



A cluster randomized trial of a multi-level intervention, delivered by service staff, to increase physical activity of children attending center-based childcare



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ABSTRACT

Objective. To evaluate the impact of a multi-level intervention on the physical activity levels of 3–5 year old children attending center-based childcare services.

Method. The trial was conducted in New South Wales Australia in 2010 in 20 centers with 459 children. The intervention, included: fundamental movement skill sessions; structured activities; staff role modelling; limiting small screen recreation and sedentary time; and anactivity promoting physical environment. Control services continued with usual routines. Physical activity during care was assessed using pedometers at baseline and at six months after baseline. Intervention implementation was assessed via observation of staff physical activity practices and audits of service environment and policy.

Results. Mean step counts at baseline and follow-up were 17.20 (CI 15.94–18.46) and 16.12 (CI 14.86–17.30) in the intervention group and 13.78 (CI 12.76–14.80) and 13.87 (CI 12.57–15.17) in the control group ($p = 0.12$). Intervention services showed significantly greater increases in the total minutes that teachers led structured activities, relative to control group services ($p = 0.02$).

Conclusion. The intervention showed no significant effect on child step counts per minute despite increasing time that staff delivered structured activity which is likely to be attributable to difficulties experienced by service staff in delivering a number of intervention components.

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Introduction

Adequate physical activity for preschool age children (age three to five), promotes bone health, is protective against obesity and contributes to social, psychological and fundamental motor skill development (Burgi et al., 2011; Janz et al., 2010; McWilliams C et al., 2009; Metallinos-Katsaras et al., 2007; Oliver et al., 2007a, 2007b; Reilly et al., 2008; Ward, 2010). The United States National Association for Sport and Physical Education have recommended that three to five year old children should engage in at least 60 min of structured physical activity per day (National Association for Sport and Physical Education, 2002). Australian physical activity recommendations advise that children aged three to five participate in a minimum of three hours of physical activity per day (Australian Government Department of Health and Ageing, 2010). Compared with these recommendations, research suggests that

children are not adequately physically active (Colley et al., 2013; Okely et al., 2009). For example a systematic review of 39 studies from seven countries (United States, Scotland, Finland, Australia, Chile, Estonia, Belgium) found that overall, only 54% of two to six year old children participated in moderate to vigorous physical activity for at least 60 min per day (Tucker, 2008).

Center-based childcare services represent a unique opportunity to deliver interventions to increase young children's physical activity levels. They provide access to a significant proportion of the population under five years, often for prolonged periods (Story et al., 2006). Research also suggests that young children are not sufficiently active during attendance at care (Boldemann et al., 2006; Bower et al., 2008; Dowda et al., 2009; Raustorp et al., 2012). A number of service characteristics have been associated with increased child activity, providing a potential target for physical activity interventions. Specifically, delivery of structured physical activities (Bower et al., 2008; Ward et al., 2010), fundamental movement skill programs (Cliff et al., 2009; Williams et al., 2008); limiting small screen recreation opportunities (Dowda et al., 2009; Okely et al., 2008); staff involvement in, and verbal prompting of children's active play (Cashmore and Jones, 2008; Gubbels et al., 2011); having a physical

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activity policy (Bower et al., 2008; Trost et al., 2010); and adequate availability of portable play equipment (Bower et al., 2008).

Experimental research examining the effectiveness of such interventions, however, is limited (Ward, 2010). Published systematic reviews (Kreichauf et al., 2012; Trost, 2011; Ward et al., 2010) together with more recent trials have identified just nine randomized controlled trials of physical activity interventions delivered in center-based childcare that have assessed physical activity using objective measures (Alhassan et al., 2007, 2012; Binkley and Specker, 2004; Cardon et al., 2009; Eliakim et al., 2007; Fitzgibbon et al., 2011; Jones et al., 2011; Reilly et al., 2006; Trost et al., 2008). Interestingly, these trials have examined interventions targeting relatively few of the many center-based characteristics associated with increased child physical activity. Two of the nine trials assessed environmental interventions including the addition of outdoor free play time (Alhassan et al., 2007) and the inclusion of portable equipment and playground markings (Cardon et al., 2009). Both failed to demonstrate a significant effect on child physical activity. The remaining seven trials focused on increasing child participation in structured teacher led activities (such as group games, gross motor or fundamental movement skill development programs) (Alhassan et al., 2012; Eliakim et al., 2007; Fitzgibbon et al., 2011; Jones et al., 2011; Reilly et al., 2006; Specker and Binkley, 2003; Trost et al., 2008) with four of these reporting a significant intervention effect (Eliakim et al., 2007; Fitzgibbon et al., 2011; Specker and Binkley, 2003; Trost et al., 2008). A common feature of effective interventions was the frequency of structured activity provided to children, with three of the four providing such activities on a daily basis (Eliakim et al., 2007; Specker and Binkley, 2003; Trost et al., 2008). In contrast, interventions providing structured activities less frequently (2–3 days per week) did not yield improvements to children's physical activity (Jones et al., 2011; Reilly et al., 2006).

Interventions which are effective and can be implemented by existing childcare service staff, as opposed to external experts or additional staff, have particular public health appeal as they are not reliant on external staff or experts or constrained by additional costs associated with their employment. In this context, and given the limited scope of previous interventions we sought to evaluate the impact of a multi-level intervention, delivered by childcare service staff, on the physical activity levels of 3–5 year old children attending center-based childcare. We hypothesized that children in services assigned to the intervention group would exhibit higher step counts per minute than children in services where usual care was provided. We also sought to measure intervention implementation, acceptability and any unintended adverse effects of the intervention on child injury.

Methods

Design and setting

A detailed protocol for the trial has been published elsewhere (Finch et al., 2010). The cluster wait-list randomized controlled trial (see Fig. 1) was conducted in a sample of eligible long day care center-based childcare services (providing care for a minimum of eight hours a day) in three local government areas of New South Wales (NSW), Australia from March to October 2010. All trial outcomes reported in this article were registered with the Australian New Zealand Clinical Trials Registry (ACTRN1261000087055). The study was approved by the Hunter New England Area Human Research Ethics Committee (approval No.06/07/26/4.04) and University of Newcastle Human Research Ethics Committee (approval No.20100038).

Participants and recruitment

Recruitment was conducted from January to February 2010.

Long day care services

To be eligible to participate in the trial, services were required to have at least 25 enrolled children aged between three and five years. A total of 70 childcare services in the study region served as the sampling frame.

Children

Children aged three to five years attending participating services were eligible for the study if they attended on the day of the week nominated by the Authorized Supervisor for baseline data collection.

Randomization and allocation

After the completion of service recruitment, a statistician not associated with the project allocated services to either the intervention or control condition using block randomization performed in a 1:1 ratio in randomly sequenced blocks of two, four or six by a computerized random number function in Microsoft Excel. Randomization of long day care services was stratified by socioeconomic status based on evidence of an association with service adoption of physical activity promoting practices (Wolfenden et al., 2010), with such status being determined by the postcode in which the service was located (Australian Bureau of Statistics, 2008). Services were informed of group allocation via a letter after baseline data collection.

Intervention

The multi-level intervention, designed using social ecological models of health behaviour Change (Stokols, 1992) aimed to influence children's physical activity behaviour through the manipulation of mediators across the social, physical and organizational environment of the childcare services (Stokols, 1996; Trost et al., 2010). Specifically the intervention targeted staff instructional practices and interactions with children (social), service physical activity policy and programming (organizational) and the characteristics and equipment available within play space (physical environment). The social ecological framework has been identified as a suitable conceptual model for the design of physical activity interventions (King et al., 2002) and has been applied when describing correlates of children's physical activity behaviours (Okely et al., 2008; Sallis et al., 1993). Furthermore, school-based interventions grounded in such social ecological theory have been found to be effective in increasing physical activity levels of children by altering instructional practices and the environment (Pate et al., 2005). The intervention, was delivered over a four month period and comprised of the following components:

1. *Daily structured fundamental movement skill development sessions:* The 20 min session included a warm up activity, an age and developmentally appropriate teacher led game focusing on one or more fundamental movement skill, and a cool down activity.
2. *Increased opportunities each day for children to participate in physical activity:* Service staff were asked to, over the course of the usual day, program and opportunistically initiate physically active structured teacher led activities such as movement based group or circle time (where children participate in dance and group active games) and modifying planned activities to incorporate active movement such as during transitions between routine activities (e.g. children performing a locomotor skill on their way to lunch).
3. *Staff role modelling of active play and delivery of instructional practices:* All staff were asked to participate with children during active child initiated free play (role modelling) and provide verbal guidance (prompts to extend active play) and encouragement (positive statements about children's activity) during each free-play period.
4. *Limiting children's small screen recreation and sedentary time:* Staff were asked to limit the amount of time children spent watching or using electronic media whilst at the service and limit time children spent sitting still to periods of less than 30 min at a time (except when eating meals or sleeping).
5. *Providing children with a physical activity promoting indoor and outdoor physical environment:* Services were asked to make more readily available their existing activity promoting resources and portable equipment to children in indoor and outdoor areas (for example ball and batting play equipment, skipping roles, hula hoops, tumbling mats, twirling play equipment and climbing frames). Services were also encouraged to include, photos, books and posters promoting physical activity within the service.

Strategies to support intervention implementation

Strategies employed to support intervention implementation by service staff are described in detail elsewhere (Finch et al., 2010). In brief, they included a 6 h training workshop for service staff (a choice of four sessions were made

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