Received: 20 August 2018 | Revised: 3 July 2019 | Accepted: 14 September 2019
DOI: 10.1111/jjns.12306

ORIGINAL ARTICLE

JAPAN JOURNAL OF NURSING SCIENCE WILEY

Evaluation of the Interaction Model of Client Health Behavior-based multifaceted intervention on patient activation and osteoarthritis symptoms

Yang Heui Ahn[1] | **Ok Kyung Ham**[2]

[1]Department of Nursing, Yonsei University Wonju College of Medicine, Wonju, South Korea

[2]Department of Nursing, Inha University, Incheon, South Korea

Correspondence
Ok K. Ham, Department of Nursing, Inha University, 100 Inha-ro, Nam-gu, Incheon 22212, South Korea.
Email: okkyung@inha.ac.kr

Funding information
This research was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (No 2012-8-5261).

Abstract

Purpose: This study evaluated a multifaceted intervention for osteoarthritis symptoms.

Methods: A cluster randomized controlled trial was conducted with a convenience sample of 90 patients aged between 45 and 82 years, who were recruited from three Community Health Posts (CHPs). The CHPs were randomized into two experimental groups (E1 and E2) and one control group (C). The intervention included health education and counseling combined with exercise classes based on the Interaction Model of Client Health Behavior. Trained community health nurse practitioners led the intervention. Stretching exercise (E1) and walking (E2) combined with muscle strengthening exercise were provided. The instruments included the Patient Activation Measure (PAM), Korean version of the Western Ontario and McMaster Universities Osteoarthritis Index (K-WOMAC), Stanford Health Assessment Questionnaire Disability Scale (HAQDS), and Center for Epidemiologic Studies Depression Scale (CES-D). The HAQDS was measured using an ordinal scale, and Likert scales were used for the other instruments. Chi-square test and analysis of covariance were used; P values <.05 were considered significant. The study was conducted in 2014.

Results: The groups were similar at the baseline ($P > .05$) except for joint pain and patient activation ($P < .05$). At post-test, the changes in the mean scores were significant for joint pain and stiffness, and physical functioning. E2 with walking exercise showed better improvements in joint pain and physical functioning than the other groups ($P < .01$).

Conclusions: Eight sessions of multifaceted intervention improved the osteoarthritis symptoms. Follow-up studies will be needed to determine the intermediate and long-term effects of the multifaceted intervention.

KEYWORDS
depression, exercise, osteoarthritis, pain

1 | INTRODUCTION

Osteoarthritis is the most common form of arthritis and a chronic degenerative disease that is characterized by joint pain, functional limitation, and reduced quality of life (Altman, 2010). Symptoms of osteoarthritis include joint stiffness, joint swelling, and progressive gait disturbance, which may result in depression and reduced self-esteem due to a loss of independence (Cho, Paek, & Kim, 2013). Worldwide estimates suggest that 9.6% of men and 18.0% of women aged over 60 years have symptomatic osteoarthritis; 80% will have limitations in movement, and 25% cannot perform their daily activities (World Health Organization, 2013). Furthermore, it could yield enormous societal and financial burdens, including income loss, healthcare costs, reduced quality of life, and psychological problems, such as depression and learned helplessness (Robbins & Kulesa, 2012). Considering these burdens, early detection and self-management of the disease is essential; however, it is often overlooked because the progression of the disease is regarded as part of the normal aging process. Despite Korea ensuring universal health care to all citizens through its national health insurance program, those in rural areas have limited access to healthcare services because most healthcare facilities are aggregated in urban areas (Ahn et al., 2017). Hence, special attention should be given to residents in rural areas.

A previous study examined the effects of Tai Chi exercise on joint pain and stiffness, physical functioning, and depression of women with osteoarthritis and found that exercise was effective in decreasing joint pain (Cho et al., 2013). Others conducted a systematic review and meta-analysis to compare the effects of aquatic exercise and ground-based exercise. They reported that joint pain decreased significantly in the aquatic exercise group. On the other hand, physical functioning, range of motion, and quality of life were similar in the two groups (Kim, Choi, Han, Kim, & Kim, 2015). They contended that a limited number of randomized controlled trials were performed targeting osteoarthritis patients. Therefore, further investigation will be needed to compare the different types of exercise intervention targeting osteoarthritis patients to provide sound evidence (Kim et al., 2015).

Patient-centered care for osteoarthritis has emphasized the control of modifiable risk factors and the prevention of co-morbidities with lifestyle change interventions (e.g., medication adherence, exercise, and weight control) (Altman, 2010). Patient-centered care places the patients at the center, builds a partnership with the healthcare team, and promotes communication between patients and providers. This approach has proven to be effective as a means of increasing the active participation of patients in their health care, thereby achieving better health outcomes (Heller, Elliott, Haviland, Klein, & Kanouse, 2009). Others reported that improved communication between patients and providers enhance the patients' understanding of their disease and treatment options, which promotes the adherence to a treatment regimen (Zolnierek & Dimatteo, 2009).

Patient activation involves knowledge, skills, beliefs, motivation, and confidence that enables individuals to participate actively in self-care practices (Heller et al., 2009). A previous study reported that an increase in patient activation was strongly related to better health outcomes among patients with chronic diseases (Hibbard & Greene, 2013). Therefore, the present study was designed to evaluate a patient-centered multifaceted intervention to promote patient activation in self-care and compare two different types of exercise interventions targeting osteoarthritis patients in a rural community in South Korea.

1.1 | Conceptual framework

This study was designed based on the Interaction Model of Client Health Behavior (IMCHB). The model consisted of three components: client singularity, client-professional interaction, and health outcome. The background and dynamic variables of the patients (client singularity) and quality and quantity of client-professional interaction were assumed to influence their health outcomes. The background variables are the demographic characteristics, social influences, previous health care experience, and environmental resources, whereas the dynamic variables include intrinsic motivation, cognitive appraisal, and affective response (Cox, 2003). The elements of the health outcome include health service utilization, health status, severity of health problems, adherence to the recommended regimen, and patient satisfaction (Cox, 2003). In the present study, a multifaceted intervention was developed to promote the dynamic variables (cognitive-affective-behavioral skills) and client-professional interaction; patient activation (adherence to the recommended regimen), physical functioning (health status), pain, and depression (severity of health problems) were included as the health outcome variables. Multifaceted interventions are those with two or more intervention components. Using a multifaceted intervention, a previous study reported that the intervention was effective in promoting disease-monitoring behavior among rheumatoid arthritis patients (Majka et al., 2018). Others validated the IMCHB-based intervention (Hickman, Clochesy, & Alaamri, 2016). They found that an intervention to promote health literacy (client singularity) and patient-provider interaction using simulation games were effective in decreasing blood pressure among hypertensive patients (Hickman, Clochesy, Pinto, Burant, & Pignatiello, 2015).

The IMCHB underscores the importance of the patient's responsibility in managing chronic disease, and emphasizes patient-directed self-care partnered with healthcare providers. The model presumes that clients can make competent health-related choices. Therefore, they are encouraged to have as much control over their health decisions and actions as possible, based on the assumption that the clients are active agents regarding their health behavior and health care (Cox, 2003). Based on the IMCHB, the aim of this study was to evaluate a multifaceted intervention to promote patient-provider communication and cognitive-affective-behavioral skills of osteoarthritis patients to determine if the intervention enhanced patient activation and improved osteoarthritis symptoms, such as physical functioning, depression, and pain (pain and stiffness). This study also compared the effects of two different types of exercise interventions (muscle strengthening/stretching exercise vs. muscle strengthening/walking exercise) that were offered in combination with a multifaceted intervention.

2 | METHODS

2.1 | Design

This study conducted a cluster randomized controlled trial. This study is a part of a larger study on the factors associated with patient activation among osteoarthritis patients (Ahn, Kim, Ham, & Kim, 2015).

2.2 | Setting and sample

A convenience sample of three Community Health Posts (CHPs) was recruited. One CHP was designated as a control group (C), and the other two CHPs were designated as experimental groups 1 and 2 (E1 and E2). The three CHPs were located at a 30–60 min distance by car from each other to prevent contamination of the intervention. The CHPs are public health clinics operated by community health nurse practitioners (CHNPs) in small villages in remote areas with a population of less than 5000 residents and scarce medical facilities (clinics, pharmacies, etc.). The CHNPs are public health officers, and 1895 CHPs are operated by 1895 CHNPs across South Korea. The function of CHPs includes primary care, health promotion, and disease prevention of community residents. The government provides education and training to CHNPs and their role and functions have been defined by government legislation (Ahn et al., 2017; Korea Ministry of Government Legislation, 2017).

From each CHP, 30 osteoarthritis patients were recruited (N = 90) after initial screening with CHNPs in charge of these three CHPs. The inclusion criteria were: (a) patients diagnosed with osteoarthritis by physicians; (b) able to communicate in Korean; and (c) agreed to participate in the study. The exclusion criteria included: (a) patients with severe pain other than arthritis pain; (b) those who have cognitive disorders; (c) had undergone joint replacement surgery; and (d) medical aid beneficiaries. Three patients were withdrawn during the intervention due to hospitalization and accidents. The remaining 87 patients completed the post-test data collection (n = 29 for E1, n = 28 for E2, and n = 30 for C). Power analysis was performed using G*Power 3.1.2 (Faul, Erdfelder, Lang, & Buchner, 2007). With an effect size of $f = 0.4$ based on a previous study on the effects of exercise intervention on joint pain and stiffness (Lee, 2006), a total of 66 patients were required (22 subjects per group) to produce an 80% power ($\alpha = .05$). Considering 30% attrition, a total of 87 patients were sufficient for the study.

2.3 | Ethics considerations

The study was approved by the institutional review board from Yonsei University Wonju Medical Center (YWNR-12-0-003). After explaining the purpose of the study, written consent was obtained from the CHNPs and osteoarthritis patients before enrolling them in the study. Confidentiality of the participants was secured throughout the study. The participants were informed that they could withdraw from the study at any time without penalty.

2.4 | Instruments

2.4.1 | General characteristics

The demographic characteristics included age, gender, marital status, education level, religion, and employment status. These variables were measured as the categorical variables. The health behaviors included smoking (current smokers) and alcohol consumption (present consumers of alcoholic beverages) and were measured using dichotomous variables (yes or no). The disease-related characteristics included comorbid condition, duration since the diagnosis of osteoarthritis, and the use of arthritis medication (yes or no).

2.4.2 | Patient activation

Patient activation was measured using the Patient Activation Measure (PAM). The 13-item instrument assessed the knowledge, skills, and confidence for self-management and the degree to which individuals take an active role in managing their health (Hibbard, Mahoney, Stockard, & Tusler, 2005). The instrument was measured using a four-point Likert scale from strongly disagree (1) to strongly agree (4). The total scores were converted to zero to 100 scales (Hibbard et al., 2005) with higher scores indicating more active patients. Based on the PAM scores, the patients were categorized from Levels 1 (least activated) to 4 (most activated). The cut-off points for Levels, 1, 2, and 3 were 47.0, 55.1, and 67.0, respectively. Scores of 67.1 and over were categorized as Level 4 (Hibbard & Cunningham, 2008).

The PAM was translated into Korean in a former study based on the World Health Organization (WHO) recommendations (Ahn et al., 2015). The translation process included the initial forward-translation by two bilingual nurse scholars, expert panel discussions with three professors, and backward translation by another bilingual translator. The former study verified the validity and reliability of the Korean version of the PAM (Ahn et al., 2015). Cronbach's alpha was .88 in a previous study (Ahn et al., 2015) and .84 in the present study.

2.4.3 | Pain

Pain was measured using the Korean version of Western Ontario and McMaster Universities Osteoarthritis Index (K-WOMAC). The reliability and validity were verified with osteoarthritis patients in Korea (Yi, Lee, & Woo, 2008). The seven items of joint pain (five items) and joint stiffness (two items) subscales were used in the study. Each item was scored on a five-point Likert scale (0 = none, 1 = slight, 2 = moderate, 3 = severe, and 4 = extreme) with higher scores indicating more pain. Cronbach's alpha was .80–.94 in a previous study (Yi et al., 2008) and .82–.84 in the present study.

2.4.4 | Physical functioning

Physical functioning was measured using the Stanford Health Assessment Questionnaire Disability Scale (HAQDS) (Lorig, Sobel, Ritter, Laurent, & Hobbs, 2001). Eight items of the HAQDS measure the patient's level of functional ability, and include questions on the locomotor activities of the lower extremity and activities that involve both the upper and lower extremities. The HAQDS was translated (Korean) and back-translated (English) in the former study based on the WHO recommendations (Ahn et al., 2015). An ordinal scale was used (0 = without difficulties, 1 = with some difficulty, 2 = with much difficulty, and 3 = unable to do); higher scores indicated severe disability. Cronbach's alpha was .85 in the former study (Ahn et al., 2015) and .85 in the current study.

2.4.5 | Depression

Depressive symptoms during the previous week were measured using the 20-item Center for the Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977). The scale was translated into Korean and the reliability and validity were verified in a former study (Cho & Kim, 1993). The scale was measured using a four-point Likert scale (0 = none of the time, 1 = one to two days/week, 2 = three to four days/week, and 3 = five to seven days/week); higher scores indicated more depressive symptoms. Scores between 16 and 24 indicated probable depression, while scores equal to or higher than 25 indicated definite depression (Park & Kim, 2011). Cronbach's alpha was .85 in a former study (Seo, Ham, & Ahn, 2007) and .82 in our study.

2.5 | Intervention

The multifaceted intervention was developed by the research team using the intervention mapping (IM) process (Kok, Bartholomew, Parcel, Gottlieb, & Fernandez, 2014). The process of IM included a needs assessment, goal setting, selection of theory-based interventions, production of program components, and development of an implementation and evaluation plan (Kok et al., 2014). The survey was conducted on 270 osteoarthritis patients, and interviews were conducted with five osteoarthritis patients as a part of the needs assessment. The following IM process was guided based on the needs assessment results (literature review, survey, and interview). The advisory committee was organized with eight experts in the field of community health (three), nursing (four), and medicine (one). Weekly meetings with advisory committee members were convened during the intervention development period. Detailed information can be found elsewhere (Ahn, 2015).

2.5.1 | Training of the CHNPs

Two CHNPs in the experimental groups were provided with 16 h of education and training by the principal investigator (PI) using the patient care manual developed by the research team. Education and training was provided for individual and group counseling, and exercise classes. The interventions for E1 and E2 were identical except for the contents of the exercise classes. Training for the muscle strengthening and stretching exercises was provided for the CHNP in charge of E1, while the training for muscle strengthening and walking exercises was provided for the CHNP in charge of E2. During the intervention period, the PI met with the CHNPs on a weekly basis to control the intervention quality, as well as discuss the progress and barriers to the implementation of the intervention. One specialist physician in orthopedics was appointed as a consultant physician. The consultant physician provided primary care to the patients and supported the CHNP practice for EI and E2.

2.5.2 | Intervention for patients

The patients in E1 and E2 were provided with eight sessions (four individual sessions and four group sessions) of a multifaceted intervention (Table 1). Based on the IMCHB, the components of client singularity (cognitive-affective-behavioral skills) and client-professional interaction were included. The intervention to promote cognitive-affective-behavioral skills included education/counseling on the disease characteristics and treatment

TABLE 1 Multifaceted intervention contents and strategies

Session	Objective	Practical activities and strategies	Materials	Type
1. Identify strengths	Identify the patient's own strengths for being a smart patient	- Encourage self-directed behaviors and self-responsibility for their own behavior - Health contracts and photo elicitation	Photo scrapbooks Health contracts sheet	Individual
2. Communication	Training communication skills	- Promote active listening and feedback to express their feelings, needs, and ideas to healthcare providers -Teach-back, ask-me-3 questions	Self-management guide Smart pocket guide	Group
3. Understanding disease	Understanding osteoarthritis and disease management	- Educate signs and symptoms, diagnosis, treatment related to osteoarthritis disease -Teach-back		
4. Pain control	Understanding and self-management of joint pain	- Assist in strengthening confidence to perform a self-directed behavior for pain management - Empathy, reflection, and self-efficacy support	- Self-management guide - Smart pocket guide - Medical supplies - Medication calendar	Individual
5. Medication adherence	Adherence to medication	-Promote motivation to adhere to medication prescriptions -Teach-back, motivation strengthening, and self-efficacy support		
6. Depressive mood	Self-management of depressed mood	- Explore the feelings of daily life and challenges - Alter distorted thoughts or behavior patterns - Motivate to engage in the self-management of depressed mood - Strengthen confidence - Motivational interview and emotional support	- Self-management guide - Smart pocket guide	Individual
7. Physical activity	Training exercise and stretching or walking	- Promote motivation to engage in physical activity - Strengthen confidence for physical activity and gaining support from family/neighbors. - E1 was provided with muscle strengthening/stretching exercise - E2 was provided with muscle strengthening/walking exercise - Teach-back, positive reinforcement, self-efficacy support, and self-monitoring	- Self-management guide - Smart pocket guide - Exercise device (band) - Health diary	Group
8. Healthy diet	Self-making a balanced diet	- Explore their healthy eating behavior - Enhance confidence to decrease the intake of high calorie foods - Obtain support from family/neighbors for diet - Self-efficacy support, and self-monitoring	- Self-management guide - Smart pocket guide - Health diary	Group

options, encouraging self-responsibility, strengthening self-efficacy, self-monitoring, positive reinforcement, and emotional support with regard to pain control, medication adherence, depression, and diet (sessions 1, 3–6, and 8 in Table 1). Communication skill training was provided to promote the client-professional interaction (week 2).

The individual sessions were conducted via home visits or telephone counseling, which lasted for approximately 30–60 min for each session. Group sessions were offered within the CHPs or other public places within the community, and lasted for 60–90 min for each session. Each group consisted of five to six patients. The patients were advised to implement self-care practices in daily life using the self-management guide and smart pocket guide, and self-care was monitored using a diary and medication calendar.

The eight sessions of intervention, involving individual counseling and group education, were identical for E1 and E2. On the other hand, the exercise classes were different in E1 and E2 to compare the two types of exercise. A previous study reported that different types of exercise interventions produced significantly different results on the outcome variables (Kil & Yang, 2012). Accordingly, E1 was provided with muscle strengthening (knee) and stretching exercise, whereas E2 was offered muscle strengthening (knee) and walking exercise.

Patients in the control group were provided with conventional care, which included treatment and a prescription with minimal health education and counseling by the CHNP in charge of the CHP. After post-test data collection, those in the control group were given education materials (self-management guide, smart pocket guide, diary, and medication calendar). The intervention was offered in 2014.

2.6 | Procedures

The PI met with the three CHNPs and obtained their approval for patient recruitment, intervention implementation, and data collection. Pre- and post-test data collection were performed by trained research assistants (n = 2) using face-to-face interview methods. The research assistants performing data collection were blinded to the group allocation. Pre-test data collection was performed in January, 2014 and post-test data collection was conducted after completing the intervention in April, 2014.

2.7 | Data analysis

The Statistical Package for the Social Sciences 23.0 for Windows was used for data analysis (IBM Corp. released 2012, Armonk, NY, USA). Chi-square test, Fisher's exact test, and analysis of variance (ANOVA) were used to examine the homogeneity of the groups. ANOVA and analysis of covariance (ANCOVA) were performed to examine the intervention effects. If the pre-test score was significant, it was included as a covariate in the analysis of the intervention effects. A post-hoc test was performed using a Scheffe's method. The assumptions of the ANCOVA test were confirmed prior to data analysis. The two-tailed null hypotheses of no difference were rejected if the P values were less than .05.

3 | RESULTS

3.1 | General and disease-related characteristics of the participants

Among all participants, female patients constituted 88.5%, and the mean age was 71.30 years (SD = 7.13, range 45–82). Forty-five percent had not received even primary education; 55.2% were married or cohabitating; 49.4% had hypertension, and the majority (62.1–70.4%) were farmers. The mean duration since the diagnosis of arthritis was 135.7 ± 111.4 months for E1, 124.1 ± 122.2 months for E2, and 143.8 ± 119.3 months for the control group ($P > .05$). The three groups had similar demographic, behavioral, and disease-related characteristics ($P > .05$) (Table 2).

3.2 | Homogeneity of the study variables at the pre-test

The three groups had similar joint stiffness (WOMAC subscale), physical functioning (HAQDS), and depression (CES-D) scores ($P > .05$). The PAM scores were significantly different among the three groups ($P < .05$). Post-hoc analysis indicated that E1 had a significantly higher PAM score than E2 and the control group (E1 > E2 > C) at the baseline. Joint pain (WOMAC subscale) was significantly different among the three groups ($P < .05$). E2 had a significantly higher joint pain score than the control group (E2 > C) (Table 3).

3.3 | Effects of a multifaceted intervention

After the intervention, the PAM scores increased for all groups ($P < .05$). The changes in joint pain and joint stiffness scores (WOMAC subcategories) were significantly different among the three groups ($P < .05$). The post-hoc test indicated that joint pain decreased for E1 and E2,

TABLE 2 Homogeneity of the general and disease-related characteristics

Variable	Category	E1 (n = 29) n (%)	E2 (n = 28) n (%)	C (n = 30) n (%)	Chi-square or Fisher's exact (*P*)
Gender	Male	2 (6.9)	4 (14.3)	4 (13.3)	0.917 (.632)
	Female	27 (93.1)	24 (85.7)	26 (86.7)	
Age, y	≤64	7 (24.1)	6 (21.4)	1 (3.3)	(.160)[a]
	65–74	14 (48.3)	12 (42.9)	17 (56.7)	
	≥75	8(27.6)	10(35.7)	12(40.0)	
Education	No education[b]	13(44.8)	8(28.6)	18(60.0)	(.145)[a]
	Elementary	12(41.4)	16(57.1)	11(36.7)	
	≥ Middle	4(13.8)	4(14.3)	1(3.3)	
Religion	Christian	7(24.1)	4(14.3)	7(23.3)	(.339)[a]
	Catholic	6(20.7)	5(17.8)	1(3.3)	
	Buddhist	6(20.7)	4(14.3)	8(26.7)	
	None	10(34.5)	15(53.6)	14(46.7)	
Job	Agriculture	18(62.1)	19(70.4)	21(70.0)	(.683)[a]
	Others	1(3.4)	—	—	
	Unemployed	10(34.5)	8(29.6)	9(30.0)	
Marital status	Married/cohabitating	16(55.2)	15(53.6)	17(56.7)	0.056(.972)
	Widowed/single	13(44.8)	13(46.4)	13(43.3)	
Health behavior	Smoking, yes	1(3.4)	1(3.6)	1(3.3)	0.002(.999)
	Drinking, yes	8 (27.6)	8 (28.6)	4 (13.3)	2.419 (.298)
	Regular exercise	6 (20.7)	6 (21.4)	2 (6.4)	6.500 (.165)
Medication adherence	Yes	7 (25.0)	13 (46.4)	9 (30.0)	3.162 (.206)
Comorbidity	Hypertension	13 (44.8)	13 (46.4)	17 (56.7)	0.975 (.614)
	Diabetes	5 (17.2)	7 (25.0)	6 (20.0)	0.536 (.765)
	Cardiovascular	3 (10.3)	5 (17.9)	3 (10.0)	(.601)[a]
		M (SD)	M (SD)	M (SD)	t (p)
Disease duration[c] (month)		135.7 (111.4)	124.1 (122.2)	143.8 (119.3)	0.206 (.814)

Abbreviations: C, control group; E1, experimental group 1; E2, experimental group 2.
[a]Fisher's exact test.
[b]No education, not even primary education.
[c]Duration since the diagnosis of osteoarthritis.

TABLE 3 Homogeneity of patient activation, joint pain and stiffness, physical functioning, and depressive symptoms

Variables	E1 (n = 29) M (SD)	E2 (n = 28) M (SD)	C (n = 30) M (SD)	F (*P*)	Post-hoc by Scheffe's method
PAM	62.9 (14.3)	57.2 (13.7)	44.6 (11.4)	15.603 (.000)	E1 > E2 > C
WOMAC joint pain	7.2 (4.1)	7.3 (3.5)	5.1 (3.4)	4.130 (.019)	E2 > C
WOMAC joint stiffness	12.2 (3.2)	12.4 (3.0)	13.8 (1.7)	2.623 (.078)	
HAQDS	4.7 (3.5)	5.7 (2.6)	4.7 (2.8)	1.081 (.344)	
CES-D	19.6 (9.7)	21.9 (8.6)	17.5 (9.0)	1.709 (.187)	

Abbreviations: C, control group; CES-D, Center for Epidemiologic Studies Depression Scale; E1, experimental group 1; E2, experimental group 2; HAQDS, Stanford Health Assessment Questionnaire Disability Scale; M, mean; PAM, Patient Activation Measure; SD, standard deviation; WOMAC, Western Ontario and McMaster Universities.

TABLE 4 Comparison of the patient activation, joint pain and stiffness, physical functioning, and depressive symptoms among the groups at post-test

Variables		E1 (n = 29)		E2 (n = 28)		C (n = 30)		
		M (SD)	D (SD)	M (SD)	D (SD)	M (SD)	D (SD)	F (*P*)
PAM[a]	Pre	62.9 (14.3)	−7.3 (19.1)	57.2 (13.7)	−7.8 (13.3)	44.6 (11.4)	−16.8 (18.9)	3.349 (.040)
	Post	70.2 (16.4)		65.0 (11.6)		61.4 (13.3)		
WOMAC[a] joint pain	Pre	7.2 (4.1)	2.5 (4.5)	7.8 (3.5)	3.4 (3.0)	5.1 (3.4)	−2.3 (5.3)	9.149 (.000)
	Post	4.7 (3.8)		4.4 (3.2)		7.4 (4.3)		E2 > E1 > C
WOMAC joint stiffness	Pre	3.0 (2.1)	1.2 (2.1)	3.8 (2.2)	1.5 (2.3)	2.8 (1.5)	−0.2 (1.9)	5.248 (.007)
	Post	1.8 (1.9)		2.3 (1.9)		2.9 (2.1)		E2 > C
HAQDS	Pre	4.7 (3.5)	2.3 (2.9)	5.7 (2.6)	2.5 (2.2)	4.7 (2.8)	−0.5 (3.3)	10.631 (.000)
	Post	2.4 (2.4)		3.1 (2.8)		5.2 (3.3)		E2 > E1 > C
CES-D	Pre	19.5 (9.7)	4.5 (9.4)	21.96 (8.6)	7.3 (9.3)	17.5 (9.0)	1.9 (6.3)	2.899 (.061)
	Post	15.0 (8.5)		14.7 (8.2)		15.6 (8.2)		

Abbreviations: C, control group; CES-D, Center for Epidemiologic Studies Depression Scale; D, Mean difference; E1, experimental group 1; E2, experimental group 2; HAQDS, Stanford Health Assessment Questionnaire Disability Scale; M, mean; PAM, Patient Activation Measure; SD, standard deviation; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

[a]Analysis of covariance test was performed with the pre-test score included as a covariate. A post-hoc test was performed using a Scheffe's method.

while it increased for C (E2 > E1 > C). The mean score for joint stiffness was significantly higher for E2 than the control group after the intervention (E2 > C). The mean physical functioning (HAQDS) scores decreased for both E1 and E2, which indicated that the patients had improved their physical functioning, while they increased for the control group ($P < .05$) with significant post-hoc test results (E2 > E1 > C). After the intervention, changes in depressive symptom (CES-D) scores were not significant among the three groups ($P = .061$) (Table 4).

4 | DISCUSSION

This study performed an evaluation of eight sessions of multifaceted intervention to promote patient activation and improve the symptoms of osteoarthritis patients residing in rural communities in South Korea. By applying the IMCHB (Cox, 2003), this study found that the intervention provided by CHNPs and the consultant physician was effective in decreasing pain symptoms (joint pain and joint stiffness), and promoting the physical functioning of osteoarthritis patients. Patient-centered multifaceted approaches incorporating cognitive-affective-behavioral skill training and patient-provider communication may have been effective in improving the arthritis symptoms. These results are meaningful in that positive effects of the multifaceted intervention were achieved despite the study participants being mostly older than 65 years and farmers, having a low education level, and suffering from arthritis for more than 10 years. Because of these characteristics, the study participants may have had difficulties in managing their arthritis symptoms without a systematic intervention.

The IMCHB underscores the importance of the patient's responsibility in managing chronic disease, and emphasizes patient-directed self-care partnered with healthcare providers (Cox, 2003). Based on the premise of the IMCHB, interventions were offered to promote self-management via individual counseling, group education, and exercise classes. Efforts to promote patient-provider communication were also included. The post-test PAM scores, which measured active participation in self-management practices, improved in the experimental and control groups, but the control group improved the most. Nevertheless, the multifaceted intervention would have had a positive impact on the patients' self-management practices because pain, joint stiffness, and physical functioning improved in the patients in the experimental groups. Similar to the present study, a former study reported that increased stages of PAM scores were associated with improved outcomes in self-management behaviors, functional status, and quality of life among patients with chronic diseases (Mosen et al., 2007).

A previous study reported that home-based exercise intervention combined with health education was effective in improving joint pain, joint stiffness, and physical functioning among the elderly in China (Chen et al., 2019). Others reported that Tai Chi exercise offered to osteoarthritis patients, which has muscle strengthening effects, was effective in decreasing joint pain (Cho et al., 2013; Song et al., 2014). Consistent with former studies (Chen et al., 2019; Cho et al., 2013), the results of the present study showed that both experimental groups had decreased joint pain and joint stiffness, while their physical functioning had improved after the intervention compared to those in the control group. These three indicators (joint pain, joint stiffness, and physical functioning) are important criteria for evaluating the health status of osteoarthritis patients. The improvements in these symptom scores also indicated that multifaceted intervention strategies, including emotional support, positive reinforcement, teach-back method, health contract, and self-monitoring, would have been effective in these patients in the management of their osteoarthritis symptoms.

This study found that both muscle strengthening/stretching exercise and muscle strengthening/walking exercise were effective in improving joint pain and stiffness, and physical functioning of patients in E1 and E2. Lee and Cho (2012) reported that pain had decreased after a six-week self-help program offered to arthritis patients, while others reported a decrease in pain sensitivity after the 12-week exercise program (Henriksen et al., 2014). In line with the present study, White et al. (2014) found that daily walking was effective in preventing falls of older arthritis patients. Roh and Park (2013) also reported that walking is effective in promoting the physical functioning of older population. Another study examined the effects of aerobic and stretching exercises and suggested that the improved metabolism of blood flow during aerobic exercise may have influenced in diminishing pain (Kiranmayi, Ponmathi, & Sivakumar, 2016), whereas stretching exercise has blood pressure reduction effects due to the production of endogenous antioxidants (Bahadoran, Pouya, Zolaktaf, & Taebi, 2015). Therefore, muscle strengthening exercise combined with stretching or walking exercise would be essential interventions that could be included in the care plan of osteoarthritis patients along with education sessions.

This study found significant improvements in PAM scores at post-test in both the experimental and control groups. At the baseline, the mean score of E1 and E2 belonged to Level 3, whereas that of the control group belonged to Level 1 (Hibbard & Cunningham, 2008). After the intervention, mean score of E1 increased to Level 4 (most activated), E2 remained in Level 3, whereas the mean score of the control group increased from Level 1 (least activated) to Level 3. This can be explained as a regression toward the mean phenomenon (Stigler, 1997). Regression toward the mean suggests that if the variable is extreme on its first measurement, it is closer to the average on its second measurement. The control group had the lowest PAM score at pre-test. Therefore, the post-test PAM score of the control group increased to an average level, similar to the experimental groups. In addition, the high pre-test PAM scores among those in the experimental groups might have influenced the study results in that they have limited spaces for additional improvements at the post-test due to ceiling effects (Wang, Zhang, McArdle, & Salthouse, 2009). On the other hand, improvements in the PAM scores would be meaningful initial steps, considering that the study population was mostly elderly individuals with low education levels. Conventional care provided by the CHNP in charge of the control group might have influenced the study results as well. A previous study provided an intervention targeting arthritis patients in rural areas of Korea, which incorporated health education, group counseling, and exercise classes (Choi, 2001). The results are partly consistent with our study in that physical functioning and self-efficacy improved in the experimental group only, whereas pain and fatigue decreased for both the experimental and control groups (Choi, 2001). Similar to the present study, the former study also provided conventional care to those in the control group by the local CHNP (Choi, 2001). Thus, this control condition may have influenced the study results.

After the intervention, the changes in depression scores were not significant among the groups in the present study ($P = .061$), even though the changes in mean score were greater for the experimental groups than the control group. The three groups belonged to the probable depression category at pre-test (Park & Kim, 2011). However, mean CES-D scores improved and belonged to no clinical symptom category at post-test in all of the three groups. Depression is a strong predictor of joint pain, and depression and pain are closely related (Riddle, Kong, & Fitzgerald, 2011). It is assumed that the multifaceted intervention, involving cognitive-affective-behavioral skill training and client-professional interaction via individual counseling and group education, influenced the improvement of depressive symptoms in part among those in the experimental groups, which in turn improved the osteoarthritis symptoms including joint pain and stiffness. Therefore, future studies will be needed to conduct a long-term evaluation of the multifaceted intervention in terms of depression and patient activation with osteoarthritis patients.

Among the intervention components, the appointment of a consultant physician is one of the strengths of this study, which helped improve the intervention quality as the physician provided advice to the CHNPs regarding patient care and prescription. CHNPs are authorized to provide primary care in designated rural areas and have prescription privileges based on a Special Act for

Development of Farming and Fishing Villages (Korea Ministry of Government Legislation, 2017). On the other hand, collaboration with a physician is not easy in rural communities in Korea, where health resources are limited, including healthcare providers. Therefore, future efforts may include fostering partnerships with local physicians and CHNPs in providing primary care to rural residents.

This study also compared two different types of exercise and found that the changes in mean scores were greater for E2 than E1 in terms of joint pain and physical functioning, suggesting that outdoor walking exercise (E2) was more beneficial for osteoarthritis patients than indoor stretching exercises (E1). Consistent with the present study, a previous study reported that outdoor activity was more effective than an indoor exercise program among female senior citizens in terms of body mass index and bone mineral density (Kil & Yang, 2012). Each exercise method would have advantages and disadvantages according to the target population. Therefore, a comparison of exercise treatments would provide valuable information for the development of intervention components for chronic disease patients. On the other hand, no study has compared walking and stretching exercises, targeting osteoarthritis patients. Therefore, the study results provide important implications for future exercise interventions for osteoarthritis patients.

The study limitation may include that external events other than intervention components could not be controlled, either in the experimental groups or control group. Therefore, this study may involve threats to internal validity, such as history. The generalizability of the study findings is limited to patients diagnosed with osteoarthritis in rural areas of Korea. In addition, randomization was performed at the group level instead of the individual level. Hence, some of the pre-test scores were significantly different between the experimental and control groups. This study attempted to adjust those differences using statistical methods. The strengths of our study may include the selection of setting and target populations, theory-based intervention, and involvement of local health personnel. The study provided multifaceted intervention applying the IMCHB targeting the vulnerable population (elderly population who had a low education level) in rural areas of Korea, where healthcare resources are scarce. Furthermore, local CHNPs were included as interveners of the study after providing training of the trainers, which will promote their capabilities in the future delivery of healthcare services to local residents. In addition, a local physician was appointed as a consultant, which may have improved the intervention quality.

5 | CONCLUSIONS

This study examined whether eight sessions of multifaceted intervention were effective in promoting patient activation and physical functioning, and in decreasing joint pain, joint stiffness, and depressive symptoms among osteoarthritis patients. Based on the IMCHB, the intervention components included cognitive-affective-behavioral skill training and client-professional interaction. The intervention also included muscle strengthening/stretching (E1) or muscle strengthening/walking (E2) exercise. Using a cluster randomized controlled trial, this study found that both experimental groups had significantly improved joint pain, joint stiffness, and physical functioning after the intervention. Between the experimental groups, E2 with outdoor walking exercise showed better symptom scores in terms of joint pain and physical functioning than E1 at the post-test. Accordingly, multifaceted intervention incorporating individual counseling, group education, and exercise classes would alleviate the devastating symptoms that osteoarthritis patients experience, and in turn will enhance their quality of life.

Osteoarthritis is the one of the most prevalent chronic diseases among elderly people worldwide. Practitioners in a community setting could function as the advocators of elderly health and in the fair distribution of healthcare resources for the elderly population to provide multifaceted interventions for chronic disease management in addition to primary care services. Future studies will be needed to conduct a long-term evaluation of the multifaceted intervention applying a randomized controlled trial at the individual level.

ACKNOWLEDGMENTS

The authors wish to thank Dr. Eun-hee Choi for her statistical advice and the public health officers who provided the multifaceted intervention to the patients in the experimental groups.

CONFLICT OF INTEREST

Authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

Study design: YHA; data collection and analysis: YHA, OKH; and manuscript preparation: YHA, OKH.

AUTHORSHIP STATEMENT

We confirm that all listed authors meet the authorship criteria and that all authors are in agreement with the content of the manuscript.

ORCID

Ok Kyung Ham https://orcid.org/0000-0001-9063-4020

REFERENCES

Ahn, Y. H. (2015). Using intervention mapping to develop a community-based disease self-management support program for patients with osteoarthritis. *Journal of Muscle and Joint Health*, 22(3), 245–257. https://doi.org/10.5953/JMJH.2015.22.3.245

Ahn, Y. H., Kim, B. J., Ham, O. K., & Kim, S. H. (2015). Factors associated with patient activation for self-management among community residents with osteoarthritis in Korea. *Journal of Korean Academy of Community Health Nursing*, 26(3), 303–311. https://doi.org/10.12799/jkachn.2015.26.3.303

Ahn, Y. H., Kwon, M. S., Song, N. H., Yoon, O. S., Lee, S. Y., Lee, Y. R., … Hwang, I.Y. (2017). *Community and public health nursing*. Seoul, Korea: Hyunmoonsa.

Altman, R. D. (2010). Early management of osteoarthritis. *American Journal of Managed Care*, 16, S41–S47.

Bahadoran, P., Pouya, F., Zolaktaf, V., & Taebi, M. (2015). The effect of stretching exercise and walking on changes of blood pressure in nulliparous women. *Iranian Journal of Nursing and Midwifery Research*, 20(2), 205–210.

Chen, H., Zheng, X., Huang, H., Liu, C., Wan, Q., & Shang, S. (2019). The effects of a home-based exercise intervention on elderly patients with knee osteoarthritis: A quasi-experimental study. *BMC Musculoskeletal Disorders*, 20, 160. https://doi.org/10.1186/s12891-019-2521-4

Cho, G. Y., Paek, Y. K., & Kim, Y. H. (2013). Effects of Tai Chi exercise program for health promotion in middle aged women with osteoarthritis. *Korean Journal of Health Promotion*, 13(4), 148–155.

Cho, M. J., & Kim, K. H. (1993). Diagnostic validity of the CES-D (Korean version) in the assessment of DSM-III-R major depression. *Journal of Korean Neuropsychiatric Association*, 32(3), 381–399.

Choi, S. H. (2001). The effect of health promotion program on health of the clients with arthritis in primary health care center. *The Journal of Korean Community Nursing*, 12(2), 344–360.

Cox, C. L. (2003). A model of health behavior to guide studies of childhood cancer survivors. *Oncology Nursing Forum*, 30(5), E92–E99. https://doi.org/10.1188/03.ONF.E92-E99

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175–191.

Heller, A., Elliott, M. N., Haviland, A. M., Klein, D. J., & Kanouse, D. E. (2009). Patient activation status as a predictor of patient experience among Medicare beneficiaries. *Medical Care*, 47(8), 850–857. https://doi.org/10.1097/MLR.0b013e318197b661

Henriksen, M., Klokker, L., Graven-Nielsen, T., Bartholdy, C., Jorgensen, T. S., Bandak, E., … Bliddal, H. (2014). Association of exercise therapy and reduction of pain sensitivity in patients with knee osteoarthritis: A randomized controlled trial. *Arthritis Care & Research*, 66(12), 1836–1843. https://doi.org/10.1002/acr.22375

Hibbard, J. H., Mahoney, E. R., Stockard, J., & Tusler, M. (2005). Development and testing of a short form of the patient activation measure. *Health Services Research*, 40, 1918–1930. https://doi.org/10.1111/j.1475-6773.2005.00438.x

Hibbard, J. H., & Greene, J. (2013). What the evidence shows about patient activation: Better health outcomes and care experiences; fewer data on costs. *Health Affairs*, 32(2), 207–214. https://doi.org/10.1377/hlthaff.2012.1061

Hickman, R. L., Clochesy, J. M., & Alaamri, M. (2016). Validation of an interaction model of health behavior among adults with hypertension. *Western Journal of Nursing Research*, 38(7), 874–892.

Hickman, R. L., Clochesy, J. M., Pinto, M. D., Burant, C., & Pignatiello, G. (2015). Impact of a serious game for health on chronic disease self-management: Preliminary efficacy among community dwelling adults with hypertension. *Journal of Health and Human Services Administration*, 38(2), 253–275.

Hibbard, J. H., & Cunningham, P. J. (2008). How engaged are consumers in their health and health care, and why does it matter? *Research Brief*, 8, 1–9.

Kil, E. K., & Yang, J. O. (2012). Effects of indoor and outdoor exercise environments on bone mineral density and body composition in old woman. *Journal of Life Science*, 22(8), 1085–1091. https://doi.org/10.5352/JLS.2012.22.8.1085

Kim, Y., Choi, H., Han, J., Kim, J., & Kim, G. (2015). Aquatic exercise for the treatment of knee osteoarthritis: A systematic review & meta-analysis. *Journal of the Korea Academia-Industrial Cooperation Society*, 16(9), 6099–6111. https://doi.org/10.5762/KAIS.2015.16.9.6099

Kiranmayi, P., Ponmathi, P., & Sivakumar, V.P.R. (2016). Comparison of aerobic versus stretching exercise programmes on pain and menstrual symptoms in subjects with primary dysmenorrhea. *Journal of Women's Health Care,* 5(4), 1–5 Retrieved from https://www.omicsgroup.org/journals/comparison-of-aerobic-versus-stretching-exercise-programmes-on-pain-andmenstrual-symptoms-in-subjects-with-primary-dysmenorrhea-2167-0420-1000327.php?aid=78795 on March 21, 2017.

Kok, G., Bartholomew, L. K., Parcel, G. S., Gottlieb, N. H., & Fernandez, M. E. (2014). Finding theory- and evidence-based alternatives to fear appeals: Intervention mapping. *International Journal of Psychology*, 49(2), 98–107. https://doi.org/10.1002/ijop.12001

Korea Ministry of Government Legislation (2017). Special Act for Development of Farming and Fishing Villages. Retrieved from http://www.moleg.go.kr/main.html.

Lee, C. Y., & Cho, Y. H. (2012). Evaluation of a community health practitioner self-care program for rural Korean patients with osteoarthritis. *Journal of Korean Academy of Nursing*, 42(7), 965–973. https://doi.org/10.4040/jkan.2012.42.7.965

Lee, H. Y. (2006). Comparison of effects among Tai-chi exercise, aquatic exercise, and a self-help program for patients with knee osteoarthritis. *Journal of Korean Academy of Nursing*, 36(3), 571–580.

Lorig, K. R., Sobel, D. S., Ritter, P. L., Laurent, D., & Hobbs, M. (2001). Effect of a self-management program on patients with chronic disease. *Effective Clinical Practice*, 4(6), 256–262.

Majka, D. S., Lee, J. Y., Peprah, Y. A., Lipiszko, D., Friesema, E., Ruderman, E. M., & Persell, S. D. (2018). Changes in care after implementing a multifaceted intervention to improve preventive cardiology practice in rheumatoid arthritis. *American Journal of Medical Quality*, 34(3), 276–283. https://doi.org/10.1177/1062860618798719

Mosen, D. M., Schmittdiel, J., Hibbard, J., Sobel, D., Remmers, C., & Bellows, J. (2007). Is patient activation associated with outcomes of care for adults with chronic conditions? *Journal of Ambulatory Care Management*, 30(1), 21–29.

Park, J. H., & Kim, K. W. (2011). A review of the epidemiology of depression in Korea. *Journal of the Korean Medical Association*, 54(4), 362–369. https://doi.org/10.5124/jkma.2011.54.4.362

Radloff, L. S. (1977). A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1 (3), 385–401.

Riddle, D. L., Kong, X., & Fitzgerald, G. K. (2011). Psychological health impact on two-year changes in pain and function in persons with knee pain: Data from the osteoarthritis initiative. *Osteoarthritis and Cartilage*, 19(9), 1095–1101. https://doi.org/10.1016/j.joca.2011.06.003

Robbins, L., & Kulesa, M. G. (2012). The state of the science in the prevention and management of osteoarthritis. *American Journal of Nursing*, 112, S3–S11. https://doi.org/10.1007/s11420-012-9272-1

Roh, K. H., & Park, H. A. (2013). A meta-analysis of the effect of walking exercise on lower limb muscle endurance, whole body endurance and upper body flexibility in elders. *Journal of Korean Academy of Nursing*, 43(4), 536–546. https://doi.org/10.4040/jkan.2013.43.4.536

Seo, B. N., Ham, Y. L., & Ahn, Y. H. (2007). A study on the relationship between level of pain and depression in middle-aged women with chronic low back pain. *Journal of Muscle and Joint Health*, 14(2), 118–126.

Song, Q., Zhang, Q., Xu, R., Ma, M., Zhao, X., Shen, G., … Wang, Y. (2014). Effect of tai-chi exercise on lower limb muscle strength, bone mineral density and balance function of elderly women. *International Journal of Clinical and Experimental Medicine*, 7 (6), 1569–1576.

Stigler, S. M. (1997). Regression toward the mean, historically considered. *Statistical Methods in Medical Research*, 6(2), 103–114. https://doi.org/10.1191/096228097676361431

Wang, L., Zhang, Z., McArdle, J. J., & Salthouse, T. A. (2009). Investigating ceiling effects in longitudinal data analysis. *Multivariate Behavioral Research*, 43(3), 476–496. https://doi.org/10.1080/00273170802285941

White, D. K., Tudor-Locke, C., Zhang, Y., Fielding, R., LaValley, M., Felson, D. T., … Neogi, T. (2014). Daily walking and the risk of incident functional limitation in knee osteoarthritis: An observational study. *Arthritis Care & Research*, 66(9), 1328–1336. https://doi.org/10.1002/acr.22362

World Health Organization (2013). *Department of chronic disease and health promotion*. Retrieved from http://www.who.int/chp/topics/rheumatic/en.

Yi, S., Lee, H., & Woo, Y. (2008). Validity and reliability of the Western Ontario and McMaster universities osteoarthritis index (WOMAC)-VA3 .0 in hip and knee osteoarthritis patients. *Physical Therapy Korea*, 15(2), 20–29.

Zolnierek, K. B., & Dimatteo, M. R. (2009). Physician communication and patient adherence to treatment: A meta-analysis. *Medical Care*, 47(8), 826–834. https://doi.org/10.1097/MLR.0b013e31819a5acc

How to cite this article: Ahn YH, Ham OK. Evaluation of the Interaction Model of Client Health Behavior-based multifaceted intervention on patient activation and osteoarthritis symptoms. *Jpn J Nurs Sci*. 2020;17:e12306. https://doi.org/10.1111/jjns.12306