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A busy day has minimal effect on factors associated with falls in older people: An ecological randomised crossover trial

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ABSTRACT

Fatigue is a common complaint in older people. Laboratory-induced muscle fatigue has been found to affect physical functions in older populations but these protocols are rigorous and are unlikely to accurately reflect daily activities. This study used an ecological approach to determine the effects of a busy day on self-reported fatigue and fall-related measures of physical and cognitive function in older people. Fifty community-dwelling adult volunteers, aged 60–88 (mean 73) years participated in this randomised crossover trial. Participants undertook assessments of balance, strength, gait, mobility, cognitive function and self-reported fatigue, before and after a planned rest day and a planned busy day (randomly allocated) at least one week apart. Participants wore an activity monitor on both the rest and busy days. On average, participants undertook twice as many steps and 2.5 times more minutes of activity on the busy, compared with the rest day. Participants had a significant increase in self-reported fatigue on the afternoon of the busy day and no change on the rest day. Repeated measures ANOVAs found no significant day (rest/busy) × time (am/pm) interaction effects, except for the timed up and go test of mobility, resulting from relatively improved mobility performance over the rest day, compared with the busy day. This study showed few effects of a busy day on physical and cognitive performance tests associated with falls in older people.

1. Introduction

Falls among older people are the leading cause of injury-related hospitalisation and are associated with reduced independence, increased morbidity and mortality, contributing to substantial personal and economic burden (Stevens et al., 2006). Risk factors for falls include poor performance in physical and cognitive tasks, such as balance, muscle strength and decision making (Tinetti et al., 1988; Mirelman et al., 2012). Fatigue, defined as a reduction in the efficiency of a muscle or organ after prolonged activity or a sense of general persistent tiredness, might exacerbate the risk of falls through its potential effects on physical and cognitive functions (Helbostad et al., 2010; Pereira et al., 2015; Brown and Bray, 2015).

Fatigue is a common complaint in older people. In a cohort of > 700 participants it was found that 50% of people aged 70 years report fatigue in undertaking their daily activities, with this proportion increasing to > 75% in a subsample followed up at age 85 years (Avlund, 2010). Reported fatigue at both age 75 and 80 was found to be significantly related to functional decline and mortality over five years (Avlund, 2010). Fatigue can affect motor and cognitive functions, which are critical for balance and preventing falls. Despite this, the effect of fatigue on fall risk factors is not well understood.

Fatigue may be exacerbated by prolonged physical or mental activity. Fatiguing exercise has been shown to have detrimental effects on strength, proprioception, standing and reactive balance (Helbostad et al., 2010; Pline et al., 2005; Kent-Braun, 2009). Findings from a systematic review suggest that muscle fatigue can impair measures of standing balance, leaning balance, mobility transfers and walking stability in older people (Helbostad et al., 2010). These findings come from studies that induce muscle fatigue via resistance or repetitive exercises to specific lower limb and/or trunk muscles. For example, after performing a fatiguing repeated sit-to-stand task, older adults had significantly wider steps, greater step length variability and alterations in trunk acceleration during level-ground walking (Helbostad et al., 2007), as well as reduced limb loading control after stepping over an obstacle (Hatton et al., 2013), compared with a rested state. Findings

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from these studies are particular to the specific muscle or muscle group fatigued and/or involve exercise protocols that are unrealistic and have little relevance to the lives of older people. Fatigue experienced during daily activities may not be isolated to muscle fatigue, but may also incorporate more central changes, including slower processing speed and impaired cognition (Brown and Bray, 2015; Marcora et al., 2009). The current study was designed to take an ecological approach to understanding whether fall risk related measures are impacted by different levels of physical activity that are natural variations in the lives of older people. We chose physical and neuropsychological assessments that have shown to be sensitive to changes following interventions (Vogler et al., 2009; Eggenberger et al., 2015; van het Reve and de Bruin, 2014; Liu-Ambrose et al., 2004).

This study aimed to compare the effects of a busy and rest day on self-reported fatigue, physical and cognitive performance measures associated with fall risk in older people. We hypothesised that a busy day would result in an increased physiological fall risk as well as poorer physical and cognitive test performance in the afternoon relative to the morning, while the rest day would induce no physical and cognitive test performance changes between the morning and afternoon.

2. Methods

2.1. Participants

Adults aged 60 years or older were recruited through a volunteer database at NeuRA and flyers posted in hospitals and retirement villages in Sydney. Inclusion criteria included: living independently in the community and being able to walk 20 m with or without the assistance of a walking stick. Exclusion criteria included being unable to stand unassisted, significant visual, cognitive or neurological impairment (including dementia, Alzheimer's disease, Parkinson's disease or multiple sclerosis), and insufficient English language skills to understand the assessment procedure.

2.2. Ethics and trial registration

All participants gave written informed consent prior to participation. The study protocol was approved by the University of New South Wales Human Research Ethics Committee (HC14340) and registered with the Australian New Zealand Clinical Trials Registry (ACTRN12615000916549).

2.3. Study protocol

This was a single-blinded randomised crossover trial (Fig. 1) to determine the effects of a busy versus rest day on outcome measures (described below). Participants attended the laboratory in the morning and afternoon on two days; randomly allocated as busy or rest, and crossed over with at least one week between. Permuted block randomisation was performed by a person external to the research team. Participants were informed of their randomly allocated condition presentation prior to attending the laboratory, to enable them to plan their day. For the busy day, participants were asked to schedule as many activities as possible into the one day (based on their estimate of their busiest of days), between 10 am and 4 pm. For the rest day, participants were asked to schedule as few daily activities as possible (based on their least busy days), between 10 am and 4 pm.

The morning and afternoon assessment were scheduled to be 6 h apart on both days. Participants were asked to wear an activity monitor (MoveMonitor v2.8.1, McRoberts B.V., The Netherlands) on both the busy and rest days, to quantify the number of steps taken and amount of time undertaking physical activity. This small wireless triaxial accelerometer, sampling at 100 Hz (84 × 50 × 8 mm, 45 g) to quantify time spent lying, sitting, standing and in locomotion (Dijkstra et al., 2010), was worn in a neoprene belt firmly fitted around the waist. During their first visit, participants completed a baseline questionnaire regarding age, gender, living arrangements, current health status, falls history, mobility status, medications, physical activity, quality of sleep, energy level, and medical conditions relevant to falls. Following this and on each subsequent visit (i.e.: the morning and afternoon of both the busy and rest days), participants undertook a battery of physical and cognitive assessments for study outcome measures.

2.4. Primary outcome measures

Participants indicated their perceived fatigue levels using the Visual Analogue Scale (VAS) for Fatigue, which consists of 18 questions assessing their level of energy and extent of physical and cognitive fatigue (Karagozoglu et al., 2012; Lee et al., 1991). Item 4 that asks 'how do you feel now?' with the response given using an 11-point Likert scale from zero ('not at all') to 10 ('extremely') was used for analysis.

The physiological falls risk score, was computed by the short-form Physiological Profile Assessment (PPA) (Lord et al., 2003), composed of five tests that assess visual contrast sensitivity, lower limb proprioception, lower limb strength, hand reaction time and standing balance (postural sway with eyes open on foam). From these five tests, a fall risk

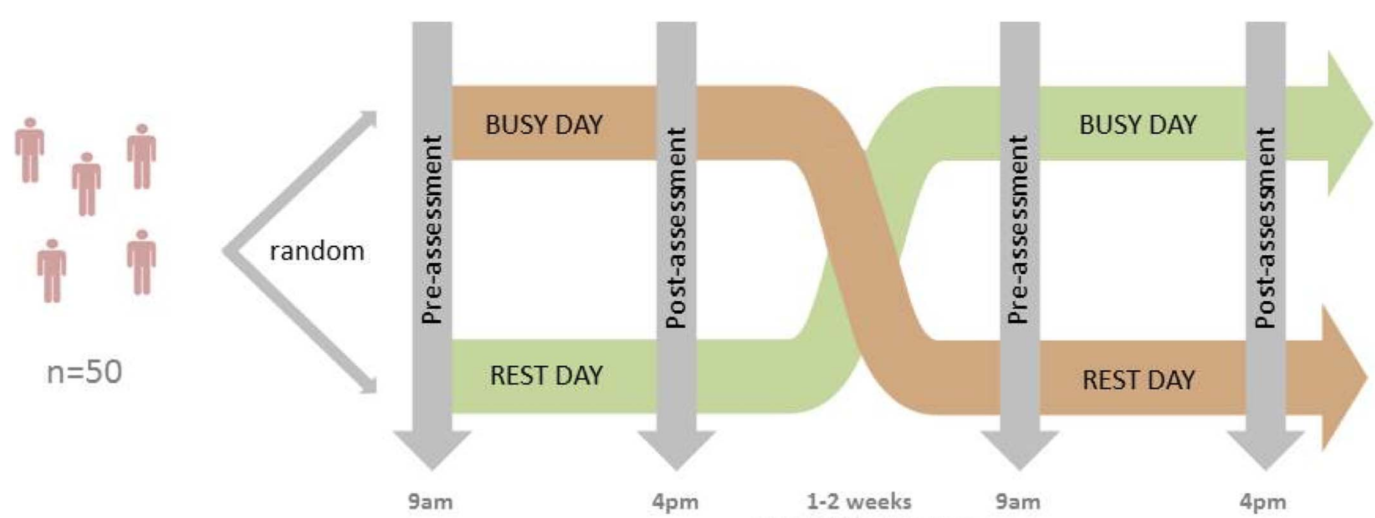

Fig. 1. Study protocol.