Prevention of recurrent falls in elderly: a pre-post intervention study in a rural community, Egypt

Abdel-Hady El-Gilany [1*], El-sayed Hatata [2], Sahar M Soliman [3], Raefa Refaat [4]

[1] MD; Professor of Public Health, College of Medicine, Mansoura University, Egypt
[2] MD; Professor of General Medicine, College of Medicine, Mansoura University, Egypt
[3] PhD Nursing; Assistant Professor of Gerontological Nursing, College of Nursing, Mansoura University, Egypt
[4] Bachelor of Nursing; Lecturer of Gerontological Nursing, College of Nursing, Mansoura University, Egypt

**** Corresponding Author:*** Abdel-Hady El-Gilany
Professor of Public Health, College of Medicine
Mansoura University, College of Medicine, Mansoura 35516, Egypt
Emails: ahgilany@gmail.com, ahgilany@hotmail.co.uk | Tel: 0020-1060714481

Running title: Prevention of recurrent falls in elderly

Abstract

Background: Nursing intervention has been reported to prevent further falls in elderly with previous falls.

Population and Methods: This as pre/post intervention study involving a convenient sample of sixty three elderly of both sexes with previous falls. Seven sessions of multiple interventions were individually delivered to the elderly in their homes in a rural community. The intervention included knowledge about falls, instruction about environmental hazards and exercise training. Change in knowledge, activities of daily living (ADLs), instrumental activities of daily living (IADLs), The Risk for Falls of Older Adult People Community Setting (FROP-Com), Berg balance scale (BBS) and environmental checklist were assessed at pre-and post-interventions.

Results: The median knowledge score increased significantly after intervention from 40 up to 133. Also the median total score of practicing exercise increased from 0 to 78. There are significant improvements in the score of all elements and the total score of environmental hazards in post 2 and 4 months. The percent of independent elderly as measured by ADLs and IADLs increased significantly at 2 months after intervention (3.2% vs. 14.3%; and 3.2% vs. 12.7%; respectively). The low risk of fall, as measured by BBS and FROP-Com score, showed significant increase at both 2 and 4 months post-intervention. Both the recurrence and effect of falls were significantly reduced during the follow-up period.

Conclusion: Despite the .small size of study population, the multiple interventions reduced both the recurrence and the sequel of falls.

Key words: Recurrent Falls, Elderly, Intervention, Community setting

Introduction

Falls are the most serious health concern facing older persons.[1] Recurrent falls are an important cause of morbidity and mortality in the elderly and are a marker of poor physical and cognitive status.[2] Falls in the elderly may be due to either intrinsic (age-related changes) or extrinsic (environmental) risk factors.[3-6]

Gerontological nurse has an essential role to reduce fall and its related injuries through providing safety measures, environmental modification, eliminating risk factors and improving the balance through exercise training program.[7,8] Education must be directed toward helping elderly persons to identify potential hazards and changing their health practice and habits accordingly.[9] Adequate physical, social and psychological rehabilitation of elderly with a history of falls and injury has been reported to prevent further falls.[6]

In Egypt few studies have explored the problem of falls in the elderly. None of these studies was community-based and none was intervention in nature. So this study aimed to test the effectiveness of multiple nursing interventions on the recurrence of fall in the elderly with previous falls within the community setting.

Population and Methods

This study was done in Menyet Sandoub village, about 5 km away from Mansoura city, Egypt during the period of May 2010 to November 2011.

The study subjects included a convenient sample of sixty three elderly of both sexes with history of fall within the last year living in the village. The exclusion criteria are bedridden elderly, severely limiting arthritis, severe psychiatric diseases and limb amputation.

The participants were interviewed and tested in their own homes. They were informed that they could stop the testing session whenever they wanted and that they were allowed to rest between tasks, if necessary. They also were told to wear stable and comfortable shoes.

The study was approved by the College of Nursing and the local Directorate of Health. An official letter was declared to the director of Menyet Sandoub Health Center. Before the interview the elderly were informed about the objective of the study and assured about confidentiality of data. The participation was voluntary.

Study tools

A sheet was developed to collect the socio-demographic data (age, sex, level of education, living condition) and knowledge related to preventive measures of falls (e.g. incidence of falls, risk factors of falls, healthy life style, consequences of falls, environmental safety, and exercises).

Katz and Akpom scale was used to assess activities of daily living (ADLs).[10] The scale included six main activities of daily living, bathing, dressing, feeding, transfers, continence, and ambulation. The six different functions are measured and scored according to the individuals' actual performance of these functions. The total score of the scale is 6-18. Elderly were classified into three categories: totally dependent (scored 13 to 18); partially dependent (score 7 to 12) and independent (score of 6 points or less).

Lawton and Brady scale was used to assess instrumental activities of daily living (IADLs).[11] This scale includes eight items with the maximum score of 16 for females and 10 for males. Six points from the maximum score were subtracted for males for gender-specific questions. The score achieved by the elder was calculated as a percentage. The degree of the elder's performance of IADL was categorized as follows: totally dependent (0-<25%), partially dependent (25- <75%), independent (≥75%).

The Risk for Falls of Older Adult People Community Setting (FROP-Com) developed by National Ageing Research Institute,[12] was used to assess the elderly persons likelihood of falling. It consists of 13 risk factors being rated, most on graded 0–3 scales. The total score of the scale is (63) and is categorized into 0 – 15 low falls risk (0-15), mild to moderate falls risk (16-24) and high falls risk (>24).

Berg balance scale (BBS) was used to assess the balance of elderly persons.[13] It consists of 14 items graded 0 - 4 scale. The total score is 56 and categorized as low fall risk (41-56); medium fall risk (21-40), and high fall risk (0-20).

An observational checklist was developed based on the literature review[14,15] to assess environmental hazards and risk factors of falls inside and outside the elderly home in addition to the availability of safety measure in elderly home**.**

Observation checklists for exercises was developed after literature review.[5-8] Scoring of the checklist of each item was designed by using a 3-point Likert scale. A score of 0, 1 or 2 was given when the task was not done, partially done or completely done; respectively.

All study tools were completed before the intervention during an individual interview with the elderly.

The intervention

The contents of the intervention were developed after thorough review of literatures.[1,3,4,16]

The intervention included seven individualized sessions (twice weekly). The duration of each session ranged from 30 to 45 minutes. The first four sessions were educational and the last three sessions were training sessions. The first session included definition, incidence, risk factors consequences of falls, importance of falls prevention and healthy life style. The second session covered proper intake of medication, over the counter medication and importance of follow-up for chronic diseases. The third

session covered the environmental and personal hygiene (bathroom, bedroom, kitchen, stairs, floor, corridors and dressing). The fourth session stressed on the appropriate use of visual, hearing and walking aids. The fifth session included balance and gait exercises (such as planter, knee and hip flexion; hip extension, side leg raise and others). Stretching exercises of the neck, shoulders, arms, hands, wrist and hamstring were included in the sixth session. The last session included muscle strengthening exercises such as stair up, arm curl and wall push-up.

Elderly were motivated and rewarded for their active participation in these measures throughout the study period by giving them moral support, refreshment and the booklet.

Teaching methods included lectures, role playing, demonstration re-demonstration, pictures, and discussion.

Booklet, in Arabic language, about incidence of falls, risk factors of falls, healthy life style, and consequences of falls, environmental safety, and exercise was given to each elderly to guide and enrich his/her memory about activities performed in each session.

Before the start of each session, elderly fallers were asked question related to the topics discussed in the previous session to identify their understanding; misses or unclear points were re-emphasized by the researcher.

Along with all sessions, the researchers used simple, brief and clear words. At the end of each session, a brief summary was given emphasizing the most important points.

By the end of the intervention reassessment was done immediately for knowledge related to preventive measures of falls. After 2 and 4 months the study subjects were re-evaluated at their homes by using the assessment of functional abilities, risk fall assessment scale, Berg balance scale**,** environmental hazards checklist to determine the effect of preventive measures on the balance and risk of falls. After one year the number of falls experienced by the elderly was used to evaluate the effectiveness of preventive measures.

Data was analyzed using SPSS (Statistical Package for Social Sciences, version 16. Qualitative variables were presented as number and per cent. Chi square test was used for comparison between pre and post-intervention. Quantitative variables were presented as median (minimum – maximum). Wilcoxon sign test was used for pre-post-comparison. $P \leq 0.05$ was considered to be statistically significant.

Results

The age of the elderly participated in the study ranged from 60 to 91 years with a mean of 69.6±6.2 years. The majorities of them are females (67.7%) and live with the family (63.5%) and either illiterate (58.7%) or just read and write (22.2%) (Table1).

Table (2) shows significant improvement of the scores of all elements of the knowledge immediately after intervention. The median knowledge score increased significantly after intervention from 40 up to 133. The practice balancing, stretching,

strengthening and the total exercise scores showed significant improvement in the post-intervention. The median total score of practicing exercise increased from 0 to 78.

There are significant improvements in the score of all elements and the total score of environmental hazards in post 2 and 4 months. The median total score increased from 23.0 pre-intervention to 13 at post 2 months and then decreased to 10 at post 4 months (Table 3).

Table (4) shows that the percent of independent elderly as measured by ADLs and IADLs increased significantly at 2 months after intervention (3.2% vs. 14.3%; and 3.2% vs. 12.7%; respectively). However, this improvement did not persist for 4 months post-intervention. The low risk of fall, as measured by BBS and FROP-Com score, showed significant increase at both 2 and 4 months post-intervention.

Table (5) shows that about 73% of fallers in the year pre-intervention do not experience any fall during the one year of follow-up after intervention. Also the incidences of hematoma, bleeding/wound and fracture resulting from falls decreased significantly during the follow-up period.

Discussion

The prevention of falls in the elderly is challenging to the nurse, especially when individuals experience multiple or recurrent falls.[17] Strategies for successful preventive measures of falls include education about falls, modification or implementation of environmental risk factors and implementation of exercise programs.[18,19]

The total knowledge score and the score of all its items increased significantly immediate post-intervention. This reflects the lack of knowledge among elderly about the falls. The same finding was reported from USA[20] and Australia.[21]

Research evidence has identified that muscle strengthening and balance training as well as stretching exercises are more effective preventing falls.[22] We found a significant improvement in the balance, strengthening and stretching exercises after intervention. This could be a contributing factor for the observed reduction in the incidence of fall during the follow-up period. This agrees with previous findings in developed countries.[22-26] However, other studies reported that exercise did not significantly reduce the incidence of falls.[27]

Safe environment has always been a priority in nursing care.[28] The environmental factors leading to fall included uneven surface, objects on surface/rug, wet surface or slippery footwear, storage problem, lack of safety features in bathroom, and having problems in transfer.[29] We found that increasing awareness about environmental modification and safety measures is associated with significant decrease in the scores of total environmental hazards and of all its items at 2 and 4 months post-intervention. This result is consistent with Buffalo in USA who mentioned a significant difference between pre and post 3 months follow-up of home hazards assessment. [20] Moreover, a study in Japan reported that home modifications reduced the subsequent falls in patients with a past history of falls.[30] Gillespie et al[25] stated that the preventive

strategies included removing tripping hazards, using non-slip mats in the bathtub and on shower floors, installing grab bars next to the toilet and in the tub or shower, putting handrails on both sides of stairways, and improving home lighting and home modification may be effective in reducing falls. On the other hand, a study in USA revealed that removing environmental hazards and education had no significant effect on the risk of falling or the monthly rate of falling.[31]

We found that the percent of dependent elderly decreased significantly after interventions as measured by ADLs and IADLs. This is consistent with previous finding from developed countries.[32,33]

The percent of elderly with low risk of falls increased significantly after interventions as measured by BBS and FROP-Com. The improvement of BBS and FROP-Com after exercise training was reported in many developed countries.[34,35]

Our intervention is associated with significant reduction in not only the number of recurrent falls but also the injuries resulted from fall after one year follow-up. Similar findings were reported from Canada;[36] New Zealand;[37] USA;[20] and UK.[38] However, two studies in USA and Canada mentioned that the multidisciplinary fall prevention program was not effective in preventing first fall and functional decline among elderly with previous falls.[39,40]

Raising awareness about fall together with training exercise and elimination of environmental hazards should be an integral part of any community-based intervention program for prevention of falls in the elderly. Community-based clinical trials are needed to confirm our findings and to evaluate the cost-benefit of such interventions. Mass media could a channel for educating elderly and their care givers about falls and their prevention.

Study limitations: our results are of local nature and can't be generalized to whole elderly at the national level. The multiple interventions together with the small sample size make it difficult to study the contribution of each intervention to falls prevention.

Conflict of Interest: None

References

1.Muir S, Berg K. Use of the Berg Balance Scale for predicting multiple falls in community-dwelling elderly people: a prospective study. Phys Therap. 2008;88(4):449-459

2.Reed J, Clarke C, Macfarlane A. Nursing older adult. United Kingdom: Graw-Hill Company. 2012: P. 59-64.

3.Tremblay J, Barber C. Preventing falls in the elderly. Human Development Family Studies. 2005;10(242):54-60.

4.Nelson M. Physical activity and public health in older adults: recommendations from the American College of Sports Medicine and the American Heart Association. Am J Sports Med. 2007;39(8):1435-1445 .

5.Gerberding J, Falk H, Arias I, Wallace D, Ballesteros. National Center for Injury Prevention and Control. Preventing fall: how to develop community-based fall prevention programs for older adults. Atlanta, GA: Centers for Disease Control and Prevention. Atlanta, Georgia. 2008 (Available from: www.doh/wa/gov/hsqu/emstrauma/injury/pubs/fallamongolderadults.pdf. Accessed at: April 25, 2010).

6.Ciaschini P, Straus S, Dolovich L. Community-based intervention to optimize falls risk management: a randomized controlled trial. Age Aging. 2009;38:724-730.

7.Day L, Fildes B, Gordon I.Fitzharris M, Flamer H, Lord S. Randomized factorial trial of falls prevention among older people living in their own homes. BMJ. 2002;325(736):128-133.

8.Haines T, Russell T, Brauer S, Urry S, Jasiewicz J, Condie P. Effectiveness of a video-based exercise program to reduce falls and improve health-related quality of life among older adults discharged from hospital: a pilot randomized controlled trial. Clin Rehabil. 2009;23(11):973-985.

9.Hazzard WR,. Hazzard's geriatric medicine and gerontology. 6th ed. (Principles of Geriatric medicine and Gerontology) New York: Graw-Hill Company. 2009: P.59-64.

10.Katz S, Akpom C. Index of ADL: A standardized measure of biological and psychological functions. International J Health Sci. 1976;6:123-140.

11.Lowton HP, Brody EM. Assessment of older people: self-care maintaining and instrumental activities of daily living. Gerontologist. 1969;1(9):179-186.

12.National Ageing Research Institute. The Department of human services funded to review and recommend a set of falls prevention resources for general use. 2005 (Available from: http://www.health.vic.gov.au/agedcare Accessed at: February 18, 2010)

13.Berg K, Woo-Daphine S. The balance scale: reliability assessment for elderly residents and patients with an acute stroke. Scand J Rehabil Med. 1995;27(1):27-36.

14.Meiner S, Luckenotte A. Gerontological nursing. 3rd ed. United States of America: St. Louis: Mosby Company. 2006: P.245-66.

15.Stevens JA, Thomas K, Teh L, Greenspan A. Unintentional fall injuries associated with walkers and canes in older adults treated in US emergency departments. J Am Geriatr Soc. 2009;57(8):1464-69.

16.Touhy T, Jett K. Ebersole and Hess: Gerontological Nursing. 3rd ed. New York: Mosby Company. 2010: P.179.

17.Clemson L, Cumming RG, Kendig H. Swann M, Heard R, Taylor K. The effectiveness of a community-based program for reducing the incidence of falls in the elderly: a randomized trial. J Am Geriatr Soc. 2004;52(9):1487-94.

18.Hsu H, Han B. Risk factors of falling among the elderly in Taiwan: a longitudinal study. Taiwan Geriatr Gerontol. 2008;3(2):141-154.

19.Larsson T, Hagvide M, Svanborg M, Borell L.Falls prevention through community intervention. A Swedish example. Safety Sci. 2010;48(2):204-208.

20.Buffalo NY. The effectiveness of two different fall prevention programs on increasing knowledge of risk factors of falls. J Disability Human Development. 2011;10(2):117-21.

21.Deery HA, Day LM, Fildes BN. An impact evaluation of a falls prevention program among older people. Accident Analysis Prevention. 2000;32:427-433.

22.Tiedmann A, Sherrington C, Close JC, Lord SR. Exercise and sports science. Australia position statement on exercise and falls prevention in older people. J Sci Med Sport. 2011;14(6):489-495.

23.Guilfoyle S, Hale I. A community-based fall prevention programs for older adults in Wisconsin. Wisconsin Med J. 2005;104(1):29-32.

24.Kannus P. Sievänen H, Palvanen M, Järvinen T, Parkkari J. Prevention of falls and consequent injuries in elderly people. Lancet. 2005;366(9500):1885-93.

25.Gillespie LD, Gillespie WJ, Robertson MC, Lamb SE, Cumming RG, Rowe BH. Interventions for preventing falls in elderly people (Cochrane Review). Cochrane Database Syst Rev. 2009;(2):CD000340.

26.Kuptniratsaikul V, Praditsuwan R, Assantachai P, Ploypetch T, Udompunturak S, Pooliam J. Effectiveness of simple balancing training program in elderly patients with history of frequent falls. Clin Intervention Aging. 2011;6:111-17.

27.Shumway-Cook A, Silver IF, LeMier M, York S, Cummings P, Koepsell TD. Effectiveness of a community-based multifactorial intervention on falls and falls risk factors in community-living older adults: A randomized controlled trial. J Gerontol A Biol Sci Med Sci. 2007;62(12):1420-27.

28.Dempsey J. Falls prevention revisited: a call for a new approach. J Clinical Nursing. 2004;13:479-485.

29.Volpato S, Leveille SG, Blaum S, Fried L, Jack M. Guralnik J. Risk factors for falls in older disabled women with diabetes: the women's health and aging study. J Gerontolog: A Biol Sci Med Sci. 2005;60(12):1539-45.

30.Otaka Y, Meigen L, Uzawa M, Chino N. The effectiveness of fall prevention program: a review-1 fall prevention in the narrow sense. Jpn J Rehabil Med. 2003;40(6):374-88.

31.Weatherall BA. Multifactorial risk assessment and management programs effectively prevent falls in the elderly. Evidence-Based Healthcare Public Health. 2004;8(5):270-272.

32.McAuley E, Jerome GL, Elavsky S, Marquez D, Ramsey S. Predicting long term maintenance of physical activity in older adults. Prev Med. 2003;37(2):110-118.

33.Schneider JK, Elveker A, Bronder DR, Meiner SE, Binder EF. Exercise training for older adult: incentives and disincentives for participation. J Gerontol Nurs 2003;29(9):21-31.

34.Bulat T, Hart-Hughes S, Ahmed S, Quigley P, Palacios P, Werner D, Foulis F. Effect of group-based exercise program on balance in elderly. Clin Interv Aging. 2007;2(4):655-660.

35.Chang JT, Morton SC, Rubenstein LZ, Mojica WA, Maglione M, Suttorp MJ, Roth EA, Shekelle PG. Interventions for prevention of falls in older adults: systematic review and meta-analysis of randomized controlled trials. BMJ. 2004;10:328-680.

36.Cusimano M, Kwok J, Spadafora K. Effectiveness of multifaceted programs for the elderly in residential care. Inj Prev. 2009;14:113-122.

37.Robertson MC, Campbell AJ, Gardner MM, Preventing injuries in older people by preventing falls: A meta-analysis of individual-level data. Am J Geriatr Soc. 2002;50(5):905-11.

38.Davison J, Bond J, Dawson P, Steen IN, Kenny RA. Patients with recurrent falls attending accident and emergency benefit from multifactorial intervention- a randomized controlled trial. Age Ageing. 2005;34(2):162-8.

39.Hendriks MR, Bleijlevens MH, van Haastregt JC, Crebolder HF, Diederiks JP, Evers SM, et al. Lack of effectiveness of a multidisciplinary fall prevention program in elderly people at risk: A randomized controlled trial. J Am Geriatr Soc. 2008;56(8):1390-1397.

40.Hogan DB, MacDonald FA, Betts J, Bricker S, Ebly E, Delarue B, et al. A randomized controlled trial of a community-based consultation service to prevent falls. CMAJ. 2001;165(5):537-43.

Table 1: Sociodemographics of study participants

	Number (%)
Age:	
60-70 years	37(58.7)
>70 years	26(41.3)
Mean ±SD	69.6±6.2
Sex:	
Male	21(33.3)
Female	42(66.7)
Education:	
Illiterate	37(58.7)
Read and write	14(22.2)
Primary and above	12(19.1)
Living condition:	
Alone	23(36.5)
With other family members	40(63.5)

Table 2: Pre and post intervention changes in the scores of knowledge and exercise

	Pre-intervention (63) Median (Min-Max)	Immediate post-intervention (63) Median (Min-Max)
Knowledge about falls		
Definition and risk factors	6.0(0-11)	21.0(9-27)***
Medications	4.0(0-9)	17.0(6-22) ***
Follow-up	6.0(0-11)	18.0(8-24) ***
Nutrition	4.0(0-7)	12.0(7.14) ***
Exercise	7.0(0-18)	29.0(9-33) ***
Measures for sleeping	0(0.-7)	0(0-12) ***
Complication of falls	1.0(0-2)	4.0(2-6) ***
Environmental safety	2.0(0-4)	8.0(3-11) ***
Safety measures	3.0(0.5)	10.0(4-13) ***
Total score	40(5-52)	133(61-207) ***
Practice of exercises		
Balance exercises	0.0(0-7)	42(9-62) ***
Stretching exercises	0.0(0-5)	21(3-28) ***
Strengthening exercise	0(0-2)	14(7-21) ***
Total score	0(0-12)	78(23-102) ***

***Significant improvement by Wilcoxon sign test at P≤0.001

Table 3: Pre and post intervention changes in the environmental hazards surrounding the elderly

	Pre-intervention (63) Median (Min-Max)	Post 2 months (62)* Median (Min-Max)	Post 4 months (62)* Median (Min-Max)
Lighting	4.0(2-7)[AB]	2.0(1-6)[AC]	2.0(1-5)[BC]
Bedroom	5.0(3-8) [AB]	3.0(1-6) [AC]	2.0(1-5) [BC]
Bathroom	3.0(1-5) [AB]	1.0(0-4) [AC]	1.0(0-6) [BC]
Kitchen	3.0(1-5) [AB]	2.0(1-4) [AC]	1.0(0-3) [BC]
Corridors	3.0(1-6) [AB]	2.0(1-4) [AC]	1.0(0-4) [BC]
Stairs	2.0(1-3) [AB]	1.0(0-2) [AC]	1.0(0-2) [BC]
Floor	3.0(1-5) [AB]	2.0(1-4) [AC]	1.0(0-3) [BC]
Street	1.0(0-2) [AB]	1.0(0-2) [A]	1.0(0-2) [B]
Total score	23.0(18-32) [AB]	13.0(8-29) [AC]	10.0(6-22) [BC]

A, B & C Significant improvement between the corresponding times by Wilcoxon sign test at P≤0.001
*One elderly died

Table 4: Pre and post intervention changes in ADLs, IADLs, BBS and FROP.Com

	Pre-intervention N(%)	Post 2 months* N(%)	Post 4 months* N(%)
ADLs:			
Independent	2(3.2) [A]	9(14.3) [A]	3(4.8)
Dependent	61(96.8)	54(85.7)	59(95.2)
IADLs:			
Independent	2(3.2)[A]	8(12.7)[A]	3(4.8)
Dependent	61(96.8)	55(87.3)	59(95.2)
BBS:			
High/moderate risk of falls	62(98.4)[AB]	28(44.4) [AC]	47(75.8) [BC]
Low risk of falls	1(1.6)	35(55.6)	15(24.2)
FROP-Com score:			
High/moderate risk of falls	62(98.4)[AB]	39(61.9)[A]	36(58.1)[B]
Low risk of falls	1(1.6)	24(38.1)	26(41.9)

*One elderly died
A, B & C Significant improvement between the corresponding times

Table 5: Pre and post 1 year changes in the number of falls and consequences of falls

	Pre-intervention N(%)	Post one year* N(%)
Number of falls:		
None	0(0)	45(72.6)
Once	28(44.4)	15(24.2)
Twice	25(39.7)	2(3.2)
Trice or more	10(15.9)	0(0)
Significance test	None Vs. any falls, P≤0.001	
Injuries after falls:#		
Bruises and redness	25(39.7)	15(24.2)
Hematoma	31(49.2) [A]	13(20.7) [A]
Bleeding and wound	11(17.5) [A]	4(6.6) [A]
Fracture	8(12.7) [A]	2(3.2) [A]

*One elderly died #Categories are not mutually exclusive
[A] Significant difference between pre and post intervention