Author's response to reviews

Title: Interchangeability of pain assessment using a visual analogue scale and a verbal rating scale - influence of pain etiology: a cross sectional study

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Author's response to reviews: see over
To the BioMed Central Editorial Team

Dear Sir,

Many thanks for all valuable comments on our manuscript MS 7102526672678088 - Interchangeability of pain assessment using a visual analogue scale and a verbal rating scale - influence of pain etiology: a cross sectional study.

The paper has been corrected as suggested by the reviewers and their comments have been taken into consideration. A detailed answer to each reviewer, Craig Hartrick and Pekka Mäntyselkä - is given below.

Reviewer Craig Hartrick

1. The method section describes that the pain among the patients included in the study were not classified according to the diagnoses or the duration but to its etiology. The used labels are in accordance with previous work by Lundeberg and Ekholm in Disabil Rehabil 2002, 24:402-406 and by Wincent et al. in Eur J Pain 2003, 7:311-321 where the pain etiology classification is described as – Chronic/idiopathic pain is a long lasting pain, which cannot be accounted for by any demonstrable organic pathology. The pain may be well localised, but if so, generally without neuro-anatomical distribution. Sometimes chronic/idiopathic pain has started as a result of trauma or disease process, but there is a striking disproportion between reported suffering, remaining symptoms, and physical signs. Nociceptive pain is originating from a primary activation of nociceptors where the nervous system is intact. The pain intensity typically increases during loading or movement and mostly originates from the musculoskeletal system. Neuropathic pain is a result of an injury or a disease process, affecting the peripheral nerves, spinal cord, or brain. Radiation of pain follows a distribution that corresponds to the damaged neuronal structure, i.e. extends along a neuro-anatomically correlated area, e.g. a dermatome of a nerve root or innervation field of a peripheral nerve (projected area).

The term chronic pain has been renamed to chronic/idiopathic pain.

The reason for referring to the musculoskeletal system was to give the location of the perceived pain but not necessarily its origin.

2. The suggested reference is included.

3. We have rewritten the sentences regarding the visual analogue scale, VAS, and omitted the term categorical.

4. The sentences in the background and discussion sections have been reworded as suggested.

5. The methods section has been rewritten in order to clarify the study design and the statistical methods. This has also been included in the background section in the description of the aim. Furthermore, for

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The title has been changed to “Lack of interchangeability between visual analogue and verbal rating pain scales: a cross sectional description of pain etiology groups”.

The two pain rating scales were given to the patients in random order, and this is a well-known statistical design technique to avoid bias in assessments. Please note that the study is cross-sectional only in the sense that the three groups of etiology are described separately. The groups are not compared by statistical tests, so there are no multiple tests performed as the aim is not to compare the pain levels between groups, but only to evaluate the interchangeability of two different pain assessment scales. The only statistical inference performed, that could be interpreted as hypothesis testing is the 95% confidence intervals of the measures of systematic disagreement, RP and RC.

6. In case of not perceiving pain in rest, which was the case among some of the patients with nociceptive pain, the engaged tissue was loaded by isometric muscle contractions or by testing the respective joints active/passive range of movement in order to provoke the pain and thereby be able to rate any actual pain. This has also been included in the Methods section.

7. The Methods section was also rewritten for clarification in order to understand the essence of the statistical treatment employed. However, we will avoid statistical formulae, as our experience is that this would change the focus from the main message of pain assessment scales to technical concerns.

For your information the expressions of our measures can be written as follows:

The empirical measure of disorder is

\[ D = \frac{2 \sum_{i=1}^{m} \sum_{j=1}^{m} x_{ij} x_{ij}'}{n(n-1)} - \frac{t}{n(n-1) - t}, \]

where \( x_{ij} \) is the ij:th cell frequency and \( x_{ij}'\) and \( x_{ij}'' \) are the upper-left and lower-right region frequencies relative to the ij:th cell, i and j =1, ..., m.

For the VAS assessments:

The number of disordered observations to the pair \((X_k, Y_k)\) is calculated by

\[ S_{k}^{ul} = \#\{l; X_l < X_k \text{ and } Y_l > Y_k\} \quad \text{and} \quad S_{k}^{lr} = \#\{l; X_l > X_k \text{ and } Y_l < Y_k\}. \]

The \( D = \frac{2 \sum_{k=1}^{n} S_k^{lr}}{n(n-1) - t}, \) where \( t = \sum_{k=1}^{n} T_k \) and \( T_k = \#\{l; X_l = X_k \text{ and } Y_l = Y_k, l \neq k\} \)

The coefficient of monotonic agreement: MA = 1-2D
Empirical measures for systematic disagreement between the assessments X and Y.

The empirical measures of relative position (RP) and of relative concentration (RC) are calculated from the two sets of marginal distributions of the square contingency table. Let \( x_v \) and \( y_v \) denote the \( v \):th category frequencies, and \( C(X)_v \) and \( C(Y)_v \) denote the \( v \):th category cumulative frequencies of the two sets of categorical marginal distributions, \( X \) and \( Y \), \( v = 1, \ldots, m \). The number of individuals is denoted \( n \).

Then, \( \text{RP} = p_{xy} - p_{yx} \)

where

\[
p_{xy} = \frac{1}{n^2} \sum_{v=1}^{m} [y_v \cdot C(X)_{v-1}], \quad \text{and} \quad p_{yx} = \frac{1}{n^2} \sum_{v=1}^{m} [x_v \cdot C(Y)_{v-1}],
\]

\[
\text{RC} = \frac{1}{M \cdot n^2} \left[ \sum_{v=1}^{m} \left( y_v \cdot C(X)_{v-1} (n - C(X)_v) - x_v \cdot C(Y)_{v-1} (n - C(Y)_v) \right) \right].
\]

\[
M = \min \{ (p_{xy} - p_{yx}^2), (p_{yx} - p_{xy}^2) \mid 0 < p_{xy}, p_{yx} < 1 \}
\]

For paired judgements on the VAS the measure of RP can easily be calculated by for each observation of one of the marginal distributions count the number of observations of the other being smaller and vice versa.

Thus \( p_{xy} = \sum_{i=1}^{n} \# \{l; X_l < Y_k \} \) and \( p_{yx} = \sum_{i=1}^{n} \# \{l; Y_l < X_k \} \)

Similarly, the \( \text{RC} = \frac{1}{Mn^2} \sum_{i=1}^{k} [S(Y_k) - S(X_k)] \)

where

\[
S(X_k) = \# \{ j, l; Y_l < X_k \text{ and } Y_j > X_k \}
\]

and

\[
S(Y_k) = \# \{ j, l; X_l < Y_k \text{ and } X_j > Y_k \}
\]

7. A scatterplot is shown in figure 2 representing the 3 groups VAS levels at different VRS levels. However, the line-plots are also shown to demonstrate the overlap and especially the changed pain labels when the VAS records were transformed into discrete five-category scales.

Reviewer Pekka Mäntyselkä

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1. We do agree that the order of the figures could seem confusing and has therefore rearranged them.

2. We have also rearranged the result section in order to clarify the parts regarding changed labels.

Sincerely Yours

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