Author's response to reviews

Title: Perceived stress and musculoskeletal pain are prevalent and significantly associated in adolescents. An epidemiological cross-sectional study.

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

Please consider the submitted manuscript for publication in BMC Public Health. We declare that the work is original, it has not been published, nor under review by any other journal.

**Berit Østerås, Hermundur Sigmundsson, Monika Haga:**

Perceived stress and musculoskeletal pain are prevalent and significantly associated in adolescents. An epidemiological cross-sectional study.

The expansion of illness among young people is documented, but the mechanisms behind are unclear. Young people are increasingly disabled because of long-term musculoskeletal pain negative stress, but there is lacking knowledge about these phenomena. A better understanding of these health risks, and their interactions are required in order to improve treatment approaches and succeed in health promotion among young people. This study provide new insight regarding perceived stress and musculoskeletal pain in adolescents. The findings shed light on prevalence, stress-pain associations, and stress as a possible explanatory factor of pain and variation in pain in young people. In addition, the results challenge traditional views regarding stress-related musculoskeletal pain. The findings may have clinical implications and provides a basis for further research.

The Regional Committee for Medical Research Ethics approved the data collection process, and the study is in line with the Declaration of Helsinki. The authors declare that they have no competing interests

Yours sincerely,
Berit Østerås,

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Point-by-point response to the editor’s concerns, 23.09.2015.

Editor’s comments:

The statistical analysis section still refers to predictive value of perceived stress, this is a cross sectional study and it would be more appropriate to talk about associations and probabilities rather than prediction which implies that there was a follow-up period. Can the authors please amend this to “the probability that perceived stress was associated with the reporting of pain”? (lines 200 to 201). Lines 232, 245, 247, 250, 254, 255, 258 and the titles of table 5 should also be changed to talk about the association or probability that variables are related to reporting of musculoskeletal pain, not prediction.”

Answer to the editor:

Thank you for your concerns. We realize that the “predictive terms” might imply that there has been a longitudinal evaluation. Now these terms are replaced, and the text is rephrased in both the paragraphs and in Table 5. Please let me know if the terminology still appears unclear.
Thank you for giving us the opportunity to submit a revision of our manuscript. We thank the reviewers for their careful reading and constructive comments of the manuscript. We have revised the manuscript according to their comments and concerns, and feel that the paper has improved considerably as a result. All changes are detailed below as a point-by-point reply to the reviewer’s comments.

The minor revisions made by referee 1 is appended in a numbered list, to clarify where to we are addressing our answers.

**Referee 1:**

All Minor Essential Revisions

**Abstract**

**Background**
1. The authors refer to distress, negative stress and perceived stress – Preferably use one term only
2. “distress are increasing among young”
3. “including the risk of”
4. “There is a need for a better understanding”
5. The authors refer to musculoskeletal pain and often to only pain – preferably always include musculoskeletal and make sure that the information provided indeed reflects musculoskeletal pain.

**Objective**
6. “The objectives were to evaluate the prevalence” – no secondary objectives are mentioned

**Methods**
7. A cross-sectional study was conducted” – please write full sentences throughout abstract
8. “elementary schools participated”
9. “The outcomes were perceived stress”
10. “and musculoskeletal pain”
11. N=422 – please check this as the total sample = 423? It appears as if 422 reported musculoskeletal pain

**Conclusions**
12. “Perceived stress and musculoskeletal pain were strongly”
13. “probability of pain; variation in pain intensity (VAS) and the number”
14. “potential indicators of disability” - revise this sentence as the study did not measure disability and thus cannot conclude this
15. The last sentence needs to be revised as the meaning is unclear – at present it can only be interpreted correctly if the entire manuscript has been read which is often not the case when reading abstracts
Answer to referee 1: Abstract

Background
1. We see your point, however, because the term “perceived stress”, as used in this article, refers to the measure outcome Perceived stress questionnaire (PSQ), other psychosocial stress-terms are applied when referring to/siting findings from other studies, not using PSQ. Distress and negative stress are commonly used as synonyms.
2. - 4. Thank you for pointing this out, we have now changed the text and used your suggestions
5. Good point, “Musculoskeletal” is added to specify “pain” more generally throughout the paper.

Objective
6. Ok, this is now corrected.

Methods

Conclusion
12.- 15. Corrected and rephrased.

Introduction

First paragraph
16. “stress stimuli, prolonged and sensitized.” This corresponds to the”
17. “when it becomes long-term”

Second paragraph
18. “Swedish population there is an increase in neck and shoulder”
19. “which is described as a psychosocial”

Third paragraph
20. “individual more susceptible to long-term”
21. level, a similar system”

Fourth paragraph
22. “coping in adolescents and can make young people”

Fifth paragraph
23. “to be associated with anxiety”
24. “also associated with pain”
25. “high prevalence of pain” – does this pain also refer to musculoskeletal pain or also psychosomatic pain – be very specific
26. “The objectives of this study were to describe perceived stress and musculoskeletal pain in 16”
27. “with respect to 1) prevalence, 2)”

Answer to referee 1; Introduction

Methods

First paragraph
28. “backgrounds, and was representative of Norwegian 10th grade pupils.”

Second paragraph
29. “to the school principals and described in the invitation to participants and in”
30. “emphasizing the voluntary and”

Third paragraph
31. “Study outcomes” – suggested subheading
32. “Perceived stress and musculoskeletal pain were outcome variables – the authors do not have secondary outcomes so it becomes unnecessary to mention primary
33. “PSQ is a valid instrument for measuring perceived stress in an adolescent population.”
34. “four factors: worries”
35. The responses to the items in the PSQ refers to experiences in the previous month.”
36. “Each item is scored on a 4-point rating scale.”

Fourth paragraph
37. “with an open line for additional sites.”
38. “pain sites, excluding the head.”
39. “The VAS is reliable as a measure”
40. “The pain questionnaire in this study also”
41. “or diseases which could possibly be related to the pain”

Sixth paragraph
42. “Mainly data from the items on”
43. “Apparently….. these items” – please rephrase this sentence, poor sentences construction

Answer to referee 1; Methods

28.- 44. We agree, the text is now corrected and rephrased.

Results

Third paragraph
45. Table 4: Also list the abbreviations for W, T, J and D in the table’s legend.

Eighth paragraph
46. “between head pain and extremity pain groups,”
47. “extremity pain groups.”
48. “extremity pain groups with respect”

Answer to referee 1; Results

45.- 49. Corrected.
Discussion

First paragraph
50. "The objectives of this study were to"

Second paragraph
51. "demonstrated a high prevalence of pain"
52. "in adolescents."
53. "during adolescence."
54. "Lower extremity pain was the pain site most frequently reported,"
55. "corresponds with the findings of"

Third paragraph
56. "mean stress level of the study sample"
57. "young people when applying"
58. References 44 and 45: What was the prevalence of moderate to severe perceived stress in these studies? Does it compare with the 22% reported in this study?
59. "prevalence of moderate to severe stress"
60. "adolescents in this study" – delete “present” from this phrase in the rest of the discussion as it is implied that the authors refer to the conducted study except if indicated otherwise.
61. "had a greater prevalence of moderate to severe stress”
62. "also discussed in Wiklund et al." – please elaborate on these findings
63. "were associated with"

Sixth paragraph
64. "The stress response appears to no longer have”
65. "more stress-related than extremity pain. This assumption resulted in an increased focus on cognitive-behavioural treatments for the presumed stress-related musculoskeletal”
66. "The findings of this study underscores the importance of a comprehensive understanding of pain mechanisms in young people,”

Seventh paragraph
67. "The group with head pain”
68. "though not significantly different"
69. "appeared for (lack of) joy”
70. "In adolescents, head pain is often associated with other conditions such as anxiety and mood disorders." Remember that headache is also regarded as a psychosocial symptom and do not solely have a musculoskeletal origin

Eighth paragraph
71. "perceived stress is predictive of”
72. "The lack of correlation between levels of stress and different types of musculoskeletal pain challenges common clinical understanding in that a painful knee could be considered just as affected by stress-mechanisms as neck and shoulder pain (Table 8)."
73. "(Table 4) implies possible stress-induced sensitization among adolescents. If we increase stress ….approaches, e.g. by intrusive….exercises, it might worsen…prolong the pain and ….conditions and lead to more illness”

Ninth paragraph
74. "The study investigated critical”
75. "The items concerning pain-related injuries/diseases” – how could this limitation
be addressed in future studies?

**Answer to referee 1; Discussion**

50.- 52. Corrected and rephrased.
53. These studies (references 39 and 40) did not evaluate moderate to severe perceived stress
54.– 61. Corrected and rephrased.
62. Appropriate suggestion, findings in Wiklund et al are elaborated on.
75. Explicit suggestions regarding how to address the limitation of the injuries/diseases items are included, see page 19 of “Strengths and limitations”.

**Conclusion**

First paragraph
76. “Perceived stress and pain are associated in adolescents.”
77. “aspects of pain i.e. number of ……correlated with stress measured by different factors i.e. worries….and demands.”

**Answer to referee 1; Conclusion**

76.-77. We agree, the text is now corrected and rephrased

**Referee 2:**

**Answer to referee 2; Major Compulsory Revisions**

1. Thank you for the comment, introduction is now shortened.
2. See your point, the term predictive, which is commonly used in regard to regression analyses, is now omitted in the text and the paragraphs are rephrased.
3. It is also possible to argue that the VAS-scale is valid to use as a continuous scale variable. Several authors emphasize that VAS has been found to allow measurements not only with interval but with ratio properties (Philip 1990, Harms-Ringdahl 2012). Separate studies, including those directed toward moderate and severe clinical pain and those directed toward both experimental and clinical pain have demonstrated ratio scale properties for the VAS-scale (Hollen et al 2005, Myles et al 2005, Price et al 2012).
4. Throughout the entire manuscript, the term pain is specified to musculoskeletal pain.
5. Because there was no need for written consents in advance (see method paragraph; procedure), the pupils were not prepared for the invitation to participate in this survey at any specific day.

6. See method paragraph; study outcomes.

7. See your point. For the purpose of this study, other confounder variables were not included in the analyses. Concerns about sociocultural- and economic conditions were taken in the preparation of the study (see method paragraph; participants), and exercise was briefly discussed. Our coming up article includes more focus on exercise, and our next study (based on another sample) includes physical fitness-testing in addition to the instruments in this current study. We agree about your arguments about confounders, and this is now mentioned as a limitation of the study (in the discussion section).

8. Good point, we are aware of gender differences related to both stress and pain. However, the aim of this current article was to examine the stress-pain relationship and different stress-pain associations. We think that the paper brings new finding into the field, and it underscores the importance of understanding these mechanisms. Hopefully it can serve as a base for further research, for example by exploring the topic in a gender perspective. It is also worth to mention that our coming up article analyzes, evaluates and discusses differences between genders. It is now mentioned as a limitation in the discussion section.

9. Moderate correlations are applied.

10. The sentence is rephrased.

11. Not as far as we know, but the instrument is validated and used in several other comparable Western European contexts; German, English, Swedish, Spanish, and in Italian (Levenstein et al 1993, Bergdahl & Bergdahl 2002, Fliege et al 2005, Montero-Marin et al 2014).

12. We considered that the correlation coefficient (Pearson product-moment correlation \( r \)) indicate the power sufficiently. Please let us know, if you disagree.

13. The adolescents reported pain intensity in general. If participants had one or few pain sites, the pain intensity reflected this site.

14. 36.3 per cent of the entire population (\( N=422 \)) reported long-term pain (see revised Table 1).

15. Table 1 and 2 is revised to clarify the distribution of study variables, separately for pain. The dichotomous variable in the logistic regression analysis was pain/no pain.

16. Point taken, the sentence is omitted.

17. Other explanatory factors are discussed, see page 14, 16 and 17.

18. See point 15.

19. We agree, the discussion section is now focusing more on actual results.

20. Thank you for pointing this out, Table 5, 6 and Table 7 are now rearranged and merged into one table.
21. We agree that this could be interesting, however, interactions of the covariates in the GLM were not considered essential for the aim and purpose of this study.