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Methods for Measuring Association between Intervention for Increasing Movement and Productivity: Systematic Review

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Abstract

Aim: The purpose of this systematic literature review is to check papers to find the best method for measuring association between health interventions and productivity and find best intervention in workplace for increasing productivity. **Method:** This systematic review was performed based on PRISMA statement methodology and performed on all papers about association between productivity with intervention for increasing physical activity, published from 2007 until June 2017. The search was limited to English language items. **Conclusion:** The results of this systematic review demonstrate that providing interventions for workers in various workplaces have a low to high affecting on productivity, as measured by objective and organization specific metrics or subjective and self-report questionnaires. The Analyze of result showed that using different methods simultaneously can make more accuracy and precision. Also it's better that before filling the self-report questionnaires researchers train all workers about the purpose of the study.

Author Keywords: Work Performance, Job Satisfaction, Intervention, Absenteeism, Sedentary

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1. Introduction

When people is sit still for too long without sufficient active breaks, this is called sedentary behavior. Globally, it is estimated that 60% of world's population is part of the workforce and spends 60% of their waking hours at work (WHO/WEF 2008). In fact, the prevalence of sedentary occupations or light intensity activity has increased from approximately 50% to more than 80% during the past five decades (Pronk 2015). This shift in occupational behavior causes change in energy expenditure that has been associated with a decrease of 100 calories per day, which, in turn, is purported to account for as much as 80% of the average increase in body weight among working men and women during this period (Church et al. 2011). Boyle et al. (2011) conducted a population-based case-control study of colorectal cancer in Western Australia in

2005-2007 and found that long-term sedentary work may increase the risk of distal colon cancer and rectal cancer (tumors that develop in the large intestine).

In the long term, such behavior can result in several health issues, such as type II diabetes, cardiovascular disorders, increased waist girth, high blood cholesterol, hypertension, and a range of musculoskeletal lesions and even premature death (Pedersen, Cooley, and Mainsbridge 2014). Sedentary behavior and physical inactivity are independent health risks; even with regular exercise, people are still exposed to increased health risks if they have a sedentary lifestyle (Groenesteijn et al. 2016). On the other hand, it is possible to influence the health behavior of a large proportion of the adult population through workplace interventions by adding some intervention to work for reducing sitting time at work can involve various types of physical activity of light to moderate intensity (WHO/WEF 2008). There are some drawbacks to these interventions. For example, the performance and productivity of workers at sitting jobs may decrease when walking at the workplace is encouraged and the employees leave their desks. Workers on a treadmill desk need to be careful not to trip or fall, and thus divide their attention between work and safety, which might compromise their productivity (Pronk et al. 2004). In addition, fine motor skills like mouse handling accuracy, math's problem-solving skills and perceived work performance decreases with some intervention like treadmill and cycling workstations (John et al. 2009). Decrements in productivity or work performance have proven difficult to measure. Whereas absenteeism could be used as one measure of work performance, other measures could consider the performance of individual employees while at work or monitor the impact associated with the state of health of a given employee on their coworkers. Data has emerged indicating the negative impact of disease on work performance (Pronk et al. 2004).

Some researchers have shown that simple interventions to increase activity at work – recommendations to walk stairs, stand up occasionally and walk during breaks – do result in small increases in physical activity (Ben-Ner et al. 2014). The effects of physical activity on employee performance are less clear-cut. No association between self-reported physical fitness and work performance was found in one study (Bernaards, Proper, and Hildebrandt 2007). In another survey-based study, a positive association between physical activity and quality and quantity of performance was reported (Pronk et al. 2004). A review suggests that fitness intervention programs decrease sickness absence (Tompa 2002). The first study that uses a within-person experimental design found that employees' self-rated job performance and mood were higher on days they exercised in the company gym than on days they did not (Coulson, McKenna, and Field 2008).

2. Materials

A systematic review of the literature was performed, searching all reviews and articles published, on all papers about association between productivity with intervention for increasing physical activity. The research was performed on three databases and scientific journals: Scopus, Medline, and Web of Science from 2007 until 2017. The string used for the search was composed according to the following criteria:

1) At least one of the following words must be present in Title, Abstract or Keywords: "active workplace", "sit stand desk", "treadmill", "productivity", "work performance", "physical activity", "sedentary work".

2) All of reviews must be about interventions and their influence on movement.

The outcomes of the three databases were merged, taking care to discard the duplicates, into a unique list of documents, excluding all records that were not full papers and open access. The search was limited to English language items and only considered the reviews (Figure 1).

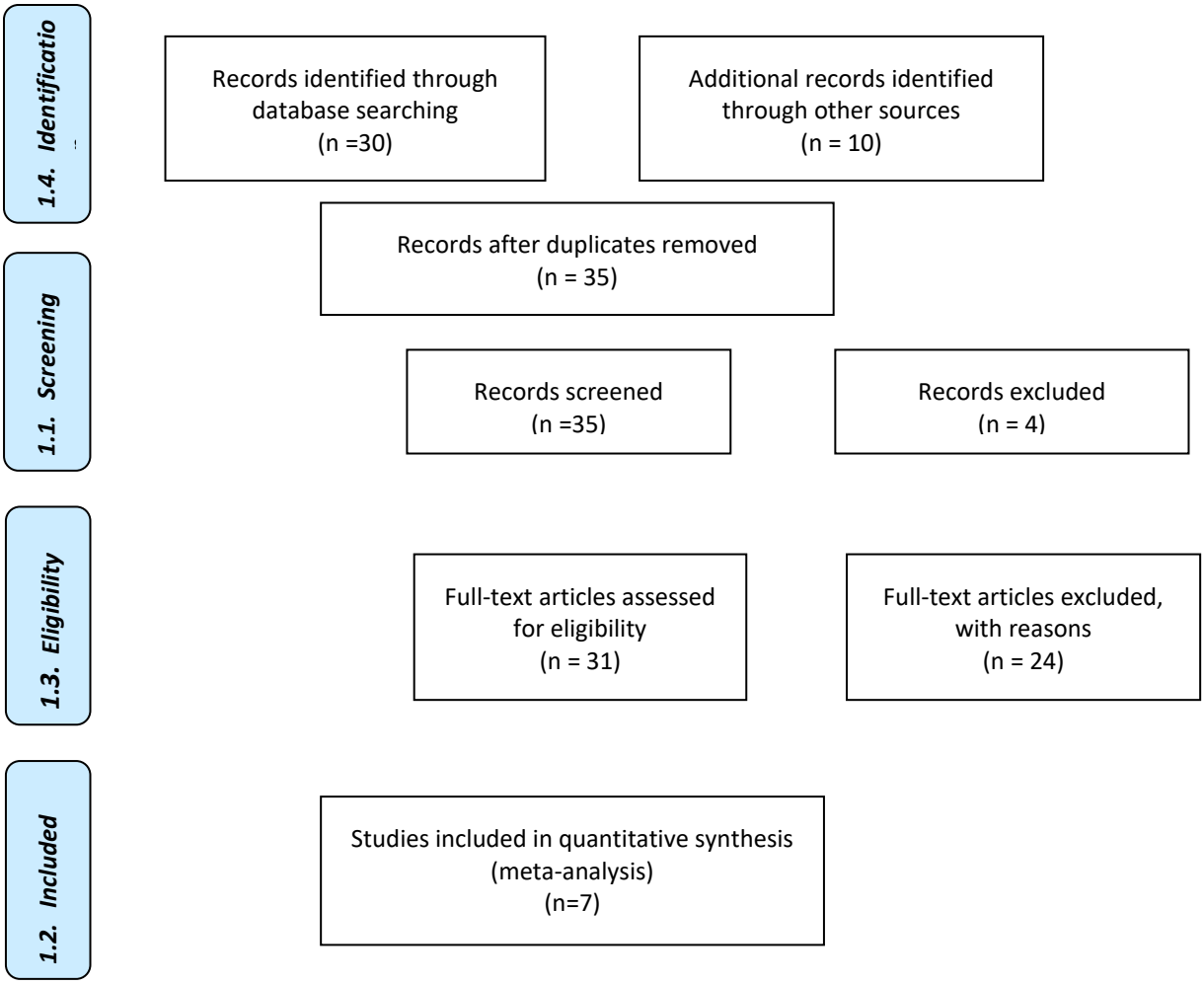

Figure 1: PRISMA flow diagram of included studies

3. Methods for Measuring Work Performance or Productivity

3.1. Work performance on WHO Health and Work Performance Questionnaire (HPQ)

Carr et al. (2016) measured Work productivity by "13-item WHO Health and Work Performance Questionnaire (HPQ)" but the authors present no data. The HPQ is a brief self-report questionnaire that obtains three types of information: screening information about the prevalence and treatment of commonly occurring health problems; information about three types of workplace consequences (sickness absence, presenteeism, and critical incidents); and basic demographic information.

This study tested an integrated intervention on occupational sedentary/physical activity behaviors, cardiometabolic disease biomarkers, musculoskeletal discomfort, and work productivity. The population were Healthy, but physically inactive, overweight/obese adults working in full-time sedentary jobs (self-reported sitting ≥75% of work day) at a large private company (1,200 employees) in the Midwest were recruited.

They estimated workplace costs of health problems in terms of reduced job performance, sickness absence, and work-related accidents/injuries.

Participants received an ergonomic workstation optimization (elliptical machine, active Life Trainer) intervention and three e-mails/week promoting rest breaks and posture variation. Other group of participants received the intervention plus access to a seated activity permissive workstation. No significant intervention effects were observed for any work productivity items measured on the Health and Work Performance Questionnaire (data not presented). As a conclusion significant associations were observed between activity permissive workstation adherences and both cardiometabolic biomarkers and work productivity outcomes, suggesting greater adherence to the intervention may result in healthier and more-productive employees.

3.1.1. The reliability and validity of the Work performance on a scale of 1 to 13 (HPQ)

Kessler et al. (2004) report presents an overview of methodological issues in estimating the indirect workplace costs of illness from data obtained in employee surveys using the World Health Organization Health and Work Performance Questionnaire (HPQ). The HPQ is a brief self-report questionnaire that obtains three types of information: screening information about the prevalence and treatment of commonly occurring health problems; information about three types of workplace consequences (sickness absence, presentism, and critical incidents); and basic demographic information. The report considers two sets of methodological issues. The first set deals with measurement. The rationale for the HPQ approach to measurement is described in this section. In addition, data are presented regarding the accuracy of HPQ measures, documenting that the HPQ has excellent reliability, validity, and sensitivity to change. The second set of methodological issues deals with data analysis. A number of analysis problems are reviewed that arise in using self-report non-experimental survey data to estimate the workplace costs of illness and the cost-effectiveness of treatment. Innovative data analysis strategies are described to address these problems.

3.2. Expanded health risk assessment questionnaire (HRA)

Pronk et al. (2004) conducted a study that its purpose was to test the association between lifestyle-related modifiable health risks (physical activity, cardiorespiratory fitness, and obesity) and work performance.

To collect the data they used a traditional health risk assessment (HRA) survey (including the traditional HRA content of demographics, physical activity assessment, and other health behaviour information) and expanded the content to include questions related to work performance (measures not typically included in an HRA). The expanded HRA survey was implemented using Interactive Voice Response (IVR) technology. Data were obtained from 683 workers.

The HRA was expanded to include questions about work limitations experienced in the prior 30 days because of physical or emotional health problems. These questions were used to construct the following summary measures:

1) a measure of number of work-loss days in the last 30 days (including both full days and partial days) ranging between 0 and 20;
2) a measure of work quality during hours at work based on a 5 point self-anchoring rating scale in which a score of 1 was defined as “a great deal of interference

with the quality of work performed" and a score of 5 was defined as "no interference with the quality of work performed";

3) a measure of work quantity during hours of work based on a similar 1-to-5 rating scale that substituted the word "quantity" for "quality";
4) a measure of interpersonal relationships with co-workers based on a 1-to-5 rating scale in which 1 was defined as "a great deal of difficulty in getting along with co-workers" and 5 was defined as "no difficulty in getting along with co-workers";
5) a rating of overall perceived job performance in which the respondent rated his or her own performance over the past 4 weeks on a 0-to-10 scale in which 0 is "the worst anyone could do" and 10 is "the very best that top workers in a job like yours can do";
6) a measure of overall perceived extra effort exerted while on-the-job in which 1 was defined as "a great deal" and 5 as "not at all." The 1-to-5 scales were standardized and low scores indicated high levels of impairment (decrement) in work performance, whereas the work-loss day's measure was kept in the natural metric of days. The self-report HRA questions represented a test version of a work performance assessment and were subsequently adapted into the World Health Organization Health and Work Performance Questionnaire (HPQ).

Results indicated that higher levels of physical activity related to reduced decrements in quality of work performed and overall job performance. In addition, higher cardiorespiratory fitness related to reduced decrements in quantity of work performed, and a reduction in extra effort exerted to perform the work; obesity related to more difficulty in getting along with co-workers; severe obesity related to a higher number of work loss days. It is concluded that lifestyle-related modifiable health risk factors significantly influence employee work performance.

3.2.1. The reliability and validity of the Extended(HPQ)

An analysis of the extended HPQ has been published (Kessler et al. 2003), the results of which indicate good concordance between the HPQ self-report measures and employer administrative records of work absence, work productivity, and critical incidents.

Kessler et al. (2003) describe the World Health Organization Health and Work Performance Questionnaire (HPQ), a self-report instrument designed to estimate the workplace costs of health problems in terms of reduced job performance, sickness absence, and work-related accidents injuries. Calibration data are presented on the relationship between individual-level HPQ reports and archival measures of work performance and absenteeism obtained from employer archives in four groups: airline reservation agents (n=441), customer service representatives (n=505), automobile company executives (n=554), and railroad engineers (n= 850). Good concordance is found between the HPQ and the archival measures in all four occupations. The paper closes with a brief discussion of the calibration methodology used to monetize HPQ reports and of future directions in substantive research based on the HPQ.

3.3. Utrecht Work Engagement Scale (UWES)

One of the studies evaluate the effectiveness of a worksite mindfulness-related multicomponent health promotion intervention on work engagement, mental health, need for recovery and mindfulness (van Berkel et al. 2014).

In a randomized controlled trial design, 257 workers of two research institutes participated. The intervention group (n = 129) received a targeted mindfulness-related training, followed by e-coaching. The total duration of the intervention was 6 months. Data on work engagement, mental health, need for recovery and mindfulness were collected using questionnaires at baseline and after 6 and 12 months follow-up.

This study reported work engagement on a scale of 0 to 6 using the Utrecht Work Engagement Scale (UWES). The Utrecht Work Engagement Scale is a self-report questionnaire that measures three aspects of engagement: vigor (6 items), dedication (5 items), and absorption (6items).

Vigor refers to high levels of energy and resilience, the willingness to invest effort, not being easily fatigued, and persistence in the face of difficulties. Dedication refers to deriving a sense of significance from one's work, feeling enthusiastic and proud about one's job, and feeling inspired and challenged by it. Absorption refers to being totally and happily immersed in one's work. Answers were given on a 7- point scale from zero to six, with higher scores representing a higher level of work engagement. The UWES has shown sufficient internal consistency (Schaufeli and Bakker 2003). In their study, internal consistency was excellent (Cronbach's alpha was 0.93).

This study did not show an effect of this worksite mindfulness-related multi-component health promotion intervention on work engagement, mental health, need for recovery and mindfulness after 6 and 12 months.

3.3.1. The validity of the UWES

"Since its introduction in 1999, a number of validity studies have been carried out with the UWES that uncover its relationship with burnout and workaholics, identify possible causes and consequences of engagement and elucidate the role that engagement plays in more complex processes that are related to worker's health and wellbeing" (Schaufeli and Bakker 2003). Validity studies that have been carried out with the UWES show that work engagement is indeed negatively associated with burnout, albeit that the relationship between vigor and exhaustion and between dedication and cynicism is somewhat less strong than was expected. Furthermore, engagement can be discriminated from workaholics. "Particularly, job resources that act as motivators seems to cause work engagement, whereas engaged employees exhibit positive job attitudes, experience good mental health, and seem to perform better than those who are less engaged. Finally, engagement is not restricted to the individual, it may crossover to others thus leading to what has been labeled collective engagement" (Schaufeli and Bakker 2003).

3.3.2. Reliability

Two aspects of UWES's reliability are considered: internal consistency and test-retest reliability, also called stability (Schaufeli and Bakker 2003).

"All scales of the UWES are highly internally consistent. Furthermore, adding another item to the vigor and absorption scales hardly increases the scales' internal consistency. In other words, as far as the internal consistency is concerned, both extra items might be eliminated as well. Although – as expected – the internal consistencies of the shortened version are somewhat lower, they are still within the acceptable range. Finally, the stability of engagement across a one-year time lag is similar to that of burnout and does differ much between the three dimensions, although the stability

coefficient of vigor seems to be somewhat higher. The stability of the shortened version is similar to that of both longer versions"(Schaufeli and Bakker 2003).

3.4. Various online detailed questionnaire

Ben-Ner et al. (2014) conducted a 12-month-long experiment in a financial services company on 43 employees (who were not pregnant nor advised by their physician to refrain from participation in the experiment) with sedentary work volunteered, to study how the availability of treadmill workstations affects employees' physical activity and work performance. They enlisted sedentary volunteers, half of whom received treadmill workstations during the first two months of the study and the rest in the seventh month of the study. Participants could operate the treadmills at speeds of 0–2 mph and could use a standard chair-desk arrangement at will. Weekly online performance surveys were administered to participants and their supervisors, as well as to all other sedentary employees and their supervisors. Using within-person statistical analyses, they find that overall work performance, quality and quantity of performance, and interactions with coworkers improved because of adoption of treadmill workstations. They measured factors that influence physical activity and performance. They include illness (days absent from work due to illness during the week prior to the weekly survey), the move of the company to a different location (staggered over a period of weeks) and change in work duties.

Overall performance was assessed for the week preceding with online detailed quarterly questionnaire concerning work, life and health and survey. This was done on a scale from 0 to 10 where 0 is the worst job performance anyone could have at your job and 10 is the performance of a top worker, how would you rate your usual job performance during the past week? They also asked about the employee's quality of performance (average of ''Consider your work yesterday, Tuesday. Please rate the quality of your work'' and ''Now consider the day before that, Monday. Please rate the quality of your work.'' Scored from 1 (Poor) to 5 (Far above average)), quantity of performance (average of ''Consider your work yesterday, Tuesday. Please rate the quantity of your work'' and ''Now consider the day before that, Monday. Please rate the quantity of your work.'' Scored from 1 (Poor) to 5 (Far above average)) and quality of interactions with coworkers for the day before the survey (a Tuesday) and for the day before that (a Monday) (average of ''Consider your work yesterday, Tuesday. Please rate the quantity of your work'' and ''Now consider the day before that, Monday. Please rate the quantity of your work.'' Scored from 1 (Poor) to 5 (Far above average)). Asking for four different dimensions of performance and for slightly different periods provides a more complete picture of an employee's assessment of his or her own performance than would be afforded by a single item and a single period. The measures are similar to those employed by Pronk et al. (2004), and were discussed with the company's management, who agreed that they capture critical dimensions of work performance that are used for performance evaluation and are comparable over time and across jobs. Supervisors were asked to rate their ten employees (on average) on the same four dimensions using items that were nearly identical to those asked of employees. Each supervisor had to complete a survey as an employee (Ben-Ner et al. 2014).

For the entire yearlong period, the net performance effect of treadmill workstations is positive, amounting to about 0.69 points for employee self-rating and 1.11 for supervisor rating on a 1–10 scale. The results suggest that the introduction of treadmill

workstations, as hypothesized, has a significantly favorable impact on both physical activity and work performance. They did not find any information about reliability and validity of the questionnaire.

In other study, Neuhaus et al. (2014) compare the efficacy of a multi-component intervention to reduce workplace sitting time, to a height-adjustable workstations-only intervention, and to a comparison group (usual practice). The multi-component intervention comprised installation of height-adjustable workstations and organizational-level (management consultation, staff education, manager e-mails to staff) and individual-level (face-to-face coaching, telephone support) elements. They had three-arm quasi-randomized controlled trial in three separate administrative units of the University of Queensland, Brisbane, Australia, with data were collected between January and June 2012 and analyzed the same year.

The online questionnaire was used to collect data on:

1. Demographics (age, gender, ethnicity, educational attainment, employment history, smoking history, medical history; baseline only).
2. Work-related elements (work-performance, e.g., rate your highest level of efficiency this week; 10-item scale ranging from 1 to 10 with higher scores indicating better work performance).
3. Absenteeism (How many days in the LAST 3 MONTHS have you stayed away from your work for more than half the day because of health problems?) and presenteeism31 (How many days in the LAST 3 MONTHS did you go to work while suffering from health problems?)

We did not find any information about reliability and validity of the questionnaire.

3.4.1. General Health Questionnaire (GHQ-12)

Blake, Zhou, and Batt (2013) did study to deliver and evaluate a five-year employee wellness program aimed at improving the health and well-being of employees in a large Nottingham University Hospitals (NHS) workplace. A theory-driven multi-level ecological workplace wellness intervention was delivered including health campaigns, provision of facilities and health-promotion activities to encourage employees to make healthy lifestyle choices and sustained behavior changes. An employee questionnaire survey was distributed at baseline (n = 1,452) and at five years (n = 1,134), including measures of physical activity, BMI, diet, self-efficacy, social support, perceived general health and mood, smoking behaviors, self-reported sickness absence, perceived work performance and job satisfaction.

The 12-item General Health Questionnaire (GHQ-12) was used to measure mood of employees and perceived work performance over the previous four weeks was measured by a single item, rated on a six-point Likert scale (0 being my worse performance, 5 being my best performance). Participants were asked to self-report on their frequency of sickness absence.

Questionnaires were distributed to employees in the following occupational groups via their pays lips: Admin & Clerical/Senior Managers; Allied Health Professionals; Ancillary; Dental; Maintenance; Medical; Nursing & Midwifery; Scientific & Professional; and Technicians. Completion was voluntary and anonymous; employees were asked to return their questionnaires to a researcher who was not employed by the same organization, via the internal mail system, within a four-week period.

The majority of the respondents at both time points (92.3% and 93.5% at baseline and follow-up, respectively) reported that they were satisfied with their overall performance at work; this did not significantly differ between baselines and follow up. Reported sickness absence levels for the previous month significantly reduced from 4.9% at baseline to 2.6% at follow up (Cramer's V = 0.13, $p < .001$).

3.4.2. Reliability and validity of the GHQ-12

The GHQ-12 displays adequate reliability and validity for use in various language and population. Its factor structure coincides, in the essential aspects, with that found in the more representative works with different kinds of populations. Between-factor differences suggest that the GHQ-12 has multidimensional properties that are not captured by a single severity score. For example, the results of this work allow affirming that the GHQ-12 can be used effectively to assess the Spanish population's overall psychological well-being and to detect non-psychotic psychiatric problems.

However, we cannot find reliability and validity of this questionnaire for this study.

3.4.3. Objective and subjective productivity questionnaire

Chau et al. (2016) evaluated the effects of sit-stand desks on workers' objectively and subjectively assessed sitting, physical activity, and productivity. This quasi-experimental study involved one intervention group (n = 16) and one comparison group (n = 15). Participants were call center employees from two job-matched teams at a large telecommunications company in Sydney, Australia (45% female, 33 ± 11 years old). Intervention participants received a sit-stand desk, brief training, and daily e-mail reminders to stand up more frequently for the first 2 weeks post-installation. Control participants carried out their usual work duties at seated desks. Productivity outcomes were company-specific objective metrics (e.g., hold time, talking time, absenteeism, wrap up time on call, average call handling time, attendance days, sick days, or customer ratings) and subjective measures was assessed by asking participants to respond to a set of statements about their work-related perceptions, energy, and feelings using a 5-point Likert scale (1 = strongly disagree; 5=strongly agree). The statements were as follows: "The physical working conditions at my location are satisfactory, "I am able to sustain the level of energy I need throughout the work day," "I feel positive at work most of the time, "and "There are no substantial obstacles at work to doing my job well."

The company's workplace wellness team provided these statements for the purposes of this study. Measurements were taken at baseline, 1, 4, and 19 weeks post-installation. Participants completed an online questionnaire (SurveyMonkey Inc Palo Alto, California, USA) at the end of each measurement week via a unique link e-mailed to each participant individually. Test periods ran from Monday to Saturday.

There were non-significant trends toward more positive work perceptions among the intervention group, while this was not evident in the control group. The intervention group expressed significantly stronger agreement at Week 19 than at baseline that they were able to sustain their energy levels throughout the workday.

In conclusion, Opt to stand demonstrates that using sit-desks to work in a standing posture does not have negative impacts on productivity, and therefore, sit-stand desks are a feasible strategy for promoting more standing in a real-world workplace setting like a call center. We did not find any information about reliability and validity of the questionnaire.

4. Discussion

The scientific literature provides ample evidence that adverse modifiable health risks such as physical inactivity is related to morbidity. In turn, these modifiable health risks have been associated with excess healthcare costs in these studies, many conducted on subjects representing employed populations. A recent review on this subject concluded that sufficient evidence exists to support this contention (Pronk et al. 2004).

Therefore, we want to develop a conceptual framework that focuses on the effects of interventions in workstations on physical activity and the work performance of sedentary employees who type on a keyboard, speak on the phone, define problems and identify solutions to them and participate in meetings. The results of this systematic review indicate statistically significant relationships between several intervention for increasing physical activity and employee work performance and productivity. A low-to-high degree of association has been reported in the different literatures between interventions and productivity.

In Table 1 we explain criterias that have been measured by several methods. For example, subjective methods measures productivity with job performance, sickness absence(work loss days), extra effort exerted, getting along with coworkers, quality and quantity of performance, energy and feelings and objective methods were specified and provided by the companies to cover the same period as the physical activity measurements.

Different groups of subjects in each study were recruited. Four groups of subjects had a sedentary workstation (Ben-Ner et al. 2014; Carr et al. 2016; Chau et al. 2016; Neuhaus et al. 2014) in 2 studies did not mentioned about workstation of subjects (Blake, Zhou, and Batt 2013; van Berkel et al. 2014) and one study recruited employee under treatment for disorders and emotional problems (Pronk et al. 2004).

We studied several interventions for increasing physical activity that effect on work performance while at work, including elliptical machine with Organizational and individual levels interventions (Carr et al. 2016). In other studies, they used trealmil workstation and sit stand desk for improving activity (Ben-Ner et al. 2014; Chau et al. 2016). Neuhaus et al. (2014) conducted multi-component intervention included height adjustable workstations, Organizational-level and Individual-level. In a five years study Blake, Zhou, and Batt (2013) evaluate employee wellness program with multi-level ecological workplace wellness such as health campaigns, provision of facilities and health promotion like brief exercise classes to fit within lunch breaks, providing access to gym facilities onsite, making alterations to class booking and payment systems to increase convenience to staff, activities to encourage employees to make healthy lifestyle choices and sustained behaviour changes.

In one study, they don't have any intervention (Pronk et al. 2004), and in another one they had to evaluate the effectiveness of a worksite mindfulness-related multicomponent health promotion intervention on work engagement, mental health, need for recovery and mindfulness (van Berkel et al. 2014).

Various interventions have a low to high affecting on productivity, as measured by objective and organization specificmetrics or subjective and self-report questionnaires.

Some studies have shown interventions with positive influence on productivity (Ben-Ner et al. 2014; Carr et al. 2016; Chau et al. 2016; Pronk et al. 2004). On study did not show an effect of worksite mindfulness-related multi-component health promotion

intervention on work engagement, mental health (van Berkel et al. 2014). Blake, Zhou, and Batt (2013) demonstrated that improvements in health behaviours, reductions in sickness absence and improvements in job satisfaction. Neuhaus et al. (2014) suggest that it is feasible to implement a multi-component intervention such as was used in Stand Up desk with high fidelity, no perceived decrease in productivity.

The importance of measuring the accuracy and consistency of questionnaires known as validity and reliability, respectively, have been documented in several studies. We comprehensively explored and described the validity and reliability of variouse questionnaires that have analised in this article. We found information about reliability and validity for four study (Blake, Zhou, and Batt 2013; Carr et al. 2016; Pronk et al. 2004; van Berkel et al. 2014) but for three of them we did not find any information for it (Ben-Ner et al. 2014; Chau et al. 2016; Neuhaus et al. 2014) (Table 1).

Methods	Articles	Criteria of productivity	population	intervention	R& V*	API
HPQ	Carr et al. (2016)	job performance sickness absence	Overweight adults with sedentary desk	multi-component intervention: elliptical machine Organizational-level	YES	+
HRA	Pronk et al. (2004)	extra effort exerted difficulty in getting along with coworkers work loss days	employees under treatment for disorders	NO	YES	+
UWES	van Berkel et al. (2014)	work engagement mental health need for recovery and mindfulness	Employees from two Dutch research institutes	mindfulness-related multicomponent health promotion	YES	No effect
Various online questionnaire	Ben-Ner et al. (2014)	work performance quality and quantity of performance interactions with coworkers Illness move of the company change in work duties	Employee with sedentary work ability to walk on Treadmill	treadmill workstations	NO	+
	Neuhaus et al. (2014)	work-performance absenteeism	Employee of administrative units of the University	multi-component intervention: height-adjustable workstations, Organizational-level, Individual-level.	NO	No decrease
GHQ-12	Blake et al. (2013)	perceived work performance and job satisfaction	Employees of hospital	multi-level ecological workplace wellness: health campaigns, provision of facilities and health-promotion, activities to encourage employees to make healthy lifestyle choices	YES	+
Objective and subjective	Chau et al. (2016)	Objective: hold time, talking time, absenteeism, wrap up time on call, average call handling time, attendance days, sick days, or customer ratings Subjective: their work-related perceptions, energy, and feelings	call center employees with seated desks	sit-stand desks	NO	+

*R&V: Reliability and validity *Amount of productivity after intervention

Table 1: Characteristics of different methods

In future studies we recommend using different criteria for the choice of the best intervention for increasing productivity. Although according to subjects, workplace, budget, time and task, interventions and method for measuring productivity will be different, however multi-component interventions have best result than only use one intervention.

According to previous studies that mainly focused on workplace and adults, four different intervention for create active workstations is used:

1. Physical changes in workplace environment;
2. A policy to change the organization of work;
3. Information and counselling;
4. Multiple interventions.

We propose that in future works researchers is better use policy changes as one of the most important component in multi-component interventions at the first. For example, in some companies there is a need to conduct trials on low cost interventions. For example, standing meetings, printers or dust-bins placed further, organisational schedule for short bouts of activity (e.g. of five to 15 minutes' duration) in workplace settings, Meeting rooms can be equipped with sit-stand workstations so that employees can choose to stand during meetings if they wish, he breaks would also encourage employees to take a walk to communicate with colleagues instead of using the telephone or email. It would be helpful to first better understand the ideas that workers and employers have about sitting and methods to decrease sitting. This could help to develop better interventions with better results and according to their demands we implement physical changes (sit-stand desks,treadmill,cyclinc workstation). On the other hand Information and counselling should be used simultaneously with policy changes for improving knowledge of employee and employers about the adverse effect of sedentary workstation and advantages of moving between sitting time. Even if people are aware of the adverse effects of sitting, and have access to facilities and programs to decrease sitting, they will still find difficulties in adapting to new behaviour.We suggest that using posters or prompts for standing in rooms and using e-health will have positive affection on movement.

After this phase and assess results we suggest using physical changes and implementing new devices for improving intervention and Subsequently improving productivity.

We recommend using sit-stand desk or some cyclic equepment like elliptical machine, can be easier and useful than treadmills for increasing movement as well as productivity.

We recommend in future studies using objective and subjective method for measuring productivity simultaneously and before research, researchers should measure the validity and reliability of the method in the pilot study.

5. Conclusion

The results of this systematic review demonstrate that providing interventions for different workers in various workplaces have a low to high affecting on productivity, as measured by objective and organization specific metrics or subjective and self-report questionnaires. We found that best method for measuring productivity at work is depedent on subjects of study and organizational demands.

To the best of our knowledge, using different methods simultaneously for measuring productivity can make more accuracy and precision and it's better that befor filling of questionnaires we train all of workers about purpose of study and how to fill out questionnaires. Using this method we can understand if different interventions are a feasible strategy for promoting productivity at work or not.

References

Ben-Ner, Avner, Darla J. Hamann, Gabriel Koepp, Chimnay U. Manohar, and James Levine. 2014. "Treadmill workstations: The effects of walking while working on physical activity and work performance". *PLOS ONE* 9 (2): e88620. DOI: 10.1371/journal.pone.0088620.

Bernaards, Claire M., Karin I. Proper, and Vincent H. Hildebrandt. 2007. "Physical activity, cardiorespiratory fitness, and body mass index in relationship to work productivity and sickness absence in computer workers with preexisting neck and upper limb symptoms". *Journal of Occupational and Environmental Medicine* 49 (6): 633–40. DOI: 10.1097/JOM.0b013e318058202c.

Blake, Holly, Dingyuan Zhou, and Mark E. Batt. 2013. "Five-year workplace wellness intervention in the NHS". *Perspectives in Public Health* 133 (5): 262–71. DOI: 10.1177/1757913913489611.

Boyle, Terry, Lin Fritschi, Jane Heyworth, and Fiona Bull. 2011. "Long-term sedentary work and the risk of subsite-specific colorectal cancer". *American Journal of Epidemiology* 173 (10): 1183–91. DOI: 10.1093/aje/kwq513.

Carr, Lucas J., Christoph Leonhard, Sharon Tucker, Nathan Fethke, Roberto Benzo, and Fred Gerr. 2016. "Total worker health intervention increases activity of sedentary workers". *American Journal of Preventive Medicine* 50 (1): 9–17. DOI: 10.1016/j.amepre.2015.06.022.

Chau, Josephine Y., William Sukala, Karla Fedel, Anna Do, Lina Engelen, Megan Kingham, Amanda Sainsbury, and Adrian E. Bauman. 2016. "More standing and just as productive: Effects of a sit-stand desk intervention on call center workers' sitting, standing, and productivity at work in the Opt to Stand pilot study". *Preventive Medicine Reports* 3: 68–74. DOI: 10.1016/j.pmedr.2015.12.003.

Church, Timothy S., Diana M. Thomas, Catrine Tudor-Locke, Peter T. Katzmarzyk, Conrad P. Earnest, Ruben Q. Rodarte, Corby K. Martin, Steven N. Blair, and Claude Bouchard. 2011. "Trends over 5 decades in U.S. occupation-related physical activity and their associations with obesity". *PLoS One* 6 (5): e19657. DOI: 10.1371/journal.pone.0019657.

Coulson, J. C., J. McKenna, and M. Field. 2008. "Exercising at work and self-reported work performance". *International Journal of Workplace Health Management* 1 (3): 176–97. DOI: 10.1108/17538350810926534.

Groenesteijn, L., D. A. C. M. Commissaris, M. Van Den Berg-Zwetsloot, and S. Hiemstra-Van Mastrigt. 2016. "Effects of dynamic workstation Oxidesk on acceptance, physical activity, mental fitness and work performance". *Work* 54 (4): 773–78. DOI: 10.3233/WOR-162348.

John, Dinesh, David Bassett, Dixie Thompson, Jeffrey Fairbrother, and Debora Baldwin. 2009. "Effect of using a treadmill workstation on performance of simulated office work tasks". *Journal of Physical Activity & Health* 6 (5): 617–24. https://www.ncbi.nlm.nih.gov/pubmed/19953838.

Kessler, Ronald C., Minnie Ames, Pamela A. Hymel, Ronald Loeppke, David K. McKenas, Dennis E. Richling, Paul E. Stang, and T. Bedirhan Ustun. 2004. "Using the World Health Organization Health and Work Performance Questionnaire (HPQ) to evaluate the indirect workplace costs of illness". *Journal of Occupational and Environmental Medicine* 46 (6): S23-S37. DOI: 10.1097/01.jom.0000126683.75201.c5.

Kessler, Ronald C., C. Barber, A. Beck, P. Berglund, P. D. Cleary, David K. McKenas, N. Pronk, G. Simon, Paul E. Stang, T. Bedirhan Ustun, and P. Wang. 2003. "The World Health Organization Health and Work Performance Questionnaire (HPQ)". *Journal of Occupational and Environmental Medicine* 45 (2): 156–74. https://www.ncbi.nlm.nih.gov/pubmed/12625231.

Neuhaus, Maike, Genevieve N. Healy, David W. Dunstan, Neville Owen, and Elizabeth G. Eakin. 2014. "Workplace sitting and height-adjustable workstations - A randomized controlled trial". *American Journal of Preventive Medicine* 46 (1): 30-40. DOI: 10.1016/j.amepre.2013.09.009.

Pedersen, Scott J., Paul D. Cooley, and Casey Mainsbridge. 2014. "An e-health intervention designed to increase workday energy expenditure by reducing prolonged occupational sitting habits". *Work* 49 (2): 289-95. DOI: 10.3233/WOR-131644.

Pronk, Nicolaas P. 2015. "Fitness of the US workforce". *Annual Review of Public Health* 36: 131–49. DOI: 10.1146/annurev-publhealth-031914-122714.

Pronk, Nicolaas P., Brian Martinson, Ronald C. Kessler, Arne L. Beck, Gregory E. Simon, and Philip Wang. 2004. "The association between work performance and physical activity, cardiorespiratory fitness, and obesity". *Journal of Occupational and Environmental Medicine* 46 (1): 19–25. DOI: 10.1097/01.jom.0000105910.69449.b7.

Schaufeli, W. B., and A. B. Bakker. 2003. "Utrecht work engagement scale: Preliminary manual". Utrecht: Occupational Health Psychology Unit, Utrecht University.

Tompa, Emile. 2002. "The impact of health on productivity: Empirical evidence and policy implications". *The Review of Economic Performance and Social Progress*, 181–202. http://www.csls.ca/repsp/2/emiletompa.pdf.

van Berkel, Jantien, Cécile R. L. Boot, Karin I. Proper, Paulien M. Bongers, and Allard J. van der Beek. 2014. "Effectiveness of a worksite mindfulness-related multi-component health promotion intervention on work engagement and mental health: Results of a randomized controlled trial". *PLOS ONE* 9 (1) : e84118. DOI: 10.1371/journal.pone.0084118.

WHO/WEF. 2008. "Preventing non communicable diseases in the workplace through diet and physical activity: WHO/World Economic Forum Report of a joint event". Accessed November 25, 2017. http://www.who.int/dietphysicalactivity/workplace/en/.