

Brief communication (Original)

Post-surgical physical activity enhancing program for elderly patients after hip fracture: a randomized controlled trial

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Background: Hip fracture seriously influences an elderly person's life and mobility, independent living, and causes earlier mortality. Although surgery is generally successful, many of the elderly suffer from decreased physical ability after surgery for hip fracture.

Objectives: To determine the effects of a physical activity enhancing program (PEP) on the level of physical activity of elderly patients after surgical treatment of hip fracture.

Methods: A randomized controlled trial of 46 elderly patients was conducted at King Chulalongkorn Memorial Hospital from January 2012 to February 2013 to evaluate the effectiveness of the Resnick self-efficacy model (2009) compared with standard care in improving physical activity. The participants were enrolled on a criteria basis and were block randomized into two groups. The intervention group attended four phases of physical training and efficacy based intervention comprising assessment, preparation, practicing, and evaluation phases with face-to-face contact and five telephone calls during seven weeks post-surgery.

Results: Six weeks after discharge, the physical activity of the intervention group increased by significantly more than the control group ($F_{1,43} = 9.63$, $P < 0.01$), with an effect size of 0.18 after controlling for preoperative physical activity. The ratio of the effect on physical activity induced by the PEP was higher than that induced by usual care (65.2% vs. 47.8%).

Conclusion: PEP is effective at improving physical activity. Efforts to follow up for longer periods and with studies using larger populations are recommended.

Keywords: Elderly patients, physical activity, physical activity enhancing program

Hip fracture prevalence increases exponentially with age; with world incidence rising each year, from 1.7 million people in 1990 to an projected estimate of 6.3 million by 2050 [1]. An estimated 25%–75% of those that are independent before their fracture can neither walk independently nor achieve their previous level of independent living within 1 year following their fracture [2]. Five percent to 12% of hip fracture patients discharged to a postacute care facility are readmitted to the hospital within 6 weeks [3]. Eighteen to 33% of these older hip fracture patients will die within the first year of their fracture [4, 5]. More than half of people, that return to living in the community after hip fracture, report having at least one fall in 6 months after injury [6].

Rehabilitation programs after hip surgery, include physical therapy and daily life activity practice (early ambulation, transfer, and practicing activities of daily living [ADLs]). They are necessary for elderly patients to regain physical performance and prevent further disability. The lack of exercise and engaging in physical activity may result in postoperative (PO) complications of muscle weakness, muscle imbalance, pain, and joint stiffness [7]. These complications affect the physical performance of elderly patients, increase mortality, and create other health problems and substantial disability, including osteoporosis and further falling, perhaps resulting in new hip fracture [8-12].

It is estimated that moderate or high physical activity levels will result in increasing a person's total life expectancy by 1.3 and 3.7 years respectively [13]. A prospective study with a follow up of 18.4 years [14] has shown that occupational and leisure-time physical activity reduced the risk of total and

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cardiovascular mortality among Finnish subjects, 25 to 74 years of age with type II diabetes. The multivariate adjusted hazard ratios associated with low moderate, and high leisure-time physical activity were 1.00, 0.82, and 0.71 ($P < 0.01$) for total mortality and 1.00, 0.83, and 0.67 ($P < 0.05$) for cardiovascular disease mortality.

The American College of Sports Medicine (ACSM) and the American Heart Association (AHA) [15] recommend that all elderly people should be encouraged to engage in at least 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week. Particularly, the ACSM position stand (2009) recommends that muscle-strengthening activities and/or balance training may need to precede aerobic training activities among very frail individuals and should be performed 2 days/week [16]. Examples of moderate-intensity physical activities include stair walking for 15 minutes, bicycling 5 miles in 30 minutes, walking 3/4 miles in 35 minutes, or raking leaves for 30 minutes. These activities can be divided throughout the day. For example, walking for ten minutes three times a day would meet the required 30 minutes of moderate-intensity physical activity a day, then adding the time spent during each of these bouts: e.g. 30 minutes of moderate-intensity activity 5 times per week [17].

Despite the well-known benefits of being physically active, there is commonly inadequate physical activity in elderly patients after hip fracture surgery. There are reports of much reduced levels of physical activity in this group at home and in their community and in leisure-time activities compared with their prefracture performance [18–22]. They spent only 3.4 hours/day upright after 3 weeks post-discharge [18]. After 2 months, they spent only $3.6 \text{ min} \pm 8.9/48$ hours in moderate-intensity physical activity [21]. On the basis of these findings under conditions of usual hip fracture care, it is important to identify novel interventions that older patients will perform regular as physical activity post hip fracture surgery.

A literature review was conducted by Lee et al. [23], using self-efficacy theory to develop interventions that could help older people to overcome psychological barriers to physical activity. One of the most widely-accepted interventions is self-efficacy based, known as the Exercise Plus Program (EPP). This is an innovative approach to motivating older women to exercise. It addresses all four mechanisms including performance achievement, verbal persuasion,

physiological feedback, and vicarious experience, and focuses specifically on strengthening outcome expectations and self-efficacy expectations [24]. One study [25] found that participants in home-based exercise programs for post-hip fractures reported more time spent in exercise activities during follow-up at 2 months after fracture, mean = 0.59 hours (95% CI, 0.15–1.33 h), at 6 months after the fracture, with a mean = 0.77 hours (95% CI, 0.03–1.50 h), and at 12 months after fracture, with the mean = 0.68 hours (95% CI, 0.05–1.41 h). An EPP for elderly with hip fracture post-surgery will produce clinically important benefits. However, the intervention reviews did not demonstrate strong efficacy [26].

Low physical activity levels are a cause of poor general outcomes after hip fracture. By contrast, self-confidence building is acknowledged as being important for elderly people in recovering from a hip fracture, given the limited availability of studies on the effectiveness of previous interventions in hip fracture patients, we developed a physical activity enhancing program (PEP) for improving physical activity, particularly focused on postoperative patients, who had the most prominent problems with poor outcomes.

Materials and method

Participants

A randomized controlled trial was conducted at King Chulalongkorn Memorial Hospital from January 2012 to February 2013; 46 patients were included in this study, which was approved by The Research Ethics Committee of Faculty of Medicine, Chulalongkorn University. Written informed signed consent was obtained from each participant. All patients were from 60 to 93 years of age and diagnosed with femoral neck fracture (28), intertrochanteric fracture (12), or subtrochanteric fracture (6). The sample size was calculated based on the significant criteria that was set = 0.05 and power = 0.90 by using G*power version 3.1.10 software. In previous studies reported by Resnick et al., the effect size (SMD) was 0.72 [27]. When the power is 90%, the α is 0.05, and the number of groups is 2, $\lambda = s(h) * N * f^2 = 11.92$, the numerator $df = 1 * n = 1(1) = 1$, and the denominator $df = s * [N - (k + q) - p + s] = 21$, a total sample size of $23 \times 2 = 46$ participants would be needed [28].

We used a simple block randomization technique with a coin flip to assign subjects into an intervention group (23 participants comprising 5 men and 18 women) that received usual standard care plus a

physical activity enhancing program, or the control group (23 participants comprising 9 men and 17 women) that received only usual standard care. Subjects were randomly assigned to either the control or intervention groups. They were informed before the intervention that they would be assigned to either group, but there was no way for them to know whether the intervention group would have a better outcome than the control group.

A physical activity enhancing program (PEP)

The PEP was a physical training component, based on Exempla Healthcare [29], American Academy Orthopedic Surgeons [AAOS] [30] and efficacy-based intervention, based on Resnick's theory of self-efficacy [31], with appropriate methods and existing resources to enhance physical activity. Efficacy expectations were dynamic and were both appraised and enhanced by four mechanisms: performance accomplishment, verbal persuasion, role modeling, and physiological feedback. The efficacy-based intervention was a process of personal regulation of goal-directed behavior or performance and was manifested by goal setting, reinforcements, self-monitoring, corrective self-reactions, and determination to reach the desired outcomes. Once goals were established, self-efficacy and outcome expectations played an influential role in the adoption and maintenance of physical activity behavior [24, 32].

This program was composed of four phases that covered five sessions of implementation within 7 weeks post-hip surgery, combining both phone calls and face-to-face interaction. The first phase, the assessment phase, aimed to assess existing self-efficacy and outcome expectations for physical activity and being ready to change physical activity. The second phase, preparation for strengthening self-efficacy and outcome expectations for physical activity, offered individual education and training in structural exercise and daily life physical activity and the benefits of regular given behaviors, verbal encouragement by credible sources, seeing others' experience and visual cueing (physical activity after hip fracture booklet, poster, and flipbook), and short and long term goal setting. The third phase, practice for strengthening self-efficacy and outcome expectations, involved every-day workouts of structural exercise and daily-life physical activity [29, 30], re-evaluating goal setting, self-monitoring, and reinterpretation and control of unpleasant sensations

associated with physical activity. The fourth phase, evaluation of physical activity behaviors, involved the energy expenditure of physical activity. The participants in the control provided their personal data and information about their physical activity level at baseline, 6 weeks after being discharged from the hospital, and received the physical activity for hip fracture booklet and a flip book and poster when they followed-up at the clinic after program termination.

Data collection

The demographic data (age, gender, socioeconomic status, and education), cognitive condition, and prefracture physical activity were collected at baseline. Information on physical activity was collected at 6 weeks after discharge. The amount of physical activity was expressed as an estimate of total energy expenditure in physical activity. The performance was measured over the previous 7 days using the total scores of the summation of duration and frequency of four domains of activities: leisure time activities, transportation, household activity, and job-related physical activity and walking in three domains: leisure time activities, transportation, and job-related physical activity using the International Physical Activity Questionnaire (long form IPAQ-L) [33].

Data analysis

Data were presented as mean value standard deviation (SD). Statistical analyses were carried out using SPSS 20.0 software (SPSS Inc, Chicago, IL, USA). A one-sample *t* test and chi-square test were used to compare the differences between groups. $P < 0.05$ was considered significant. An analysis of covariance (ANCOVA) was conducted to examine the differences of physical activity in each arm of study at 6 weeks after discharge. In addition, multivariate analysis of covariance (MANCOVA) was conducted to compare the self-efficacy and outcome expectations in each arm of the study on the day of discharge. A $P < 0.05$ was considered significant.

Results

Demographic information

Most of the participants were female (76%); the mean age was 75.2 ± 8.4 years. Most were widows (6%), completed primary school (52%), and had an almost sufficient income (59%). The most common type of diagnosis was femoral neck fracture (61%),

with partial hip arthroplasty (54%). Baseline personal and clinical characteristics between groups were not significantly different (**Tables 1 and 2**).

At discharge time, self-efficacy, positive outcome expectations, and negative outcome expectations for physical activity were significantly different between the experimental and control group after controlling for age ($\eta^2 = 0.18$, $P = 0.04$). The score of the self-efficacy intervention group significantly increased by

8.35 over the control group ($F_{1,43} = 6.17$, $P = 0.02$), with an effect size of 0.13. The positive outcome expectations of the intervention group significantly increased by 3.17 over the control group ($F_{1,43} = 5.24$, $P = 0.03$), with an effect size of 0.11. The negative outcome expectations of the intervention group significantly reduced by 2.05 over the control group ($F_{1,43} = 3.99$, $P = 0.05$), with an effect size of 0.09 (**Table 3**).

Table 1. Participant characteristics at baseline (n = 46)

Characteristic	Experimental group (n = 23)		Control group (n = 23)		χ^2	df	P
	Number (%)	Number (%)	Number (%)	Number (%)			
Women	18 (78)		7 (74)		0.12	1	0.73
Marital status					2.1	3	0.55
Single	3 (13)		2 (9)				
Married	8 (35)		11 (48)				
Windowed	12 (52)		9 (39)				
Divorced			1 (4)				
Education level					2.7	4	0.62
No education	3 (13)		5 (22)				
Elementary school	13 (57)		11 (48)				
High school	1 (4)		3 (13)				
Diploma	3 (13)		3 (13)				
Bachelor's degree	3 (13)		1 (4)				
Master's degree							
Income					0.90	1	0.77
Insufficient	9 (39)		10 (44)				
Sufficient	14 (61)		13 (57)				

Table 2. Participant characteristics at baseline (n = 46)

Personal data	Experimental Group (n = 23)		Control Group (n = 23)		t	df	P
	Mean	SD	Mean	SD			
Age	77.61	7.88	72.9	8.36	-1.96	44	0.06
Chula Mental Test	17.17	1.78	17.39	1.78	0.42	44	0.38
Prefracture physical activity	3536.78	3527.62	1908.35	2040.03	-1.92	44	0.06

Table 3. Comparison of self-efficacy, positive outcome expectations, and negative outcome expectations between the experimental and control group at discharge time point after controlling for age

Measure	Experimental group (n = 23)		Control group (n = 23)		η^2	Univariate F	Multivariate F
	Mean	SD	Mean	SD			
Self-efficacy	60.69	8.77	52.34	13.10	0.13	6.165*	2.95*
Positive outcome expectations	37.17	4.25	34.00	5.98	0.11	5.23*	
Outcome expectations	8.30	2.53	10.35	3.17	.0085	3.99	

*Significant at the 0.05 level (2-tailed). Box's test of equality of covariance and Levene's test of equality of error variances $P > 0.05$

Physical activity

At baseline, overall participant in the intervention and control groups showed a moderate level of physical activity, with a mean of 2722.57 metabolic equivalent tasks (MET)/min/w (SD = 2965.82). Job-related physical activity was 624.88 MET/min/w (SD = 1314.08). Transportation activity was 402.85MET/min/wk (SD = 468.86). Household activity was 1001.74 MET/min/w (SD = 1752.79). Leisure-time activity was 694.10 MET/min/w (SD = 929.71).

At 6 weeks post-discharge, there was a significant increase in physical activity in the intervention group compared with the control group after controlling for prefracture physical activity, with an effect size of 0.18 ($F_{1,43} = 9.63, P < 0.01$). The amount of overall physical activity of the intervention group significantly increased by 961.37 MET/min/w over the control group, as shown in **Table 4**.

To confirm the effects of the physical activity enhancing program, we determined efficacy of physical activity before and after treatment, and the efficacy was divided into three grades: (1) markedly effective: when after treatment physical activity improved with a total score similar to the prefracture physical activity level; (2) effective: after treatment physical activity improved with a total score drop of less than 100%, but over 50%, (3) ineffective: total scores were less than 50% of physical activity during the prefracture period. As shown in **Table 3**, physical activity was effective (markedly effective and effective) in the majority (65%) of the PEP group.

The ratio of efficiency (markedly effective and effective) induced by the PEP was higher than that induced by usual care (65% vs. 48%). Furthermore, the ratio of markedly effective induced by the PEP was significantly higher than that induced by usual care (30% vs. 8%), as seen in **Table 5**.

Discussion

The outcome of PEP showed that at six-weeks follow up, the amount of physical activity of the intervention group significantly increased by 961.37 MET/min/w over the control group. This means that PEP was successful in improving physical activity. This study supported evidence that specific approaches for enhancing self-efficacy (performance accomplishment, verbal persuasion, vicarious experiences, and physiological feedback) can increase the physical activity level for elderly patients after surgery for hip fracture by using nursing strategies: sufficient knowledge and skill about physical activity with cueing, goal achievement, and unpleasant symptom treatment with guidance to monitor progress and verbal encouragement by prescreening and a telephone approach.

Consistent with findings from Resnick et al. [24] and Allegrante [34], the self-efficacy intervention was effective in demonstrating greater physical activity performance when compared with attention-control intervention. The increase in self-efficacy was significantly correlated with physical activity [35, 36]. Initial intervention should be early, incorporating physical and psychosocial functioning improvement

Table 4. Comparison of physical activity between the treatment and control group at post-test after controlling for prefracture physical activity

Measure	Experimental group (n = 23)		Control group (n = 23)		η^2	F	P
	Mean	SD	Mean	SD			
Physical activity	1738.24	983.50	776.87	727.52	0.18	14.20	0

*Significant at the 0.05 level (2-tailed). Levene’s test of equality of error variances $P = 0.21$

Table 5. The effective of physical activity enhancing program and usual care treatment (n = 23)

	Change after MPEP implementation		
	Markedly effective	Effective	Ineffective
MPEP	7 (30.4%)	8 (34.8%)	8 (34.8%)
Usual care	2 (8.7%)	9 (39.1%)	12 (52.2%)

[26, 37]. Implementing an effective PEP by the healthcare provider, motivating patient encounters, and achieving goals (face-to-face and telephone contact), and individual care within the current situation remain important challenges for improving care.

Our findings revealed the PEP's strength, particularly when there was extensive implementation of breaking the goals into short- and long-term goals and encouragement of patients to initiate and continue physical activity by using each small goal achievement and self-monitoring (diary and log book). These methods are effective in the buildup and accumulation of confidence [38]. In addition, making an individual's effort and progress visible through the use of personal exercise diaries, was seen to be helpful by elderly Taiwanese participants in a community-based walking intervention program [39].

We also showed that the PEP strength, particularly regarding the combination of the four primary sources of self-efficacy, is likely to have the potential to produce optimal results. A positive finding was also found in a community-based walking intervention program with the use of the self-efficacy theory to inform health care provider carried out by a rehabilitation nurse [40]. In addition, the strengths of this study were the random assignments among the participants in both groups and the criteria for recruitment.

PEP was effective in providing action for the elderly participants with hip fracture post-surgery. Moreover, this study encouraged and monitored physical activity levels weekly and used telephone follow-ups to improve the process of care and to enhance physical activity performance. Similarly, a previous study found the effects of a self-efficacy based intervention on stroke survivors [41]. They used both face-to-face and telephone contacts to encourage individuals' confidence in initiating and maintaining regular exercise.

These findings suggest that the level of self-efficacy and positive outcome expectations is an important element in achieving physical activity. One reason is that elderly patients with hip fracture are likely to need special support to improve their physical and psychosocial functioning for enhancing their physical activity behavior. The PEP with mutually-planned structural and daily-life physical activity between the participants and healthcare provider, using a variety of techniques based on strengthening self-efficacy, was associated with a large improvement in physical activity [26].

The findings of this study showed that a PEP promoted better physical activity for the elderly with hip fracture post-surgery. PEPs should be promoted in the healthcare setting by incorporating them into regular care. In addition, regular physical activity is crucial to decreasing clients' morbidity and mortality [42]. With a broader perspective, interventions can be designed to focus on other activities to improve the well-being and quality of life. Effective physical activity behavior by using a PEP can also reduce the costs of repeated falls with fractures [9]. This mode of care delivery, using face-to-face and telephone reinforcement is worth considering for other health behavior-changing programs; participants selected from several areas are needed for further study.

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References

1. Cooper C, Campion G, Melton LJ. Hip fractures in the elderly: a world-wide projection. *Osteoporos Int.* 1992; 2: 285-9.
2. Magaziner J, Hawkes W, Hebel JR, Zimmerman SI, Fox KM, Dolan M, et al. Recovery from hip fracture in eight areas of function. *J Gerontol A Biol Sci Med Sci.* 2000; 55:M498-507.
3. Boockvar KS, Halm EA, Litke A, Silberzweig SB, McLaughlin M, Penrod JD, et al. Hospital readmissions after hospital discharge for hip fracture: Surgical and nonsurgical causes and effect on outcomes. *J Am Geriatr Soc.* 2003; 51:399-403.
4. Parker M, Johansen A. Clinical review hip fracture: *BMJ.* 2006; 333:27-30.
5. Moran CG, Wenn RT, Sikand M, Taylor AM. Early mortality after hip fracture: is delay before surgery important? *J. Bone Joint Surg.* 2005; 87A:483-9.

6. Shumway-Cook A, Marcia AC, Gruber W, Robinson C. Incidence of and risk factors for falls following hip fracture in community-dwelling older adults. *Phys Ther.* 2008; 85:648-55.
7. Mangione KM, Palombaro KM. Exercise prescription for a patient 3 months after hip fracture. *Phys Ther.* 2005; 85:676-87.
8. Berry SD, Samelson EJ, Hannan MT, McLean RR, Lu M, Cupples LA, et al. Second hip fracture in older men and women: The Framingham study. *Arch Intern Med.* 2007; 167:1971-6.
9. Fox KM, Hawkes WG, Hebel JR, Felsenthal G, Clark M, Zimmerman SI, et al. Mobility after hip fracture predicts health outcome. *J Am Geriatr Soc.* 1998; 46: 169-73.
10. Rodaro E, Pasqualini M, Iona LG, Di Benedetto P. Functional recovery following a second hip fracture. *Euro Medicophys.* 2004; 40:179-83.
11. Talkowski JB, Lenze EJ, Munin MC, Harrison C, Brach JS. Patient participation and physical activity during rehabilitation and future functional outcomes in patients after hip fracture. *Arch Phys Med Rehabil.* 2009; 90: 618-2.
12. Zid n L, Kreuter M, Fr ndin K. Long-term effects of home rehabilitation after hip fracture – 1-year follow-up of functioning, balance confidence, and health-related quality of life in elderly people. *Disabil Rehabil.* 2010; 32:18-32.
13. Franco OC, de Laet C, Peeters A, Jonker J, Mackenbach J, Nusselder W. Effects of physical activity on life expectancy with cardiovascular disease. *Arch Int Med.* 2005; 165:2355-60.
14. Hu G, Eriksson J, Barengo NC, Lakka TA, Valle TT, Nissinen A, et al. Occupational, commuting, and leisure-time physical activity in relation to total and cardiovascular mortality among Finnish subjects with type 2 diabetes. *Circulation.* 2004; 110:666-73.
15. Nelson ME, Rejeski WJ, Blair SN, Duncan PW, Judge JO, King AC, et al. Physical activity and public health in older adults recommendation from the American College of Sports Medicine and the American Heart Association. *Circulation.* 2007; 116:1094-105.
16. Centers for Disease Control and Prevention. How much physical activity do older adults need? 2011: CDC publication. [online]. 2011. [cited 2014 Aug 18]; Available from: <http://www.cdc.gov/physicalactivity/everyone/guidelines/olderadults.html>. last updated June 17, 2014.
17. World Health Organization. Definition of an older or elderly person 2014: WHO. [online]. 2014. [cited 2014 Aug 18]; Available from: <http://www.who.int/healthinfo/survey/ageingdefnolder/en/index.html>.
18. Bernhardt J, Borschmann K, Crock D, Hill K, McGann A, DeGori M. Stand up and be counted: measuring time spent upright after hip fracture and comparison with community dwelling older people. *Physiotherapy.* 2005; 91:215-22.
19. Jongjit J, Komsopapong L, Songjakkaew P, Kongsakon R. Health-related quality of life after hip fracture in the elderly community-dwelling. *Southeast Asian J Trop Med Public Health.* 2003; 34:670-4.
20. Norton R, Butler M, Robinson E, Lee-Joe T, Campbell AJ. Declines in physical functioning attributable to hip fracture among older people: a follow-up study of case-control participants. *Disabil Rehabil.* 2000; 22: 345-51.
21. Resnick B, Galik E, Boltz M, Hawkes W, Shardell M, Orwig D, et al. Physical activity in the post-hip-fracture period. *J Aging Phys Act.* 2011; 19:373-87.
22. Taylor NF, Barelli C, Harding KE. Community ambulation before and after hip fracture: a qualitative analysis. *Disabil Rehabil.* 2010; 32:1281-90.
23. Lee LL, Arthur A, Avis M. Using self-efficacy theory to develop interventions that help older people overcome psychological barriers to physical activity: a discussion paper. *Int J Nurs Stud.* 2008; 45:1690-9.
24. Resnick B, Orwig D, Yu-Yahiro J, Hawkes W, Shardell M, Hebel JR, et al. Testing the effectiveness of the exercise plus program in older women post-hip fracture. *Ann Behav Med.* 2007; 34:67-76.
25. Orwig DL, Hochberg M, Yu-Yahiro J, Resnick B, Hawkes WG, Shardell M, et al. Delivery and outcomes of a yearlong home exercise program after hip fracture: a randomized controlled trial. *Arch Intern Med.* 2011; 171:323-31.
26. Crotty M, Unroe K, Cameron ID, Miller M, Ramirez G, Couzner L. Rehabilitation interventions for improving physical and psychosocial functioning after hip fracture in older people (Review) *Cochrane Database of Systematic Reviews.* [online]. 2010. [cited 2014 Aug 18]; Available from: <http://www.ncbi.nlm.nih.gov/pubmed/20091644>.
27. Foster C, Hillsdon M, Thorogood M. Interventions for promoting physical activity: *Cochrane Database of Systematic Reviews.* [online]. 2005. [cited 2014 Aug 18]; Available from: <http://www.ncbi.nlm.nih.gov/pubmed/15674903>.
28. Dattalo P. Determining sample size: Balancing power, precision, and practicality. New York: Oxford University Press; 2008.

29. Exempla Lutheran Medical Center. Hip fracture plus patient handbook [online]. 2010. [cited 2014 Aug 18]; Available from: http://lutheran.humanmotioninstitute.com/assets_partners/lutheran/documents/HMI%20Hip%20Fracture%20Plus%20Patient%20Bk.pdf
30. American Academy Orthopedic Surgeons. Total hip replacement exercise guide. OrthoInfo. [online]. 2007. [cited 2014 Aug 18]; Available from: <http://orthoinfo.aaos.org/topic.cfm?topic=A00303>. last updated July 1, 2007.
31. Resnick B. Self-efficacy. In: SJ Peterson, TS Bredow (Eds.). Middle range theories: Application to nursing research (2nd ed.), Philadelphia: Lippincott William & Wilkins; 2009.
32. Resnick B, Palmer MH, Jenkins L, Spellbring AM. Path analysis of efficacy expectations and exercise behavior in older adults. *J Adv Nurs.* 2000; 31:1309-15.
33. Craig CL, Marshall AL, Sj tr m M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc.* 2003; 35:1381-95.
34. Allegrante JP, Peterson MG, Cornell CN, MacKenzie CR, Robbins L, Horton R, et al. Methodological challenges of multiple-component intervention: lessons learned from a randomized controlled trial of functional recovery after hip fracture. *HSSJ.* 2007; 3: 63-70.
35. Inguino TPL. Factors related to long-term adherence to regular exercise in older women post hip fracture: UMB Digital Archive. [online]. 2008. [cited 2014 Aug 18]; Available from: <http://archive.hshsl.umaryland.edu/handle/10713/999>.
36. McAuley E, Blissmer B. Self-efficacy determinants and consequences of physical activity. *Exerc Sport Sci Rev.* 2000; 28:85-8.
37. Di Monaco, M. Hip fracture in older people: A rehabilitation perspective. *Eur J Phys Rehab Med.* 2011; 47:253-5.
38. van de Laar KE, van der Bijl JJ. Strategies enhancing self-efficacy in diabetes education: a review. *Sch Inq Nurs Pract.* 2001; 15:235-48.
39. Lee LL, Arthur A, Avis M. Evaluating a community based walking intervention for hypertensive older people in Taiwan: a randomized controlled trial. *Prev Med.* 2007; 44:160-6.
40. Resnick B, Luisi D, Vogel A. Testing the Senior Exercise Self-efficacy Project (SESEP) for use with urban dwelling minority older adults. *Public Health Nurs.* 2008; 25:221-34.
41. Shaughnessy M, Resnick BM. Using theory to develop an exercise intervention for patients post stroke. *Top Stroke Rehabil.* 2009; 16:140-6.
42. Marks R. Physical activity and hip fracture disabilities: a review: *Journal of Aging Research.* [online]. 2011 [cited 2014 Aug 18]; Article ID 741918. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3092612/>