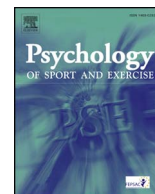




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## Review Article

A meta-analysis of physical activity interventions in people with physical disabilities: Content, characteristics, and effects on behaviour<sup>☆</sup>Jasmin K. Ma<sup>a,b,\*</sup>, Kathleen A. Martin Ginis<sup>a,b,c</sup><sup>a</sup> School of Health and Exercise Sciences, University of British Columbia, Canada<sup>b</sup> International Collaboration on Repair Discoveries (ICORD), University of British Columbia, Canada<sup>c</sup> Faculty of Medicine, Department of Physical Medicine and Rehabilitation, University of British Columbia, Canada

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## ABSTRACT

**Objectives:** Among samples of people with physical disabilities, the effects of physical activity (PA) interventions and the factors that influence intervention success are unknown. The purpose of this meta-analysis was to i) evaluate the overall effect of interventions on PA behaviour and ii) examine the influence of intervention characteristics, theory, and behaviour change techniques (BCTs) on PA intervention effects in persons with physical disability.

**Design:** Meta-analysis.

**Method:** Medline, Embase, PsychINFO, and AMED databases were searched for randomized controlled trials that evaluated the effects of a PA intervention in people with physical disability. Data were extracted regarding study and intervention characteristics and use of theory. Intervention descriptions were coded using the BCT Taxonomy version 1.

**Results:** A total of 24 articles met the inclusion criteria. Overall, interventions had a small to medium-sized effect on PA behaviour ( $g = 0.35$ ,  $k = 22$ , 95% CI [0.21, 0.48]). Interventions that used theory ( $g = 0.53$ ,  $k = 12$ , 95% CI [0.38, 0.68]) had larger effects than interventions that did not,  $p < 0.001$ . Interventions that included self-monitoring of behaviour produced larger effects ( $g = 0.45$ ,  $k = 12$ , 95% CI [0.28, 0.63],  $p = .04$ ) and interventions with monitoring of behaviour by others without feedback produced smaller effects ( $g = 0.05$ ,  $k = 3$ , 95% CI [-0.22, 0.32],  $p = .02$ ) than studies without these BCTs.

**Conclusion:** Interventions to increase PA behaviour in people with physical disability are effective, especially when theory is used to guide their development. Research is needed to examine a wider range of BCTs and the moderating effects of intervention characteristics on PA behaviour.

Among people with physical disabilities, physical activity (PA) participation rates are even lower than the sub-optimal levels reported in the general population. For instance, in a British national survey (Sport England, 2016), just 17% of adults with a disability reported at least one session of exercise or sport per week, compared to 40% of able-bodied adults. Furthermore, a Dutch study found that daily accelerometry counts were up to 60% lower in people with various disabilities and chronic conditions than in an able-bodied reference sample (van den Berg-Emons, Bussmann, & Stam, 2010). Given the tremendous personal, environmental and systemic PA barriers faced by people with disability (Martin Ginis, Ma, Latimer-Cheung, & Rimmer, 2016), these statistics are not particularly surprising. Nevertheless, the data do speak to the need for targeted PA behaviour change interventions for

populations with disability.

Several meta-analyses have demonstrated the effectiveness of PA behaviour change interventions in the general population (e.g. Conn, Hafdahl, & Mehr, 2011; Michie, Abraham, Whittington, & McAteer, 2009; Webb, Yardley, & Michie, 2010). For instance, Conn et al. (2011) reported an average effect size of  $d = .19$  across 206 studies of healthy adults that compared an intervention to a control condition. Exploratory moderator analyses revealed that interventions were more effective when delivered by research staff than by people trained by researchers (e.g., health care providers), and when delivered face-to-face, rather than through mediated channels (e.g., telephone, internet). There was no association between the magnitude of behaviour change and either the number of intervention strategies used or the amount of

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time devoted to the intervention. However, intervention content did seem to matter. Interventions that used only behavioural strategies (e.g., goal setting, self-monitoring) were more effective than interventions that used educational/informational strategies.

Physical activity intervention content has been addressed in several meta-analyses (e.g., [Michie, Abraham, Whittington, McAteer, & Gupta, 2009](#); [Olander et al., 2013](#); [Webb, Joseph, Yardley, & Michie, 2010](#)), with a particular focus on behaviour change techniques (BCTs). Behaviour change techniques are “observable, replicable, and irreducible” mechanisms of change within a behavioural intervention ([Michie, Johnson, & Johnston, 2015](#); [Michie et al., 2011a,b](#)). Development of reliable methods for coding and classifying BCTs has helped advance knowledge regarding the most effective ‘ingredients’ of PA interventions for various populations ([Michie et al., 2011a,b, 2013](#)).

For instance, [Michie et al. \(2009\)](#) coded the characteristics and content of PA and healthy eating behaviour change interventions in healthy adults. Across 69 PA studies, the overall effect on behaviour was  $d = 0.32$ . Interestingly, only intervention content was associated with intervention effectiveness. Specifically, interventions that included the BCT of self-monitoring plus one of four other self-regulation BCTs (intention formation, prompting specific goal setting, providing feedback on performance, and prompting review of behavioural goals) produced significantly larger effects ( $d = .38$ ) than interventions that did not include these BCTs ( $d = .27$ ). Other intervention characteristics—such as intervention duration, setting, delivery format (e.g., group versus individual), person delivering the intervention, or number of BCTs used—were unrelated to intervention effects.

The effectiveness of self-regulation BCTs in changing PA behaviour has also been supported in a systematic review of reviews and meta-analyses of studies of adults at risk for developing type II diabetes ([Greaves et al., 2011](#)). High quality randomized controlled trial (RCT) evidence showed overall medium-sized changes in self-reported PA (standardized mean difference = 0.30). Similar to [Michie et al.’s \(2009\)](#) findings, the use of self-regulation BCTs (goal setting, prompting self-monitoring, providing feedback on performance, goal review) was associated with larger effects. No associations were found between effect sizes and intervention delivery format, provider, mode, or intensity. Taken together, these reviews suggest that delivery characteristics of an intervention are not nearly as important as whether the intervention employs BCTs targeting an individual’s ability to self-regulate.

It is not known, however, if these findings generalize to populations with disability. Because people living with physical disability experience unique barriers to PA (e.g., limitations in functional ability, inaccessible facilities, negative attitudes from others; [Martin Ginis et al., 2016](#)), they may have unique needs for intervention content and delivery. For instance, given the lack of good quality, basic information on PA for people with disabilities ([Shaw, Mallory, Arkell, & Martin Ginis, 2017](#)), provision of information/education may be an important aspect of intervention effectiveness. Furthermore, because of transportation and architectural barriers to accessing intervention settings (e.g., clinics, universities), mediated forms of intervention delivery (e.g., telephone, internet) may be more effective than face-to-face delivery. Although these issues have not yet been addressed in a meta-analysis of the disability literature, a recent meta-synthesis provides support for the unique intervention needs of people with disabilities.

Specifically, [Williams, Ma, and Martin Ginis \(2017\)](#) conducted a meta-synthesis of 10 qualitative studies that explored experiences of adults with physical impairments who had participated in PA-enhancing interventions. Thematic analysis revealed five intervention components that participants considered important for intervention success. The components included: giving consideration to how the intervention is communicated and delivered (e.g., by whom and through what medium); providing information on PA and the self-management of impairments and related symptoms; teaching behavioural strategies for initiating and maintaining PA (e.g., action planning, goal-setting, obtaining feedback); and addressing participants’ need for social support,

particularly from health professionals. The authors recommended that these intervention characteristics and content be taken into consideration when developing PA-enhancing interventions for people with disabilities.

A recent scoping review catalogued 24 studies that used behaviour change strategies aimed at increasing community-based PA in adults with physical or cognitive disabilities ([Lai, Young, Bickel, Motl, & Rimmer, 2017](#)). The authors defined behaviour change strategies as the theoretical frameworks used in the studies, rather than as BCTs. Sixteen studies mentioned a theoretical framework, with two studies ‘informed by theory’, 10 ‘applying theory’ and four ‘testing theory’. [Bandura’s \(1997\)](#) social cognitive theory was the most often-cited framework (14 studies). All but one study reported a significant increase in PA. These findings suggest that interventions that are theory-based or ‘theory-inspired’ ([Michie et al., 2016](#)) are generally effective for increasing PA in people with disabilities. It is not known, however, which specific content and characteristics of the interventions account for their effectiveness. A meta-analysis was undertaken to address these knowledge gaps.

Specifically, we conducted a meta-analysis of RCTs of PA behaviour change interventions involving persons with physical disability, in order to identify intervention characteristics and BCTs that produce the greatest behaviour change. Based on previous reviews, it was hypothesized that: 1) overall, interventions would result in significant increases in behaviour; 2) the largest effects would be produced by interventions that used theory and by interventions employing BCTs related to self-regulation; 3) intervention effectiveness would be unrelated to delivery setting (group versus individual), intervention intensity, or number of BCTs used. No hypotheses were formulated regarding the effects of intervention provider or mode of delivery; while there is a rationale for the importance of these characteristics in populations with disability ([Williams et al., 2017](#)), evidence is mixed regarding their importance in the general population ([Conn et al., 2011](#); [Michie et al., 2009](#)).

## 1. Methods

### 1.1. Search strategy and study selection criteria

PRISMA guidelines were followed in the conduct of this review ([Supplementary Fig. 1](#)). The first author (JM) and a research assistant conducted independent searches of electronic databases for relevant articles. Reference lists of selected reviews were also searched and experts in the field were consulted to search their personal libraries to identify any other relevant articles. The original search included articles published until April 2015 and was updated in April 2017. AMED (1985-present), Embase (1974-present), ERIC (1966-present), Medline (1946-present), PsychINFO (1987-present), and PubMed (1950-present) databases were searched using the following keywords (for a sample search strategy see [Supplementary File 1](#)): (1) Terms for interventions: ‘intervention stud\*’ OR ‘program’ OR ‘curriculum’ OR ‘physical education’ OR ‘promotion’ OR ‘initiative’ OR ‘behaviour change’ OR ‘strateg\*’ (2) Terms for physical activity: ‘physical activity’ OR ‘exercise’ OR ‘physical fitness’ OR ‘sports’ (3) Terms for disability: ‘disabled persons’ OR ‘stroke’ OR ‘cerebral palsy’ OR ‘amputee’ OR ‘spinal cord injur\*’ OR ‘multiple sclerosis’ OR ‘osteoarthritis’ OR ‘Parkinson disease’.

Limits were set to include only articles written or translated in English. Terms for disability were based on our experience with similar reviews indicating the need to include these terms to maximize coverage of the literature (e.g. [Martin Ginis et al., 2016](#); [Williams et al., 2017](#)). Conditions that do not necessarily result in physical disability (e.g., traumatic brain injury, rheumatic conditions) were not included.

Study inclusion criteria were: (a) original reports of RCTs published in peer-reviewed journals; (b) articles that reported quantitative data from interventions designed to increase PA performed in home and/or

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