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Review Article

The effects of standing desks within the school classroom: A systematic review

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ABSTRACT

Background. The school classroom environment often dictates that pupils sit for prolonged periods which may be detrimental for children's health. Replacing traditional school desks with standing desks may reduce sitting time and provide other benefits. The aim of this systematic review was to assess the impact of standing desks within the school classroom.

Method. Studies published in English up to and including June 2015 were located from online databases and manual searches. Studies implementing standing desks within the school classroom, including children and/or adolescents (aged 5–18 years) which assessed the impact of the intervention using a comparison group or pre–post design were included.

Results. Eleven studies were eligible for inclusion; all were set in primary/elementary schools, and most were conducted in the USA (n = 6). Most were non-randomised controlled trials (n = 7), with durations ranging from a single time point to five months. Energy expenditure (measured over 2 h during school day mornings) was the only outcome that consistently demonstrated positive results (three out of three studies). Evidence for the impact of standing desks on sitting, standing, and step counts was mixed. Evidence suggested that implementing standing desks in the classroom environment appears to be feasible, and not detrimental to learning.

Conclusions. Interventions utilising standing desks in classrooms demonstrate positive effects in some key outcomes but the evidence lacks sufficient quality and depth to make strong conclusions. Future studies using randomised control trial designs with larger samples, longer durations, with sitting, standing time and academic achievement as primary outcomes, are warranted.

Contents

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1. Introduction

Due to advances in technology and environmental changes over the last few decades, particularly in more developed countries, many people spend the majority of their waking day sedentary (Ng & Popkin, 2012). Sedentary behaviour has been defined as "any waking behaviour characterised by an energy expenditure ≤1.5 METs while in a sitting or reclining posture" (Sedentary Behaviour Research Network., 2013). Adverse associations between high levels of sedentary behaviour and cardio-metabolic health risk markers (for example: obesity, blood pressure, cholesterol, insulin, and reduced cardiorespiratory fitness) have been reported in children (Marshall et al., 2004; Mitchell & Byun, 2014; Tremblay et al., 2011). Furthermore, high levels of sedentary time have also been associated with reduced self-esteem and academic performance (Tremblay et al., 2011). These effects are largely independent of moderate-to-vigorous-physical activity (Mitchell & Byun, 2014).

While children are the most active age group, sedentary behaviour is increasingly prevalent in this population; data suggest that Canadian and US children spend around 60% (6–8 h) of waking hours sedentary, while studies suggest that UK children spend more than 65% of waking hours sedentary (Colley et al., 2011; Steele et al., 2009; Whitt-Glover et al., 2009). Sedentary behaviour has been found to track from childhood into adolescence and adulthood (Biddle et al., 2010). Therefore, the development of effective strategies to reduce sedentary behaviour is imperative for the current and future health of young people.

While children function in multiple environments including the home, community and school, evidence suggests that children sit for longer during school hours compared to non-school hours (Abbott et al., 2013). School pupils typically spend the majority of their school day in a classroom where the environment dictates prolonged periods of sitting. The classroom is therefore an important and opportune environment for the implementation of interventions aiming to reduce sitting (Salmon, 2010).

Environmental changes in the workplace such as the implementation of adjustable sit-to-stand desks, which enable the user to alternate between sitting and standing, have led to significant reductions in sitting time (Alkhajah et al., 2012; Pronk et al., 2012) and increases in energy expenditure (Cox et al., 2011; Reiff et al., 2012) in adults. In these studies, sit-to-stand desk use was associated with a number of health benefits, including reductions in blood pressure (Cox et al., 2011), back and neck pain (Pronk et al., 2012), increases in HDL cholesterol (Alkhajah et al., 2012), and improved mood states (Pronk et al., 2012). As employed within the workplace, making environmental changes to the classroom could be an effective way of reducing children's sitting time. Such interventions could provide the opportunity to reduce total sedentary time, as well as the ability to break up prolonged bouts of sitting, both of which have been shown to be beneficial to health in children (Saunders et al., 2013; Tremblay et al., 2011). Classroom-based interventions may also help target health inequalities by being accessible to all children. The question of whether standing desks are beneficial in the classroom is an important public health topic; however a review of the current evidence has not been conducted to date. The term 'standing desk' is used differentially across studies and can encompass sit-to-stand desks, standing workstations, stand-sit workstations, stand-biased desks and adjustable furniture. For simplicity the term standing desk is used herein to incorporate all of these terms. The purpose of this systematic review was to examine the effects of interventions that have implemented standing desks within the school classroom.

2. Method

2.1. Search strategy

Search strategies were built around four groups of keywords: Standing desk (sit-to-stand desk, standing desk, standing workstation, stand-sit workstation, stand-biased desks, adjustable furniture); school classroom (elementary, school, classroom, high school, classroom environment, secondary, primary, middle, academic); study type (intervention, trial, controlled trial, randomised controlled trial (RCT), quasi-intervention, feasibility, pilot); and sample type (young people, children, adolescents, girls, boys, youth). Science Direct, PubMed, Web of Science, Cochrane Library, Cochrane Library central register of controlled trials, APA Psych NET and EPPI Centre databases were searched using the key terms. In addition, manual searches of personal files were conducted along with screening of reference lists of relevant articles.

2.2. Inclusion criteria

For inclusion, studies were required to (1) be an intervention with either a comparison (control) measure or pre and post intervention measures; (2) include a standing desk as the experiment/treatment within a school classroom setting with its impact independently measured; (3) include children aged 5–11 years, and/or adolescents aged 12–18 years (or a mean within these ranges) as study participants. Studies that did not state the mean age of participants were classified as pre-school children, school-aged children or adolescents depending on the ages of the majority of the sample; (4) be published in a peer-reviewed journal in the English language; and (5) be published up to and including June 2015.

2.3. Identification of relevant articles

Potentially relevant articles were selected by the authors who (1) screened the titles (AS); (2) screened the abstracts (AS); and (3) if abstracts were not available or did not provide sufficient information, retrieved the full article and screened using a standardised in/out form developed for this study to determine whether it met the inclusion criteria (AS). At each stage a selection of papers were cross-checked by NP and SC. Where there was uncertainty or disagreement regarding inclusion, a discussion was held between the authors to reach a decision.

2.4. Data extraction and coding

Detailed information was extracted from each article by AS using a standardised data extraction form developed for this systematic review. Data extraction was cross checked by NP and SC. Information extracted from each article included: study setting, sample characteristics, study design, intervention design and implementation, length of intervention, standing desk characteristics, outcome measures and assessments, and study quality criteria. In addition, information about the study outcomes (e.g. intervention effects) were extracted (Table 1). The impact of the standing desk intervention on each outcome measure was coded as: + = significant positive effect; − = significant negative effect; 0 = no significant effect; * = no statistical test performed (Table 2).

2.5. Study quality

Quality of included studies was assessed by AS and NP using the Delphi list (Verhagen et al., 1998) as used in previous systematic reviews of behavioural interventions with children (Brown et al., 2013; Haapala, 2012; Van Stralen et al., 2011). AS assessed the quality of the entire sample and NP assessed the quality of a subsample (>30%). Where there was disagreement (n = 1 paper) discussions were held to reach a consensus.

The Delphi list includes 8 assessment items: randomisation methods, treatment allocation, comparisons of main outcomes at baseline, eligibility criteria, blinding of assessor, blinding of participants, provision of point estimates and measures of variability, and if intention-to-treat analysis was used. Item 6 ('were the participants blinded?') was excluded from the list as it was deemed inappropriate