Courtney, Mary D. and Edwards, Helen E. and Chang, Anne M. and Parker, Anthony W. and Finlayson, Kathleen J. and Bradbury, Carolyn and Nielsen, Zoe (2010) *Improved functional ability and independence in activities of daily living for older adults at high risk of hospital readmission : a randomised controlled trial.* Journal of Evaluation in Clinical Practice. (In Press)

Title: Improved functional ability and independence in activities of daily living for older adults at high risk of hospital readmission: A randomised controlled trial

Authors

Prof. Mary D. Courtney, PhD

Assistant Dean (Research), Faculty of Health

Institute of Health and Biomedical Innovation

Queensland University of Technology, Brisbane, Australia

Prof. Helen E. Edwards, PhD

Head, School of Nursing and Midwifery

Institute of Health and Biomedical Innovation

Queensland University of Technology, Brisbane, Australia

Prof. Anne M. Chang, PhD

Professor of Nursing Research (Acute Care)

Institute of Health and Biomedical Innovation

Queensland University of Technology & Mater Health Services, Brisbane, Australia

Prof. Anthony W. Parker, PhD

Professor, School of Human Movements

Institute of Health and Biomedical Innovation

Queensland University of Technology, Brisbane, Australia

Ms Kathleen Finlayson, MNsg

Institute of Health and Biomedical Innovation

Queensland University of Technology, Brisbane, Australia

Ms Carolyn Bradbury, BPhty

Physiotherapist, Mater Adult Hospital

South Brisbane, Queensland, Australia *

Dr Zoë Nielsen, PhD

Senior Research Assistant

Institute of Health and Biomedical Innovation

Queensland University of Technology, Brisbane, Australia

Corresponding Author

Prof. Mary D. Courtney

Faculty of Health, Queensland University of Technology

Victoria Park Rd, Kelvin Grove, 4059

Queensland, Australia

Ph: 61 7 3138 3887 Fax: 61 7 3138 3814 Email: m.courtney@qut.edu.au

Running Title: Improved functional ability in older adults

Key words: older adults, functional ability, exercise, telephone follow-up

*Now employed at Sub-Acute and Residential Care Services Program, Metro North, Brisbane, Australia

Abstract

Objective: During hospitalisation older people often experience functional decline which impacts on their future independence. The objective of this study was to evaluate a multifaceted transitional care intervention including home-based exercise strategies for at-risk older people on functional status, independence in activities of daily living, and walking ability.

Methods: A randomised controlled trial was undertaken in a metropolitan hospital in Australia with 128 patients (64 intervention, 64 control) aged over 65 years with an acute medical admission and at least one risk factor for hospital readmission. The intervention group received an individually tailored program for exercise and follow-up care which was commenced in hospital and included regular visits in hospital by a physiotherapist and a Registered Nurse, a home visit following discharge, and regular telephone follow-up for 24 weeks following discharge. The program was designed to improve health promoting behaviours, strength, stability, endurance and mobility. Data were collected at baseline, then 4, 12 and 24 weeks following discharge using the Index of Activities of Daily Living (ADL), Instrumental Index of Activities of Daily Living (IADL), and the Walking Impairment Questionnaire (Modified).

Results: Significant improvements were found in the intervention group in IADL scores (p<.001), ADL scores (p<.001), and WIQ scale scores (p<.001) in comparison to the control group. The greatest improvements were found in the first four weeks following discharge.

Conclusions: Early introduction of a transitional model of care incorporating a tailored exercise program and regular telephone follow-up for hospitalised at-risk older adults can improve independence and functional ability.

INTRODUCTION

Approximately 70% of the total burden of disease of illness and injury currently experienced by Australians is due to chronic diseases, costing almost $34 billion annually [1]. In today's ageing society, it is becoming increasingly important for older people to maintain their independence in the performance of activities of daily living (ADLs) and instrumental activities of daily living (IADLs) [2-4]. The incidence of chronic disease increases with age, and older people have significantly higher rates of hospital admission and length of stay than the general population. Importantly, during hospitalisation many older people experience functional decline and deconditioning which results in long-term loss of independence and decreased quality of life [5-9].

Many chronic diseases are amenable to prevention by controlling their risk and protective factors [10] and one of the preventable risk factors that impacts adversely on the prevalence of major chronic diseases is physical inactivity [1]. The promotion of exercise for physical and mental health is widely accepted by medical authorities across the world [11] and is public policy in Australia [12]. Exercise has been reported to be beneficial in reducing falls [13], sarcopenia [14], depression [15], improved quality of life [4], balance [2, 16], and stair walking capacity [17]. Exercise and physiotherapy programs have also been shown to improve physical function and to enhance ability to maintain ADLs [2, 18] and IADLs [19], generally after hospitalisation, as well as specifically after experiencing health problems that require substantial lifestyle change, such as diabetes or stroke [3]. A review of home-based exercise for older populations demonstrated that moderate intensity aerobic training can improve cardio-respiratory health and overall functioning [20]. Walking alone can increase cardiovascular fitness, reduce body weight, BMI and body fat, and decrease resting diastolic pressure in previously sedentary but otherwise healthy individuals. One systematic review of resistance training in older adults found improvements in strength and gait speed [21]. However, Cochrane reviews have demonstrated that while exercise prescription can improve health-related quality of life for patients with heart failure [22], the effect of exercise on functional outcome measures such as ADLs is inconclusive [23]. Additionally, in older patients exercise or program adherence and maintenance can be problematic despite people generally acknowledging the benefits of exercise [24]. Thus, providing additional support via telephone as well as designing programs that address adherence issues by enhancing participation, e.g., through goal-setting [25], may be important in achieving significant outcomes. While it is generally acknowledged that some form of support by health professionals post-discharge is important [26], the best form, of support in terms of its nature, duration, and frequency is still unclear for older adults at-risk for hospital readmission [27].

The results reported here are part of a larger study which aimed to determine the effectiveness of an intervention for older people at risk of hospital readmission on emergency health service use [28], health, functional ability, quality of life, psychosocial outcomes and cost-effectiveness [29]. Results on functional ability, independence in activities of daily living, and program adherence are reported in this article.

Aim

The aim of this study was to evaluate the effectiveness of a multifaceted transitional care intervention including hospital and home-based exercise strategies for at-risk older adults on functional status and independence in activities of daily living.

Hypothesis

In comparison to the control group, participants in the intervention group will have improved functional ability and independence in activities of daily living, as measured with the

Walking Impairment Scale [30], Activities of Daily Living Scale [31] and Instrumental Activities of Daily Living Scale [32].

METHODS

Design

A randomised controlled trial was undertaken to evaluate the effectiveness of a multifaceted 24-week transitional care intervention on functional status and independence in activities of daily living.

Sample

Participants were recruited from medical wards at a tertiary referral metropolitan hospital in Australia. Patients were eligible for inclusion if they were aged 65 years and over, admitted with a medical diagnosis and had at least one risk factor for readmission (i.e., aged 75 or older, multiple hospital admissions in the previous six months, multiple comorbidities, lived alone, lack of social support, poor self-rating of health, functional impairment, and/or a history of depression). Exclusion criteria were based on inability to participate in the intervention, as follows: patients who required home oxygen; were dependent on a wheelchair or unable to walk independently for three meters (patients independently using walking aids were included); lived in a nursing home; or had a cognitive deficit or progressive neurological disease.

Procedure

Eligible patients were recruited within 72 hours of admission and informed consent was obtained. Following collection of baseline data the research nurse contacted the project coordinator who was blinded to baseline data and randomly allocated participants to either a control or intervention group via a computerised randomisation program.

Participants in the control group received the routine care, discharge planning, follow-up care, and rehabilitation advice normally provided. The intervention group, in addition to usual care, received a 24-week intervention consisting of an individually tailored exercise program, strategies for maintenance of health promoting behaviours, a home visit and regular telephone follow-up. Intervention group participants were assessed on gait, balance, body strength and function using the Berg Balance Scale [33], the Timed Up and Go Test [34], an isometric muscle power test, and a walk test. The individualised exercise program consisted of exercises to enhance balance, muscular strength and flexibility, and included muscle stretching exercises; balance training exercises; a walking program to enhance aerobic capacity and mobility; and muscle strengthening (resistance exercises for upper and lower body). An intervention registered nurse (RN) undertook a home visit within 48 hours of discharge to assess the home environment and address transitional concerns. Follow-up care was then provided via weekly telephone calls for the first four weeks, followed by monthly calls for a further five months. During the telephone follow-ups feedback was sought on management of treatment regimes, health promotion activities, and exercise plan and goals which were adjusted to reflect participants' progress during the preceding time period. Descriptive notes on self-reported participant support, health issues, adverse incidents, exercise issues and adherence, pedometer data, and progress on reaching goals were recorded at each follow-up. Detailed information on the intervention is published in Courtney et al. [28].

Variables, Measures and Data Collection

Baseline data on demographics, health and medical history were collected from medical records and participant interviews. Self-administered questionnaires were used to gather baseline data from both groups on functional status using the Instrumental Activities of Daily Living [31], Index of Activities of Daily Living [32], and the modified version of the Walking Impairment Questionnaire [30]. Follow-up questionnaires were administered via telephone at 4, 12 and 24 weeks from discharge by senior research assistants who were blinded to the patients' group allocation.

The Index of ADL was designed to measure physical functioning of older and chronically ill adults and has been widely used in both community and institutional settings. The Index has shown moderate to high predictive validity and inter-rater reliability [35]. The IADL is designed to measure a higher level of physical functioning than the Index of ADL, particularly for community populations with lower levels of disability. The scale has seven items measuring independence in activities such as travelling, shopping, preparing meals, housework and managing medications, the telephone and money [32]. The Walking Impairment Questionnaire (WIQ) measures self-reported difficulty with walking speed, walking distance and stair climbing ability on 0–4 Likert scales [30]. It has been validated against the six minute endurance test and the four metre velocity test [36], and shown to be valid and reliable as a self-administered and telephone-administered questionnaire [37].

Statistical Analysis

Statistical analysis was undertaken using the Statistical Packages for the Social Sciences Version 15. Baseline data from both the intervention and control groups were analysed to ensure comparability of the groups using Chi square, Mann-Whitney *U* and *t* tests. Repeated measures analysis of variance was used to determine the effect of the intervention on functional ability outcomes. All analyses were conducted as ‘intention-to-treat’ and analyses included controls for any covariates where necessary.

Ethics approval

Ethical approval for the study was received from the Human Research Ethics Committees of the participating institutions and complied with the Declaration of Helsinki rules for human experimentation.

RESULTS

A sample of 128 patients (64 intervention, 64 control) was recruited. The attrition rate was 16% (n=21) over six months, with higher attrition rate in the intervention group (22%, in comparison to 9% of the control group). Reasons for loss to follow-up were similar in both groups (e.g., deterioration in health, death, or changed address), with the exception of the number of patients changing their mind about participating in the project, which occurred in four intervention group participants and no control group participants. There were no differences in demographic characteristics, comorbidity, risk factors for readmission, functional ability or quality of life variables in those who were lost to the study in comparison to those who completed the 24 weeks follow-up period. The flow of participants through the study is shown in Courtney et al. [28]. There were no adverse effects or accidents attributed to the exercise program.

General demographic and medical information

Almost twice as many women (62%, n=76) as men (38%, n=46) participated in the project, with the average age being 78 years (ranging from 65 to 96 years). Most participants (96%) had multiple comorbidities, the most common being cardiac disease (78%, n=95), respiratory disease (49%, n=60), orthopaedic conditions (48%, n=59), gastrointestinal disease (40%, n=49), and endocrine disorders (38%, n=46). Overall, cardiac disease (27%, n=33), respiratory disease (26%, n=32), gastrointestinal problems (19%, n=23) and falls (14%, n=17) were the most frequent diagnoses on admission to hospital. The majority of participants (97%, n=118) had multiple risk factors for readmission, with 61% having four or more, including multiple comorbidities (96%, n=117), aged over 75 years (66%, n=81), functional impairment (60%, n=73) and living alone (56%, n=68) [28]. There were no significant differences between intervention and control groups with regard to demographic variables, diagnosis, number and type of comorbidities, number of risk factors, or length of hospital stay. However, poor self-rating of health was significantly higher (p=.038) in the intervention group (65%) compared to the control group (47%). This factor was controlled for in the subsequent analysis as a covariate.

Functional status and independence in activities of daily living

Instrumental Activities of Daily Living and Activities of Daily Living

Mean scores for both groups at all time points were calculated for the IADL scale (possible range from 0 to 7) and ADL scale (possible range between 0 to 6), with high scores indicating greater dependence, shown in Table 1. Scores on the ADL scale were quite low (overall mean at baseline 0.35, *SD* 0.21), indicating a floor effect with most of this sample independent in bathing, dressing, transferring, toileting and feeding. The mean IADL score at baseline was 2.4 (*SD* 1.9), indicating a mild to moderate impairment in functional ability. Repeated measures ANCOVA found significant interaction effects over time and between groups for both IADL scores ($F(3,282)=30.645$, $p<.001$) and ADL scores ($F(3,282)=9.733$, $p<.001$), with the intervention group showing greater improvement in functional ability over the 24 weeks from discharge in comparison to the control group. The greatest improvements in the intervention group were seen in the first 4 weeks following discharge, a time when they received the greatest amount of intervention (weekly telephone calls).

Walking Impairment

The distance, speed and stairs subscales of the modified WIQ were analysed. Scoring of the subscales was guided by the work of Coyne et al. [37], where low scores indicate greater impairment in walking or climbing stairs. Responses to the item “Didn’t do for other reasons” were fewer than 50%; therefore, this item was excluded in the analysis. The intervention and control group means and standard deviations for the three subscales of the WIQ are presented in Table 1. A repeated measures ANCOVA found significant interactions over time and between groups for walking distance scores ($F(3,231)=19.49$, $p<.001$); walking speed scores ($F(3,231)=17.66$, $p<.001$) and for climbing stairs scores ($F(3,231)=16.98$, $p<.001$), demonstrating that in comparison to the control group, the intervention group had greater improvements over time in their ability to walk longer distances, the speed they were able to walk, and in the number of stairs they could climb without difficulty. Once again, the greatest improvements in the intervention group were seen in the first 4 weeks following discharge (see Figure 1 for example of this as related to walking impairment distance).

Program adherence

Adherence to the exercise program remained fairly stable over the 24 weeks of the intervention. Approximately 50 to 60% of intervention group participants adhered to their individual programs ‘all or most of the time’, while nearly another 20% undertook their exercise programs some of the time, thus around three-quarters of the group adhered to the program at least ‘some of the time’. Of the 24 - 36% of participants who only adhered to their program ‘none or a little of the time’, non-adherence was generally related to feeling unwell (34%), shortness of breath (33%), experiencing pain or lower limb oedema (57%), or lacking energy (17%). Other reasons for non-adherence included low or waning motivation (22%), weather conditions (such as summer heat; 22%), and feeling that they were already exercising enough through incidental activity (7%).

Around 40 to 50% of the intervention group participants adhered to all four components of their exercise program (stretching exercises, balance exercises, walking program and strengthening exercises). Another 30 – 40% of the group continued only with the walking program, as shown in Figure 2. Survey data indicated that resistance training and strengthening exercises was the program component least frequently undertaken. Notes from the physiotherapist and registered nurse suggested some participants found these exercises too difficult or strenuous (14%), time consuming (10%), or painful in light of existing medical conditions or symptoms (15%). Across the four exercise components, beyond simply reporting feeling ‘very or highly motivated’, there were also a number of positive factors noted that appeared to foster adherence. In particular, receiving encouragement from family (14%), having people comment on how well they look or how much better they are walking (10%), weight loss (12%), and feeling as though they were achieving or maintaining their goals (31%) led to continued adherence overall. Interestingly, of those who had been readmitted to hospital, around a third reported increased program adherence after returning home.

DISCUSSION

This study was conducted to evaluate the effectiveness of an innovative transitional care program in improving functional status and independence in activities of daily living in at-risk older adults. The program demonstrated significant benefits in these areas, particularly with regards to managing instrumental activities of daily living and walking capacity.

While some studies have found that exercise can enhance the ability to maintain independence in ADLs amongst adults $\geq$65 years [2, 18, 30], or IADLs amongst physically frail adults $\geq$75 years still living at home [19], a systematic review found ADL measures have not consistently improved with exercise interventions [23]. This inconsistency may be due to several factors. Exercise prescription alone does not always equate to improvements in functional ability - a combination of interventions to encourage health-promoting behaviours and maintain motivation over time is required to foster physical gains. Managing activities of daily living requires individuals to possess a variety of physical abilities (e.g. muscular strength, balance, flexibility and aerobic capacity). As such, exercise programs that do not address a range of different types of exercises may not find physical improvements translated into improved functional ability. Crucially, this is why a multifaceted approach to transitional care involving exercise and support over the long term appears to be important.

With more systematic reviews and clinical trials being conducted on exercise and transitional care programs, it is becoming increasingly apparent that exercise programs often have specific benefits based on the type of exercise engaged in, the duration and/or intensity and frequency of a program, as well as the nature of the program (e.g., in-hospital versus post-discharge, group or community-based versus home-based, standardised versus individually-tailored). For example, the potential to improve stair walking capacity of older communitydwelling adults who were previously fit but not actively involved in a structured exercise program was found [17] for the duration of a 24-week training strength and resistive training program. However, benefits were predominantly observed for tests involving strength (i.e. repetitions for five muscle groups) rather than function (balance – functional reach; coordination – floor rise; and, mobility – timed up and go, walking up and down stairs). Notably, there were no improvements in balance and coordination function tests, although those measuring mobility improved. Similarly, in a systematic review of 29 studies of exercise rehabilitation for adults with mild to moderate heart failure [22], exercise duration and walking distance improved significantly, however, most of the exercise programs reviewed were short-term in nature and benefits were also limited to the short term. The exceptions were training programs offering higher intensity exercises and those which were longer than 12 weeks in duration [22]. Although the exercises in the present study were tailored to the needs of participants with a much broader range of chronic conditions and were generally not high intensity, the 24 week length of the program appears to have obtained similar benefits to those noted by Rees et al. for heart failure patients. It could be argued that initiatives to prevent functional decline due to hospitalisation need to go beyond in-hospital strategies and should consider longer term programs. Results here suggest that on-going follow-up care and home assessment are important aspects to ensure that improvements in functional ability and independence are gained and maintained.

The individual tailoring of the program based on patient progress and circumstances may have contributed to gains in ADLs and IADLs previously not achieved in studies with hospitalised older patients [23]. Older adults have reported they prefer to exercise in their own home environment [20, 38] and this factor may have helped with the program's implementation and success. In circumstances where individuals find it difficult to access community or centre-based exercise programs this type of tailored exercise program is well suited. The continued support from a RN in adapting the program from the hospital to home environment and providing long term encouragement and feedback via the telephone may also have contributed to beneficial outcomes. Atienza [20] concluded that home-based programs that incorporated telephone-based support facilitate program participation, high exercise adoption and program adherence amongst older adults.

While rates of exercise adherence amongst those in the intervention group were generally very high, a number of factors were found to be associated with non-adherence. Many of the barriers to exercise adherence reported by Forkan et al. [39]: poor health (especially pain), shortness of breath, 'low or waning motivation' and weather conditions were also factors found to be associated with non-adherence in this study. Additionally, the feeling by some that they were already exercising enough through incidental activity is a new factor; although it may be associated with 'low outcomes expectations'.

Factors identified as facilitating adherence in this study such as encouragement, feedback on appearance or walking ability, weight loss, and feelings of achievement could be categorised into two primary types of motivators – those related to self-efficacy or attainment of one's goals and those associated with receiving encouragement from others or social support. This concept is supported by a number of review articles on exercise adherence amongst older adults [40-42]. Knowledge of the barriers and motivators to exercise amongst the elderly may be useful in predicting reasons for older people at-risk for readmission failing to adhere fully to a prescribed exercise program. In particular, it is possible that if an individual is still feeling unwell after discharge and lacks social support full adherence to a prescribed exercise program may be difficult. Thus, efforts to continue to monitor how an individual is feeling and to tailor the exercise program, together with efforts to increase social support may prove to be particularly important when aiming to improve functional ability, exercise adherence and, ultimately, independent living.

Limitations

Participants in the intervention group were more likely to voluntarily withdraw from the study in this sample (6.3%, compared to none from the control group) which may have resulted in some bias when interpreting results. The possibility of response bias was also present as measures of independence in activities of daily living and walking ability were obtained by self-report questionnaires.

Conclusion

This innovative multifaceted transitional care program demonstrated significant benefits in improved functional ability and independence and improved walking ability. The intervention's six month duration, individually tailored exercise program and continued nursing support via telephone are believed to have fostered greater program adherence and achievement of significant gains in functional ability, independence and walking. At present, because the intervention combined both exercise and telephone support, the relative contribution of each component is unknown and further research in this area is recommended. In addition, it is recommended that health professionals caring for older adults at risk of readmission include a tailored exercise program and telephone follow-up support for 6 months following hospital discharge.

Acknowledgments

The authors would like to thank Jan Armstrong for her assistance in preparing this article and the physiotherapy and nursing staff at the participating hospital for their contribution to the study.

Role of the funding source

This study was funded by the Australian Research Council Discovery Projects Grant Scheme. The funding body had no role in study design; collection, analysis or interpretation of data; report writing or decisions on publication.

REFERENCES

1. National Public Health Partnership. (2001) Preventing chronic disease: a strategic framework. Background paper. Melbourne, Australia: NPHP.

2. Armstrong, M., Bates, A., Castell, S. & Krolik, P. (2002) Staying active-staying safe: development of a physical activity and falls prevention resource for older people who dwell in the community. *New South Wales Public Health Bulletin*, 13 (1-2), 13-14.

3. Legg, L., Drummond, A. & Langhorne, P. (2009) Occupational therapy for patients with problems in activities of daily living after stroke *Cochrane Database of Systematic Reviews*, 3, CD003585.

4. Spirduso, W. & Cronin, D. (2001) Exercise dose-response effects on quality of life and independent living in older adults. *Medicine and Science in Sports and Exercise*, 33, S598-S608.

5. Covinsky, K.E., Palmer, R.M., Fortinsky, R.H., Counsell, S.R., Stewart, A.L., Kresevic, D., Burant, C.J. & Landefeld, C.S. (2003) Loss of independence in Activities of Daily Living in older adults hospitalized with medical illnesses: increased vulnerability with age. *Journal of the American Geriatrics Society*, 51 (4), 451-58.

6. DeVito, C.A., Morgan, R.O., Duque, M., Abdel-Moty, E. & Virnig, B.A. (2003) Physical performance effects of low-intensity exercise among clinically defined high-risk elders. *Gerontology*, 49 (3), 146-54.

7. Graf, C. (2006) Functional decline in hospitalized older adults. *American Journal of Nursing*, 106 (1), 58-68.

8. Parker, S.G. (2005) Do current discharge arrangements from inpatient hospital care for the elderly reduce readmission rates, the length of inpatient stay or mortality, or improve health status? Health Evidence Network. Copenhagen, Denmark: World Health Organisation. 1-17.

9. Sager, M., Franke, T., Inouye, S., Landefeld, C., Morgan, T. & Rudberg, M. (1996) Functional outcomes of acute medical illness and hospitalisation in older persons. *Archives of Internal Medicine*, 156 (6), 645-8.
10. AIHW. (2002) Issues and priorities in the surveillance and monitoring of chronic diseases in Australia. Australian Institute of Health and Welfare. Canberra, Australia.
11. CDC. (2006) CDC/WHO collaborating centre workshop on global advocacy for national physical activity plans. Centers for Disease Control and Prevention/World Health Organization. San Diego, CA.
12. National Public Health Partnership. (2005) Be Active Australia: a framework for health sector action for physical activity. Melbourne, Australia: NPHP.
13. Carter, N.D., Khan, K.M., McKay, H.A., et al. (2002) Community-based exercise program reduces risk factors for falls in 65- to 75-year-old women with osteoporosis: randomized controlled trial. *Canadian Medical Association Journal,* 167 (9), 997-04.
14. Yarasheski, K. (2003) Exercise, aging, and muscle protein metabolism. *The Journals of Gerontology: Series A : Biological sciences and medical sciences*, 58A (10), 918-22.
15. Mather, A.S., Rodriguez, C., Guthrie, M.F., McHarg, A.M., Reid, I.C. & McMurdo, M.E. (2002) Effects of exercise on depressive symptoms in older adults with poorly responsive depressive disorder. *British Journal of Psychiatry*, 180, 411-15.
16. Howe, T.E., Rochester, L., Jackson, A., Banks, P.M. & Blair, V.A. (2009) Exercise for improving balance in older people. *Cochrane Database of Systematic Reviews,* 3, CD003585.
17. Brandon, L.J., Boyette, L.W., Lloyd, A. & Gaasch, D.A. (2004) Resistive training and long-term function in older adults. *Journal of Aging & Physical Activity*, 12 (1), 10-28.
18. Wang, L., Van Belle, G., Kukull, W.B. & Larson, E.B. (2002) Predictors of functional change: a longitudinal study of nondemented people aged 65 and older. *Journal of the American Geriatrics Society*, 50 (9), 1525-34.

19. Gill, T., Baker, D., Gottschalk, M., N., P., Allore, H. & Van Ness, P. (2004) A prehabilitation program for the prevention of functional decline: effect on higher-level physical function. *Archives of physical medicine and rehabilitation*, 85 (7), 1043-49.

20. Atienza, A. (2001) Home-based physical activity programs for middle-aged and older adults: summary of empirical research. *Journal of Aging & Physical Activity*, 9 (2), S38-58.

21. Latham, N.K., Bennett, D.A., Stretton, C.M. & Anderson, C.S. (2004) Systematic review of progressive resistance strength training in older adults. *Journal of Gerontology: Medical Sciences*, 59A (1), 48-61.

22. Rees, K., Taylor, R.S., Singh, S., Coats, A.J.S. & Ebrahim, S. (2004) Exercise based rehabilitation for heart failure. *Cochrane Database of Systematic Reviews*, 3, CD003331.

23. de Morton, N.A., Keating, J.L. & Jeffs, K. (2007) Exercise for acutely hospitalised older medical patients. 1 (1), CD005955.

24. Goggin, N. & Morrow, J. (2001) Physical Activity Behaviours of Older Adults. *Journal of Aging and Physical Activity*, 9, 58-66.

25. Peri, K.K., Parsons, J. & McPherson, A., et al. (2009) Physical rehabilitation involving goal setting for older people living in the community. *Cochrane Database of Systematic Reviews*, 3, CD003585.

26. Parker, S.G., Peet, S.M., McPherson, A., et al. (2002) A systematic review of discharge arrangements for older people. *Health Technology Assessment*, 6 (4), i-iv.

27. Mistiaen, P. & Poot, E. (2006) Telephone follow-up, initiated by a hospital-based health professional, for postdischarge problems in patients discharged from hospital to home. *Cochrane Database of Systematic Reviews*, 4, CD004015.

28. Courtney, M., Edwards, H., Chang, A., Parker, A., Finlayson, K. & Hamilton, K. (2009) Reduced emergency readmissions and improved quality of life for older adults at risk of

hospital readmission: Randomised controlled trial *Journal of the American Geriatrics Society*, 5 (3), 395-402.

29. Graves, N., Courtney, M., Edwards, H., Chang, A., Parker, T. & Finlayson, K. (2009) Cost-effectiveness of an intervention to reduce emergency re-admissions to hospital among older patients. *PLoS ONE*, 4 (10, e7455), 1-9.

30. Regensteiner, J., Steiner, J., Panzer, R. & Hiatt, W. (1990) Evaluation of walking impairment by questionnaire in patients with peripheral arterial disease. *Journal of Vascular Medicine and Biology*, 2, 142-150.

31. Katz, S. & Akpom, C.A. (1976) 12. Index of ADL. *Medical Care*, 14 (5 Suppl), 116-118.

32. Lawton, M.P. & Brody, E.M. (1969) Assessment of older people: self-maintaining and instrumental activities of daily living. *The Gerontologist*, 9 (3), 179-186.

33. Berg, K.O., Maki, B.E., Williams, J.I., Holliday, P.J. & Wood-Dauphinee, S.L. (1992) Clinical and laboratory measures of postural balance in an elderly population. *Archives of Physical Medicine and Rehabilitation*, 73 (11), 1073-80.

34. Wall, J.C., Bell, C., Campbell, S. & Davis, J. (2000) The timed get-up-and-go test revisited: measurement of the component tasks. *Journal of Rehabilitation Research & Development*, 37 (1), 109-13.

35. Bowling, A. (1997) Measuring health: a review of the quality of life measurement scales. 2nd ed. Buckingham: Open University Press.Book

36. McDermott, M., Liu, K., JM, G., Martin, G., Criqui, M. & Greenland, P. (1998) Measurement of walking endurance and walking velocity with questionnaire: Validation of the walking impairment questionnaire in men and women with peripheral arterial disease. *Journal of Vascular Surgery*, 28 (6), 1072-1081.

37. Coyne, K.S., Margolis, M.K., Gilchrist, K.A., Grandy, S.P., Hiatt, W.R., Ratchford, A., Revicki, D.A., Weintraub, W.S. & Regensteiner, J.G. (2003) Evaluating effects of method of

administration on Walking Impairment Questionnaire. *Journal of Vascular Surgery*, 38 (2), 296-04.

38. Nelson, M.E., Layne, J.E., Bernstein, M.J., et al. (2004) The Effects of Multidimensional Home-Based Exercise on Functional Performance in Elderly People. *Journals of Gerontology Series A: Biological Sciences & Medical Sciences*, 59A (2), 154-160.

39. Forkan, R., Breeanna, P., Smyth, N., Wirkkala, H., Ciol, M.A. & Shumway-Cook, A. (2006) Exercise adherence following physical therapy intervention in older adults with impaired balance. *Physical Therapy*, 86 (3), 401-410.

40. Brassington, G.S., Atienza, A.A., Perczek, R.E., DiLorenzo, T.M. & King, A.C. (2002) Intervention-related cognitive versus social mediators of exercise adherence in the elderly. *American Journal of Preventative Medicine*, 23 (2S), 80-86.

41. Chao, D. & Foy, C.G. (2000) Exercise adherence among older adults: Challenges and strategies. *Controlled Clinical Trials*, 21, 212S-217S.

42. Rhodes, R.E., Martin, A.D., Taunton, J.E., Rhodes, E.C., Donnelly, M. & Elliot, J. (1999) Factors associated with exercise adherence among older adults. *Sports Medicine*, 28 (6), 397-411.

FIGURES

Figure 1. Percentage level of impairment in distance scores over six months.

Figure 2. Type of exercise undertaken over six months.

Table 1. Mean scores (M) and standard deviations (SD) for the Instrumental Activities of Daily living (IADL) scale, Index of Activities of Daily Living (ADL) and Walking Impairment Questionnaire distance, speed, and stairs subscales.

	Baseline Mean (SD)		**4 weeks Mean (SD)**		**12 weeks Mean (SD)**		**24 weeks Mean (SD)**	
	I *	**C***	**I**	**C**	**I**	**C**	**I**	**C**
IADL**	2.16	2.62	1.47	3.29	1.27	3.56	1.13	4.33
	(1.71)	(2.04)	(1.50)	(2.03)	(1.67)	(1.98)	(1.71)	(2.15)
ADL***	0.36	0.35	0.07	0.69	0.18	0.75	0.16	1.27
	(0.74)	(0.65)	(0.25)	(1.21)	(0.68)	(1.25)	(0.42)	(1.71)
Distance†	23.54	20.22	53.62	28.90	54.83	21.59	62.89	19.93
	(33.07)	(32.97)	(25.88)	(30.21)	(27.79)	(26.17)	(28.17)	(24.93)
Speed ††	16.21	14.43	41.30	22.09	44.62	17.89	48.56	16.58
	(19.15)	(20.61)	(21.90)	(22.52)	(24.57)	(20.67)	(25.75)	(19.94)
Stairs†††	27.70	24.12	46.73	26.06	51.23	24.40	57.20	22.18
	(29.67)	(30.01)	(29.35)	(25.65)	(28.13)	(22.28)	(27.80)	(24.32)

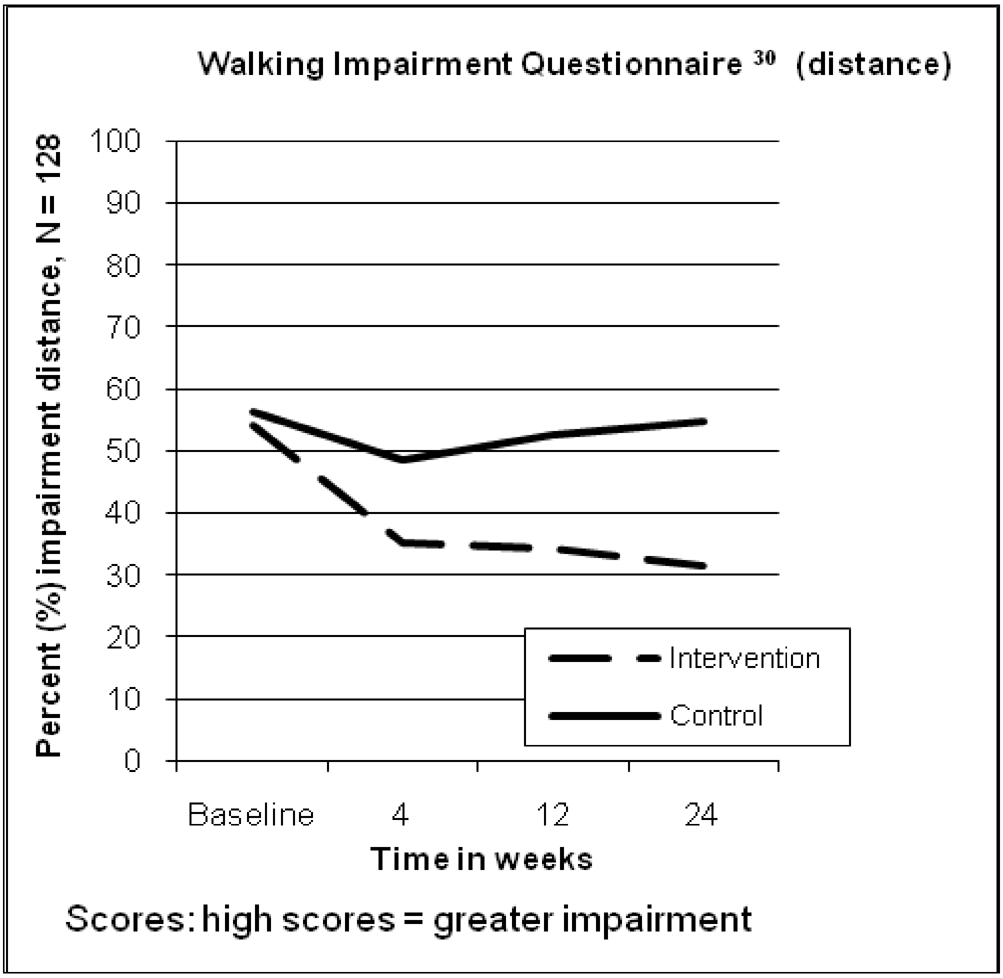
*** I**=Intervention; **C**=Control.

** $F(3,282) = 30.645$, $p < 0.001$; *** $F(3,282) = 9.733$, $p < 0.001$

† $F(3,231) = 19.49$, $p < 0.001$, Scale 0 – 100, where higher scores inicate greater ability

†† $F(3,231) = 17.66$, $p < 0.001$, Scale 0 – 100, where higher scores inicate greater ability

††† $F(3,231) = 16.98$, $p < 0.001$, Scale 0 – 100, where higher scores inicate greater ability



Note: Greatest change seen in first 4 weeks of intervention.

Figure 1. Percentage level of impairment in distance scores over six months.

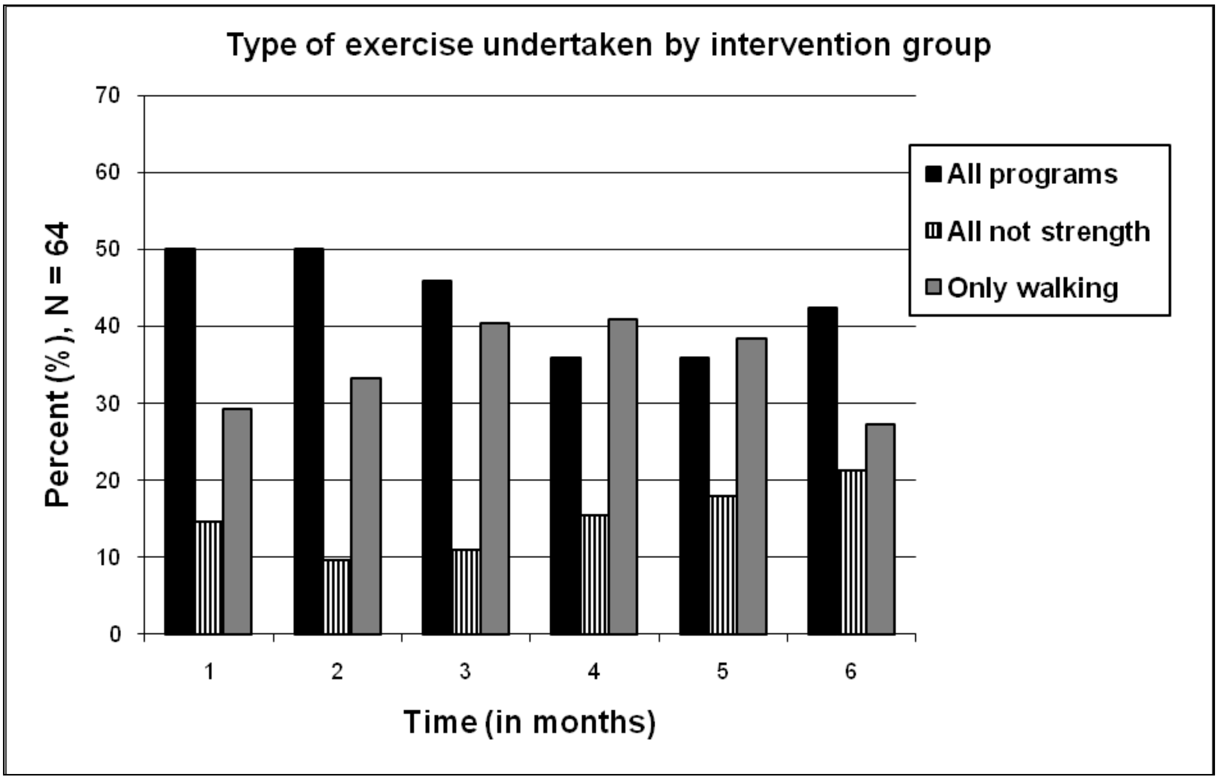


Figure 2. Type of exercise undertaken over six months.