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Effectiveness of Home Health Care Service for Elders after Spinal Surgery

Jun, Myunghee[1] · Jung, Ji Young[2]

[1]School of Nursing, Daejeon University, Daejeon, Korea & University of Wisconsin-Milwaukee, Milwaukee, USA
[2]Department of Nursing, Wonkwang Health Science University, Iksan, Korea

Purpose: This study was done to evaluate effectiveness of home healthcare services (HHCS) specialized for elders who received spinal surgeries. **Methods:** A non-equivalent control group pre-post test quasi-experimental study was performed. HHCS was developed based on the Rice model of dynamic self-determination for self-care. For data collection, a control group (n=23) and an experimental group (n=23) were selected by matching age, BMI, pain, general characteristics and type of spine surgery. Measurement tools to evaluate uncertainty and knowledge were developed by the authors. The Numeric Rating Scale (NRS) and Japanese Orthopedic Association Back Pain Evaluation Questionnaire (JOABPEQ) were used to evaluate pain levels. Muscular strength in the legs was measured using a digital muscle tester and tape ruler. Questionnaires were used to evaluate disability in performing ADL and psychological distress levels. **Results:** The experimental group showed significant decrease in uncertainty (p=.028), increased knowledge (p=.038), and partially decreased pain (p=.003-.331). Partial muscle strength increased significantly (p=.021-.644). Disability in performing ADL and psychological distress in the experimental group decreased significantly compared to control group (p=.002, p=.004). **Conclusion:** Results indicate HHCS is an efficient home care nursing program for these elders. Further experimental studies with larger samples are required to confirm effects of HHCS.

Key words: Health services for the aged; Home care services; Pain; Knowledge; Muscle strength

INTRODUCTION

The elderly population in South Korea consists of 11.0% of the total population and shows a continuously increasing trend at a significant speed (Statistics Korea, 2011). Moreover, the population of elders who live alone will rapidly increase. According to the estimation of the Statistics Korea (2012), the population of elders over 65 who live alone was 34.2% in 2010 and will increase by up to 38.0% in 2035.

National Health Insurance Corporation (NHIC) (2011) reported that the number of general spinal surgery performed in 2010 was increased by 11.3% compared to the counterpart in 2009. Particularly, spinal surgery was the second-most-frequently-performed surgery among population over age 60. A huge amount of reimbursements by NHIC was made for the general spinal surgery for the elderly patients. With the rapid increase of the elderly population receiving spinal surgeries, they often face more difficulties and require more consideration than young adults after the surgeries (Deyo, 2007; Djurasovic, Glassman, Carreon, & Dimar, 2010).

Many authors suggested that uncertainty of the prognosis after spinal surgery is one of the major problems (Deyo, 2007; Harvey, 2005; Saban & Penckofer, 2007). Jun, Choi, and Lim (2010) reported that elderly patients expressed the feeling of uncertainty about the prognosis of the disease after performing an ethnographic study in 20 participants. They discovered that one of the major problems of the elderly patients after the surgery was lack of knowledge regarding self- care information at home, especially for the patients who have to manage post-operative therapeutically-applied back braces. In order to reduce the uncertainty

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Address reprint requests to : Jung, Ji Young
Department of Nursing, Wonkwang Health Science University, 344-2 Sinyong-dong, Iksan, 570-750, Korea
Tel: +82-63-840-1318 Fax: +82-63-840-1319 E-mail: jio110@wu.ac.kr
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of the patients suffering from persistent pain after the surgery, knowledge about the disease process and post-op management is required. The knowledge can be obtained by providing nursing educational interventions (Choi, Kim, Jun, & Jung, 2011; McClune, 2001).

Lumbar spinal stenosis is the most common cause of impaired ADL (Activities of daily living) performance in elders, which results in back and lower extremity pains that are especially severe in neurogenic claudication (Mekhail, Vallejo, Coleman, & Benyamin, 2012; Sobottke et al., 2012; Suri, Rainville, Kaliehman, & Katz, 2010). After surgery, patients experience worsened psychological distress because the improvement of symptoms including pain, muscle weakness and impaired ADL performance did not meet their expectations (Jun & Jung, 2010a).

Elders who need spinal surgery have limited access to preoperative information due to physical and psychological distress, and current rapid family structural changes in Korea (Jun et al., 2010). They need more time to learn about the post-operative self-care, especially mastering the psychomotor skills that may take a long time to learn.

Even though surgical interventions are performed to correct the structural problems of the degenerative diseases, pains the patients have cannot be completely eliminated. Patients often expect that the surgery will completely resolve problems because they took risks and paid high surgical costs (Deyo, 2007). The uncertainty about the efficacy and safety of innovative surgical interventions should be managed. Basically the unique role of home healthcare nurses is to help patients learn to improve their health and quality of lives (Rice, 2006). With their extensive support in education and resources, patients and caregivers can take good care of themselves at home (Rice). Most studies on exercise programs during hospitalization for elders who had undergone spinal surgeries have been conducted in the field of sport science or rehabilitation discipline (Nielsen, Jørgensen, Dahl, Pedersen, & Tønnesen, 2010; Yu & Kim, 2006). However, in the nursing literatures, there have rarely been studies which investigate the effect of the home health care services (HHCS) for elders following spine surgery.

Therefore, in order to relieve uncertainty in the elderly patients after spinal surgeries, HHCS is necessary to provide them with patient education, patient advocacy, spiritual & aesthetic communication and case management.

1. Aim of the study

In this research we concentrated on evaluating the effects of the home health care service (HHCS) specially tailored to the needs of elders who have undergone spinal surgery. The specific objective was to investigate the effectiveness of HHCS on the uncertainty, knowledge, pain, leg muscle strength, disability of performing ADL and psychological distress of the patient.

2. Theoretical framework

Based on the model of dynamic self-determination for self-care (Rice, 2006), we developed the HHCS for the study (Figure 1).

So it is assumed that health care providers can reduce the uncertainty of the patient by improving patients' awareness about their situation. The model of dynamic self-determination for self-care is based on the role of the home care nurses' role as facilitators. Rice (2006) believed that the home care nurses' role is that of a facilitator for patient self-determination of self-care through numerous strategies including patient education, patient advocacy, spiritual-aesthetic communication, and case management. According to Rice's framework of the home nurses' role as a facilitator, we constructed home care services for elders who have experienced spinal surgery in this study for the eventual purpose of reducing the uncertainty of those patients who take care of themselves at home after the surgery.

According to the model of dynamic self-determination, the effect of the home health nurse's intervention varies. Therefore, before designing the home health nursing service, the variables as motivational factors should be considered. These factors include age, body mass index (BMI), pain, general characteristics (gender, marital status, economic status, education level, religion and job) and related factors to spinal surgery (type of surgery and orthosis, operational level, symptoms and combined chronic diseases). Successful management of home care needs at home in this study is assessed by determining factors like uncertainty, knowledge regarding post-operative self-care, pain (Numeric rating scale[NRS], Japanese orthopedic association back pain evaluation questionnaire [JOABPEQ]), muscle strength, disability of performing ADL and psychological distress.

METHODS

1. Study design

In this study, we employed a non-equivalent control group pre-post-

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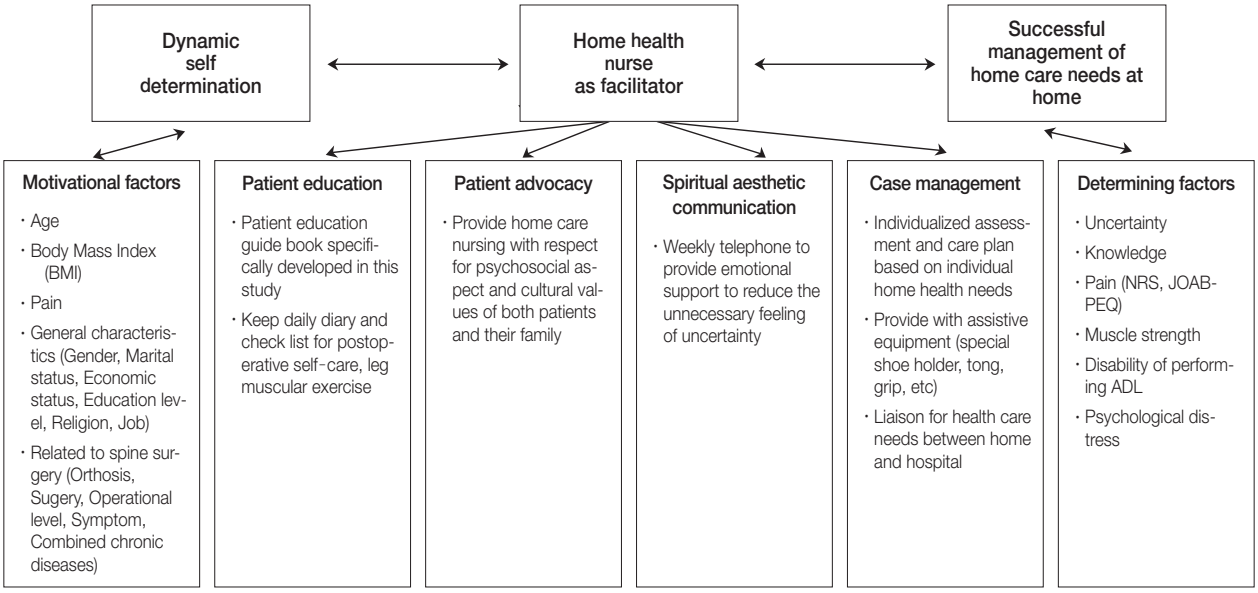

ADL = Activities of daily living; NRS = Numeric rating scale; JOABPEQ = Japanese orthopedic association back pain evaluation questionnaire.

Figure 1. Theoretical framework of this study based on Rice's model of dynamic self-determination.

test design using convenience samples.

2. Setting

This study was performed at a specialized clinic for spinal surgery located at one city, in Korea.

3. Sample

Elderly patients who were admitted to the clinic for spine surgery selected conveniently. Before starting the study, a letter in which the purpose of this study was explained was sent to the clinic and thus permission was received. Researchers went to the clinic and recruited the participants. Cohen's formula (1992) was used, where there are two groups, an alpha at .05 was set as the significant level, d = .80 for effect size, and .80 of statistical power (1–β). Sample size in each group was determined to be 26. Researchers contacted the participants in each group, and explained the study purpose. Informed consent was obtained from all participants. 45 patients were first enrolled to the control group and completed pre-test. Another 26 patients were recruited for the experimental group by matching with the age, BMI, pain, general characteristics, and the type of spine surgery. Total 23 pairs were successfully matched. 25 patients from control group and 3 patients from experimental group did not show up for follow-up care. With the final 23 sample size in each group (total 46 patients), statistical power (1–β) has been changed to .75.

MEASUREMENTS

1. Uncertainty

The instrument to assess uncertainty was developed in this study based on the clinical experience and literature review (Jun et al., 2010; Mishel, 1988). This was a self-report scale which employed a 5-point Likert-type scale with 12 questions. For example, the questionnaire included the process of pain, satisfaction level with symptoms, and procedure of physical exercise, prognosis of the disease and treatment, and ultimate of the outcome the surgery. Cronbach's alpha of the scale was .77 -.86 in this study.

2. Knowledge

The instrument used to measure knowledge regarding post-operative self-care following spinal surgery was developed for this study by authors. The instrument included 11 questions regarding post-operative home care after spinal surgery which were answered by placing yes or no next to each question. For example, patients were asked about the adequate posture, rest and exercise, keeping daily activities, caring of

back braces, expected symptoms and prognosis following surgery. The total score ranged from 0 to 11 points, with higher scores indicate greater knowledge. Reliability of the scale in this study was CR-20 = .68.

3. Pain

NRS and JOABPEQ was used for pain measurement. NRS score ranged from 0-10 with higher scores indicating greater pain. JOABPEQ was translated into Korean version by the authors (Fukui et al., 2009). Translated version was validated by confirming the original version with reverse translated version. It consisted of total 25 items related to back pain which consist of 5 domains: severity of lower back pain, level of impairment of lumbar function, walking abilities, social life function, and level of mental health. The range of the score for each domain is from 0 to100, with higher scores indicating a better condition. The five functional scores are used respectively. For evaluation between two groups, Fukui et al. recommends use of the statistics of Mann-Whitney U test excluding participants whose pretest and posttest scores both exceed 90 points from the analysis. Cronbach's alpha of the scale was .76-.90 in this study.

4. Leg muscle strength

In order to measure the strength of upper leg (thigh) muscle, mid-thigh circumference, muscle strengthening power of Quadri and Hamstring muscle were measured using a digital muscle tester (AP1110, USA). In addition to these, a ruler (Cm) was used for mid-thigh circumference.

5. Disability of performing ADL

This scale was developed for elders undergone spinal surgery by Jun and Jung (2010a) which measures how they have difficulties in performing ADL while they have to keep on wearing spinal orthosis (back brace) after surgery at home. The instrument employed a 3-point Likert-type scale with 10 questions. The total score range was from 10 to 30, with higher scores indicating a higher disability of ADL. The Cronbach's alpha was .84 in this study.

6. Psychological distress

This scale was developed for the elderly undergone spinal surgery by Jun and Jung (2010a). The instrument originally included ten questions which measure the subjective distress at home after spinal surgery. In this study, only 9 questions were selected from the original. The instrument employed a 3-point Likert-type scale. The total score range was from 9 to 27, with higher scores indicating a higher psychological distress. The Cronbach's alpha is .73 in this study.

The face validity of each instrument of uncertainty, knowledge, disability of performing ADL and psychological distress was verified by clinical nurses, physicians, and PhD holders in the study of nursing all of whom are experts in spinal surgery.

PROCEDURE

Rice's model, dynamic self-determination for self-care, was used to guide the role of home care service. Content of the service was constructed according to the facilitator's role suggested by Rice (2006) (Figure 1). HHCS developed in this study can be summarized: a) Patient education including patient guide book which was developed for this study (Jun & Jung, 2010b), daily check list and diary for postoperative self-care, and leg muscular exercise (Jung, 2010). b) Patient advocacy including providing home care nursing with respect for psychosocial aspect and cultural values of both patients and their family. c) Spiritual & aesthetic communication including weekly telephone counseling and providing emotional support to reduce uncertainty. d) Case management including individualized assessment, care plan and providing with assistive equipment (shoe holder, tong, grip, liaison for health care needs between home and hospital, etc.) based on individual home health needs.

Control group's pre and post-test data were collected at 6-week intervals. This service was provided to the experimental group from the admission until the 6th week after surgery. The control group was provided with routine follow-up care at out-patient clinic. The experimental group's pre and post-test data were collected before and after home health care service. Pre-test included uncertainty, knowledge, pain (NRS, JOABPEQ) and muscle strength. Post-test includes pre-test measurements, disability to perform ADL, and psychological distress.

HHCS was performed by three advanced practitioner nurses (APNs) who include 1 home healthcare APN and 2 gerontologic APNs. They provided the patients and their family with pre-discharge education, 2 times of home visiting care and weekly telephone calls in accordance with the protocol developed in this study based on Rice's model (Figure 1).

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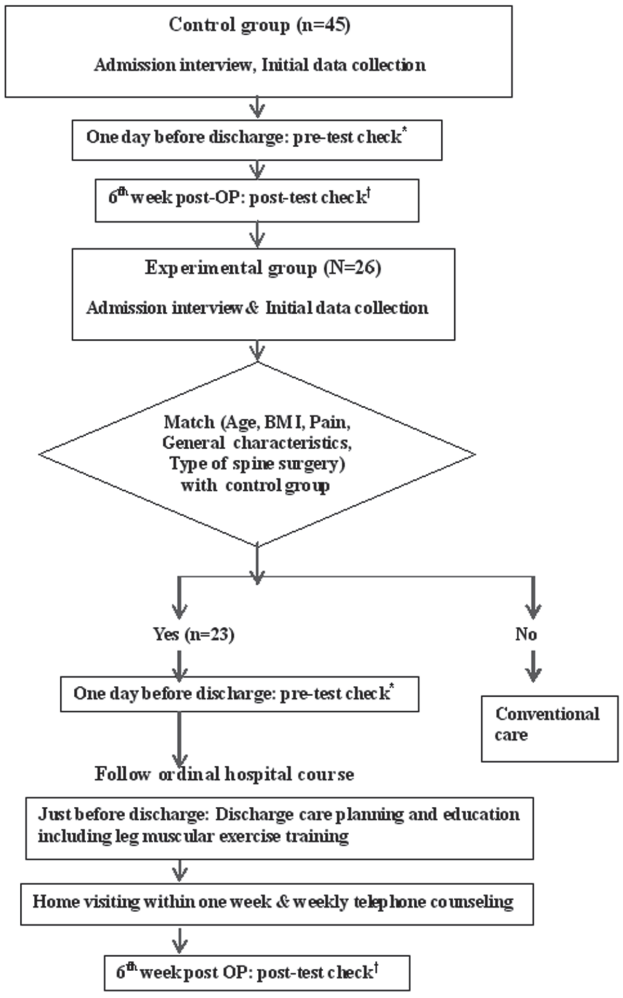

* Pre-test measures uncertainty, knowledge, pain, leg muscle strength, leg muscular exercise training and demonstration
† Post-test measured uncertainty, knowledge, pain, leg muscle strength, disability of performing ADL, psychological distress.
OP=Operation; BMI=Body mass index; ADL=Activities of daily living.

Figure 2. Flow of study procedure.

ANALYSIS

Predictive Analytics Software (PASW) statistics version 18 (SPSS Inc., Chicago, Illinois, USA) was utilized to analyze the data. Demographic characteristics were analyzed using the mean, the standard deviation and frequencies. Differences between groups were evaluated by Mann-Whitney U test, χ^2-test and Fisher's Exact test.

ETHICAL CONSIDERATION

This study was approved by a research review board of a university hospital in Korea (No. DJOMC-65). The purpose, procedure and anonymity policy were explained to all participants prior to starting the program and informed written consent was obtained from each participants. Each participant was informed that he or she had a right to drop from the program at any time during the experiment. Small rewards including an educational book and a shoe holder were given to each participant.

RESULTS

1. Demographic characteristics and homogeneity

Mean age of the control group was 69.04±5.27 year and, that of experimental group was 69.09±5.60 year. Mean BMI of the control group was 23.54±2.78 and, that of experimental group was 24.47±3.68. Total period of having pain history was 1,440.83±3,682.75 days in control group and, 1,185.13±2,352.81 days in experimental group. Both groups consisted of 65.3% women. In both groups, 74.0% have been married, 47.8% were in low economic status. Ratio of the patients who had Thoraco Lumbar Spinal Orthosis (TLSO) was 39.2% in control group, 34.8% had TLSO in experimental group. In both groups, 34.8% had the surgery of decompression and fusion. No significant differences were found in all the general characteristics and characteristics related to the spinal surgery ($p>.05$) (Table 1).

2. Homogeneity of dependent variables

The results of a Mann-Whitney U-test showed that there were no differences in uncertainty ($Z=-1.18$, $p=.235$), knowledge ($Z=1.36$, $p=.173$), level of pain, NRS ($Z=-0.82$, $p=.411$), and JOABPEQ ($Z=-1.63$--0.12, $p>.05$) between two groups. Also all the parameters related to leg muscle strength tests were not significantly different between two groups ($p>.05$) (Table 2).

3. Effectiveness of the home health care service

The changes in the variables utilized to measure the effectiveness of the home health care services are presented in Table 3.

The uncertainty of control group from pre-test to post-test was increased from 32.26±6.44 to 33.52±6.72, and that of experimental group was decreased from 29.73±6.91 to 25.56±6.81. These changes between two groups were significantly different ($Z=2.19$, $p=.028$).

Table 1. Homogeneity Test of Age, BMI, Pain, General Characteristics and related to Spine Surgery between Control and Experimental Groups (*N*=46)

	Variables	Categories	Exp. (n=23) M±SD or n (%)	Cont. (n=23) M±SD or n (%)	Z or χ^2	*p*
Age (year)			69.09±5.60	69.04±5.27	0.17	.939
BMI			24.47±3.68	23.54±2.78	-0.88	.379
Pain	Period of pain before surgery (day)		1,185.13±2,352.81	1,440.83±3,682.75	-0.34	.733
	Hospitalization period (day)		14.39±6.02	14.39±6.65	-0.22	.826
	Duration of surgery (hour)		2.36±1.19	2.27±0.93	0.45	.648
General characteristics	Gender	Female	15 (65.3)	15 (65.3)	0.00	1.000
		Male	8 (34.7)	8 (34.7)		
	Marital status	Married	17 (74.0)	17 (74.0)	0.00	1.000
		Divorce or bereaved	6 (26.0)	6 (26.0)		
	Economic status	Lower	11 (47.8)	11 (47.8)	1.51	.470
		Middle	5 (21.8)	8 (34.8)		
		High	7 (30.4)	4 (17.4)		
	Education level	No formal education	4 (17.4)	7 (30.4)	1.10	.577
		Elementary school	10 (43.5)	8 (34.8)		
		≥ Middle school	9 (39.1)	8 (34.8)		
	Have religion	Yes	17 (73.9)	13 (56.5)	1.53	.216
		No	6 (26.1)	10 (43.5)		
	Have a job	Yes	15 (65.2)	14 (60.9)	0.09	.760
		No	8 (34.8)	9 (39.1)		
Related to spine surgery	Type of orthosis	TLSO	8 (34.8)	9 (39.2)	0.10	.952
		LSO	13 (56.5)	12 (52.1)		
		Girdle	2 (8.7)	2 (8.7)		
	Type of surgery	Decompression	4 (17.4)	5 (21.7)	0.60	.963
		Deompression+fusion	8 (34.8)	8 (34.8)		
		Decompression+disectomy	3 (13.0)	2 (8.7)		
		Disectomy	6 (26.1)	5 (21.7)		
		Kyphoplasty	2 (8.7)	3 (13.0)		
	Operational level	1 level	16 (69.6)	18 (78.3)	0.45	.502
		More than 2 level	7 (30.4)	5 (21.7)		
	Major symptom before surgery*	BP	2 (8.7)	2 (8.7)	3.04	.922
		RLLP only	1 (4.3)	1 (4.3)		
		NIC	1 (4.3)	0 (0.0)		
		BP+RLLP	2 (8.7)	4 (17.4)		
		BP+NIC	1 (4.3)	1 (4.3)		
		RLLP+NIC	4 (17.4)	6 (26.1)		
		BP+RLLP+NIC	12 (52.3)	9 (39.2)		
	Have chronic diseases	Yes	16 (69.6)	18 (78.3)	0.45	.502
		None	7 (30.4)	5 (21.7)		

Exp.=Experimental group; Cont.=Control group; BMI=Body mass index; TLSO=Thoraco lumbo sacral orthosis; LSO=Lumbo sacral orthosis; BP=Back pain; RLLP=Radiating lower legpain; NIC=Neurogenic intermittent claudication.
*Fisher's exact test.

In control group, the knowledge score was increased from pre-test 5.04±2.01 to post-test 5.47±2.10. Also in experimental group, post-test score 7.91±1.64 were much more increased from pre-test 5.86±1.57. These difference of knowledge score between two groups was statistically significant ($Z=-2.07$, $p=.038$).

Differences of NRS pain score measured between pre-test and post-test of HHCS were 2.54±3.43 in experimental group, and 1.78±3.51 in control group. This difference between two groups was not significant ($Z=0.54$, $p=.589$). Among JOABPEQ, all the scores of five subscales of the experimental group were increased more from the pre-test to post-test than those of the control group. Walking ability, social life function and the mental health score showed significant differences between two groups ($p<.05$), but lower back pain and lumbar function were not.

Muscle strength was measured by power and circumference. Muscle strengthening power was increased in the post-test of the experimental group than in the pre-test, but decreased in the post-test of control

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Table 2. Homogeneity Test of Dependent Variables before Discharge between Control and Experimental Groups (N=46)

Variables	Categories		Exp. (n=23) M±SD	Cont. (n=23) M±SD	Z	*p*
Uncertainty			29.73±6.91	32.26±6.44	-1.18	.235
Knowledge			5.86±1.57	5.04±2.01	1.36	.173
Pain	Pain (NRS)		4.48±2.53	5.00±2.08	-0.82	.411
	JOABPEQ*	Lower back pain	31.67±26.18	27.21±22.08	-0.32	.746
		Lumbar function	42.39±11.49	42.85±13.76	-0.29	.774
		Walking ability	25.15±22.26	16.32±23.91	-1.63	.102
		Social life function	19.74±17.00	22.90±22.37	-0.12	.906
		Mental health	43.68±22.45	46.32±22.93	-0.25	.805
Muscle strength	Muscle strengthening power (Lb)	RQM	61.72±12.30	65.91±13.97	-1.10	.272
		LQM	61.55±13.44	66.37±15.51	-1.37	.170
		RHM	55.02±8.13	59.06±11.90	-1.05	.291
		LHM	55.76±9.60	59.38±13.61	-0.86	.385
	MTC (cm)	Right	38.28±3.49	36.66±3.87	1.47	.141
		Left	37.98±3.14	36.33±3.67	-1.45	.147

*2 cases of the control group were removed because total score were exceeded 90.
Exp.=Experimental group; Cont.=Control group; NRS=Numeric rating scale; JOABPEQ=Japanese orthopedic association back pain evaluation questionnaire; RQM=Right quadriceps muscle; LQM=Left quadriceps muscle; RHM=Right hamstring muscle; LHM=Left hamstring muscle; MTC=Mid thigh circumference.

group than in the pre-test. These differences from pre-test to post-test between two groups were significantly different except for left quadriceps muscles ($p<.05$). Only left mid-thigh circumference (MTC) of the experimental group has increased from pre-test to post-test, but the amount of decrease in the control group is bigger than in the experimental group. These changes between two groups were not significant.

On the 6th week after surgery, disability of performing ADL of control group (Mean=29.60) was significantly higher than that of experimental group (Mean =23.91) ($Z=-2.90$, $p=.004$). Also psychological distress of control group (Mean =21.26) was significantly higher than that of experimental group (Mean =16.65) ($Z=-3.25$, $p=.002$).

DISCUSSION

It has already been over 20 years since home health care advanced practitioner nurse (APN) system was established in Korea, however, disease-centered care or special nursing care for the elderly patients has yet to be developed. This study constructs HHCS to provide effective home care with the elderly who need individual care following spinal surgery. HHCS employed the structure of the model of dynamic self-determination for self-care (Rice, 2006) as well as interventions by three APN to deliver the service to patients. As Lee (2007) stated that home visiting nurses' capacity is the most crucial to carry out the job successfully in his research on satisfaction level with home care service, the structure and the contents of the healthcare education provided by home health care APNs continuously supported patients and reflected patients' needs at home.

This model originally focused on the individual patient needs. Its purpose was for the patient to successfully manage healthcare needs at home without the presence of professional health care providers. In this model, a major role of a home care nursing is the facilitator of patient home independence, not a direct caregiver. HHSC was found to be effectual in increasing the level of the post-operative knowledge and in lessening the patients' burden of uncertainty.

When Jun et al. (2010) observed the elderly patients after spinal surgery at home, they reported that the patients often experienced uncertainty before they receive a spinal surgery. Since the ultimate goal of the spinal surgery is to prevent further nerve damage which may lead to paralysis rather than to cure an ailment, their pain may not be relieved even after the surgery not meeting the expectation they had prior to the surgery. They are often disappointed and suffer from the feelings of uncertainty about the ongoing prognosis (Saban & Penckofer, 2007). In this study, the level of uncertainty of the experimental group resulted to show a significant reduction compared to the control group. It showed that the patient education on home health care nursing was effectual in lessening the level of uncertainty by increasing the knowledge level. We think the most important component of HHCS to result in this effect was that professional home healthcare nurses' visiting patients' homes, assessing the patients' needs and directly provided the nursing interventions which they had hoped to have. For example, we educated the same leg exercise as Jung (2010)'s study.

Table 3. Effects of Home Health Care Service on Uncertainty, Knowledge, Pain, Muscle strength, Disability of Performing ADL and Psychological Distress (*N*=46)

Variables	Categories			Exp. (n=23) M±SD	Cont. (n=23) M±SD	Z	*p*
Uncertainty			Pretest	29.73±6.91	32.26±6.44		
			Posttest	25.56±6.81	33.52±6.72		
			Pretest-posttest	4.17±8.68	-1.26±6.66	2.19	.028
Knowledge			Pretest	5.86±1.57	5.04±2.01		
			Posttest	7.91±1.64	5.47±2.10		
			Pretest-posttest	-2.04±2.65	-0.43±2.76	-2.07	.038
Pain	Pain (NRS)		Pretest	4.48±2.53	5.00±2.08		
			Posttest	1.93±2.02	3.22±2.79		
			Pretest-posttest	2.54±3.43	1.78±3.51	0.54	.589
	JOABPEQ*	Lower back pain	Pretest	31.67±26.18	27.21±22.08		
			Posttest	63.97±25.79	48.97±31.15		
			Pretest-posttest	-32.29±31.12	-21.76±34.58	-0.97	.331
		Lumbar function	Pretest	42.39±11.49	42.85±13.76		
			Posttest	56.88±18.05	50.79±16.64		
			Pretest-posttest	-14.49±16.51	-7.93±17.57	-1.24	.214
		Walking ability	Pretest	25.15±22.26	16.32±23.91		
			Posttest	67.39±28.31	38.77±31.09		
			Pretest-posttest	-42.23±32.72	-22.44±28.41	-2.02	.044
		Social life function	Pretest	19.74±17.00	22.90±22.37		
			Posttest	49.23±26.12	33.97±29.09		
			Pretest-posttest	-29.49±22.30	-11.06±27.92	-2.27	.023
		Mental health	Pretest	43.68±22.45	46.32±22.93		
			Posttest	61.20±19.72	40.45±28.38		
			Pretest-posttest	-17.51±26.86	5.87±15.58	-2.96	.003
Muscle strength	Muscle strengthening power (Lb)	RQM	Pretest	61.72±12.30	65.91±13.97		
			Posttest	67.08±9.84	60.42±10.93		
			Pretest-posttest	-5.36±15.13	5.49±14.82	-2.30	.021
		LQM	Pretest	61.55±13.44	66.37±15.51		
			Posttest	67.80±13.18	63.78±13.46		
			Pretest-posttest	-6.24±7.54	2.58±15.45	-1.74	.081
		RHM	Pretest	55.02±8.13	59.06±11.90		
			Posttest	60.03±9.98	56.07±7.75		
			Pretest-posttest	-5.01±11.09	2.98±11.92	-2.03	.042
		LHM	Pretest	55.76±9.60	59.38±13.61		
			Posttest	61.05±10.63	56.75±8.95		
			Pretest-posttest	-5.29±13.20	2.63±13.05	-1.91	.050
	MTC (cm)	Right	Pretest	38.28±3.49	36.66±3.87		
			Posttest	38.27±2.88	36.45±3.82		
			Pretest-posttest	0.01±1.51	0.20±1.64	-0.46	.644
		Left	Pretest	37.98±3.14	36.33±3.67		
			Posttest	38.12±2.80	35.96±3.52		
			Pretest-posttest	-0.13±4.54	0.36±1.53	-1.23	.217
Disability in performing ADL			Posttest	23.91±6.43	29.60±6.38	-2.90	.004
Psychological distress			Posttest	16.65±3.79	21.26±5.64	-3.25	.002

*2 cases of the control group were removed because total scores exceeded 90.
Exp.=Experimental group; Cont.=Control group; NRS=Numeric rating scale; JOABPEQ=Japanese orthopedic association back pain evaluation questionnaire; RQM=Right quadriceps muscle; LQM=Left quadriceps muscle; RHM=Right hamstring muscle; LHM=Left hamstring muscle; MTC=Mid thigh circumference; ADL=Activities of daily living.

This study showed that HHCS was effective in increasing the knowledge level of the patients, which was considered to be effective in reducing the patients' feelings of uncertainty about their post-operative prognosis. We think that the result was gathered by providing deliberately designed educational materials on home health care after their discharge. Generally, standard educational tools were designed and developed for young adult patients. Most of educational materials in hospitals for patients were printed in small font and contained numerous medical jargons, making

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it difficult for the elderly patients to understand (Jun & Jung, 2010b).

Also, in the cases where elderly patients are faced with having a big surgery, most of the decision making related to treatment and pre- and post-operative education were heavily dependent on their grown-up children. While performing this study, we observed that most of the elderly patients' families hired privately contracted caregivers, who had the responsibilities of most post-operative care for the elderly patients during hospitalization. Consequently, the health care educational information provided to the family members could not be delivered directly to the elderly patients. Also, many of the elderly patients had to face the difficulties of taking care of themselves after discharge. Since they were not actively involved in health education during the hospitalization period, they were not fully aware of how to perform the post-operative home health care for themselves (Jun et al., 2010). Therefore, the end result is a circumstance of imposing additional uncertainty and emotional frustration to the elderly patients, something that no patient should have to endure.

In this study, the HHCS showed that it was capable of reducing post-operative uncertainty, pain, and limitations of daily living activities, psychological distress and which resulted in an increase of muscle strength of lower extremities and greater knowledge for the elderly patients. The HHCS program consisted of facilitative activities by including patient education, patient advocacy, spiritual & aesthetic communication and case management based on the Rice's model (Rice, 2006).

While Jung (2010) studied the effect of her exercise program during patients' hospitalization periods, our program started one day prior to patients' discharge and continued at home for the following 4 weeks. In our study, patients were reinforced by following-up care through telephone counseling and home visiting nurses. When Jung followed-up the patients for four weeks after the operation, leg muscular strengthening exercises showed positive effects on the circumference of thighs and muscular strength of quadriceps femoral muscles of the patients. However, muscular strength of hamstrings, pain and disability of daily living activities of the experimental group did not show statistically significant differences when compared to the control group. In our program, the leg muscle strength revealed a significant increase in the experimental group. But, the mid-thigh circumference was not significantly increased as it was in the study of Jung. We think that the result is related to the fact that many of the patients in our study suffered from post-operative inflammatory edema, which was found to be especially severe in the patients who underwent the PLIF (posterior lumbar intervertebral fixation) surgery. So, we recommend researchers to be cautious of using mid-thigh circumferences as an outcome indicator of a leg muscle strengthening exercise.

In this study, HHCS did not show significant effects on relieving the level of NRS score and sum dimension of JOABPEQ. But, the scores related to the walking ability, social life function and mental health of the JOABPEQ resulted to show a significant improvement. Nielsen et al. (2010) found that the post-operative hospital stay with less complications, functionality, and satisfaction without pain in sixty patients improved by providing an integrated program of inpatient rehabilitation for degenerative lumbar disease. Like Nielsen et al. early initiated rehabilitation education including leg muscle strengthening exercise before discharge and its reinforcement through home health care service was effective in improving self-care abilities of the patients at home.

In fact, most of the authors were not successful in reducing the patients' back pain after the surgery (Mekhail, Vallejo, Coleman, & Benyamin, 2012; Nielsen et al., 2010). Although the goal of the spinal surgery is to prevent further nerve damage that may eventually lead to paralysis and disabilities, patients expect complete back pain disappearance by receiving a spinal surgery. Therefore, the patients are often disappointed after realizing that the pain reduction is not accomplished to the degree in which they expected (Jun & Jung, 2010a; Lee & Lee, 2000; Lee, 2004). As our data showed, HHCS may be effective in elevating the levels of walking ability, social life function and mental health, but may not be significantly effective in relieving the level of the pain. The HHCS did not significantly reduce the level of the physical pain. Nevertheless, it is noteworthy that our service showed significant effects in promoting walking and socio-psychological functions and limited lower back pain. We think that this result was gathered by the informational and psychological support of HHCS.

Even though we could not perform our study in a randomized controlled experimental design, we tried to attain homogeneous characteristics between control and experimental group through matching with major confounding factors like age, BMI, Pain, general characteristics and related to spine surgery. Furthermore, nurses delivering HHCS were not involved in measure outcome variables in minimizing the hollow effect. We think that these efforts lead to show the successful effect of HHCS without interference of the confounding variables. But, in terms of the measurement, some questionnaires on psychosocial distress and uncertainty did not have strong reliabilities. Also, further studies are considered to be needed to develop more effective programs with larger timeframes and a greater degree of interaction between educators and participants.

CONCLUSION

In this study we tested the effectiveness of HHCS provided by home healthcare APNs for the eldery who had undergone spinal surgery. HHCS consisted of 4 distinctive roles of the home healthcare nurses based on Rice's model. Using a non-equivalent control group pre-post-test design, this study found that the program was significantly effective in reducing the level of uncertainty, the level of pain in some aspects, disability of performing ADL and psychological distresses by increasing both the knowledge level of post-operative self-care at home and the muscular strength of the legs.

Conclusively, we found potentials of home care nursing to increase the welfare of elders who have had spinal surgery. Integrated HHCS based on Rice's model would allow home care nurses to provide profound and practical home healthcare. However, there is still room for further improvement of the research outcome. Further high quality experimental studies with larger sample sizes are needed to confirm the effectiveness of this program. Also we recommend that home health care service be provided by advanced practitioner nurses for more successful outcomes, and HHCS program be incorporated in the home care practices and home care nursing educational curriculum.

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