**Author’s response to reviews**

**Title:** Influencing walking behavior can increase the physical activity of patients with chronic pain hospitalized for multidisciplinary rehabilitation: An observational study

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**Author’s response to reviews:**

Answers to reviewer 1:

Physical Activity is more important for people to healthy life, especially for patients suffering from chronic pain following an orthopedic trauma. This problem has been indicated but not solved yet. Therefore, in this context, the researchers analyze the benefits of practicing habitual physical activity and activity during rehabilitation.

Well prepared article. It need some changes (Reviewer’s suggestion to Authors’ consider, below). The study idea is good. Research undertaken by the authors are a very important subject. However, the manuscript is presented redundantly, including the introduction and discussion.

Thank you for reviewing our manuscript and for your positive comments.

It need minor changes.

Here are some suggestions for authors to consider:

1. **Key words:** authors should be decided small or lowercase letters

   We checked with recent BMC MSD articles, and the keyword format seem OK, i.e., comma separated, and first noun capitalized.
2. Background: Authors wrote on abstract (lines 42-43) “..to access moderate-to vigorous physical activity (MVPA)…” But in background were not information about MVPA - Authors should consider clarifying this chapter. The authors generalize towards global physical activity. It should be clear, what kind of physical activity, exercises? In my opinion this chapter is too long.

We agree that the introduction did not introduce the concept of MVPA, which is well known for physical activity specialists, but not for others. This has been corrected. In addition, we have rewritten the end of the introduction, which has been shortened.

3. Methods (Study design and setting): In this chapter authors should consider short comment about functional testing and interdisciplinary program (Reader should know something about exercises therapy, vocational therapy…(line 126-130)

We agree that the reader should have access to information about the rehabilitation program. We just published a companion article that includes more details. We have added this reference.

4. Has the study been approved by the Bioethical Committee? Is it conformed to the Helsinki Declaration? Did all of the patients provided written informed consent prior to the study, including enrolment and data collection?. Please explain

According to journal policy, ethical declaration must be placed at the end of the article. It can be found in the declaration section.

5. Simple size : this chapter is necessary to clarify for example (Raosoft, Inc. US. 2004) –the margin error of 5%, with a confidence level of 95%, and a population size of 300, to give a sample size of 169 pupils.

Given the complexity of the statistical analysis (mixed models), it was not possible to apply classical power analyses. A better approach would have been a simulation analysis, but this would have greatly complexified the paper. Besides, the rule-of-thumb we applied (15 observations per parameter) is based on simulation results, as explained in the given reference. Note that we have changed the place of the sample size section after the statistics, which makes the explanation clearer.
6. Instrument: the Kappa Statistic should be used as a measure of intra-examiner reliability and intra-class correlation coefficients as a measure of reliability for this method.

We added a reference about the accuracy of our accelerometer.

7. Results – (1) “The GLMM (Model 1, Table 3) inferred that a significant difference existed between…” What type of coefficient was observed? Please provide quantitative data. Were there observed any differences between men and women in each models?

The coefficients are given in Tables 3 and 4. Given the log-link of the generalized model, the coefficients are multiplicative, not additive as in standard linear models. To ease the interpretation, percent changes are given, which are computed as exp(coef)-1. Note that p-values were not presented in the main text because confidence intervals are equivalent and more informative. However, p-values can be found in the supplementary file.

Regarding sex effects, as explained, women were underrepresented in our samples, therefore, the statistical power was not sufficient to study sex effects. Further studies are needed in a larger sample to address this question.

8. Discussion: (a) The discussion can be shortened - The discussion is too global and widely.

We agree, the discussion was too complicated. We have deleted about 20 lines from it.

9. Conclusions: Please add short Implications for Practice

We added a final sentence about practice for a better ending of the conclusion.

Answers to reviewers 2

Thank you for reviewing our manuscript.

Abstract:

* Please avoid using all unnecessary abbreviations/acronyms (LoL, Sp, UpL, MVPA, PA, WA). Commonly no acronyms are used in the abstract.
We agree that the abbreviations made many paragraphs unclear. We have suppressed them from the abstract, and some of them from the main text.

* When starting a sentence with a number, please write it alphabetically (i.e., 272 or 93 participants).

This has been corrected

* Your study design or analysis are not clear in your abstract. There was no information on the Mixed Linear Model analysis or the measured variables. Later you talk about 12 variables that were included in the model which your reader has no prior knowledge about.

The abstract has been clarified in the revised version. I did not find where we talk about 12 variables. We mentioned 12 parameters, which is not equivalent. N Categorical variables are coded with n-1 parameters in linear models (i.e., dummy variables), and each interaction also counts for one parameter.

Introduction:

* Ensure your objectives in the abstract and introduction are the same/very similar.

Although the wording is not identical, we believe that the meaning is similar in the revised manuscript.

Methods:

* Please avoid using all the unnecessary and uncommon abbreviations/acronyms stated above (in addition, DMR).

We suppress some abbreviations to clarify the manuscript (CRR, PA, GLMM, DMR, WT, SLPA)

* Page 6, Line 118 => Your study did not include a survey only. Why do you mention your study had a cross-sectional survey design. You have administered the BPI survey but also have collected physical activity performance data.
You are right, the description of the study design was not clear. This has been improved in the revised version.

* Page 6, Line 126 => what is the definition of "moderate to severe after-effects"? Please clarify

We agree that this sentence is not very accurate, but it is the setting description. Our clinic hospitalizes a broad range of cases, from mild to very severe. We added this sentence in the beginning of the “participants” section for a better description of the participants: “Study candidates had functional impairments and were unable to return to work after orthopedic trauma following work, traffic, sport, or leisure accidents.”

* Page 6, Line 133-135 => Please write amputation or severe comorbidities as exclusion criteria

The text is “The eligibility criteria were as follows: 1) chronic pain >3 months, 2) age >18 years and < 65 years, 3) no amputation, 4) walking without aids, 5) no severe comorbidities, 6) French speaking, 4) live in Switzerland.”

* Page 7, Line 140 => suggestion: perhaps you can use thoracic spine rather than dorsal.

This has been corrected.

* Page 7, Line 150 => Suggestion: Instead of writing a section on the risk of bias in your study, write this section as a limitation of your study in the discussion.

According to the STROBE guidelines for reporting cross-sectional studies (http://www.equator-network.org/wp-content/uploads/2015/10/STROBE_checklist_v4_cross-sectional.pdf) the method section should contain a bias sub-section, which “Describe any efforts to address potential sources of bias”.

* Page 7, Line 151 => Please rephrase the blue-collar workers

The issue of women underrepresentation is recurrent in our clinic, and, hence, in our studies and publications. We use the term “blue-collar worker” to describe a working-class person who performs manual labor, a class in which women are underrepresented. We attempt to be coherent
among our publications by using similar wording for the description of our patients. Therefore, we keep this term because it is used in many of our publications: it helps the reader understand that studied populations are similar across our studies.

* Page 7, Line 156 => You have to provide further information on the INTERMED score. How is it measured, what is the range and how the scores are interpreted.

We have added the following sentence that provides further information:

“The INTERMED is an observer-rated instrument that summarizes information from, biological, psychological, social, and health care domains. The INTERMED scores range from 0 to 60. Patients with scores beyond 20 are considered as complex cases.”

* Sample size => Up to this point, there is no information on any model being used in this study and you just talk about a model to justify your sample size. This could have been partially clarified in your abstract. Also, you can include the sample size analysis as part of data analysis, where you also talk about the model and your reader also knows about the variables measured / included in your study. This section should be written clearer.

We agree, this section cannot be understood without a knowledge of models and model parameters. This section has been moved after the statistics section.

* Procedure: In general, it requires significant clarification. Although this manuscript is part of a bigger project, it should be clear for the reader without referring to the previous published study.

After a thorough re-checking, we are confident that the manuscript contains the information to replicate the study. The only part that was not extensively described is the method to detect the walking bouts in the acceleration signal. Our opinion is, that this would be too technical for a medical journal such as BMC musculoskeletal disorders. This information is available in a companion article published in an engineering journal (IEEE TNSRE, Terrier et al. 2017), which is given in reference.

Please clearly state and explain the variables you included in your mix model analysis. You only talk about the variables at the end of your data analysis section.
We agree, presenting the variables in the first place greatly improves the reading. This has been corrected.

* Page 8, Line 179 => Why some participants activity level was measured before attending the hospital. Please clarify the aim. What was the number of participants?

We have clarified this point in the revised manuscript: “In order to validate the use of days-off activity level as a proxy for habitual physical activity, we also investigated the physical activity level of some participants at home before the rehabilitation stay.”

The number of participants is given in the result section and in Table 1.

* Data Processing => Suggestion: avoid using "we" repeatedly and throughout your manuscript. Preferably use passive tense. But I leave this decision to the section editor as this is acceptable in some journals.

Recent writing guidelines recommend the use of the active voice. For instance, the 6th edition of the Publication Manual of the American Psychological Association states in rule 3.18: “Prefer the active voice” with the following example: “Preferred: We conducted the survey in a controlled setting. Nonpreferred: The survey was conducted in a controlled setting”.

* Please avoid using so many uncommon acronyms: LW, WA, MVPA, WT

The number of abbreviations has been reduced from 15 to 9, from which two are common abbreviations (CV, NS).

* Statistics: This section requires significant clarification. Instead of stating that: "see the recent study by Murphy et al. [44] for an example of hierarchical modelling in the field of PA and chronic pain. ", you have to clearly provide this information for your reader. They can access the reference for further information but the reference should not replace any required information in your study.

We checked whether our description of statistical methods was compliant with scientific writing guidelines. The APA manual of style states (rule 2.07):

“Assume that your reader has a professional knowledge of statistical methods. Do not review basic concepts and procedures or provide citation for the most commonly used statistical
procedures. If, however, there is any question about the appropriateness of a particular statistical procedure, justify its use by clearly stating the evidence that exists for the robustness of the procedure as applied.”

We think that our description of statistical procedures meets these requirements. Linear mixed models are standard methods that a scientist with “professional knowledge” should know; as a result, there is no need to extensively explain it.

Regarding the robustness and the appropriateness of the statistical procedure, we discuss why we chose generalized linear mixed models, that is: hierarchical organization of the data, and non-gaussian distribution of the dependent variables (as evidenced in the supplementary materials). Furthermore, we provide two references to studies that applied a similar approach for comparable data.

* Line 217 => It is stated that "the interactions between predictors were first examined through analyses of variance..." Please clarify all the predictors used in your model prior to this statement. You only have clarified the variables afterwards (Lines 223-231).

This has been clarified by moving the description of the variables at the beginning of the statistics section.

* Line 232 => The reader should constantly check what each acronym stands for (GLMMs).

We have reduced the number of abbreviations (see above), and suppressed GLMM.

Results and discussion

* Participants: Please first summarise some important information on your patient demographics, then refer the reader to table 1

We have rewritten the beginning of the result section to include information about patients:

“We obtained data for 272 patients, from which 93 wore the accelerometer at home before hospitalization (Table 2). As expected, women were underrepresented (21%). The mean age was 44 year. Patients with upper-limb pain was the most represented group (42%), followed by lower limb pain (33%), and back pain (22%). Given the small number of patients with polytrauma (2%), we excluded this category from the models that explored the effects of injury site and PI (models 5–7).”
In the results section, Line 249-50, it is stated that "Regarding PI, we experienced one missing value, which was imputed with the mean value." Did you do the same for other variables such as PA? Because in your discussion, (Line 320) it is stated that "Considering the study's methodology further, we experienced many missing days due to poor compliance in wearing the accelerometer, especially during weekends. We are confident that we correctly captured average PA patterns, given the large number of observations." Please clarify.

We experienced only one missing value for pain interference. Inconsistent numbers of analyzed days among participants are not a problem, because of the use of mixed models. Mixed models can assess within- and between-subject variance in presence of missing values, which is their great advantage compared to repeated measure ANOVA. We have clarified that in the revised manuscript.

Conclusion
* Lines 417-421 do not belong to the conclusion of your study. They can be part of the discussion.

We added a last sentence to make the paragraph more conclusive: “In practice, adding more walking in a patient’s daily activities could be an effective strategy.”