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Health condition and physical function as predictors of adherence in long-term strength and balance training among community-dwelling older adults

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ABSTRACT

Aim: Strength and balance training (SBT) has remarkable health benefits, but little is known regarding exercise adherence in older adults. We examined the adherence to strength and balance training and determinants of adherence among ≥75 year old adults.
Methods: 182 community-dwelling individuals (aged 75–98 years, 71% female) began group-based SBT as part of a population-based Geriatric Multidisciplinary Strategy for the Good Care of the Elderly study. Training was offered once a week for 2.3 years. Adherence was defined as the proportion of attended sessions relative to offered sessions. Participants were classified based on their adherence level into low (≤33.3%), moderate (33.4–66.5%) and high (≥66.6%) adherers.
Results: The mean length of training was 19 ± 9 months, and 68% continued participation for at least two years. The mean training adherence was 55 ± 29% for all participants and 18%, 53% and 82% for low, moderate and high adherers, respectively. High adherence was predicted by female sex; younger age; better cognition; independence in Instrumental Activities of Daily Living; higher knee extension strength; faster walking speed; and better performance on the Berg Balance Scale and Timed Up and Go tests. Poorer self-perceived health and the use of a walking aid were related to low adherence.
Conclusions: Long-term continuation of training is possible for older community-dwelling adults, although poorer health and functional limitations affect training adherence. Our findings have implications for tailoring interventions and support for older adults to optimize their exercise adherence.
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1. Introduction

Physical activity and exercise promote healthy aging and prevent mobility limitations and disability (Ip et al., 2013). Strength and balance training (SBT) is an important part of the health-enhancing exercise and physical activity guidelines for older adults (American College of Sports Medicine et al., 2009), and also recommended for prevention of falls (Panel on Prevention of Falls in Older Persons, American Geriatrics Society and British Geriatrics Society, 2011). However, strength and balance training is still relatively uncommon among rapidly increasing older population. In Finland, less than 17% of the adults aged 75–79 years engage in muscle-strengthening activities weekly, and participation even decreases with age (Laitalainen, Helakorpi, & Uutela, 2010).

Low adherence to exercise may threaten the achievable health benefits, but yet little is known about adherence to SBT among older adults. An important issue when implementing exercise interventions is whether the recruited participants can continue the training for a relatively long time and with reasonable frequency. Previous studies have reported high adherence rates in randomized controlled trials (RCTs) where participants have completed more than 70% of their prescribed exercise sessions (Martin & Sinden, 2001; Nyman & Victor, 2012). Most RCTs have

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been conducted with a highly selected sample of older adults, though regular exercise might be most required and effective for those older adults with functional limitations and comorbidities (American College of Sports Medicine et al., 2009; Panel on Prevention of Falls in Older Persons, American Geriatrics Society and British Geriatrics Society, 2011). Information regarding to older adults adherence to exercise interventions may improve the design and implementation of exercise programs in community-settings (Glasgow, Vogt, & Boles, 1999).

To the best of our knowledge, no study has reported the determinants of adherence to supervised long-term SBT in ≥75 year old adults. Previous studies have reported adherence to shorter-term (Fielding et al., 2007; Sjösten et al., 2007) or home-based exercise interventions (Jette et al., 1998) and assessed self-report measures such as self-efficacy (Koeneman, Verheijden, Chinapaw, & Hopman-Rock, 2011), attitudes (Hawley-Hague et al., 2014) or socioeconomic characteristics (Chevan, 2008) as potential determinants of training adherence. However, the role of health and physical function related factors in predicting SBT adherence has not been reported previously. The aim of this study was to investigate adherence to SBT during a 2.3-year intervention period in a community-based sample of adults aged ≥75 years. We also studied whether health status or performance-based measures of physical function predicted adherence to the SBT intervention.

2. Materials and methods

2.1. Participants

This study is part of a larger project, Geriatric Multidisciplinary Strategy for the Good Care of the Elderly (GeMS), which is a population-based intervention study that evaluated the effects of annual geriatric assessment and optimization of care (Lihavainen et al., 2011). A population-based sample of 1000 people aged ≥75 years who lived in Kuopio, Finland was invited and randomized into an intervention ($n = 500$) and control group ($n = 500$). A total of 781 individuals (81 living in residential care facilities) participated in the study. The community-dwelling individuals of the intervention group ($n = 339$) received physical activity counseling and the opportunity to start SBT. The participants of this study ($n = 182$) are a subgroup of the intervention group, i.e., those individuals who started the offered SBT intervention. The eligibility for SBT was based on clinical examination by a physician. Exclusion criteria were minimal. Only individuals at high risk of adverse events were excluded. If a participant had acute health condition at the baseline examination, it was possible to start SBT later when the condition was sufficiently controlled. Inclusion criterion was the ability to move independently or with minimal help at the gym. Those participants of the intervention group who did not start the offered SBT ($n = 157$) were older and had lower health, MMSE score and physical functioning compared to the SBT-initiators analyzed in this study (Aartolahti, Hartikainen, Lönnroos, & Häkkinen, 2014). Only few SBT-initiators ($n = 8$, 4%) had previously participated in SBT at gym regularly, at least once in a month. The GeMS study was approved by the Research Ethics Committee of Northern Savo Hospital District and Kuopio University Hospital. Written informed consent was obtained from study participants.

2.2. Strength and balance training (SBT)

The individually tailored annual physical activity counseling with the physiotherapist preceded the strength and balance training. Counseling started with a semi-structured interview that charted the participants' current and prior physical activity. Practical and detailed goals for future physical activity were set. Opportunity to participate in group-based SBT was offered once a week between September 2004 and December 2006 and supervised by a physiotherapist. Training was organized in small groups in the city center and was free of charge. Each training session started with combined 15 min warm-up and balance exercises. Progressive strength training included knee extension and flexion, leg press, hip adduction, abduction and extension, and abdominal crunch with gym equipments (Technogym, Italy). The intensity of training was determined by repetition maximum (RM): 60–85% of 1 RM, 2–3 sets and 8–12 repetitions. After a couple of introductory training sessions the prediction of one repetition maximum was done using multiple repetition maximum testing with 3–6 repetitions to failure (Knutzen, Brilla, & Caine, 1999). Progression was accomplished by increasing the load while maintaining the same number of repetitions.

2.3. Adherence

The SBT participation was recorded by the physiotherapist on the training logs at the gym. The total length of training was 2.3 years but the gym was closed on midweek holidays and summer holidays. Thus the number of offered training sessions per participant varied from 94 to 104. Training adherence was measured by the number of training sessions attended relative to the number of training sessions offered, and expressed as adherence percentage. For the statistical analysis, the participants were categorized according to their adherence level: (1) ≤33.3%, low adherers, (2) between 33.3 and 66.6%, moderate adherers, and (3) ≥66.6%, high adherers.

2.4. Comprehensive geriatric assessment

Three trained nurses, two physiotherapists, and two physicians collected the GeMS data. Sociodemographic factors, health status, cognitive and physical functioning, and ability to perform activities of daily living were assessed. The balance, mobility and muscle strength measurements were carried out by the physiotherapists.

2.4.1. Health status

Comorbidity was defined using a modified version of the 18-item Functional Comorbidity Index (FCI) (Groll, To, Bombardier, & Wright, 2005). The FCI takes into account the number of medical conditions, with higher scores indicating greater comorbidity. This study collected data on the following conditions: (1) rheumatoid arthritis and other connective tissue diseases, (2) chronic asthma or chronic obstructive pulmonary disease, (3) Parkinson's disease or multiple sclerosis, (4) osteoporosis, (5) coronary artery disease, (6) heart failure, (7) myocardial infarction, (8) stroke, (9) diabetes, (10) depression, (11) visual impairment, (12) hearing impairment, and (13) obesity.

Cognitive function was assessed using the Mini-Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975), and depressive symptoms were assessed using the 15-item Geriatric Depression Scale (Sheikh et al., 1991) with scores ≥5 indicating possible depression. Self-rated health was assessed with the following question: "How would you rate your health at the moment?" The participants selected one of five responses. In the analysis, alternatives 1 and 2 (good or very good) and 4 and 5 (poor or very poor) were combined. Hospital admissions were identified from the Finnish National Hospital Discharge Register maintained by the National Institute for Welfare and Health (Sund, 2012).

2.4.2. Physical function

The Berg Balance Scale (BBS) (Berg, Wood-Dauphinee, Williams, & Maki, 1992) and the Timed Up and Go test (TUG) (Podsiadlo & Richardson, 1991) were used to assess balance and

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