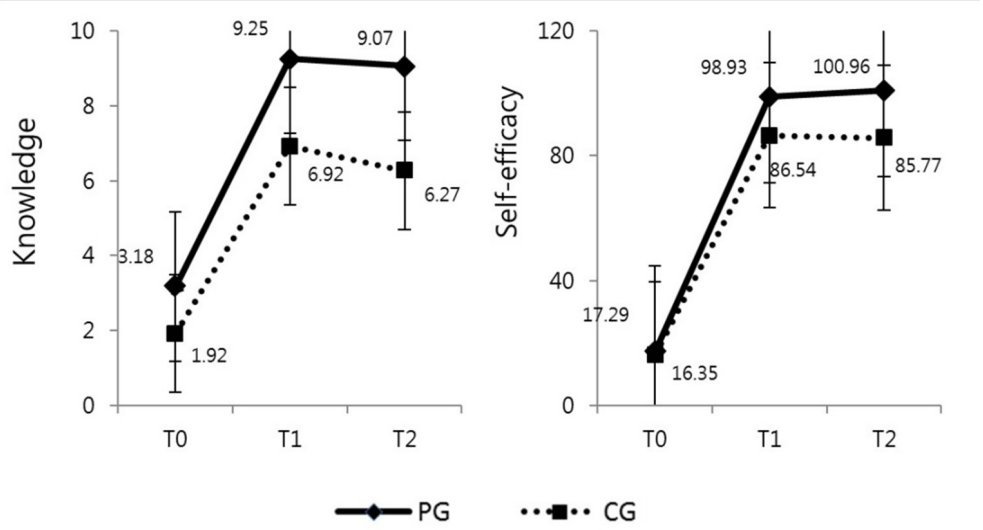

PG=PCE group; CG=control group; T0=0 day (before the intervention); T1=0 day (after the intervention); T2=4 weeks after

Figure 2. Group differences over time in outcome measures.

3. CPR Skills and Performance

The mean initial score on CPR skills and performance (total score=9) in the PCE group was 0.89±0.83, and this increased to 8.79±0.42 at post-test 1. In the control group, the mean score on CPR skills and performance was 0.58±0.50, and this increased to 8.27±0.53 at post-test 1. The repeated measures ANOVA indicated significant improvements between the two groups ($F=8.10$, $p=.008$), as well as between pre-test and post-test 1 ($F=1798.81$, $p<.001$) in CPR skills and performance. There were significant group-by-time interactions ($F=4.81$, $p=.036$) in CPR skills and performance (Table 3).

DISCUSSION

This study was the first to develop a patient-centered intervention including CPR education for the family caregivers of patients with cardiovascular diseases in South Korea. The PCE program in this study was tailored using individual families' preferences, needs, and values, as opposed to previous cardiovascular interventions or education programs that did not consider the families' own lifestyles. This study showed that the PCE program was an effective nursing intervention for family caregivers and provided preliminary evidence about enhancing knowledge about cardiovascular disease and CPR, self-efficacy, and skills and performance in a cardiac emergency.

Patient-centered interventions in healthcare focus on the patient and family. Although the healthcare provider knows more about the disease and how to care for the patient's health, patients know more about themselves. Therefore, treatment plans in patient-centered interventions consist of the mutual interaction and understanding between the patient, family, and healthcare provider to maximize the effectiveness, feasibility, and, eventually, the quality of nursing care [12,14].

Recently, patient-centered interventions have been applied to cardiovascular diseases and have been shown to be effective. Leone et al.[22] investigated the effectiveness of a patient-centered intervention in discharge education by interviewing registered nurses caring for patients with heart failure. They insisted that nurses should form a partnership with the patients and family caregivers and provide tailored care to meet their unique needs and concerns to improve satisfaction and decrease hospital readmissions.

Similar to the present study, previous studies have shown face-to-face education and telephone follow-up to be effective ways of increasing long-term knowledge. Buckley et al.[23] showed that individualized 40~50 minute face-to-face education sessions and telephone follow-up within 4 weeks can enhance knowledge of heart disease and symptoms. This knowledge lasted 12 months after the education in the patients with acute myocardial infarction. Dudas et al.[24] applied a person-centered

Table 2. Homogeneity Test of Family Caregivers' Characteristics (*N*=54)

Characteristics	Categories	PG (n=28)	CG (n=26)	χ^2 or t	*p*
		n (%) or M±SD	n (%) or M±SD		
Gender	Male	13 (46.4)	17 (65.4)	1.96	.161
	Female	15 (53.6)	9 (34.6)		
Age	<40	2 (7.1)	1 (3.8)	3.07	.689
	40~49	6 (21.4)	3 (11.5)		
	50~59	10 (35.7)	9 (34.6)		
	60~69	7 (25.0)	11 (42.3)		
	70~79	3 (10.7)	2 (7.7)		
Marital status	Non-married	2 (7.1)	1 (3.8)	1.26	.532
	Married	25 (89.3)	25 (96.2)		
	Others	1 (3.6)	0 (0.0)		
Religion	Catholicism	10 (35.7)	7 (26.9)	3.76	.288
	Protestantism	11 (39.3)	6 (23.1)		
	Buddhism	3 (10.7)	5 (19.2)		
	Others	4 (14.3)	8 (30.8)		
Education	Elementary school	0 (0.0)	1 (3.8)	2.76	.430
	Middle school	3 (10.7)	6 (23.1)		
	High school	18 (64.3)	14 (53.8)		
	College or higher	7 (25.0)	5 (19.2)		
Occupation	Housewife	11 (39.3)	7 (26.9)	4.03	.672
	Self-employed	9 (32.1)	8 (30.8)		
	Professional/Office job	6 (21.4)	9 (34.6)		
	Student	1 (3.6)	0 (0.0)		
	None	1 (3.6)	2 (7.7)		
Relationship with patient	Spouse	22 (78.6)	24 (92.3)	5.35	.069
	Children	5 (17.9)	0 (0.0)		
	Brother or sister	0 (0.0)	0 (0.0)		
	Parents	1 (3.6)	2 (7.7)		
Patient's age	40~49	2 (7.1)	3 (11.5)	1.16	.764
	50~59	14 (50.0)	10 (38.5)		
	60~69	7 (25.0)	9 (34.6)		
	70~79	5 (17.9)	4 (15.4)		
Diagnosis*	Hypertension	17 (60.7)	22 (84.6)	3.84	.050
	Hyperlipidemia	9 (32.1)	17 (65.4)	5.97	.015
	Angina	7 (25.0)	0 (0.0)	7.47	.006
	Arrhythmia	1 (3.6)	0 (0.0)	0.95	.331
	Coronary artery disease	4 (14.3)	4 (15.4)	0.01	.910
	Others	3 (10.7)	0 (0.0)	2.95	.086
Skills & performance		0.89±0.83	0.58±0.50	1.67 (2.55)†	.152 (.117)†
Knowledge		3.18±0.95	1.92±0.85	5.13 (0.13)†	.543 (.719)†
Self-efficacy		17.29±5.54	16.35±3.88	0.72 (2.48)†	.078 (.122)†

*Multiple selection; †ANCOVA; PG=PCE group; CG=Control group.

care approach for chronic heart failure patients to improve and empower them to take care of their illness. They tried to manage uncertainty in illness among patients by increasing knowledge to reduce hospital stays and improve activities for daily living through a multidisciplinary team approach.

The significant improvement of knowledge and self-efficacy in the PCE group in the present study supports Boyne et al. [25], who found a telephone follow-up intervention to be effective at creating positive changes in self-care abilities and self-efficacy among patients with heart failure. However, an automatic tele-

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Table 3. Changes in CPR Knowledge, Self-efficacy, Skills and Performance Over Time (*N*=54)

Variables	Groups	Pre-test	Post-test1	Post-test2	Group	Time	GroupxTime
		M±SD	M±SD	M±SD	F or Z (*p*)	F or Z (*p*)	F or Z (*p*)
Knowledge*	PG (n=28)	3.18±0.95	9.25±0.80	9.07±0.72	91.09	364.25	8.10
	CG (n=26)	1.92±0.85	6.92±0.74	6.27±0.92	(<.001)	(<.001)	(.001)
Self-efficacy*	PG (n=28)	17.29±5.54	98.93±6.19	100.96±3.73	15.19	1162.28	4.30
	CG (n=26)	16.35±3.88	86.54±5.67	85.77±4.57	(<.001)	(<.001)	(.019)
Skills & performance*	PG (n=28)	0.89±0.83	8.79±0.42	-	8.10	1798.81	4.81
	CG (n=26)	0.58±0.50	8.27±0.53	-	(.008)	(<.001)	(.036)

PG=PCE group; CG=control group; *log transformation.

monitoring device with a preset program was used in the study conducted by Boyne et al.[25], whereas nurse-led telephone follow-up was used in the present study.

In contrast to our findings, Holst et al.[26] found no significant changes in self-care behavior or quality of life during 1 year of monthly telephone follow-up conducted for patients with heart failure. They suggested more extensive interventions to enhance self-care behavior considering patients' cognitive function, personality, and environment. Additionally, in a study conducted by Bekelman et al.[27], a multidisciplinary team (nurse, cardiologist, and psychiatrist) provided patient-centered disease management including tele-monitoring and self-management support, but there was no significant difference in health status or 1-year hospitalization rates. However, the intervention group showed significantly fewer deaths and improved depression scores.

All of these approaches attempted to demonstrate the effectiveness of patient-centered interventions in cardiovascular disease. It has been shown that a comprehensive understanding of the learner's needs and preferences are important in any education strategy, because it empowers learners to change their behavior [28]. Kliegel et al.[5] suggested that the family caregivers and friends of cardiac arrest survivors have considerable needs in learning CPR. Moreover, the majority of these people stated that they are ready to perform CPR in an emergency situation by using knowledge and skills learned from CPR education. Dracup et al.[4] recommended the integration of CPR instruction with other programs for cardiac patients and family members. For improvements in patients' emotional states and psychosocial adjustment, it was more effective to provide CPR instruction in combination with education about cardiac risk factors and a social support group compared to providing CPR instruction alone. Therefore, patient-centered education integrating CPR instruction is expected to result in a synergy and satisfies both practical nursing requirements and family caregivers' needs.

Knowledge, self-efficacy, and performance of CPR increased significantly in both groups after education, and similar results have been reported in previous studies [5,9,10,21]. Prior study showed a significantly higher level of knowledge, positive attitude, and skills after a one-day CPR course for cardiac arrest survivors and their families [5]. One month after parents of infants and children completed CPR education, self-efficacy had improved significantly, and anxiety about CPR performance had decreased. However, this previous study did not measure CPR skills and performance, and there was no statistically significant differences in CPR knowledge [21]. In South Korea, Lee et al.[9] showed the effectiveness of CPR education on knowledge and attitude in non-healthcare providers. However, the control group did not receive CPR education, and the performance of CPR was not evaluated. Kim and Lee [10] showed that CPR education with practical training resulted in more improved knowledge, self-efficacy, and performance than did basic theoretical CPR education for nursing students.

In the present study, most of the participants had not experienced CPR education before, therefore CPR skills and performance improved significantly between the pre-test and the post-test1 for both the PCE group and the control group. Although the number of caregivers for patients with angina was higher in the PCE group than in the control group, it did not statistically affect the outcome variables and also in terms of caregivers voluntarily choosing to participate. Video-based CPR self-education with a manikin was effective in the control group. However, the PCE group with an interactive nursing instructor showed statistically

more improvement in CPR performance than did the control group. This result supports earlier studies, which suggest that video-based CPR practice can be useful to introduce CPR and enhance performance, but additional interactive feedback and instruction for individual learners can improve the resuscitation skill remarkably [10,29].

Our study has several limitations. First, most of the participants were the spouses of the patients (85.2%), over 40 years old (94.4%), and had no previous experience of CPR education. The participants were also limited to the family caregivers of cardiovascular patients, because the intensity of CPR training is sometimes too strong for patients. Second, the follow-up ended 4 weeks after baseline, with no long-term follow-up. Regular follow-up would decrease knowledge loss and increase compliance and the effect of the PCE program. In a previous study, results suggested that CPR training for nurses should be carried out at least every 3 to 6 months to prevent any decline of skills and knowledge [30]. In another study the importance of repeated CPR education for patients and their family caregivers was also emphasized [5]. Because KACPR based on the American Heart Association's 2010 CPR guideline provided information knowledge and skills in CPR decreased significantly in 1~6 months or 7~12 months, re-education in a shorter period of time, over 2 years, is required [18]. Therefore, more frequent re-training would be needed for non-healthcare providers to maintain the acquired skills and knowledge. Third, CPR skills and performance were not measured at week 4, because each participant had a different outpatient schedule. Also the researcher who provided the CPR education obtained the data from pre- and post-tests. It failed to meet the criteria of double-blind study. Furthermore, clinical data such as the incidence of cardiac emergency, CPR response rate, and mortality were not obtained.

Despite these limitations, this is the first study to incorporate a patient-centered intervention with CPR education, focusing on the patients and the families. Although everyone acknowledges the vital role of family caregivers in resuscitation following a cardiac emergency, tailored CPR education for patients and family caregivers have not commonly been provided. The results of the present study show the synergistic effect of a patient-centered intervention with CPR training on the quality of care in both usual and emergency situations. Therefore, the present study is worthwhile, because it is able to show that tailored PCE is a comprehensive nursing intervention for patients with cardiovascular diseases and their family caregivers.

CONCLUSION

This study brings attention to the importance and effectiveness of integrating patient-centered education by nurses into CPR training for the family caregivers of cardiovascular patients. Overall knowledge about cardiovascular disease and knowledge, self-efficacy, and performance of CPR were significantly improved after completing the PCE program. The results of the present study encourage the use of tailored, patient-centered interventions in cardiovascular nursing practice. Long-term follow-up studies are needed to demonstrate whether the effects of PCE are maintained afterwards. Additionally, further research is recommended to investigate the effectiveness and feasibility of PCE for other people and in various settings.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

ACKNOWLEDGEMENTS

We would like to thank all of the study participants and their families.

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