Re: Revision of the manuscript: 6820268369665463

Dear Editor,

Thank you very much for the reviewers’ comments on the manuscript “Identification of candidate categories of the International Classification of Functioning Disability and Health (ICF) for a Generic ICF Core Set based on regression modelling”. We found them extremely helpful.

The manuscript has been revised taking all reviewers’ comments into account. Please find enclosed a detailed description of the corresponding amendments and changes, as well as the revised version of the manuscript. All changes in the manuscript have been underlined.

Yours sincerely,

Alarcos Cieza, PhD, MPH
COMMENTS OF REVIEWER 1

1. **Comment of the reviewer on the applied regression analysis:** “To get an idea of the appropriateness of the applied regression models, a residual analysis should be made and included in the paper.”

Thank you very much for this comment, which encouraged us to study this issue in more detail. We repeated the regression analyses presented in this study using a Heteroscedasticity-Consistent Standard Error (HCSE) estimator. The results achieved with the HCSE estimator are highly consistent with the results presented in the originally submitted manuscript, which were calculated with a standard error estimator that assumes homoscedasticity. Since the HCSE estimator is the most appropriate method to model our data according to the literature, we report the results of the regression analyses using the HCSE estimator in the revised version of the paper.

In the next paragraphs, we summarize for the reviewer the analyses performed using the HCSE estimator, as well as the few changes in the statistical inferences based on these analyses when compared to the results presented in the originally submitted paper. We subsequently list the paragraphs that have been added to the revised version of the paper.

**Testing the assumption of homoscedasticity:**

Whereas violation of the assumption of the normality of the residuals tends to be relatively harmless to inference in ordinary least square regression, the violation of the homoscedasticity assumption can produce p-values for hypothesis tests that are either too small or too large compared to the true p-value and can affect the width of confidence intervals. Therefore, this assumption has to be carefully examined¹, and when violated, regression analyses able to account for it have to be applied. We proceeded as follows for the revision of the manuscript:

- The residuals were plotted against the predicted values for each of the regression analyses performed in this study. Obvious departures from the homoscedasticity assumption were detected.

- White tests² for each of the performed regression models were conducted to test the null hypothesis whether the variance of the residuals is not homogenous. The variance of the residuals was proved not to be homoscedastic.

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Consequently, all regression analyses presented in the paper were again performed using a Heteroscedasticity-Consistent Standard Error (HCSE) estimator of ordinary least square regression, which is the most appropriate method for addressing the effects of heteroscedasticity (Long & Ervin, 2000; Mackinnon & White 1985; White, 1980). With this method, the regression model is estimated using ordinary least squares, but the standard errors are estimated without imposing a constraint (either assumed or modelled) on the structure of the errors. We applied the most frequently used and most recommended HCSE estimator known as HC3 (MacKinnon & White 1985).

The results of the analyses using the HCSE are highly consistent with the results of the regression analyses using the regression estimator that assumes homoscedasticity and that were presented in the originally submitted paper. The statistical inferences regarding the following four variables in five of the fourteen performed models were different when applying the HCSE estimator:

a. The comorbidity *chronic widespread pain* does not remain as a significant independent variable in model II

b. *e580 Health services, systems and policies* does not remain as a significant independent variable in model IV and VII

c. *d920 Recreation and leisure* does not remain as a significant independent variable in model XI

d. *e450 Individual attitudes of health professionals* does not remain as a significant independent variable in model VIII.

The corresponding $R^2$ or variance explained in the five named models is minimally smaller.

The methods section of the paper has been amended. Now, it is stated that the homoscedasticity assumption has been tested and that our data violate this assumption. We also provide the information that ordinary least square regression using a HCSE estimator is applied to analyse the data. The following paragraphs have been added to the section *analyses*:

**Test of the homoscedasticity assumption**

To verify whether the data met the regression assumption of homoscedasticity, the residuals were plotted against the predicted values for each of the regression analyses performed (see below). Obvious departures from the homoscedasticity assumption were consistently detected and consequently a White test (White, 1980) conducted. The variance of the residuals proved
always not to be homoscedastic based on the White test.

Consequently, all regression analyses presented in the paper were performed using a Heteroscedasticity-Consistent Standard Error (HCSE) estimator of ordinary least square regression (Long & Ervin, 2000; Mackinnon & White 1985; White, 1980). With this method, the regression model is estimated using ordinary least squares, but the standard errors are estimated without imposing a constraint (either assumed or modelled) on the structure of the errors. We used the most frequently used and most recommended HCSE estimator known as HC3 (MacKinnon & White 1985; Hayes AF 2005).

The following references have accordingly been added to the reference list:


The sentence “A multiple-linear model with stepwise selection with p < .05 for inclusion and exclusion of a variable was used for these four regression analyses.” has been changed to:

A multiple-linear model using the HC3 estimator with stepwise selection with p < .05 for inclusion and exclusion of a variable was used for these four regression analyses.

The sentence “Again, stepwise selection with p < .05 for inclusion and exclusion of a variable was used.” has been changed to:

Again, stepwise selection using the HC3 estimator with p < .05 for inclusion and exclusion of a variable was used.

Tables 3 and 4 have been changed according to the results of the new analysis.

In addition, a further explanation to the relatively low variance explained by the ICF categories has been added to the discussion:
Third, no interaction terms were included in the models since the purpose of the study was simply to propose a method to select ICF categories and to identify candidate ICF categories for a Generic ICF Core Set. However, it is possible that interaction terms including, for example, \textit{b130 energy and drive functions} and \textit{b280 sensation of pain}, contribute to general health as measured by the item 1 of the SF-36. The interaction terms should be included in future studies.

2. \textbf{Comment of the reviewer on the applied regression analysis}: “The authors should give some short comments on their operationalisation of the first qualifier”

Thank you for this comment referring to a very important issue. We have now addressed it in the methods and discussion sections.

In the \textit{measures} section of the \textit{methods}, the following paragraph has been added to the description of the ICF checklist:

In this study, broad ranges of percentages as they are provided by WHO [11] were used as a reference system to quantify the problems of the patients in each of the different ICF categories and the extent to which a determined environmental factor was a barrier or a facilitator.

0 – NO problem (none, absent, negligible,...) \(0-4\%\)

1 – MILD problem (slight, low,...) \(5-24\%\)

2 – MODERATE problem (medium, fair...) \(25-49\%\)

3 – SEVERE problem (high, extreme,...) \(50-95\%\)

4 – COMPLETE problem (total,...) \(96-100\%\)

The following sentence has been added to the section \textit{data collection} of the methods:

The ranges of percentages used as references to quantify the problems of the patients in each of the different ICF categories were also introduced and explained.

The section \textit{data collection} has been positioned after the section \textit{measures} to make sure that the reader can understand the explanation of the information provided during the training of the persons who performed the data collection.

The following paragraph has been added to the discussion:

It has also to be taken into account that no further operationalisation of the qualifier scale besides the broad ranges of percentages provided by WHO were used in this study. The ICF checklist in its current form contains a more detail description of the qualifiers. For example, in the component \textit{body functions 1 (mild impairment)} is defined as “a problem that is present less than 25\% of the time, with an intensity a person can tolerate and which happens rarely over the last
30 days”. The descriptions of the ICF qualifiers were not available at the time when the data collection of the study presented here was planned and carried out. Future studies should include the actual descriptions of the qualifier scale, since they may improve the reliability and validity of the data. Within this context it is important to mention that reliability studies are being currently performed at the ICF Research Branch at the Ludwig-Maximilian University to study the psychometric properties of the qualifier scale.

3. Minor essential revisions

We also thank the reviewer for the minor essential revision. We have changed the manuscript accordingly.

Please consider that we have also changed the sequence in which the models were presented in tables 3 and 4. We realized that the description presented in the results section did not correspond to the order and numbering of the models presented in tables 3 and 4.