



Measuring physical activity with accelerometers for individuals with intellectual disability: A systematic review



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ARTICLE INFO

Keywords:

Objective measurements
Accelerometer
Intellectual disability
Exercise
Physical activity

ABSTRACT

Background: Multiple studies have reported differing physical activity levels for individuals with intellectual disabilities when using accelerometers. One of the potential reasons for these differences may be due to how researchers measure physical activity. Currently there is a lack of understanding on measurement protocol of accelerometers.

Aims: The purpose of this study was to synthesize the current practice of using accelerometers to measure physical activity levels among individuals with intellectual disabilities.

Methods: A systematic search was conducted using multiple databases including Medline (1998–2015), Sport Discus (1992–2015), Web of Science (1965–2015), and Academic Research Premier (2004–2015). Seventeen articles were found that met the inclusion criteria.

Results: There is a lack of consistent research protocols for measuring physical activity levels with accelerometers. Issues with the amount of time participants wore the accelerometer was a challenge for multiple studies. Studies that employed external strategies to maximize wear time had higher compliance rates.

Conclusion: There is a need to establish and standardize specific accelerometer protocols for measuring physical activity levels of individuals with intellectual disabilities for higher quality and more comparable data.

What does this paper add?

Currently, there are studies suggesting that individuals with intellectual disabilities are less physically active than their typically developed peers when physical activity levels are measured using an accelerometer. However, others have argued that this assumed group difference in physical activity level may not be true (Frey, Stanish, & Temple, 2008). This review is intended to address that assumption by providing a summary of the different accelerometer protocols used to measure and quantify physical activity levels among individuals with intellectual disabilities. This review showed that the differences in physical activity are a result of different protocol approaches used and not differences in physical activity level. These results raise concerns about the usage of different protocols across different studies, therefore, accelerometer protocol recommendations were made. It is believed that a more uniform approach may lead to higher quality physical activity data for individuals with intellectual disabilities at both the individual and population level.

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1. Introduction

Physical activity (PA) is defined as any bodily movement by the skeletal muscles that results in energy expenditure (Caspersen et al., 1985). Positive health benefits have been associated with engaging in regular PA (Iannotti, Kogan, Janssen, & Boyce, 2009). In order to obtain these health-related benefits, it is recommended that individuals follow the *2008 Physical Activity Guidelines for Americans* (U.S. Department of Health and Human Services, 2008). These guidelines suggest that adults engage in 150 min of moderate to vigorous PA (MVPA) per week and that children engage in 60 min of MVPA every day. The benefits of PA can be applied to any population, including individuals with intellectual disabilities (ID). A meta-analysis conducted by Bartlo and Klein (2011) demonstrated that people with ID could improve their overall health and independence by engaging in PA.

Determining whether individuals with and without ID meet the PA guidelines is important because PA levels are an indicator for health (Haskell, Blair, & Hill, 2009; Janssen & LeBlanc, 2010). Therefore, the first step in measuring PA levels is to have an accurate measure of PA. Subjective and objective measures are two distinct approaches to measure PA levels. Subjective measures rely on responses and reports of PA from individuals. The use of subjective measurements has been debatable (Dyrstad, Hansen, Holme, & Anderssen, 2014; Johnson, Yun, & McCubbin, 2014; Laporte, Montoye, & Caspersen, 1985; Vanhees et al., 2005; Westerterp, 2009) because many researchers questioned the accuracy of subjective measures due to recall bias, high rate of errors (Cuesta-Vargas, Paz-Lourido, & Rodriguez, 2011; Dyrstad et al., 2014) and low rate of compliance (Innerd et al., 2015). Recently, there has been increased support for utilizing objective measures to estimate PA levels (Bassett, Troiano, McClain, & Wolff, 2015; Reilly et al., 2003; Sirard & Pate, 2001). Objective methods such as pedometers, heart rate monitors, and accelerometers are more likely to produce non-biased PA estimations (Sirard & Pate, 2001), though they estimate PA through different approaches. In recent years, accelerometers have become one of the criterion measures for physical activity. Accelerometers measure the acceleration of movement with the ability to estimate the frequency, intensity, and duration of PA and remain the most commonly used device in research settings (McGarty, Penpraze, & Melville, 2014a).

Many previous studies have used accelerometers to examine PA levels in individuals with and without ID (Dixon-Ibarra, Lee, & Dugala, 2013; Einarsson et al., 2015; Temple, 2010; Temple and Walkley, 2003; Troiano et al., 2008). However, different studies measuring PA levels of individuals with ID show varying results, suggesting inconclusive results (Temple, Frey, & Stanish, 2006). For example, many studies have shown that individuals with ID have lower PA levels compared to individuals without disabilities when measured with accelerometers (Einarsson et al., 2015; Foley, Bryan, & McCubbin, 2008; Frey, 2004; Pan et al., 2015). While many other studies using accelerometers have suggested that individuals with ID did meet the recommended PA guidelines (Izquierdo-Gomez et al., 2014; Sandt & Frey, 2005; Shields et al., 2009). Additionally, a study found no significant difference in PA levels between individuals with and without ID (Sharav & Bowman, 1992). Although there are many potential possibilities for these inconclusive results, one possibility may be directly related to the accuracy of the measurement (Frey et al., 2008; Temple et al., 2006; Ward, Evenson, Vaughn, Rodgers, & Troiano, 2005b). Furthermore, the appropriate measurement protocols for accelerometer use in individuals with ID has not yet been recommended and there appears to be a wide deviation in the current research.

To accurately reveal the current levels of PA among individuals with ID, consistent assessment practices are a critical step. One of the long-term implications of lacking standardized accelerometer protocols for individuals with ID may be a poor understanding of actual PA levels for this population. With different accelerometer protocols producing differing amounts of time spent in PA categories, such as sedentary, light, moderate or vigorous, interpretation of PA levels of individuals with ID could be difficult. By understanding the procedures employed in each study, it may lead to higher quality measurement protocols and results. Therefore, the purpose of this study was to synthesize the current practice of using accelerometers to measure PA levels among individuals with ID and make recommendations for the standardization of accelerometer protocols.

2. Method

2.1. Scope of study and search strategy

To examine accelerometer protocols used in measuring PA levels of individuals with ID, a systematic review of the current literature was conducted using the following databases: Medline (1998–2015), Sport Discus (1992–2015), Web of Science (1965–2015), and Academic Research Premier (2004–2015). The key terms used to identify peer-reviewed articles that involved individuals with ID were: “mental retardation” or “MR” or “intellectual disability” or “ID” or “developmental disability” or “DD”. Developmental disability was included in the literature search because it is a common place co-occurring term used in reference to individuals with ID (Turygin, Matson, Adams, & Williams, 2014). The key words used to search for articles using accelerometry-based monitors were “accelerometer” or “accelerometry”. The key terms used to search for measuring PA levels were “physical activity” or “exercise”. The key terms were linked together during the searches in each database. All searches of the literature were conducted in March 2015.

The inclusion criteria for articles in this study were: (a) PA level of individuals with ID, (b) used accelerometer to measure PA, (c) used cut points to categorize intensity levels of PA in free-living environments, (d) peer-reviewed, and (e) reported results in percent of time or number of minutes spent in each category of PA intensity. Studies were excluded when they were: (a) written in a language other than English and no English version was available, (b) without an abstract, (c) a systematic review, (d) abstracts and/or proceedings for presentations, and (e) studies aimed to calibrate and validate accelerometers or cut points. Calibrating and validating accelerometers studies were excluded because the aims of these studies were to synthesize PA measuring practices during free-living conditions.

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