Author's response to reviews

Title: Spine Day 2012: Spinal pain in Swiss school children- epidemiology and risk factors

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Author's response to reviews: see over
Dear editor
Dear referees

Many thanks for giving us the opportunity to improve our manuscript. Your comments were very helpful and we thoroughly revised the manuscript according to them. In the following, you find a point by point response to your concerns. In this response as well as in the manuscript, all changes are marked in yellow.

We hope that the manuscript is now acceptable for publication and thank you for the editorial effort.

Sincerely yours,
Brigitte Wirth

Editorial comment

1. The editor required including the full institutional names or canton reference of the ethical committees that approved the study.
   We apologize for this omission and complemented the sentence in the last paragraph on page 4 as follows: “Ethical approval for this study was given by the Ethics committees of all cantons of Switzerland that required an Ethics proposal for this type of study (BS/BL, LU, SG, VD) and by the Ethics committee of ETH Zurich.”
Referee 1

General comments

1. The referee made the statement that the aims of this study were clearly stated, answered and discussed. Some of the methods, however, should be explained in more detail.

We thank for this basically positive feedback and revised the manuscript according to the points raised by the referees.

Major compulsory revisions

2. The referee requested an explanation how the chiropractors gave the overall rating of the children’s spinal health and asked whether they used a scoring system.

We thank the referee for this criticism, which was also raised by the other referee. The overall chiropractic rating was of clinical nature and not based on any scoring system, but on the clinical findings and the clinical expertise of the chiropractors. This rating was of high interest for the parents. However, we agree that it was not the focus of the present study, why we decided to omit this issue (including table 3) from the manuscript.

3. The referee wanted to know more about the questionnaire used: whether it was used or validated before and why we did not use an already validated and published questionnaire.

The questionnaire was used in former Spine Days, but was updated and complemented according to recent literature (e.g. the questions on smoking and parental smoking was new). It was piloted, but not validated. We did not use an already validated and published questionnaire, because, to our knowledge, there was no such questionnaire focusing on spinal problems in children and adolescents at that time. Some studies used the Roland Morris Disability Questionnaire and/or the Hanover Functional Ability Questionnaire, which were not designed for the adolescent population and focus on abilities/disabilities. We wanted rather ask for pain characteristics as frequency and intensity and for possible risk factors. Meanwhile, the “Young Spine Questionnaire” has recently been published (Lauridsen et al, 2013). It is quite similar to our questionnaire by asking for all three spinal areas separately, but is so far available only in English and Danish.
Since the other referee asked for the wording of the questionnaire, we included on page 14 the following two appendices:

**Appendix 1: Questionnaire**

1. Do you have now or did you ever have pain in your back or neck?
2. If you ever have experienced pain: How often did you have pain in the last month?
3. If you ever have experienced pain: How severe was your pain (VAS)?
4. If you ever have experienced pain: What did you do against your pain?
5. How often per week do you sit in front of the computer or the TV?
6. For how long at a time do you sit in front of the computer or the TV?
7. What type of schoolbag do you use?
8. Do you smoke or do your parents smoke?
9. Do your parents suffer from back or neck pain?

**Appendix 2: Clinical examination**

1. Height
2. Weight
3. Back profile inspection: static posture
4. Feet and knee inspection: static deviations
5. Matthiass arm-raising test: hold arms for 60 seconds in 90 degrees flexion
6. Single leg stance for 10 seconds with open and closed eyes
7. Adam’s forward bend test: rib hump
8. Finger floor distance in forward bending
9. Mobility (range of motion): neck, thoracic spine, lumbar spine
10. Palpation: painful spinous processes

Furthermore, we inserted this issue as a limitation on page 13:

"Another limitation was the fact that the questionnaire which was used was not validated. However, to our knowledge, no validated questionnaire focusing on children and adolescents was available at that time. Meanwhile, the “Young Spine Questionnaire” has recently been published [42], although it has not yet been translated and validated in German. Nevertheless, in future, the question on consequences of spinal pain should be reworded, since this is an important measure for severity [10]."
4. **The referee required the exclusion criteria to be mentioned in the method section.**

We mentioned in the first two paragraphs on page 5 that only children between 6 and 16 years whose parents gave their signature on the questionnaire were included in the analyses. Furthermore, we stated in the data analysis section on page 7 that for epidemiologic analyses, data sets with missing values were excluded from the corresponding analyses only (available case-analysis). For the risk factor analyses, only complete data sets could be included (complete case analysis) (N=434, 211 boys, mean age=10.4±2.8 years). However, to make the exclusion criteria clearer, we rewrote this paragraph on the pages 4-5 as follows:

“Altogether, 1040 children and adolescents participated. In compliance with the decision of the responsible Ethics committees, the parents (or the legal representatives), but not the children had to give their signature on the questionnaire if they agreed that the (anonymized) data of the children were included in this study. Since the present study focused on school children aged 6 to 16 years, the exclusion criteria for this study were being younger than 6 or older than 16 years and missing a parental or guardian signature. Thus, data of 104 children younger than 6 years and of 18 adolescents older than 16 years were not analyzed. Information about age was missing on 11 questionnaires. These children were excluded from further analyses.”

5. **The referee suggested including the anthropometric data of the three age groups as well as of the total population.**

We apologize for this omission. We complemented the corresponding paragraphs on page 5 (general population) and on page 6-7 (age groups) as follows:

Page 5: “Consequently, 836 questionnaires (382 boys, 449 girls, 5 with missing gender information; mean age = 10.3 ±2.8 years, mean height = 1.45±0.17 m, mean weight = 38.3±13.5 kg) were included in the data analysis.”

Page 6: “For analysis of spinal pain epidemiology, the children were divided into three age categories representing three different school grades in Switzerland (there were slight variations between cantons): 6-9 years (mean age = 7.6±1.1 years, mean height = 1.30±0.09 m, mean weight=27.2±6.0 kg), 10-12 years (mean age = 11.0±0.8 years, mean height = 1.50±0.09 m, mean weight=40.3±9.1 kg), 13-16 years (mean age = 14.0±1.0 years, mean height = 1.66±0.09 m, mean weight=54.0±10.0 kg).”

Page 7: “For the risk factor analyses, only complete data sets could be included (complete case analysis) (N=434, 211 boys, mean age=10.4±2.8 years, mean height =1.46±0.17 m, mean weight=39.0±13.9 kg).”
6. In the eyes of the referee, the VAS score of up to 4.5 was quite high which should be discussed and compared to literature.

A VAS score of 3.7 (for the 6 to 9 years old) and of 4.5 (for the 13 to 16 years old) is on the lower bound of the VAS score interval that defines moderate pain according to pain definitions in children and adolescents (Hirschfeld et al, in press). The comparison to literature is difficult, since most studies in the field focus rather on pain prevalence and incidence (Jeffries et al, 2007) than on pain severity. Severity was rather assessed by asking for constraints caused by back pain than by a VAS measure (Kjaier et al, 2011; Milanese et al, 2010), although a consensus approach towards standardization of back pain definitions advised using such a scale for the optimal back pain definition (Dionne et al, 2008). Nevertheless, a study that investigated 15 years old adolescents found a mean VAS score of 4.24 (±2.22), which is close to our finding of 4.5 (±1.8) points in this age group (Pellisé et al, 2009). For a more precise appraisal of the findings on pain severity, we specified the corresponding sentence on page 10 as follows: “Severity of pain, in contrast, only slightly increased with age. In all age groups, it was moderate according to pain definitions in children and adolescents [34], which corresponds to findings from other studies [35].”

7. The referee required a more thorough discussion of the effect of passive smoking on back pain in adolescents.

The referee is right that this issue was scarcely discussed. However, there is not much information on this matter available. Nonetheless, we found an additional study that raised the hypothesis that second-hand smoke might promote back pain in adolescents similarly than active smoking, probably on the basis of biologic mechanisms affecting disc health (Feldman et al, 1999). We inserted this reference and rewrote the paragraph on page 11 as follows:

“As for second-hand smoke, a study that found a positive relationship between active smoking and back pain in adolescents raised the hypothesis that second-hand smoke might promote back pain in adolescents similarly than active smoking, probably on the basis of biologic mechanisms affecting disc health [38]. Indeed, promotion of disc degeneration by exposure to passive smoking has been shown in rats [39]. The only study, however, which was found that investigated the role of passive smoking on LBP in childhood did not find an association [15]. Nevertheless, the role of passive smoking in the development of spinal pain needs further investigation.”
8. The referee commented that the fact that a selection bias could not be excluded should be acknowledged and discussed in the manuscript.

We thank the referee for this comment. We are well aware that our results do not represent overall prevalence since a selection bias cannot be excluded. Although we stated in the aims on page 4 and in the first paragraph of the discussion section on page 9 that this study was not representative, we agree with the referee that this issue should be acknowledged as a limitation of the study. Thus, we complemented the limitation section on page 12 as follows: “The participation on Spine Day was optional which almost certainly led to a selection bias. Thus the prevalence rates in this study may not represent the overall prevalence of adolescent back pain in the general Swiss population which is a major limitation of this project. A representative study that assesses the burden of adolescent spinal pain in the Swiss population is desirable.”

References to this response
Referee 2

General comments

1. The referee stated that the manuscript focused on an important and under-investigated area. Furthermore, she acknowledged that the manuscript was clear and well written and that we made good use of the data available. We very much appreciate this feedback and made any effort to sufficiently answer the points raised by the referee.

Major compulsory revisions

2. The referee asked for more information about the questionnaire used and asked whether it was validated or pilot-tested. She furthermore suggested that the wording should be included in the method section or attached as additional material. We thank the referee for this helpful suggestion. Although the questionnaire was roughly described on the pages 5 and 6, we agree that it might be helpful to include the wording in the appendix. Thus, we included on page 14 the following two appendices:

Appendix 1: Questionnaire
10. Do you have now or did you ever have pain in your back or neck?
11. If you ever have experienced pain: How often did you have pain in the last month?
12. If you ever have experienced pain: How severe was your pain (VAS)?
13. If you ever have experienced pain: What did you do against your pain?
14. How often per week do you sit in front of the computer or the TV?
15. For how long at a time do you sit in front of the computer or the TV?
16. What type of schoolbag do you use?
17. Do you smoke or do your parents smoke?
18. Do your parents suffer from back or neck pain?

Appendix 2: Clinical examination
11. Height
12. Weight
13. Back profile inspection: static posture
14. Feet and knee inspection: static deviations
15. Matthiass arm-raising test: hold arms for 60 seconds in 90 degrees flexion
16. Single leg stance for 10 seconds with open and closed eyes
17. Adam's forward bend test: rib hump
18. Finger floor distance in forward bending
19. Mobility (range of motion): neck, thoracic spine, lumbar spine
20. Palpation: painful spinous processes

This questionnaire was used in former Spine Days, but was updated and complemented according to recent literature (e.g. the questions on smoking and parental smoking was new). It was piloted, but not validated. We did not use an already validated and published questionnaire, because, to our knowledge, there was no such questionnaire focusing on spinal problems in children and adolescents at that time. Some studies used the Roland Morris Disability Questionnaire and/or the Hanover Functional Ability Questionnaire, which were not designed for the adolescent population focus and mainly focus on abilities/disabilities. We wanted rather ask for pain characteristics as frequency and intensity and for possible risk factors. Meanwhile, the “Young Spine Questionnaire” has recently been published (Lauridsen et al, 2013), which is, to our knowledge, so far available only in English and Danish. We inserted this issue as a limitation on page 13:

“Another limitation was the fact that the questionnaire which was used was not validated. However, to our knowledge, no validated questionnaire focusing on children and adolescents was available at that time. Meanwhile, the “Young Spine Questionnaire” has recently been published [42], which has, however, to be translated and validated in German first. Nevertheless, for future use of the presented questionnaire, the question on consequences of spinal pain should be reworded, since this is an important measure for severity [10].”

3. The referee wondered how the chiropractors tested spinal mobility.
Spinal mobility was tested by assessing range of motion. To be more precise, we complemented the corresponding sentence on page 6 as follows: “The chiropractors investigated spinal mobility (range of motion) and tested whether palpation of the vertebrae was painful.”
4. In the opinion of the referee, the overall chiropractic rating was not of relevance/interest if it was not related to the children’s pain.

We thank the referee for this criticism, which was also raised by the other referee. The overall chiropractic rating was of clinical nature and not based on any scoring system, but on the clinical findings and the clinical expertise of the chiropractors. This rating was of high interest for the parents. However, we agree that it was not the focus of the present study, why we decided to omit this issue (including table 3) from the manuscript.

5. The referee suggested summarizing the findings on pages 8-9 by risk factors in order to make clear that the four factors age, gender, parental smoking and parental spinal pain showed consistent patterns and were of particular interest.

We thank the referee for this comment. We rewrote the paragraph on spinal pain in general according to the referee’s suggestions:

“A summary of the results of all tested possible risk factors for adolescent spinal pain is shown in Table 3. The regression analyses showed that female gender is, with an odds ratio (OR) of 1.9 (p=0.003), a risk factor for spinal pain in children (Table 4). An increase in age was associated with spinal pain regardless of gender, with OR of 1.3 (p=0.001) for boys and 1.4 (p<0.001) for girls. Similarly, the exposure to parental smoking demonstrated a consistent association with an increased risk for spinal pain, with OR of 2.4 for boys (p=0.020) and 2.2 for girls (p=0.051). In contrast, BMI, mobility (FFD), posture (Matthiass Test) and coordination (single leg stance) did not show any consistent association with spinal pain (OR values around 1.0). No distinct pattern emerged for the factors parental spinal pain, trunk symmetry and type of schoolbag. Spinal pain in mother and/or father, which was present in the vast majority of parents (Table 3), tripled the risk for spinal pain in girls (OR=3.3, p=0.027), but did not seem to be of relevance in boys (OR=1.5, not significant). Similarly, the presence of a positive Adam’s sign, indicating trunk asymmetry, significantly increased the risk for spinal pain only in girls (OR=3.4, p=0.027), but not in boys (OR=1.0, not significant). Conversely, the use of a briefcase or shoulder bag significantly decreased the risk for spinal pain in girls (OR=0.027, p=0.005), but showed only a trend for an increased risk in boys (OR=3.6, p=0.092).”

For the different spinal areas, however, we prefer presenting the risk factors by spinal area, since the implication of consistent patterns for risk factors is debatable and the regional approach is one of the key points of this study. We admit of course that some
chance findings cannot be ruled out, but it might also be possible that the different spinal areas are put at risk by different influence factors.

Minor essential revisions

6. The referee wanted to know whether the children whose information about age was missing were excluded (page 5).
   Yes, these children were excluded from analyses, which we made clear by introducing the following sentence on page 5: “Information about age was missing on 11 questionnaires. These children were excluded from further analyses.”

7. On page 6, the referee did not understand the sentence “…as this study aimed to identify valid and reliable screening tests that can be used in future school settings” and missed an explanation for including/excluding clinical findings in the analyses.
   We pursue the objective to develop a screening protocol that can be used in larger settings such as schools where no chiropractor is available. Thus, we did not include in the analyses all tests that have compulsorily to be conducted by a clinical specialist. For clarification, we rewrote the corresponding sentence on page 6 as follows: “However, as this study aimed to identify valid and reliable screening tests that can be used in future in larger (school) settings (in absence of clinical specialists), all clinical tests that are to be conducted by specialists were not included in the analyses.”

8. The referee wondered what “enter method” on page 6 means and asked whether it was stepwise inclusion or not. She furthermore wondered about the term “categorical factors”, since the variables seemed to be dichotomous.
   Enter method (forced entry) is a term in SPSS which means that all predictors are forced into the model simultaneously/in one block. Some statisticians recommend choosing rather this approach than stepwise methods (Field 2009, p.212).
   With a view to the term “categorical”, the referee is right that the variables were dichotomous or binary. In SPSS, the term “categorical” refers to variables that are made up of categories - in its simplest form just of two categories (Field 2009, p.8). To avoid any misunderstanding, we clarified the corresponding sentence on page 7 as follows:
“For the determination of risk factors, logistic regression analyses (forced entry/enter method) were conducted including the following categorical (binary) factors (coding 0/1): ….”

9. **The referee suggested combining the tables 5 and 6.**
   We thank the referee for this suggestion which we implemented on page 21. The former tables 5 and 6 have been combined to the new table 4.

10. **On page 7, the referee wanted to know why we expressed FFD as percentage of height and asked for some reference for this method.**
    We chose this approach because we detected a significant dependency of finger floor distance (FFD) on age (Pearson correlation coefficient $r=0.17$, $p<0.001$), height ($r=0.23$, $p<0.001$, see diagram below) and weight ($r=0.15$, $p<0.001$), which might confound the results. For this reason, we chose to normalize FFD for height. By this approach, the influence of the confounders could clearly be reduced (age: $r=0.10$; height: $r=0.14$; weight: $r=0.08$). To our knowledge, there is no reference for this method. However, its influence on the results is marginal, which is illustrated in the table below using the example of low back pain. Nevertheless, this method should be validated before further use.

Scatter diagram of FFD versus height:
Risk factors for low back pain using FFD in absolute values (left) and FFD normalized to body height (right):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>FFD absolute values</th>
<th>FFD normalized to height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exp (B)</td>
<td>p</td>
</tr>
<tr>
<td>Age</td>
<td>1.38</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Gender</td>
<td>2.45</td>
<td>0.014</td>
</tr>
<tr>
<td>Spinal pain parents</td>
<td>2.98</td>
<td>0.068</td>
</tr>
<tr>
<td>Smoking parents</td>
<td>1.55</td>
<td>0.314</td>
</tr>
<tr>
<td>Computer /TV per week</td>
<td>1.39</td>
<td>0.425</td>
</tr>
<tr>
<td>Schoolbag</td>
<td>0.44</td>
<td>0.154</td>
</tr>
<tr>
<td>Trunk asymmetry</td>
<td><strong>3.15</strong></td>
<td><strong>0.015</strong></td>
</tr>
<tr>
<td>Posture</td>
<td>1.19</td>
<td>0.673</td>
</tr>
<tr>
<td>Coordination</td>
<td>0.48</td>
<td>0.161</td>
</tr>
<tr>
<td>Mobility</td>
<td>0.94</td>
<td>0.110</td>
</tr>
<tr>
<td>BMI</td>
<td>0.98</td>
<td>0.822</td>
</tr>
</tbody>
</table>

11. The referee stated that in the discussion about BMI, the risk of chance findings should be mentioned.

The referee is right to raise this criticism. We implemented this reservation on page 12 as follows: “Although it cannot be ruled out that this result was found by chance and thus needs confirmation, this finding shows again the necessity to investigate spinal pain per area as well as to conduct further research on risk factors for TSP, as current data are scarce [9].”

Discretionary revisions

12. The referee suggested redesigning table 4 since there is too much text in the cells.

We very much appreciate this comment. We redesigned the former table 4 (now table 3) on page 20.

13. The referee asked what “for review” means in relation to some references in the discussion.

By the term “for review”, we wanted to make clear that these references refer to review articles. However, we removed the term “for review” and just indicated the numbers of the corresponding references.

References to this response