Author’s response to reviews

Title: Theory-driven, web-based, computer-tailored advice to reduce and interrupt sitting at work: development, feasibility and acceptability testing among employees

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Author’s response to reviews: see over
Dear Editor,

We thank the reviewers for their time and effort to read our paper. The feedback was valuable and we hope the editors find our modifications and explanations satisfactory.

Please find below our detailed responses (regular text) to the comments (bold text). We have made all changes suggested where appropriate and provided explanations where we felt a change was not appropriate or possible. Changes made to the manuscript text are in italic and underlined, unchanged manuscript text is in italic. Please be assured that we are happy to make further changes to the manuscript if needed.

**Reviewer 1: Kelly Mackenzie**

**Major Compulsory Revisions:**

1. The scene is set nicely in the introduction section to provide a sound rationale of the need for interventions to reduce/interrupt workplace sitting. However, there needs to be more detail in the final paragraph. There is mention of "the literature" regarding an intervention that integrates self-management and includes tailoring constructs, but the reader needs to understand what you mean by this and what the literature is telling you. In addition, given the paper is looking at the acceptability and feasibility of an intervention, more detail should be provided rather than simply "Important aspects in the process of intervention development are the evaluation of the feasibility and acceptability of potential intervention strategies in particular contexts and target groups".

The first three paragraphs are the introduction and rationale to the final paragraph containing the actual research questions. The literature of which there is mention in the final section is described in detail in the original first three paragraphs, for example:

> Interactive web-based interventions create the opportunity for on-going contact with and support to its respondents, and use tools that support self-regulatory skills, such as goal setting activities, self-monitoring tools, skill building activities, email reminders, booster sessions, and interactive activities [30,31]. Despite the advantages (low cost, no limitations due to time or location, two billion Internet users worldwide [32]) …

In addition, more details about the development, theoretic background and content of the present intervention were given in the methods section (paragraph ‘Development of the theory-driven, web-based, computer-tailored intervention’).

Still, as requested, we added some more detail to the final section of the background section (yet, not much in order to avoid repetition):

> … Consequently, in the future, intervention strategies that can effectively and affordably reach large numbers of employees are needed. In order to avoid the implementation of effective and affordable strategies that do not apply to the target population and to determine whether an intervention is appropriate for further
effectiveness testing, studies that examine the feasibility and acceptability of such approaches [24,25] are first needed.

Therefore, a web-based, computer-tailored intervention aimed at reducing sitting at work was developed. Based on the abovementioned literature, we aimed to develop an interactive intervention [32,33] that integrates self-management (e.g. goal-setting and action planning) [32,33]. In addition, we aimed to include tailoring-constructs based on a health behaviour theory, as a review showed that theory-based computer-tailored interventions reported more positive outcomes compared to non-theory-driven interventions [35]. Important aspects in the process of intervention development are the evaluation of the feasibility (What is the ability to reach employees with the intervention? Who is requesting the advice?) and acceptability (How do those requesting the advice evaluate the intervention?) of potential intervention strategies in particular contexts and target groups [26,27]. This can prevent implementing an intervention that does not appeal to the target population. The first objective of the present paper was to describe (the development of) this theory-driven web-based, computer-tailored advice. The second objective was to report on the feasibility of reaching employees by comparing characteristics of employees taking part in the intervention with those who did not. Finally, the third objective was to report on the acceptability of the advice among those who participated. The overall research question was ‘Is a theory-driven, web-based, computer-tailored intervention feasible and acceptable for employees to reduce or interrupt workplace sitting?’.

2. There needs to be a "Study Design" section in the methods, which is currently absent. As such, the reader cannot easily determine whether the methods used are appropriate or not. The methods would have benefitted from a mixed methods approach.

As suggested, information about the study design has been added to the revised manuscript.

**Study design and study sample of the feasibility and acceptability testing**

This descriptive study tested the feasibility and acceptability of the intervention in a quantitative way. Participants were recruited...

In addition, we discussed the use of only quantitative data as a limitation of the study:

Third, qualitative methods were not applied during intervention development, while including input from the target group, could have enhanced the intervention. For example, the perceived uselessness of separating the advice in several sections could have been discovered earlier. Also for the feasibility and acceptability testing, a mixed methods approach, including focus groups or interviews, could have resulted in more in-depth information about certain aspects, such as the high initial response rate and
the relatively low proportion completing an action plan. In addition, through qualitative methods, the potential benefits of this advice in a multi-component intervention could have been discussed.

3. Were there any elements of co-production with the intervention development, or was it developed by the researchers only? If so, please include details of the co-production methods used. If it wasn’t used, this needs to be included as a limitation of the study, as the use of co-production may have resulted in some of the barriers to the intervention being addressed during the development phase.

During the development of the intervention, there were no elements of co-production. The research team is very experienced in developing and evaluating computer-tailored interventions, however we agree that a co-production approach from the early start could have strengthened the intervention. As such, we included this aspect as a limitation of the study:

Third, qualitative methods were not applied during intervention development, while including input from the target group, could have enhanced the intervention. For example, the perceived uselessness of separating the advice in several sections could have been discovered earlier. …

4. As the study was not aiming to determine an effect size of the intervention in terms of reducing/interrupting workplace sitting time, there was no need to do a formal power calculation. However, I think this study could be improved by including pre- and post-intervention data on workplace sitting time to provide an initial assessment of effectiveness, although it would not likely be statistically significant. By including these data, it would make this study a more comprehensive pilot.

This is a valuable suggestion, however this study did not include pre- and post-intervention behavioral data of those requesting the advice, as testing the effectiveness was not the purpose of the present study. The need for more comprehensive testing was clearly stated in the original abstract (final sentence) and conclusion section (final sentence) that the next step is to test the effects of the intervention in a proper RCT:

Abstract Conclusions: It is feasible to reach employees, however more efforts are needed to reach lower educated and full-time workers. Most of the employees who requested the advice found it acceptable and reported they changed their behaviour or intended to change it. Interrupting sitting appeared more achievable than reducing workplace sitting. Further research should examine the effects of this intervention in a rigorous randomised controlled trial.

Discussion Conclusions: … Future research should investigate the effects of this intervention on correlates of sitting (e.g. knowledge, attitudes) and on reductions and interruptions of sitting in a pre-post-test randomized controlled trial.
5. In the discussion about the acceptability of the intervention, it is stated that the "authors assumed it would be a strength to split up the advice into separate sections to be requested when suitable for the users, only 8.5% of the employees thought it was useful". This demonstrates why a co-production approach may have been beneficial and hence warrants some discussion here.

We agree with the reviewer that a co-production approach from the early start could have strengthened the intervention. As such, we included this aspect as a limitation of the study:

Third, qualitative methods were not applied during intervention development, while including input from the target group, could have enhanced the intervention. For example, the perceived uselessness of separating the advice in several sections could have been discovered earlier. Furthermore...

6. There are typographical and grammatical errors throughout the paper which would need to be addressed prior to publication e.g. in the background section, the use of the word scare instead of scarce. Also the use of English is at times a little colloquial rather than academic.

The entire paper was carefully checked for spelling and grammar. For example, the following changes were made:

Employees interested to request the advice (n=112) were sent the website link, a personal login and password.

So the evidence on the effectiveness of each and every single strategy is still scarce...

Leaving a choice to the users to decide what and when should be requested...

These totals were truncated to 16 hours/day.

Minor Essential Revisions:

1. There are a couple of missing recent references that the paper may benefit from including:

We thank the reviewer for pointing out these relevant reviews. The papers have been included in the revised version of the manuscript:

So the evidence on the effectiveness of each and every single strategy is still scarce and our understanding of how to best influence workplace sitting is yet limited [24,25].

2. The data presented appear to be sound and statistical analyses seem to be appropriate. However, in the penultimate paragraph of the results section, the final sentence needs clarifying/rewriting as it does not make sense in its current form. The tables appear to be appropriate and clearly display the data.

We thank the reviewer for her positive comments on our data, analyses and tables. The last sentence of the results section was indeed not clear and has been changed into:

"About 16% (n=7/43) reported to be ‘certain’ or ‘very certain’ they could succeed in replacing sitting by periods of standing."

3. Generally, I feel that the strengths and limitations sections need more detail. It might be worth discussing why questionnaires were used to measure the acceptability of the study rather than focus groups/interviews, as this would have provided more detailed information to inform the future development of this intervention. It would also be useful to discuss the benefits of co-production in intervention development. It might also be helpful to discuss the benefits of multi-component interventions.

We choose to use questionnaires to assess the acceptability of the intervention, as this was also the method used to evaluate our other computer-tailored interventions. We added this to the methods section of the revised manuscript:

"Online acceptability questionnaire (completed after requesting the advice; used for the acceptability testing)

Based on existing questionnaires assessing the acceptability of previous computer-tailored interventions [36,38], a self-administered evaluation questionnaire was developed. Six items (understandability, logic, length, clarity, lay-out of the questions, and ease of answering the questions) were..."

However, we agree that some additional limitations needed to be discussed, so we revised the strengths and limitation section into:

"The overall strength of this research... Second, the assessment questionnaires were based on or similar to existing validated questionnaires [40,46-48,53-55] and the questionnaire evaluating the acceptability of the advice was also based on existing measures [36,38]. There are, however, some limitations to take into account. First, .. Second, ... Third, qualitative methods were not applied during intervention development, while including input from the target group, could have enhanced the intervention. For example, the perceived uselessness of separating the advice in several sections could have been discovered earlier. Also for the feasibility and
acceptability testing, a mixed methods approach, including focus groups or interviews, could have resulted in more in-depth information about certain aspects, such as the high initial response rate and the relatively low proportion completing an action plan. In addition, through qualitative methods, the potential benefits of this advice in a multi-component intervention could have been discussed. …

4. When discussing the fact that this web-based, computer-tailored intervention had a high initial response rate (i.e. those requesting advice), there is then a comparison with response rates from studies using similar interventions, which are all substantially lower. However, it is not entirely clear why this study might have had a higher initial response rate. This information possibly could have been obtained if qualitative work had also been carried out.

In the original manuscript we already addressed the high response rates in the discussion section:

Further research should confirm whether recruiting in workplaces via email, without any telephone or face-to-face contact, is indeed most effective in reaching employees for web-based, computer-tailored interventions. The present study group could possibly be a sample of already engaged employees as they previously participated in another study. Because of the select sample here, the actual number of employees open to participate and receive advice may be overestimated.

But still, we agree with the reviewer and therefore discussed the use of qualitative data in the revised discussion (see above, minor essential revision n° 3).

**Discretionary Revisions:**

1. The title might read better if changed to: "Theory-driven, web-based, computer-tailored advice to reduce and interrupt workplace sitting: development, feasibility and acceptability testing among employees".

We changed the title according to the suggestion of the reviewer.

2. I think that the question of this study is: "Is a theory-driven, web-based, computer-tailored intervention feasible and acceptable to employees in reducing/interrupting workplace sitting?". This does seem to be an appropriate and well-defined question.

We agree and added this question to the final paragraph of the introduction, stating the research aims:

The first objective of the present paper was to describe (the development of) this theory-driven web-based, computer-tailored advice. The second objective was to report on the feasibility of reaching employees by comparing characteristics of employees taking part in the intervention with those who did not. Finally, the third objective was to report on the acceptability of the advice among those who participated. The overall research question was ‘Is a theory-driven, web-based,
computer-tailored intervention feasible and acceptable for employees to reduce or interrupt workplace sitting?".

3. The first sub-heading in the methods section could read "Development of the theory-driven, web-based, computer-tailored intervention".

The first sub-heading was changed accordingly.

4. When you talk about reducing and interrupting sitting time I think it can get a little confusing for the reader. It would seem to me that reducing sitting time is the overall aim and the methods of doing the are either by interrupting and/or replacing workplace sitting time. Maybe this needs to be a little clearer.

The overall aim of the intervention was to influence both the duration and the pattern of sedentary behaviour. The literature makes clear that both aspects (high amount of sitting and prolonged periods of sitting) are independently associated with health risk factors, so we do not only need to promote reductions in sitting time, but also interruptions in sitting. When promoting interruptions (or breaks) from sitting, the aim is not per se to reduce the total amount of sitting time, but really to change the ‘pattern’ of the sitting (in order to avoid prolonged periods of sitting). This matter was explained in the original version of the manuscript (background section) and some additional information was added to make this aspect more clear:

Recent evidence showed that both the total amount of sedentary time and the pattern of sedentary behaviour (i.e. prolonged uninterrupted periods) were associated with several adverse health effects in adults, e.g. obesity, metabolic syndrome, type 2 diabetes, some cancers, and all-cause and cardio-vascular disease mortality [5,8-10], independent of other factors such as body weight, diet and physical activity [1]. For example, the negative health impact of sedentary behaviour even occurs in those meeting the health-related guideline for physical activity (150 minutes of moderate-intensity aerobic physical activity a week) [11]. Therefore, interventions to reduce (limit the amount of sitting) and/or interrupt (limit prolonged sitting bouts) sitting at work are needed [12].

5. You talk about decision rules - could you clarify, as I do not know what is meant by these?

These decision rules are the computer algorithms defined by the researchers. Based on these ‘rules’ the software decides what feedback messages should be given to what answers of the user. Some additional information was added to the revised manuscript to make this clear:

A set of decision rules (i.e. pre-established computer algorithms defined by the researchers) selected the feedback messages that were matched and tailored to the specific answers of the user [37].
6. A figure displaying the procedure might be worth considering to clarify the understanding of the methods.

We believe that the original figure did already explain most of the procedures, however some additional information was added, resulting in a revised figure 1:

![Flowchart Diagram](image)

7. The figure presented in the paper appears to be genuine. The only issue to be mindful of is the way the response rates have been calculated. It might be more appropriate for the denominator to be 179 throughout.

We believe it is more logical to use the denominators as in the original submission (see above), as the boxes on the right hand side show who did not fulfill a certain ‘step’ and the ratios on the left and right should sum up to 100% (see above).
8. With any technology-based interventions, there is always a propensity to increase health inequalities. This may warrant some discussion.

The reviewer makes a good point, so this aspect was discussed in the revised manuscript:

The fact that employees with a college or university degree were more likely to request the advice is not surprising as highly educated individuals may have more knowledge about and interest in health-related behaviours [63]. It is also possible that higher educated individuals are more digital media savvy or have access to the internet through more devices (e.g. laptop, tablet, smartphone), however most employees have computer access at work. Therefore everyone was able to request the advice. Still, particular attention is needed to reach more low educated individuals in the future. Especially as some may argue that access, affordability, usability and appropriateness of e-health interventions and digital health literacy may be lower among vulnerable or underserved groups, which may lead to increased health inequalities [64]. Maybe when more attention in the media [58] is directed towards the damaging health consequences of too much sitting, this group will also be interested in receiving advice. For physical activity for example, media attention has led to increases in population awareness and knowledge about this public health problem [65].


Reviewer 2: Nipun Shrestha

Minor Essential Revisions

Page 5 line 18 It is not true that there are no computer tailored interventions in the literature. There are two studies that have used computer prompts


- Pedersen SJ, Cooley PD, Mainsbridge C. An e-health intervention designed to increase workday energy expenditure by reducing prolonged occupational sitting habits. Work 2014;49(2):289-95.


However these studies are not interactive web based interventions that the authors are trying to access feasibility and acceptability.
The first two interventions are indeed computer- or web-based programs aiming to reduce workplace sitting. They were included in the background section of the original manuscript (initial references 13 and 15). However, these interventions were not ‘computer-tailored’, as intervention content was not personalized for individual participants:

- In the first study, the intervention included the use of prompting software loaded onto employees’ PC. An advice window, reminding participants to take a break, appeared on the monitor (for 1 minute every 30 minutes from the time the PC was started). The window could not be minimized or moved, but participants could work in any opened windows around it. Besides some generic educational information, no personally-tailored intervention components were included in this study.

- The e-health intervention of Pedersen et al, included the use of prompting software deactivating employees’ computer screens every 45 minutes. Employees could then view more than 60 short burst physical activity video demonstrations and they were asked to engage in a non-sitting activity. The software logged their daily progress and the amount of time they had spent out of their chairs and the amount of calories expended for that activity were graphically presented to the employees. This study did also not provide personally tailored feedback.

- We were not aware of the latter Msc thesis, however after reviewing the thesis we concluded that the intervention was not computer-tailored, as one group got social cognitive-based e-newsletters focusing on reducing workplace sitting and another groups received similarly formatted e-newsletters focusing on health education. Still, the content of the letters was the same for all participants within each group.

As such, we have not changed the manuscript and are still confident this is the first computer-tailored intervention to reduce and interrupt sitting in the workplace.