Author’s response to reviews

Title: Tracking physical activity using smart phone apps: Assessing the ability of a current app and systematically collecting patient recommendations for future development

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Version: 1 Date: 13 Sep 2019

Author’s response to reviews:

Dear Editors:

We appreciate the opportunity to revise our manuscript “Tracking physical activity using smart phone apps: Assessing the ability of a current app and systematically collecting patient recommendations for future development” for consideration by BMC Medical Informatics and Decision Making. The reference ID is MIDM-D-19-00108.

All authors have approved the revised manuscript and agree with its re-submission.
Below we respond to the editor and reviewers’ comments.

Sincerely Yours,
All authors

Editor comments

• Editor: Comment 0:
This paper presents an interesting study. However, as an article, there are several improvements that are required before publication. In particular, authors need to:

• Editor: Comment 1:
1. State the rationale for the study, and justify the use of the methodologies (e.g. analyses) and theories. Currently, the importance/relevance of the paper is not coming through, and the methods are somewhat unclear.

Authors response: A section has been added in the introduction entitled ‘the present study’ this summarises the variables and rationale for the paper as well as the importance of the variables selected in relation to the study.

• Editor: Comment 2:
2. Include limitations of the study including minimal use of the app and what that could mean for the inferences made from the Results. This is particularly relevant for the Discussion.

Authors response: In the discussion these has been articulated and explained; with focus on not capturing data in real-time and reference is given to progressing technologies (e.g. smart watches) which can track data more reliably.

• Editor: Comment 3:
3. More and recent references are required throughout.

Authors response: You will see throughout the paper, introduction, methods and discussion more up to date and recent references have been added.

Reviewer 1 Comments

• Reviewer 1: Comment 0:
The paper reported physical activities changes for patients of pre- and post-bariatric surgery by collecting data from mobile apps. The paper is strong in the language and organized presentation. But there are a couple of questions regarding methods, study conduct, and validity of results. Below please find my comments for your consideration.
• Reviewer 1: Comment 1:
Major comments:
1. Introduction. While the specific aims are clearly stated, the significance of the proposed research questions is not clear. Given a considerable number of relevant studies (i.e., mHealth, physical activities, wearable HIT), it is not clear what knowledge gaps or methodological limitations the present work is attempting to address. This weakness largely harms the scientific value of the work. For example, the authors did mention the change in physical activities for patients of pre- and post-bariatric surgery. However, the authors provided no, or very limited references, to demonstrate why it is important and how the present work can make scientific contributions to it.
In addition, the Introduction is weak in (1) literature review, (2) demonstrating state-of-the-art study in the proposed research domain/topic, and (3) demonstrating the scientific contribution to informatics (also see comment 3).

Authors response: We have now tried to focus on emphasising the knowledge gaps which believe are two-fold:
- First, the work draws on a specific population (bariatric surgery patients) and tracking their physical activity – this is important since maintaining weight will be a long-term goal for them.
- Second, the development of technology and highlighting its issues. Even if lightly, we touch upon the reasons why participants dropped out – and these issues in itself relate to the technology of this trial and therefore, its contributions lay in improving technology to eradicate these problems.

• Reviewer 1: Comment 2:
2. The paper has a couple of major limitations in methods and conduct. (1) The data collection seems to be not satisfactory resulting in substandard sample size for robust results. For example, of the 117 participants who reported data on WLCompanion app, there is only an average of 12 days data were collected. This is acceptable for an pilot report but is perhaps not the best practice for a journal publication. (2) Owing to the small sample size and incomplete data collection, I suggest to carefully re-consider the validity of the regression models. Even when the numbers suggest a statistical significance, the inferential results could be less meaningful. (3) Authors generated statistical results and conclusions based on multiple subsets of data analysis with different sample sizes. It is not clear whether these data are from the same group of participants or not. If not, there may be alternative interpretations/conclusions to those results as compared to what was proposed in the paper. A clarification or downstream analysis is needed to ensure the validly of the results and conclusion.

Authors response: Thank you for your comments regarding our data. We have revised and updated our results to reflect and build on the data we have collected. We have refined our justifications as to why we believe this data collected is important. Given the specific clinical population used in the study (bariatric surgery patients) as well as the eligibility criteria (Android phones) we believe the sample size allows us to draw conclusions from this. However, we do not limit the conclusions to this – in our revision of the discussion we talk more in depth of other populations and technological advancement our study can relate to as well as its foundational importance in technologies for health tracking. We have made more of an effort to enhance our results section making it clearer (particularly with figure one) which participants were categorised into which groups and how comparisons came about.

• Reviewer 1: Comment 3:
3. The Discussion is suggested to include the authors' understanding and suggestions as to how the present work is related to medical informatics in areas of interest or general.
Authors response: The discussion has now been updated to reflect elements of medical informatics and moving forward how we may use such technologies and/or this health related data.

Reviewer 2 Comments

• Reviewer 2: Comment 0: This study aimed to evaluate the feasibility of two smartphone apps to monitor patients' physical activity pre- and post-bariatric surgery. The paper is relatively well-structured; the writing could be improved. The background is confusing and missing important references throughout. It is not clear why the authors chose to use the Theoretical Domains Framework. Methods lack important information. The results are poorly organised and very confusing. The conclusion overstates the results

• Reviewer 2: Comment 1:
Specific comments:
Background
-Does not follow the usual inverted pyramid format and states the study objective in the first and last paragraphs.

Authors response: The background has been updated with headings to provide more clarity to build up a stronger argument and rationale for the study.

• Reviewer 2: Comment 2:
-Paragraphs 2 and 3 should be merged into a single paragraph

Authors response: These paragraphs have been merged.

• Reviewer 2: Comment 3:
-Page 5, line 12: it is not clear what the authors mean by "simpler technologies".

Authors response: This has now been changed to technologies used on a daily basis

• Reviewer 2: Comment 4:
-Paragraph 4 is too vague ("richer physical activity profiles"; "reliable smartphone app") and misses many important references, such as:

Authors response: This paragraph has now been changed with some added depth and clarity with vague terms. These references have been reviewed and added, it should also address the issue with the inclusion of more up to date references.
• Reviewer 2: Comment 5:
-Paragraph 5 is badly written.

Authors response: The literature review section has been updated and changed in some parts, with some headings added for more clarification.

• Reviewer 2: Comment 6:
Methods
-The study design is not described by the authors in the first paragraph. The authors mentioned having registered the trial but do not provide details as to whether the present paper is a subgroup analysis of this trial or what aspect of the trial the paper covers.

Authors response: Added sub-group analysis of this trial.

• Reviewer 2: Comment 7:
- The methods state the aims once again—unnecessary. Furthermore, some of the aims stated in the methods section are not research aims and are not linked to research outcomes (e.g. remotely monitor patients' physical activity…..”—for what purpose?). Aim 3 is very poorly defined.

Authors response: The specific aims are detailed here (comparative to the introduction). These remain in the methods section as the results section has now changed (additional headings) and we believe it presents a more coherent structure by having the aims follow seamlessly into the results. Some of the aims have been updated to justify the reasons and rationale behind such aims. The introduction also adds clarity into why certain variables were collected. In relation to you questions above – remotely monitor patients’ physical activity – this is the nature of the technology through the smartphone, to capture their physical activity in daily life – and this should now read more explicitly in the revised manuscript.

• Reviewer 2: Comment 7:
- No information about the development, testing, and validity of the "TDF informed survey" is provided.

Authors response: More information about the TDF is provided including validity and that it is a well-used tool in behaviour change and interventions.

• Reviewer 2: Comment 8:
- The description of both apps is poor and does not mention the behaviour change techniques used. Authors should refer to the CONSORT-EHEALTH guidelines for details about how to describe the intervention.

Authors response: a section has been added under measures which utilises to the CONSORT-EHEALTH guidelines of the apps used in this study. A further section, Behaviour Change Technique has been added to describe the behaviour change techniques used in the study with examples given.
• Reviewer 2: Comment 9:
-There is no mention of when patients were recruited and how long the recruitment period lasted.

Authors response: added this into the first part of the methods

• Reviewer 2: Comment 10:
-How was withdrawal assessed

Authors response: Details have been given in a flow chart (figure one)

• Reviewer 2: Comment 11:
-What was the study duration??

Author response: There was no requirement set for how long patients should participate in the study in order to be included in the analyses – now stated in the methods section. As a result, there was huge variability in the number of days of physical activity recorded for each participant and there were a lot of gaps in each participant’s data also as they would turn off location services or delete the app and download again at a later date – this is captured in figure one.

• Reviewer 2: Comment 12:
Results
-The criterion for inclusion in the final analysis is an extremely low bar and it is not explained the rationale for this choice. The authors should at least provide more information about the quality of the data they gathered. What was the median and IQR of the number of days per participant where the smartphone’s location services were on for 50% of the time between 6am and 10pm? Is this what is presented in page 10?

Authors response: For quality of data the main factors were time duration when their mobile was on and we recorded data. Location tracking was shared for more than 50% during their mobile tracking time. Flow diagram (figure one) also explains that patients with low quality or incomplete data for reasons mentioned in the flow diagram were removed and that’s why out of the total 494 only 274 patients data were chosen for analysis. The reviewer understands correctly. That is, the final number of participants were 274 are those who kept their mobile phones on between 6am and 10pm and provided us their location data for 50% or more during that time. These 274 patients were divided into pre, post and pre & post (3 groups). The median and IQR values for individual group is given later.

• Reviewer 2: Comment 13:
- The analysis of physical activity measures is very confusing (page 11). It is not clear how this analysis is related to the study aims. Figure 1 is misleading as it does not include the total number of days used to calculate the average minutes walked per day in each group.

Authors response: Yes, the reviewer is right, so basically we have given that information in pre-surgery, post-surgery and pre and post-surgery group. Further clarification is added to figure one [pre-surgery with activity (n = 107); post-surgery with activity (n = 131) and pre and post-surgery with activity (n = 36)].
• Reviewer 2: Comment 14:
- Linear regression analysis seems pointless as the aim is not clear. Did you have a pre-defined hypothesis?

Authors response: Added in the background why we want to assess other health related behaviours alongside physical activity.

• Reviewer 2: Comment 15:
Discussion and conclusion: generally overstate the results.

Authors response: This has been re-written to include different sections and more articulation in terms of the study including implications for the future.

• Reviewer 2: Comment 16:
References: incorrect formatting

Authors response: These have now been updated.