



## Ergometer-cycling with strict versus minimal contact supervision among the oldest adults: A cluster-randomised controlled trial



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### ABSTRACT

**Objective:** To evaluate the feasibility and short- and long-term effects of two 10-wk structured ergometer-cycling programs among elderly in assisted-living residences.

**Design, setting, and participants:** Eight assisted-living residences (N=95; age = 81.2 ± 5.9 years) were randomly assigned to one of three conditions: 1) ergometer-cycling with strict coach-supervision (STRICT, N=3; n=35); 2) ergometer-cycling with autonomy-supportive minimal contact coach-supervision (AUT; N=3; n=36); or 3) control condition (CON; N=2, n=24).

**Intervention:** Three-weekly progressive ergometer-cycling sessions for 10 weeks.

**Main outcome measures:** Feasibility, physical activity (PA), muscular strength, functional performance and quality of life (baseline, post-intervention (10weeks) and 6-month follow-up).

**Results:** 83 participants were analyzed post-intervention, 75 at follow-up. Adherence was higher in STRICT than AUT during the intervention ( $p=0.001$ ), but not during follow-up. Compared with CON, both programs showed positive short- and long-term effects on moderate-intensity PA ( $p=0.034$ ). With regard to strength, functional performance and well-being, no time-by-group interaction effects were found. When comparing high-adherers (adherence ≥ 80%) to low-adherers, a greater increase in functional performance and in well-being and a trend towards a lower decrease in strength were found in the short-term ( $p=0.047$ ,  $p<0.001$  and  $p=0.054$ , respectively).

**Conclusion:** Both interventions were feasible and equally effective to increase long-term engagement in PA, irrespective of the type of supervision. When adherence is high, positive effects on strength, performance and well-being can be expected.

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### 1. Introduction

Populations around the world are aging rapidly, and the fastest growing segments are the old (75–84 years) and the old-old (≥85 years) (Christensen, Doblhammer, Rau, & Vaupel, 2009). Aging is characterized by declines in physical fitness and strength, which diminish physical functioning and therein threaten independency (Spirduso, Francis, & MacRae, 2005). Therefore, retaining physical functionality is essential to maintain a worthwhile quality of life at older age.

Regular physical activity (PA) can attenuate the maladaptive impact of aging, but the majority of older adults are insufficiently physically active to maintain their present physical functionality level (Sjöström, Oja, Hagströmer, Smith, & Bauman, 2006; Varo

et al., 2003). Moreover, PA involvement progressively diminishes with increasing age (Buchman et al., 2014), which stresses the importance of PA promotion among older adults in public health policy.

In community-dwelling older adults, regular PA has been shown to delay the physical disablement process, which is characterized by reduced muscular strength and a loss of daily functioning (Pahor et al., 2014; Tak, Kuiper, Chorus, & Hopman-Rock, 2013). However, individuals who have the most potential to improve physical functioning are probably those who have just entered the early stages of physical impairment. In the last two decades, assisted-living residences have become a popular housing option for older adults who experience some difficulty in daily life activities (Giuliani et al., 2008; Schulz, Noelker, Rockwood, & Sprott, 2006). Assisted-living residences provide a combination of housing, personalized supportive services and health care to assist older adults in coping with daily life demands. Personalized support can include assistance with medication, meal preparation

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and access to medical care. In addition, social and recreational activities are provided to the residents (Tighe et al., 2008). In contrast with nursing home residents who are supervised during the whole day, assisted-living residents live independently. Support is only provided when required. Assisted living is often viewed as temporary to delay the definite referral to a nursing home. However, it is currently unclear whether increasing the physical activity of assisted-living residents can slow down this referral.

International PA guidelines for older adults recommend being physically active at least 150 min a week at a moderate intensity. Deconditioned older adults are advised to start with a low training volume, which should gradually increase and they should be as physically active as their abilities and conditions allow (American College of Sports Medicine, 2013; Chodzko-Zajko et al., 2009; Nelson et al., 2007). Furthermore, guidelines typically prescribe both cardiovascular and muscle-strengthening exercise in order to improve physical functioning. However, old-old adults have such a low level of physical capacity and muscular strength that cardiovascular exercise might provide a stimulus that is sufficiently high to induce positive effects on both cardiovascular capacity as well as muscular strength (Fisher & Steele, 2014). Ergometer-cycling is particularly attractive as training modality for those individuals, considering that it is safe, easy to perform, has limited impact on the joints and does not require as much postural control as walking or cycling outside (Bouaziz, Schmitt, Kaltenbach, Geny, & Vogel, 2015). But more research is necessary in this functionally limited age category.

Traditional PA interventions consist of structured training programs under the strict supervision of a coach. The coach systematically prescribes exercise according to the principles of training progression – i.e., with an attainable exercise load (i.e., intensity and volume) and sequence that results in optimal physical responses. Such interventions have the advantage that the coach provides and promotes a structure in exercise that is optimal to achieve the desired adaptive physical outcomes. Previous reviews have indicated that such structured PA interventions can be effective among (community-dwelling) older adults. However, their effects tend to be small and short-lived (Chase, 2014; Conn, Minor, Burks, Rantz, & Pomeroy, 2003; van der Bij, Laurant, & Wensing, 2002). In addition, implementation possibilities of these strictly supervised interventions are limited because they require a lot of organization, time and financial support.

In order to facilitate large-scale implementation, procedures to promote PA should consider less demanding forms of supervision, such as supervision with minimal contact moments between coach and participants. To optimize the long-term effectiveness of this approach, it is crucial to base the intervention on validated assumptions of motivation theories, such as the Self-Determination Theory (SDT) (Deci & Ryan, 1985; Ryan & Deci, 2000). The SDT proposes that individuals' motivation to exercise is of better quality when it originates from a more self-inherent appreciation of exercise involvement. Individuals would be more likely to *want to* exercise when this is in line with their personal preference (i.e., autonomy), because they feel or think that this is effective in achieving outcomes that they self-inherently value (i.e., competence), including feeling positively connected to others (i.e., belongingness). Exercise environments that facilitate 'autonomous' exercise motivation, as opposed to controlled motivation, have been shown to yield better long-term exercise involvement (Ryan & Deci, 2000; Teixeira, Carraca, Markland, Silva, & Ryan, 2012). An autonomy-supportive approach has been found to be effective in promoting PA among (community-dwelling) older adults (Van Hoecke, Delecluse, Bogaerts, & Boen, 2014). The question remains whether it can also provide a valuable framework to promote PA among assisted-living facilities, where

residents are often older and more dependent on others compared to community-dwellers. In other words, the feasibility of exercise trials with autonomy-supportive, minimal contact supervision is yet to be determined among assisted-living residents.

Previous exercise feasibility trials in similar settings required either strict supervision and/or relatively expensive equipment (Alvarez-Barbosa et al., 2014; Bossers et al., 2014; Fien, Henwood, Climstein, & Keogh, 2016; Hassan et al., 2016; Sievanen, Karinkanta, Moisio-Vilenius, & Ripsaluoma, 2014). Strict supervision requires a lot of organization, time and financial support, which ultimately limits large-scale implementation given that financial resources for physical activity are often restricted (Hanson et al., 2014). Therefore, our study evaluated the feasibility of an easy-accessible inexpensive ergometer-cycling program with either autonomy-supportive, minimal contact supervision (AUT) or traditional strict supervision by a coach (STRICT) among old and old-old adults in assisted-living residences. In addition, the effectiveness of the two ergometer-cycling interventions on PA, muscular strength, functional performance and quality of life was investigated. We hypothesized that both interventions would be significantly more effective at improving PA, muscular strength, functional performance and quality of life compared with a control condition (CON). In addition, we hypothesized that STRICT would result in higher adherence rates than AUT in the short-term, while AUT would result in higher long-term adherence rates due to the provided autonomy support.

## 2. Methods

### 2.1. Trial design

This cluster-randomized controlled trial was designed as a parallel-group study, with two different ergometer-cycling interventions and one control condition. The intervention duration was 10 weeks, followed by a 6-month follow-up. Baseline, post-intervention and follow-up measurements were performed from January to March 2013, from April to June 2013, and from October to December 2013 respectively.

### 2.2. Participants

In 8 assisted-living residences in Flanders (i.e., Dutch-speaking region of Belgium), 417 residents were personally contacted to participate in the study (September – December 2012). These residents lived in independent units, but they were offered a considerable range of supportive services (i.e., provision of meals, house-cleaning, etc.). The exclusion criteria were (1) cognitive impairment as diagnosed by the general practitioner, (2) any specific contra-indication for participation in the ergometer-cycling training program or in the measurements (i.e., severe thrombotic or neurological disease; recent cardiovascular event or serious lung-, heart- or vascular disease; uncontrolled hypertension or diabetes type-II, infection, or tumor; major bone fracture in the past 4 months), and (3) involvement in a structured PA program in the last three months. The selection procedure was approved by the Ethics Committee of the Group Biomedical Sciences of KU Leuven. Ninety-five residents met the eligibility criteria and signed an informed consent.

### 2.3. Randomization

Randomization took place at the level of the assisted-living residence to minimize contamination between interventions. Given that a lower drop-out can be expected in the control condition as compared to the intervention conditions, allocation ratio was 3:3:2. After stratification for the number of residents, the

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