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HEALTH PSYCHOLOGY | RESEARCH ARTICLE

Six-month follow-up of a theory-informed, multi-component intervention to reduce sedentary behaviour in the workplace

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Abstract: There is limited evidence exploring the long-term effectiveness of sedentary behaviour interventions. This study aimed to explore participant experiences six months post-intervention to evaluate the long-term effectiveness of a low-cost, theory-informed, multi-component, individually tailored, six-week intervention for the reduction of occupational sedentary behaviour. Twenty-five participants who completed a sedentary behaviour intervention participated in a six-month follow-up. Participants wore an activity monitoring device and participated in a semi-structured interview. Interview transcripts were thematically analysed. The pre- and post-intervention quantitative data were analysed via paired samples *t*-tests. Occupational sitting time was reduced by an average of 40.6 ± 76.1 min/work day at six months as compared to pre-intervention. Twenty-three participants indicated that they had continued with their occupational sedentary behaviour change with various stages of change identified. Self-efficacy towards goal achievement remained high at the six-month follow-up. The most prominent goal identified by the participants to reduce occupational sedentary behaviour was walking. Barriers included attending seated meetings, perceived workloads or work tasks and work environments. Suggested strategies to overcome barriers included changing the work environment, providing prompts and receiving support from management. The current study provides insight into the long-term adherence to an occupational sedentary behaviour intervention.

ABOUT THE AUTHOR

Teneale McGuckin is currently a PhD candidate under the supervision of Associate Professor Rebecca Sealey and Associate Professor Fiona Barnett who both have research expertise in healthy lifestyle interventions. Teneale's project surrounds the reduction of sitting time in the workplace with a specific interest in theory-informed behaviour change strategies. This project supports the wider views of the importance of reducing sedentary behaviour especially in the workplace.

PUBLIC INTEREST STATEMENT

Evaluating the long-term effectiveness of sedentary behaviour interventions is an emerging area of interest within the field. The current study explores a six-month follow-up of a workplace intervention which aimed to reduce occupational sitting time. Most of the participants from the intervention phase suggested they were able to continue with their occupational sedentary behaviour change at six months post-intervention with walking considered the most effective strategy. As expected, there were barriers which prevented participants from reducing their sitting time including long and numerous meetings, increased workloads and poorly planned workstations. Further research is required to explore the long-term effectiveness of occupational sedentary behaviour change interventions.

Subjects: Physical Activity and Health; Exercise Psychology; Health Psychology

Keywords: sitting time; occupational; intervention

1. Introduction

Occupational sedentary behaviour is a major contributor (49%) to overall sitting time (Parry & Straker, 2013). Consequently, the workplace is an ideal setting to implement an intervention to reduce sedentary behaviour, especially for those who work in an office setting (Clemes et al., 2015; Parry & Straker, 2013). For individuals who are employed in predominantly desk-based roles, the recommendation is to stand or move for 2–4 h per work day (Buckley et al., 2015). In an attempt to reduce occupational sedentary behaviour, multi-component interventions have been implemented and have been found to be successful in reducing occupational sedentary behaviour (Chu et al., 2016) with numerous studies reducing or interrupting occupational sitting time with positive short-term outcomes. For example, a four-week multi-component intervention including the installation of sit-to-stand workstations and other motivation-based strategies was able to reduce sitting time by 2 h/day for office workers (Healy et al., 2013). Additionally, a low-cost four-week multi-component intervention which included support from managers, workplace champions to send emails, installing computer software, increased social media awareness, and point-of-decision prompts reduced sitting time by 26 min/day for office-based workers (Mackenzie, Goyder, & Eves, 2015). Furthermore, an eight-week intervention determined that short (1–2 min) frequent breaks every half hour were more effective in reducing occupational sedentary behaviour compared to longer (2 × 15 min) less frequent breaks (Mailey, Rosenkranz, Casey, & Swank, 2016). It appears that interventions which aim to reduce occupational sitting time are effective in eliciting short-term behaviour change; however, there is limited literature surrounding the long-term adherence to behaviour change following the completion of multi-component sedentary behaviour reduction interventions.

Long-term behaviour change can be associated with the maintenance stage of the transtheoretical model. During this stage of change, behaviour has been modified for at least six months and up to an unspecified time period where behaviour change has been consistent without relapse (Prochaska, Norcross, & DiClemente, 2013). It is unlikely that successful behaviour change occurs on the first attempt and frequent relapses and recycling through the other stages of pre-contemplation, contemplation, preparation and action may occur (Prochaska, DiClemente, & Norcross, 1992). There are barriers which may potentially cause relapses and therefore inhibit long-term reductions in occupational sitting time. Examples of these barriers include interruption to workflow, bad weather and excessive workloads (Bort-Roig et al., 2014; Cooley, Pedersen, & Mainsbridge, 2014). Additionally, workplace social norms are likely to present as a barrier (Hadgraft et al., 2016). For instance, sending emails is considered to be the most appropriate form of communication in the workplace rather than speaking face-to-face with a colleague (Waters et al., 2016). A lack of self-efficacy may also be a contributing factor to unsuccessful behaviour change as a person may not perceive they are capable of changing the problematic behaviour. Self-efficacy influences personal choices, the level of effort exerted to change behaviour, perseverance and resilience in the face of barriers (Bandura, 1988). Therefore, if a worker is unable to overcome the potential barriers, they are unlikely to have high self-efficacy in their belief of successfully reducing their occupational sitting time.

A Cochrane review conducted by Shrestha et al. (2016) discussed the importance of continuing research in the area of occupational sitting time, particularly for long-term adherence. This is highlighted by Danquah et al. (2017) who suggested that no multi-component sedentary behaviour intervention had a follow-up of more than three months. This suggests that there is a gap in the literature regarding the evaluation of long-term effectiveness of theory-informed workplace interventions that specifically focus on reducing sedentary behaviour. The aim of the current study was to explore participant experiences six months post-intervention to evaluate the long-term

effectiveness of a low-cost, theory-informed, multi-component, individually tailored intervention to reduce sedentary behaviour in the workplace.

2. Methods

2.1. Ethics

Ethical approval for the study was obtained from the institutional human ethics committee. Participants were provided with an information sheet and signed an informed consent form to participate.

2.2. Recruitment

Participants ($n = 27$) who completed a six-week theory-informed intervention to reduce occupational sedentary behaviour at a higher education institution (McGuckin, Sealey, & Barnett, 2017) were contacted via email and invited to participate in a six-month follow-up data collection phase. As reported in McGuckin et al. (2017), participants who completed the six-week intervention were able to reduce their sitting time by 45.2 ± 60.7 min per work day. Within the sample, participants who did not have access to sit-to-stand workstations were able to successfully reduce their sedentary behaviour by 25.0 ± 35.4 min per work day with the use of education, individualised feedback, prompts, goal setting, verbal persuasion and self-contracts as key strategies of the multi-component intervention (McGuckin et al., 2017).

2.3. Procedures

Participants were provided with an ActivPAL activity monitoring device (PAL Technologies Ltd, Glasgow, Scotland) and instructed to wear it for five days during work hours. Participants were familiar with wearing the ActivPAL and were provided with multiple adhesion options. Participants also recorded daily work hours and ActivPAL wear time to assist with data extraction points. The ActivPAL has been used extensively to collect quantitative movement patterns (Hardy et al., 2013; Kim & Welk, 2015; Swartz et al., 2014; Urda, Lynn, Gorman, & Larouere, 2016) and is a valid and reliable measurement tool (Grant, Ryan, Tigbe, & Granat, 2006; Ryan, Grant, Tigbe, & Granat, 2006). The ActivPAL data was used to determine if the 2 and 4 h recommendations by Buckley et al. (2015) were met at the six-month follow-up.

Following the ActivPAL data collection, participants were invited to complete a semi-structured interview conducted by the principal investigator. The interviews were audio-recorded and the interview topics are listed in Table 1.

2.4. Statistical analysis

The open-ended responses from the follow up interviews were transcribed verbatim and were thematically analysed according to Braun and Clarke (2006). The six-month follow-up ActivPAL and self-efficacy data were compared to the pre- and post-intervention data and analysed via paired samples *t*-tests using SPSS version 22 (SPSS Inc. Chicago, IL, USA). Statistical significance was set at $p < .05$, with 95% confidence intervals (CI) and effect size (ES) also presented.

Table 1. Semi-structured interview topics

Interview topics

Continuation of behaviour change
Successful goals for reducing occupational sedentary behaviour
Barriers to changing occupational sedentary behaviour
Strategies to overcome barriers
Identifying stage of change (Prochaska et al., 2013)
Identifying self-efficacy towards goal achievement (McAuley, 1993)

3. Results

3.1. Participants

One participant was no longer employed at the organisation and therefore could not be included in the study. Another participant declined to participate and indicated that their workload had prevented them from being “up and active”. A total of 25 out of 27 eligible participants volunteered to participate in the follow-up study.

3.2. ActivPAL data

Of the 25 participants who volunteered for the follow-up study, 23 participants had three full days of data to analyse. Table 2 provides the average daily sitting time over a three-day sampling period for the total group and then separated into participants with and without sit-to-stand workstations. Table 3 represents the participants who met the 2 h/day and 4 h/day recommendation to stand or move during work hours to reduce occupational sitting time (Buckley et al., 2015) based on the ActivPAL data. Of the seven participants who met or exceeded the 4-h recommendation, three had sit-to-stand workstations installed.

3.3. Continuation of behaviour change

Of the 25 participants who volunteered for the follow-up study, 23 participants indicated that they had continued with their occupational sedentary behaviour change in some form. This was defined as “successful continuation of sedentary behaviour change” which was characterised by the following responses:

Definitely, at work and also at home. (Participant 16)

Absolutely. And, for my birthday, I was bought a FitBit which I’m wearing and it’s really made me pay attention. (Participant 11)

I have with some of [the goals], some I haven’t been able to [continue with] ... (Participant 13)

I have [continued] with some, I think I have reverted a bit back to the old ways ... because everything that is set up around me is for me to be sitting down ... (Participant 17)

Two participants said that they had not continued with their behaviour change. This was defined as “unsuccessful continuation of sedentary behaviour change” and is characterised by the following response:

Not particularly. You can see that I took the stand up desk away, only because the students were singing out for it—I mean they probably get way more use out of it. (Participant 18)

3.4. Effective goals for reducing occupational sedentary behaviour

The most prominent goal identified by the participants was “walking” ($n = 24$ responses). This included walking at lunch time, walking to visit colleagues and walking further to the bathroom or to fill their water bottle or to empty their rubbish. This was characterised by responses such as follows:

I do take the long route to the toilet ... [I] visit colleagues rather than phoning them. (Participant 12)

The main thing I’ve done is tried to walk, if I don’t have to go across campus for anything I’ve tried to walk at lunchtime a bit more. (Participant 2)

I don’t sit for any longer than about half an hour ... Even if it’s a matter of getting up and walking outside, I walk around the car park and come back and sit down again. (Participant 23)

Table 2. Average \pm standard deviation (SD) daily occupational sitting time (min), confidence intervals (CI) and effect size (ES) at pre-intervention, post-intervention and 6-month follow-up

Participants	Mean \pm SD (mins)			CI (ES)		
	Pre-intervention	Post-intervention	6-month follow-up	Pre-post	Pre-6-month	Post-6-month
All participants (n = 23)	344.4 \pm 60.6	292.4 \pm 76.3*	303.7 \pm 79.4*	25.1, 78.7 (0.75)	7.7, 73.5 (0.58)	-30.0, 7.4 (0.14)
Participants without sit-to-stand workstation (n = 17)	340.7 \pm 67.0	311.4 \pm 68.8*	324.9 \pm 63.1	11.6, 47.1 (0.43)	-6.9, 38.5 (0.24)	-37.8, 10.8 (0.20)
Participants with sit-to-stand workstation (n = 6)	354.7 \pm 40.2	240.7 \pm 76.1*	243.7 \pm 95.6 ^a	28.3, 199.6 (0.23)	.00, 221.9 (1.51)	-30.9, 24.9 (0.03)

*Significant difference ($p < .05$) from pre-intervention data.

^aApproaching significance ($p = .05$) compared to pre-intervention data.

Table 3. Number of participants who met or exceeded the 2 and 4 h recommendation of standing and/or moving pre- and post- intervention and at six-month follow-up on one or more days during the ActivPAL monitoring period

Recommended duration to stand or move during the work day	Pre-intervention	Post-intervention	Six-month follow-up
2 h	12	14	10
4 h	2	5	7

3.5. Barriers to changing occupational sedentary behaviour

The participants identified that “workloads or work tasks” ($n = 10$), “attending meetings” ($n = 6$) and “work environments” ($n = 5$) were the key barriers for reducing occupational sedentary behaviour. This was characterised by the following responses:

I just fixate on [work task] and I don't really get up until I'm done. (Participant 13)

Longer meetings ... where you are not in control of the meeting ... there almost needs to be a cultural change [in the workplace] to recognise when you have groups of people together for long lengths of time, you are actually promoting this unhealthy behaviour. (Participant 5)

The difficulty with standing is you could stand at your desk using the monitor stands when you're just working on the keyboard. The minute you start to use the phone or spread out and do paperwork ... you can't do it and it's really hard. (Participant 19)

3.6. Strategies to overcome barriers

A variety of strategies to overcome some of the barriers were suggested. The suggestions included “changing the work environment” by installing sit-to-stand workstations or creating a standing space ($n = 8$) and “providing prompts” by installing computer software, having campaigns or competitions ($n = 8$). This was characterised by the following responses:

Currently being stuck at the front desk is kind of my biggest drama. If I could have a standing desk, that would probably be the only option to relieve that ... (Participant 7)

I think I could set reminders in my calendar or my phone or something to actually get up every hour at least. (Participant 22)

When discussing the behavioural norm surrounding sitting during meetings and feeling unable to stand during meetings, “social norms” was explored with a participant responding with the following statement:

... In the big picture, there could be a complaint through workplace health and safety around this kind of practice to try and make people more comfortable ... (Participant 27)

3.7. Stage of change

Thirteen participants were in the action stage of change at six-month follow-up, as they continued to work towards their goals. Seven participants had moved to the maintenance stage as they indicated that they were able to successfully reduce their occupational sedentary behaviour for six months or longer. Five participants had relapses and returned to the contemplation or preparation stages as they were not regularly attempting to change their behaviour.

3.8. Self-efficacy towards goal achievement

There was no difference found for self-efficacy ($n = 24$) when comparing the six-month follow-up ($81.3\% \pm 19.1\%$) with the pre-intervention ($72.9\% \pm 18.5\%$; CI [-18.6, 1.9]; 0.45) or the post-

intervention (82.9 ± 14.9 ; CI [-5.3, 8.6]; 0.09) scores. Self-efficacy scores differ from that reported in McGuckin et al. (2017) due to the smaller sample size.

4. Discussion

The six-month follow-up results highlighted that the average reduction in daily occupational sitting time between pre- and post-intervention (52 min/day for $n = 23$) was maintained at six months (41 min/day). Once removing those participants who had access to a sit-to-stand workstation, there were no statistically significant differences in occupational sitting time across the three time points (group average 14–29 min/day reduction). It should be noted that in McGuckin et al. (2017), the reduction in sitting time of 25 min/day post-intervention for those without access to a sit-to-stand workstation was statistically significant for 21 participants; however, the significance is not observed with the 17 participants included at six-month follow-up. Danquah et al. (2017) observed that the reduced sitting time after one month was 71 min which decreased to 48 min at the three-month follow-up. Although the data in the current study was not statistically significant, the long-term effectiveness of the intervention presents a similar pattern to Danquah et al. (2017). In addition to the whole participant group maintaining reduced occupational sitting time, 10 participants were able to meet the Buckley et al. (2015) recommendation of progressively including standing or walking by 2 h/work day, and seven participants were able to meet or exceed the target Buckley et al. (2015) recommendation of standing or walking by 4 h/work day on one of the assessable days. Of the seven participants who met or exceeded the 4 h/day recommendation, three participants had access to a sit-to-stand workstation. The number of participants who met the 4 h/day recommendation increased at six-month follow-up compared to immediately post-intervention with three participants being consistent with their behaviour change from post-intervention to the six-month follow-up.

Without the use of a sit-to-stand workstation, the participants as a group were unable to significantly reduce their occupational sedentary behaviour six months after the intervention. This suggests that the use of low-cost, theory-informed, individually tailored strategies such as education, individualised feedback, prompts, goal setting, verbal persuasion and self-contracts were effective to modify short-term occupational sedentary behaviour; however, once the strategies were removed, the participants were unable to maintain their sedentary behaviour change. Most people attempting to change behaviour will recycle through the stages of change multiple times before a maintenance of the behaviour is achieved (Prochaska et al., 1992). It was evident that relapses occurred for the current participants; however, the majority of participants resumed their attempt to reduce their sedentary behaviour change. Seven participants were able to successfully move to the maintenance stage by stabilising their interruptions to occupational sedentary behaviour and avoiding relapses (Prochaska et al., 2013). The majority of participants perceived that they had continued with their behaviour change strategies after the intervention finished and had high self-efficacy towards their goal achievement. The strategies which were considered the most effective surrounded walking such as walking further to the bathroom/rubbish bin/water cooler, walking to visit a colleague or walking during their lunch break. Previous literature has also indicated that stair walking and walking meetings are effective ways to reduce occupational sitting time (Commissaris et al., 2016; Gilson, Burton, Van Uffelen, & Brown, 2011). It should be noted that even though the participants indicated that they successfully progressed to the maintenance stage, the quantitative data did not fully support the same pattern. This suggests that the goals set by participants may not have been significant or challenging enough to elicit long-term sedentary behaviour change.

The participants identified multiple barriers for changing their occupational sedentary behaviour including long or numerous meetings, increased workloads and poorly planned workstations. These findings are similar to previous research such as Bort-Roig et al. (2014) who identified that office workers perceived that screen-based work which required them to remain seated at their computer was the most prominent barrier. To overcome some of these barriers, the participants in the current study suggested changing the work environment, providing prompts and increasing

support from managers or other relevant areas. Similar findings were presented by Waters et al. (2016) who described workplace culture and the physical environment as key strategies to improve the likelihood of reducing occupational sedentary behaviour for office workers. Based on the current findings and previous literature, it appears that being able to overcome barriers depends on financial support and cultural buy-in from management or the organisation. Due to the financial cost of installing sit-to-stand workstations or changing the environment, it is advised to promote goal setting surrounding walking or standing activities as the means of reducing occupational sedentary behaviour. Providing opportunities for employees to actively engage with their behaviour change by planning goals to reduce occupational sedentary behaviour may increase the levels of perceived behavioural control experienced by the employees (Ajzen, 1991). This strategy, however, requires support for a workplace culture change by those in senior management roles which may influence subjective norms and attitudes surrounding reducing occupational sedentary behaviour (Ajzen, 1991).

Previously, short-term occupational sedentary behaviour change has been linked to participants having perceived behavioural control over the behaviour; however, barrier self-efficacy was linked to long-term (12 months) reductions in occupational sitting time (Hadgraft et al., 2017). During the intervention period of the current study, participants most likely perceived they were in control of their behaviour as a result of significant reductions in sitting time and high self-efficacy to achieve their goals. It is likely, however, that the participants had low self-efficacy to overcome barriers that presented themselves after the intervention and therefore long-term behaviour change did not occur. The planning that the workers participated in was action planning rather than coping planning (Leventhal, Singer, & Jones, 1965; Sniehotta, Schwarzer, Scholz, & Schuz, 2005). To explore this concept further with respect to the current study, the participants set goals on how they will perform their sedentary behaviour change in the workplace; however, they did not plan for strategies to overcome barriers other than discussing them with the principal investigator during the regular communication. Once the intervention ceased, the principal investigator did not contact the participants and therefore verbal persuasion was no longer provided. The lack of planning to overcoming barriers and the removal of verbal persuasion may have hindered the long-term behaviour change adherence for some participants.

The current study provides interesting insight into the long-term adherence to and barriers of a theory-informed, multi-component intervention. For practical application of the findings, it is suggested that behaviour change strategies used within the intervention (McGuckin et al., 2017) should continue after the intervention ceases for long-term behaviour change to occur. The study is not without limitation, including the small sample size and predominantly female population group. Therefore, the findings may not be generalisable to other workplaces or population groups. However, the findings of the current study contribute to the literature which suggests further research is required to determine effective interventions to reduce occupational sedentary behaviour in the long-term (Shrestha et al., 2016). Future research should continue to explore long-term adherence to sedentary behaviour interventions, with a particular focus on strategies to overcome perceived barriers which would increase barrier self-efficacy.

5. Conclusion

The group average reduction in daily sitting time between pre- and post-intervention was maintained at six months. For participants without access to a sit-to-stand workstation, the reduction in sitting time was not maintained at the six-month follow-up. Of the 23 participants, 10 participants were able to stand or walk for 2 h/work day, and seven participants were able to reach the 4 h/work day recommendation. As expected, there were barriers identified by the participants which included longer or numerous meetings, increased workloads and poorly planned workstations. These barriers are the likely cause of the relapses identified during the interviews. To overcome some of the barriers, participants suggested that there are a variety of strategies which could be implemented such as changing the work environment, providing prompts and having support from managers or other relevant areas. The finding of the current

study suggest that short-term behaviour change can occur as a result of a low-cost, theory-informed, multi-component, individually tailored intervention; however, long-term adherence to sedentary behaviour is compromised once the intervention strategies are removed. Further research is required to explore the long-term effectiveness of theory-informed, multi-component interventions.

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