

Important Factors in the Effectiveness of Interventions for Decreasing Occupational Sedentary Behavior (Short Review)

Sara Maheronnaghsh¹; Mario Vaz²; Joana Santos³ and Sara Shahedi Ali Abadi¹

¹Department of Occupational safety and health (DEMSSO), Faculty of Engineering university of Porto

²Department of Mechanical Engineering, University of Porto

³Environmental Health Department, Research Centre in Health and Environment (CISA), Porto

ABSTRACT

Occupational sedentary behavior (SB) is an occupational risk and an independent predictor of poor health and mortality. The impact of implemented interventions in workplaces for reducing SB has been studied several times, and their outcomes have been investigated. The purpose of this study is to identify the factors that can increase the effectiveness of the interventions in workplaces. **Methodology:** The search was conducted in Scopus, PubMed, Web of Science and other resources for articles published in scientific journals from 2010 until 2019 in English, using a set of keywords as “sedentary behavior”, “physical activity”, “effectiveness” “occupational” and “intervention”. **Results and discussion:** The review included ten studies that examined the effectiveness of interventions on physical activity (PA) and/or SBs and searched about factors that have an impact on failure or success of interventions. Various factors were identified like individual, organizational, and social factors associated with the SB and PA. Supportive workplace policies, time for involvement in intervention, paying for activity, environment, and job type requirements were the main organizational factors. Also, Interpersonal and educational factors, and some sociodemographic factors associated with the PA. Furthermore, social factors have a significant effect on willingness to do PA in workers. **Conclusion:** Current evidence shows that some organizational, individual, environmental, and social factors influence work PA; therefore, before choosing the intervention, they need to be considered in each population individually.

Keywords: Physical activity, Workplaces, Behaviour change, Occupational health, Health management

1. INTRODUCTION

SB has defined as any waking behavior characterized by an energy expenditure of ≤ 1.5 METs and a sitting or reclining posture (Fenton et al. 2017). In the past five decades, 80% of workers have one-third of the workday in a sedentary situation (Smith, Ekelund, and Hamer 2015). They are exposed to the various adverse effects like ergonomic risk factor (Thorpe et al. 2012), reduction of the energy expenditure (Buman et al. 2017; Cleland et al. 2013) and consequently increasing body weight and the risk of developing diabetes (Church et al., 2011). There is growing evidence that prolonged sitting is associated with multiple health risks, including musculoskeletal disorders, cardiovascular diseases and some forms of cancer (Gao et al. 2016).

Previous investigations show that a wide variety of these outcomes can be treated or improved through increasing physical activity (Healy et al. 2012). Some different interventions can be implemented in workplaces to promote PA and decrease SB. These strategies are being designed over the years in several workplaces, and their outcomes are investigated. There are some studies about making changes in the environment (e.g., use the high-adjustable desk, cycle workstation) or create new policies (e.g., permit to have breaks or exercise, use supportive strategies for being active at work). In other research works, the survey was conducted about the impact of training and information about the adverse effect of SB and the benefits of PA for workers or use multiple interventions that are a mixture of several interventions at the same time or over different time (Neuhaus et al. 2014). Various

methods were utilized to measure SB/PA in previous studies; questionnaire-based methods have been most frequently used until recently. Although they are low-cost method, easy to use with low participant burden but to address some of the limitations in self-report, researchers tend to use technological innovations in objective monitoring of SB, such as accelerometers and posture sensors (Healy et al. 2011; Maheronnaghsh, Santos, and Vaz 2018).

While there is some strong evidence regarding the impact of interventions on reducing sedentary behavior in workplaces (Chau et al. 2012), there is also a need to explore how interventions can remain effective and implemented in workplaces to sustain improvements.

Almost all studies had a short (one to three month) or very short-term (less than one month) follow-up, and there were no studies with a long-term follow-up of more than one year (Shrestha et al. 2016). Interventions can be effective when not only improve PA and reduce SB but also have acceptability between workers and sustainability in the long term. Studies have to assess the longer-term impact of interventions on behavioral changes in SB and PA with appropriate and qualitative methods.

For this reason, they need to analyze the target group and the work environment before selecting interventions. Depending on the characteristics of the tasks/workplace, various types of intervention can be implemented such as walking on a treadmill in workstation (Levine & Miller, 2007; Tudor-Locke, Schuna Jr., Frensham, & Proenca, 2014) and using sit-stand desk (Josephine Y Chau et al., 2016; E. F. Graves,

C. Murphy, Shepherd, Cabot, & Hopkins, 2015; Gao et al., 2016). Also, different studies evaluated the effects of changes in chairs to enable more activity, such as balloon chairs (Beers, Roemmich, Epstein, & Horvath, 2008), using cycle workstation (Rovniak et al., 2014; Sabia & Anger Jr., 2016). Some other intervention, such as changing the layout of the workplace, to make possible more physical activity (Commissaris, Douwes, Schoenmaker, & de Korte, 2006).

Interventions should ensure sustainable effects, to effectively change habits and encourage the employers and employees to be interested in participating. There is evidence to demonstrate the need to investigate about components that are included in interventions for reducing SB to generate a meaningful and permanent reduction in sedentary time.

Therefore for having effectiveness intervention, it is needed to consider intervention's components and effective factors on changing physical activity habits (Buman et al., 2017). In this short review, various factors that increase the effectiveness of the intervention to reduce workers' SB and increase PA will be identified.

2. MATERIALS AND METHODS

The research was performed in Scopus, PubMed and web of science and other resources, and included all articles published in scientific journals from 2010 until 2019 April in English. A set of root keywords as "sedentary behavior", "physical activity", "occupational", and "intervention" was used to search through databases using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement.

After first screening, following criteria were used to include articles; (1) At least one of the following words must be present in title, Abstract or Keywords: "interventions", "effectiveness", "socioecological factor", "improve physical activity", "workplace", and the roots "physical activity", "sedentary work"; (2) Any of the following words should be present neither Title nor Keywords: "daily life", "clinical", "elderly", "children", "adolescents". The outcomes of different keyword combinations and sources were merged, taking care to discard the duplicates, into a single list of documents, excluding all records, which were not full papers, open access, or just protocol. After the full-paper screening, some papers were excluded, and ten articles were included in this study.

3. RESULTS

The total number of papers, before exclusion was 459. Additionally, six records were identified through other sources. The total number of papers, after eliminated duplicate, was 420 and 9 articles were matched with the search criteria. Most of the discarded papers focused on interventions and affection of them on productivity and job satisfaction, or they were measure association between interventions and physical activity. Other papers were eliminated because they

focused on daily life and clinical scope, children, adolescence, or elderly people.

Two studies used "behavior change techniques" to identify the most appropriate interventions for improving physical activity (Susan Michie, van Stralen, and West 2011; Munir et al. 2018). Other studies used various questionnaires to evaluate PA and SB at the workplace and also to collect individual and sociodemographic information, psychological parameters, and job type (Neuhaus, Healy, Fjeldsoe, et al., 2014; Michie, Atkins and West, 2015). As a result, they characterized individual and organizational factors that have an impact on SB and PA in workplaces (Clemes et al. 2016; De Cocker et al. 2015). In order to identify the amount of PA and SB, two studies used questionnaires, and four studies used the accelerometer to collect data about physical activity instead of a questionnaire (Brett & Pires-Yfantouda, 2017). All studies considered the effect of individual factors on physical activity, whereas six studies also evaluated organizational factors (Brett and Pires-Yfantouda 2017; Munir et al. 2018; Plotnikoff et al. 2005a, 2010), and just three studies searched about social factors (Table.1).

4. DISCUSSION

This short review identified factors that increase the effectiveness of interventions for reducing SB and improving PA. Recently researchers have begun to emphasize the importance and potential of using socio-ecologically based approaches to choose effectiveness intervention in the workplace due to the decrease of PA.

Two studies used comprehensive ecological frameworks (i.e., the Ecological Model of Physical Activity; EMPA and (Plotnikoff, Prodaniuk, Fein, & Milton, 2005) method for understanding PA and effective factors in the workplace (Plotnikoff, Pickering, Flaman, & Spence, 2010).

In this framework, Plotnikoff et al., 2010 identified different levels in the ecological model influence on PA and SB: (a) individual (i.e., demographic factors and individual employee characteristics related to PA behaviors such as skills, knowledge, confidence, age, and gender). (b) social (i.e., the influence of the corporate culture, social relationships, supervisor relationships related to PA behavior of employees). (c) organizational (i.e., infrastructure, leadership, and desire of the workplace to promote PA, how the organization is structured). (d) Community (i.e., how the workplace interacts effect on PA behavior of employees), (e) policy (i.e., the workplace's policies regarding employees' PA behavior), and (f) physical environment (i.e., the physical environment of the workplace including the buildings, workplace layout, and surrounding area related to PA behavior of employees). Although ecological models of PA suggest that environments may have a direct influence on physical activity behavior, these models also propose that environmental influences on PA may be influenced

by psychological variables such as beliefs and other factors (Plotnikoff et al., 2010).

They believed that self-efficacy (SE) has an essential role in perceptions of workers about the workplace environment, and they concluded that employers should also include strategies to bolster self-efficacy for having more PA.

In another study (Munir et al., 2018) described that to develop the effectiveness of the intervention in workplaces is necessary to change the sitting behavior

functions (Education, Persuasion, Incentivisation, Coercion, Training, Enablement, Modeling, Environmental Restructuring, and Restrictions) have a crucial role in the acceptability and effectiveness of the intervention in workplaces (Munir et al., 2018). The BCW aid in identifying the most appropriate strategies for facilitating behavior change according to the requirements of employees, employers, and the work environment.

Also, they indicate that the BCW guide can be

Table 1: Included papers in this short review

Article	country	Aim	Population	Interventions	Duration	Method of measure SB
(Munir et al. 2018)	UK	develop the Stand More AT Work intervention, which aims to reduce sitting time	office workers	height-adjustable workstations	3 months	self-monitor
(Plotnikoff et al. 2005b)	Canada	To develop a comprehensive, multilevel workplace physical activity Assessment Tool	office workers	Multilevel, ecological-based interventions		Developed Physical Activity Assessment Tool
(Brett and Pires-Yfantouda 2017)	UK	To examine the effectiveness of a facilitated pedometer-based to increase walking behavior	office workers	Pedometer and encouragement, education, story sharing, goal setting and social support	8 weeks	Silva Ex Step pedometer
(Neuhaus et al. 2014)	Australia	To compare the efficacy of a multi-component intervention to reduce workplace sitting time	office workers	height-adjustable workstations-only intervention	6 months	activPAL3
(Clemes et al. 2016)	UK	To examine domain-specific sitting times reported across socio-demographic groups of office workers	office workers	-	-	self-reported
(De Cocker et al. 2015)	Belgium	To examine employees' reflections on occupational sitting and to examine the potential acceptability and feasibility of intervention strategies to reduce sedentary time on a working day.	office workers	(standing during phone calls/meetings, PC reminders, increasing bathroom use by drinking more water, active sitting furniture, standing desks) and (lunch) breaks (physical activity, movement breaks, standing tables)	-	semi-structured questionnaire and interview
(Susan Michie, van Stralen, and West 2011)	UK	To evaluate frameworks of behavioral interventions for increase PA	Administrative worker	-	-	-
(Munir et al. 2018)	UK	This is a practical guide to designing and evaluating behavior change interventions and policies	Administrative worker			
	Canada	To explore the role of self-efficacy in the relationship between perceptions of the workplace environment and workplace PA.	Different population groups	-	-	self-reported

of workers and employers. For this reason, they used the Behavior Change Wheel (BCW) (Susan Michie, van Stralen, & West, 2011) and its functions to enhance the development of the intervention. The BCW is a comprehensive framework for designing interventions by integrating behavior theory to understand and target mechanisms of action within the intervention (S Michie, Atkins,

& West, 2015). The BCW has three layers, including Capability (physical and psychological), Opportunity (social and physical), and Motivation (automatic and reflective). The second layer of the BCW- social and physical - comprises nine intervention

applied successfully in the context of designing a workplace intervention for increasing PA. Scotland's new Strategy for Physical Activity, "Let's make Scotland more active" (Executive, 2003), aimed at increasing and maintaining the proportion of physically active people in Scotland. This study suggests that three conditions are necessary to enable behavior change in physical activity: high self-efficacy, a firm intention and readiness to change, and a supportive social network and environment with no barriers. Their findings are also similar to those of Neuhaus et al. (Neuhaus, Healy, et al., 2014), but they recognized the importance of social opportunity and social influence in reducing

sitting at work based on "social cognitive theory." Social-ecological models of sedentary behavior emphasize the importance of considering the multiple key factors that influence individual behavior. These include the policy environment, the physical and psychosocial environment, and intrapersonal factors that can affect on improving PA and reducing SB. They suggested that knowledge, social identity, beliefs about capabilities, and self-regulation of behavior were essential to address in their intervention. Brett & Pires-Yfantouda (2017) examined factors that have an impact on the effectiveness of a pedometer-based intervention to increase walking behavior amongst staff at a Scottish university. They realized that academic staff was more likely to report that work pressures – such as teaching, lunchtime meetings, or urgent deadlines for grant applications or journal articles – precluded regular daytime walking. Indeed, individual and organizational factors affect the amount of physical activity (Brett & Pires-Yfantouda, 2017). Clemes et al. (2016) analyzed the influence of sociodemographic factors on sedentary behavior to inform effective interventions. They examined domain-specific sitting times reported across sociodemographic groups of office workers. It was observed that sedentary behaviors were most prevalent amongst males, younger adults, obese individuals, individuals educated up to school level, those not meeting physical activity guidelines, single/divorced/widowed adults, full-time workers, and high work-time sitters. They suggested that these sociodemographic groups should be targeted for interventions designed to reduce sedentary behavior.

In another study, De Cocker et al. examined employees' and executives' perceptions of occupational sitting and to explore the potential acceptability and feasibility of intervention strategies to reduce and interrupt sedentary time on a working day. They used semi-structured questionnaires in five themes included personal sitting patterns, intervention strategies during working hours, (lunch) breaks, commuting, and intervention approach. The survey recognized employee and employers suggestions to select the best intervention with the highest feasibility and effectiveness according to their working hours and breaks in the workplace.

They also identify several barriers, including productivity concerns, impracticality, the awkwardness of standing, and the habitual nature of sitting. Facilitating factors included raising awareness, providing alternatives for simply standing, making some strategies obligatory, and workers taking some personal responsibility (De Cocker et al., 2015). Overall, raising knowledge about the adverse effect of SB, providing alternatives for interventions, providing some acceptable obligating strategies for employees, but also leaving the choice to decide and employees taking responsibility was considered to be facilitating factors and would increase acceptability and effectiveness of the intervention.

5. CONCLUSIONS

This short review investigated different factors that affected workers' SB and/or PA and also analyzed their methods that were used to measure this effect. It has shown that a few studies have been conducted in this field. However, few studies identified various factors like individual, organizational, social, and socio-demographic factors that affect the SB and PA. Results demonstrated that it is necessary to change the sitting behavior of workers by using some behavior change methods and identify important factors that improve the effectiveness of the intervention in workplaces. Also, using socio-ecologically based approaches can recognize barriers to participate in the intervention program among different groups of employees with various requirements of their job. Further research should examine the association of multiple factors on PA and SB in diverse populations and organizations.

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