Author's response to reviews

Title: Increased number of somatic pain sites is associated with poor mental health in 18,104 adolescents: a cross-sectional study

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Version: 2 Date: 27 August 2012

Author’s response to reviews: see over
27/08/2012

Professor Akemi Tomoda
Journal Editorial Office
*BMC Psychiatry*

Dear Professor Tomoda,

On behalf of all the authors, I would like to ask you to reconsider our manuscript now entitled “A greater number of somatic pain sites is associated with poor mental health in adolescents: a cross-sectional study” for publication in *BMC Psychiatry* as a Research Article. We greatly appreciate your and the reviewers’ the helpful comments on the original version of our manuscript. We have revised the manuscript according to those suggestions and comments as follows.

MS:1821470444731573
Title: Increased number of somatic pains is associated with poor mental health in 18,104 adolescents: a cross-sectional study

**Editor:**

1. **Comment:** After reading through your manuscript, we feel that the quality of written English needs to be improved before the manuscript can be considered further. We advise you to seek the assistance of a fluent English speaking colleague, or to have a professional editing service correct your language. Please ensure that particular attention is paid to the abstract.

Thank you very much for your valuable advice. Based on your suggestion, we had a professional editing service correct the English in our manuscript, with particular focus on the abstract.

2. **Comment:** Please format your abstract according to the guidelines for authors. Please check the instructions for authors on the journal website to ensure that your manuscript follows the correct structure for this journal and article type.
We appreciate your suggestions. We checked the instructions for authors again and formatted the abstract according to those instructions. Also, we edited the structure of our manuscript to follow the guidelines.

3. Comment: All figures must have a figure title listed after the references in the manuscript file. The figure file should not include the title or number (e.g. Figure 1…etc.)

Thank you very much for noting this. We included the figure title in the manuscript file, and excluded the title and number from the figure file.

Reviewer Norio Mori:
1. Comment: Rationale why they focused on “the number” of pain is not adequately described. To claim that “the number” of pain is a useful sign, this is essentials.

As the reviewer points out, the focus on “number” of pain sites is a key feature of this study. Therefore, to clarify the reason for our focus, we edited sentences explaining the background of the study.

Background
Modified sentences:
“Although a linear relationship between number of pain sites and level of depression has been suggested in a few previous studies using adolescent samples [10-11], those studies used samples with relatively narrow age ranges and took into account only frequently reported pains. Because complex questions and long-term recall are required to characterize pain in more detail including its severity, frequency, and nature, we speculated that a simpler reporting of pain might be feasible as an indicator. Therefore, the present study employed a broad age range during adolescence and a simple report of somatic pain.”

2. Comment: “Academic impairment” and its perception by students (“perceived academic impairment”) may not be the same. The authors’ descriptions may be a little confusing regarding this, in the introduction and discussion. They should be corrected. Also, more elaborate explanation is required why they focused on the association of the “perception” and somatic pain.
According to the reviewer's comment, we modified several sentences in the Background and Discussion to clarify whether the described academic performance was objectively or subjectively reported. Considering the reviewer’s comment, we added a sentence to explain the rationale to focus on the association between academic impairment and pain.

**Background**

*Modified sentence:*

“Although a previous study found that students with chronic pain experienced a decline in academic grades [13], another study reported that the level of academic competence in adolescents with chronic pain was consistent with their intellectual ability [14].”

**Effect of somatic pain on perceived academic impairment (in Discussion)**

*Modified sentences:*

“The association between somatic pain and perceived academic impairment is comparable to a previous study that showed a positive association between number of pain sites and problems in daily activities [28]. Additionally, results from the present study are consistent with a study showing a correlation between a decline in academic performance scores and poor mental health [29].”

**Effect of somatic pain on perceived academic impairment (in Discussion)**

*Modified sentences:*

“Thus, the observed mediation by poor mental health suggests the following pathways: 1) somatic pain may have caused poor mental health that in turn decreased concentration on studies and induced a perceived decline in academic performance; 2) a perceived decline in academic performance caused poor mental health that induced somatic pains; 3) poor mental health induced both somatic pains and a perceived decline in academic performance; or 4) somatic pain/poor mental health induced school absence, which led to a perceived decline in academic performance.”

**Background**

*Added sentence:*

“Given that school is equivalent to “work” for adolescents, that association should be a focus of investigation.”
3. Comment: Information regarding the perceived academic impairment (or poor concentration and frustration due to challenges in the academic performance) in their samples is not adequately given. In the results, it appears only in Table 4, not in other Tables, This makes an abrupt impression. More information should be given, probably in Table 1 and in the text regarding the perceived academic impairment.

We appreciate the reviewer’s suggestion. We added information about the prevalence of perceived academic impairment in Table 1.

4. Comment: Perceived academic impairment was evaluated using simple questions. This may be noted in the limitations.

Based on the reviewer’s comment, we noted that using simple questions in evaluating perceived academic impairment was a limitation.

Strengths and limitations
Modified sentences:
“The present study used a simple self-report measure of decline in academic performance, and we did not examine report cards. Therefore, the present findings may not reflect actual academic performance.”

5. Comment: In section 4.4, the authors showed four possible pathways for the association among pain, poor mental health and (perceived) academic achievement, including one where absence from school plays a role. In this case, the authors should describe whether the subjects included students who are long-term absent from school and they played a significant role in the association.

We did not include students who were absent from school at the time of the survey. Inclusion of those students and evaluation of long-term absence might have contributed to clarifying the pathway between somatic pain and perceived academic achievement. Therefore, we added this to the limitations of the study.

Strengths and limitations
Modified and added sentences:
“Moreover, we included only students who were present at the time of the survey. If the absent students had been included and length of absence had been evaluated, the pathway between somatic pain and perceived decline in academic achievement might have been better clarified.”

6. Comment: The reason why the neck/shoulder pain was selected as the third site of pain should be elaborately explained.

As the reviewer pointed out, the reason why neck/shoulder pain was selected might be difficult to understand. Therefore, we edited the text in the Methods section.

Three sites of somatic pain

Deleted sentences:
“However, reports on the prevalence of neck and shoulder pain, limb pain, and low back pain have been inconsistent [6-7, 10, 19]. While the prevalence of limb pain and low back pain were similar [6], neck and shoulder pain has been consistently found to be more prevalent than low back pain [10, 19].”

Added sentence:
“Based on prevalences reported in previous studies [6, 10, 19], neck and shoulder pain is the third most prevalent.”

Reviewer Beverley Raphael:
1. Comment: Discretionary revisions-further discussion of potential reasons for these correlations

Based on the comment from the reviewer, we added two references and further discussion of potential reasons for the relationship between somatic pain and poor mental health.

Association between number of pain sites and poor mental health (in Discussion)

Added sentence:
“In addition, social distress and physical pain reportedly have common underlying neural circuitry [26], and inflammatory mediators are potent modulators of affect [27].”
Reviewer Akira Babazono:
1. Comment: First of all, one month prevalence of somatic pains seems to be high. The prevalence of headaches, neck and shoulder pain and abdominal pain were respectively 35.5%, 19.7%, and 35.1%.

Some of the previous studies we cited reported lower prevalences of somatic pain than in this study. However, some of those found even higher prevalences. For example, the prevalence of headache was reported as 25% to 60.5%. The prevalence of abdominal pain was reported as 21% to 43.3%. One study reported a similar prevalence of neck and shoulder pain (15%) as that in our study. Therefore, we think our sample was representative of the general public. To clarify this, we modified a sentence in the Discussion.

**Prevalence of somatic pains and poor mental health**

*Modified sentence:*

“However, the prevalence of somatic pains in the present study was similar to that reported in previous studies.”

2. Comment: Secondly, their mental health was unusually poor. The mean GHQ-12 score of girls was as high as 4.25. The proportions of those had poor mental health with no pain, headache only, neck and shoulder pain only, abdominal pain only, headache and neck and shoulder pain, headache and neck pain and shoulder pain were respectively 28.9%, 44.7%, 50.5%, 45.7%, 63.0%, 60.2%, 61.5%. The data could be biased and would not be a representative of the population.

Our samples comprised 93.1% of the potential participants. Therefore, we considered the samples fairly representative. We described this in the Descriptive statistics section as follows: “From these 18,250 participants, 18,104 responses were analyzable (a total of 93.1% of students from all the schools.” In the Strengths and limitations section we wrote “Because the response rate was relatively high, the sample in this study is considered representative of junior high and high school students within the survey area.” Also, the mean GHQ-12 score in this study was comparable to that in a previous study cited (total 3.54, boys 3.23, girls 3.91) that used randomly selected schools. In addition, the proportion of those with a total GHQ-12 score of $\geq 4$ in this study (43.7%) was very similar to that in a previous study (44.0%) cited.
Therefore, we consider the sample in our study representative. To clarify this, we modified a sentence in the Discussion section.

**Prevalence of somatic pains and poor mental health**

*Modified sentence:*

"The mean total score of the GHQ-12 was similar to that found in a previous study (3.54, SD 3.04) conducted in Japan [17]."

**Reviewer Kazuhito Yokoyama:**

1. *Comment:* The term “poor mental health” is unclear. The authors should define it clearly.

We defined students with considerable depression or anxiety as having poor mental health (i.e., a GHQ-12 score of 4 or higher). To clarify this, we made a change in the Methods section.

**GHQ-12**

*Modified sentence:*

"We defined individuals with a total GHQ-12 score ≥4 as having poor mental health, based on findings from previous studies [17-18]."

2. *Comment:* It is likely that the subjects with increased number of complaints or subjective symptoms, i.e. high GHQ scores, report somatic pains more. Similarly, such person may report low perceived academic achievements. The authors must convince readers that increased number of somatic pains predict some pathological conditions in terms of psychology or psychiatry.

Because this was a cross-sectional study, we cannot conclude that a greater number of somatic pains “predicts” depression or academic impairment. We stated this in the Discussion section. However, to make this clearer, we modified sentences in a subsection of the Discussion.

**Association between number of pain sites and poor mental health**

*Modified sentences:*
“Because the present study employed a cross-sectional design, a causal relationship between somatic pains and poor mental health could not be determined. However, to date, a bidirectional relationship between somatic pain and poor mental health has been suggested from several studies using adult samples [24-25], and there appears to be evidence supporting this relationship. In addition, social distress and physical pain reportedly have common underlying neural circuitry [26], and inflammatory mediators are potent modulators of affect [27].”

3. Comment: Methods-How did the authors select 45 junior high schools and 28 high schools? How many schools in Tsu-city and Kochi Prefecture? Information on the nature of subjects is not sufficient. Also, explanation of survey procedure, including measures (questionnaires), is hard to understand.

We appreciate the questions and comments from the reviewer. We re-wrote the Methods section to clarify how we selected the schools. Also, we edited text regarding the survey procedure to make it easier to understand.

**Study design, sample, and survey procedures**

*Modified sentence:*

“The present study employed a cross-sectional design and used a sample of adolescent students in public junior high schools (7th–9th grades) and public high schools (10th–12th grades).”

*Deleted sentence:*

“The sample consisted of students in 45 public junior high schools (7th-9th grades) and 28 high schools (10th-12th grades) in Tsu City (population 280,000) and Kochi Prefecture (population 790,000) in Japan.”

*Modified sentence:*

“The principal investigators of the study asked all the heads and administrators of public junior highs in the city of Tsu (population 280,000) and public junior high/high schools in Kochi prefecture (population 790,000) to participate in the survey.”

**Perceived academic impairment**

*Modified sentences:*
“Perceived academic impairment was assessed using the following two questions: “Have you had difficulty concentrating on your studies recently?” “Do you feel frustrated with a recent decline in your academic performance?” The participants were asked to choose one response from the following four: “yes”, “somewhat”, “not really”, and “no”. The participants who selected “yes” were regarded as having a perceived academic impairment."

**Additional variables**

*Deleted sentences:*

“Additionally, a previous study which revealed that abuse, substance use, and violence during childhood were associated with the adult-onset of headaches [22]. Thus, associations among those variables with and somatic pain have been previously suggested.”

**4. Comment:** Methods-explanation of the statistical analysis is unclear. Describe the methods precisely.

In accordance with the reviewer’s comment, we edited the description in the Statistical analysis section to make it clear and concise.

**Statistical analysis**

*Deleted sentence:*

“The associations between demographic characteristics and somatic pains or the mean of GHQ-12 total scores were examined using cross tabulations.”

*Modified sentence:*

“Chi-square tests were performed to compare the prevalence of somatic pains between genders or school grades.”

*Modified sentence:*

“The parametric t-test was used to compare means of GHQ-12 total scores between different genders or school grades.”

*Modified sentences:*

“Multivariable analysis using logistic regression modeling was performed in which the outcome of interest was poor mental health, and the exposure of interest was the number of pain sites. Variables found to have an association with both outcome and exposure were
selected as possible confounders. The likelihood ratio test was performed to examine interaction between age, gender, and the number of pain sites. A similar analysis was conducted treating each pain site as the exposure of interest.”

Modified sentence:
“In addition, multivariable logistic regression analysis was conducted in which the outcome of interest was perceived academic impairment, and the exposure of interest was the number of pain sites.”

Deleted sentence:
“Three models were developed for the analysis to obtain odds ratio as measures of effect.”

5. Comment: The manuscript is too lengthy; it should be more concise. English grammar should be revised.

We appreciate the reviewer’s suggestion. We deleted several sentences in the Methods and Results sections, and made many changes throughout the manuscript to make it more concise. Also, we had a professional editing service correct English grammar in our manuscript.

6. Comment: Do not repeat the values in Tables and text.

We deleted some values in the text and several sentences to avoid repetition in the tables.

Association between number of somatic pain sites and poor mental health

Deleted sentences:
“The odds of poor mental health in students with one pain site was approximately 1.9 times higher than those with no pain site (OR 1.84; 95% CI: 1.70 to 2.00). The OR for those with two pain sites or three pain sites was 3.09 (95% CI: 2.80 to 3.40) and 5.43 (95% CI: 4.65 to 6.35), respectively.”

7. Comment: Subheadings are unnecessary.
According to the guidelines, the manuscript can be broken into subsections with short, informative headings. Therefore, we kept most subheadings but changed some of them into more concise ones and deleted the numbering.

Modified subheadings:
"Prevalence of somatic pains and GHQ-12 scores"
"Prevalence of somatic pains and poor mental health"
"Strengths and limitations"

I hope that these revisions have sufficiently addressed the reviewers’ comments. Thank you very much for your kind consideration of our manuscript.

Respectfully yours,

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