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# Understanding why an active video game intervention did not improve motor skill and physical activity in children with developmental coordination disorder: A quantity or quality issue?☆

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ABSTRACT

*Background:* Active video games (AVGs) have been identified as a novel strategy to improve motor skill and physical activity in clinical populations. A recent cross-over randomized trial found AVGs to be ineffective at improving motor skill and physical activity in the home-environment for children with or at-risk for developmental coordination disorder (DCD).
*Aims:* The study purpose was to better understand why the intervention had been ineffective by examining the quantity and quality of AVG play during an AVG intervention for children with or at-risk for DCD.
*Methods and procedures:* Participants (n = 21, ages 9–12) completed the 16 week AVG intervention. Detailed quantitative and qualitative data were systematically triangulated to obtain the quantity of exposure (AVG exposure over time, patterns of exposure) and quality of use (game selection, facilitators and barriers to play).
*Outcomes and results:* The median AVG dose (range 30–35 min/day) remained relatively stable across the intervention and met the prescribed dose. Play quality was impacted by game selection, difficulty playing games, lack of time, illness, technical difficulties and boredom.
*Conclusions and implications:* The ineffectiveness of a home-based AVG intervention may be due to quality of play. Strategies to improve the quality of game play may help realize the potential benefits of AVGs as a clinical tool for children with DCD.


## What this paper adds?

This is the first study to provide a detailed description of both the quality and quantity of active video game use by children with developmental coordination disorder. It uses multiple data sources to examine the reasons why a crossover, randomized control trial using active video games to increase motor skill and physical activity in children with DCD was ineffective.

☆ Trial Registration: Australia and New Zealand Clinical trials Registry (ACTRN 12611000400965).

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Participants achieved the prescribed therapeutic dose, but the selection of less difficult games and low efficiency of game play likely undermined any improvements in physical outcomes. This study provides detailed information for clinicians and practitioners considering the potential use of active video games as part of therapy and interventions. Future interventions using active video games may need more individually direct prescriptions, coaching, or intermittent supervision to ensure the quality of play.

## 1. Introduction

Active video games (AVGs) are an innovative strategy currently being trialed and used by clinicians to improve movement outcomes of motor skill development and physical activity. Active video games (also called exergaming, active-input e-games) are electronic games requiring large body movements to play the game, in contrast to small digit movements in traditional sedentary electronic games. Common examples are Nintendo Wii Remote, PlayStation Move and Microsoft Kinect which sense player movement with a hand held wand, dance mat or camera (Straker, Abbott, Collins, & Campbell, 2014). Previous studies, though limited in design and sample size, have used AVGs to improve coordination in survivors of childhood brain tumors (Sabel et al., 2016) and in physical rehabilitation in adolescents with physical disabilities (Chang, Chen, & Huang, 2011): a study using AVGs to promote physical activity among childhood cancer survivors is currently ongoing (Kauhanen et al., 2014).

One common movement impairment in children that affects 1% to 19% of the population is developmental coordination disorder (DCD) (Zwicker, Missiuna, Harris, & Boyd, 2012). Developmental coordination disorder is characterized by reduced motor skill proficiency that creates functional performance deficits with impact on daily living which are not likely to be due to intellectual or other neurological/psychiatric disorders (Barnhart, Davenport, Epps, & Nordquist, 2003; Polatajko, Fox, & Missiuna, 1995). Children with DCD have been found to have lower levels of physical activity and higher rates of obesity compared to typically developing peers, which has been associated with a reduction in motor skills (Green et al., 2011; Hendrix, Prins, & Dekkers, 2014; Rivilis et al., 2011). This reduction in physical activity may have meaningful implications as children with DCD's low physical activity may be related to a lower quality of life (Raz-Silbiger et al., 2015). It is hypothesized that motor skill and physical activity are part of a cycle whereby children with poor motor skill are less likely to participate in physical activity, and children who have low participation in physical activity do not develop adequate motor skill (Straker et al., 2011). Thus, interventions to increase both motor skills and physical activity participation of children with DCD are needed.

Active video games may be particularly successful interventions for children with DCD as they offer increased opportunities to practice motor skills and provide positive physical activity experiences in their home without judgement from peers (Barnett, Dawes, & Wilmut, 2013). Limited evidence suggests that AVGs can enhance the motor skills of children with DCD (Ashkenazi, Weiss, Orian, & Laufer, 2013; Hammond, Jones, Hill, Green, & Male, 2014; Jelsma, Geuze, Mombarg, & Smits-Engelsman, 2014; Salem, Gropack, Coffin, & Godwin, 2012). However, these studies have been small feasibility studies (Ashkenazi et al., 2013; Hammond et al., 2014), or were administered in a supervised setting for a short duration of 6 to 10 weeks (Jelsma et al., 2014; Salem et al., 2012). No studies to our knowledge have tested the effect of AVGs on physical activity in children with DCD.

Effectiveness of AVGs when played at home, where they offer the greatest advantage in terms of low resource requirements and high dose feasibility, has not been demonstrated (Baranowski et al., 2012; Maloney et al., 2008; Straker, Howie et al., 2015). The evidence for AVGs to influence physical activity in real world settings among typically developing children has been inconclusive as many studies using objective measures of physical activity have found no substantial effect in healthy populations (Baranowski et al., 2012; Maddison et al., 2011; Maloney et al., 2008; Straker, Abbott, & Smith, 2013). Because of this lack of consistent translation from the laboratory to the home (Liang & Lau, 2014), Active Healthy Kids Canada has released a position statement that does not recommend AVGs for increasing physical activity, however, the authors suggest AVGs may be useful for motor skill development in children with movement impairments (Chaput et al., 2013).

A recent randomized cross over study tested the effect of a home-based AVG intervention on motor skill and physical activity of children with DCD (Straker et al., 2011). While children perceived improvements in motor performance and self-reported physical activity following the AVG condition, there were no significant changes in objectively measured motor skill proficiency (Straker, Howie et al., 2015) or objectively measured physical activity (Howie, Amity, & Straker, 2016) following the AVG condition of the RCT.

In light of this failure of a home-based AVG intervention to improve the physical activity or motor skills of children with DCD, there is a clear gap in the translation of AVGs into practice. A better understanding of how, when, and importantly why (and why not) children are playing AVGs is needed (Chaput et al., 2013; Langford et al., 2014) and will help to optimize AVG strategies. Thus, the purpose of this study was to better understand why the intervention had not been successful by examining the quantity and quality of AVG use by children with DCD during a randomized crossover clinical trial. Mixed-method data were triangulated from multiple sources to help to explain the gap between AVG success in the supervised clinical setting and limited success in the home environment.