Author's response to reviews

Title: Staging of mobility, transfer and walking functions of elderly persons based on the codes of the International Classification of Functioning, Disability and Health

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Author's response to reviews: see over
Emily Crow, PhD, Executive Editor

_BMC Geriatrics_

**Dear Dr. Crow:**

Please find attached a copy of the manuscript entitled “Staging of mobility, transfer and walking functions of elderly persons based on the codes of the International Classification of Functioning, Disability and Health,” which I would like to submit for consideration of publication as a research article in _BMC Geriatrics_.

This paper should be of interest to a broad readership, particularly those interested in the health and healthcare of older people, because it details the development of a new scale for staging basic mobility and walking functions based on the International Classification of Functioning, Disability and Health (ICF). Our results suggest that these newly developed scales facilitate simple and clear descriptions of elderly functional levels and enable standardization of care and rehabilitation. Therefore, with the ICF as a common taxonomy, these scales can be used as an assessment tool in international geriatric care settings.

The work presented herein is original, has not been previously published in whole or in part, and is not under consideration for publication in any other journal. All authors listed have contributed sufficiently to the project to be included as authors, and all those who are qualified to be authors are listed in the author byline. I attest to the fact that all authors listed on the title page have read the manuscript, attest to the validity and legitimacy of the data and its interpretation, and agree to its submission to _BMC Geriatrics_. All authors have no conflicts of interest to declare.

I would like to thank you in advance for considering this manuscript. Please feel free to contact me if you have any questions or require further information.

**Sincerely,**

Jiro Okochi

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Dear Dr. Finch and Dr. Burger:

Thank you very much for your valuable comments. We have incorporated your suggestions into our manuscript, and we believe it is now improved. Please find below our responses to your comments.

Reviewer 1: Dr. Finch
Minor Essential Revisions
Introduction
1. Line 61; I believe the codes are not truly hierarchical but provide increasing precision in the categorization or definition for each function in the domains.

Answer:
As suggested, the following sentence was added to the manuscript:
“The number of digits in an ICF code represents an increasing level of precision in the categorization or definition for each function in that domain.”

2. Line 63: The ICF is a classification system not a true measurement system unless the qualifying codes are used this is a picky point, but one that needs to be considered. This is stated in the following sentence.

Answer:
The following sentence was added as suggested.
“Because the ICF was developed as a classification system, it requires an additional step for use as a measurement system, i.e., using a qualifier with the ICF code.”

3. Line 82: ICF codes do- not does

Answer: Changed as suggested.

4. Line 90: an instead of the

Answer: Changed as suggested
5. Line 93: you might want to define what a threshold is for those readers not familiar with the word or the concept or further clarify the following sentence as: threshold 5” stair climbing” threshold 4 “walking a short distance”. Etc

Answer: Changed as suggested

6. Line 103: this was- not this is.

Answer: Changed as suggested.

7. Line 105: a very short example might help the reader e.g. item XX is not an ICF codable item.

Answer: As suggested, an example was given in this sentence.
“For example, “Fastening a necklace (clasp) behind your neck” is difficult to code in terms of the ICF.”

8. Line 117: to be more precise the Rasch model does not require a Guttman probabilistic structure as this would over fit the Rasch Measurement model but it provides a Guttman like response structure; that is the response categories for each item must be order by difficulty. The authors are correct in the following sentences especially in the case of binary response items, but have overstated the Rasch requirements in the first sentence in line 117.

Answer: Changed as suggested as follows.
“If the items with a binary response pattern fit the Rasch model, they provide a Guttman-like response structure.”

Methods
1. Line 180: If more than 4 items fitted the Rasch model a panel the panel of experts chose the final items based on their applicability in daily care setting thereby providing evidence for face validity of the items. I do not believe that experts think of face validity in choosing items they provide face validity for the items.
Answer: The words “face validity” were omitted from the sentence as suggested.

2. Line 186 could the authors provide in the methods the age categories used for testing the stability of the scale.

Answer: The age categories were added to the method as suggested.
“age group (under 74 years, 75 to 84 years, 85 to 94 years and over 95 years)”

Discussion
1. Page 11 Line 227: I cannot follow this sentence very well. Table 3 is introduced without being presented in the results or interpretation in the discussion. This I believe is a problem of language and a lack of explanation. The legend for the figure is very well explained, however.

Answer: Table 3 is corrected to Figure 3 as suggested.

2. Line 242: I do not follow the logic here. There was no DIF by location. Are the authors implying that because there is no DIF in their items by location it is more efficient/better than the ICF core sets that are context specific-this statement needs to be made slightly clearer for the reader. The items and codes used here are indeed part of the Activities and Participation brief core set for geriatrics.

Answer: We are not arguing whether our approach is better than a ICF Core-Set approach. Therefore, we changed the sentence as below:
“Our approach differs from most ICF Core-Set approaches because our method does not select patients by diagnosis. This is because, in sub-acute care settings such as nursing homes or rehabilitation care facilities, as well as in home care settings such as day care, patients are not divided by disease category. Some cross-group categories were shown using DIF analysis in this study. No DIF was found between the elderly persons in institutions and day-care facilities, which implies the applicability of this method for both settings. In addition, the scales can be used as a classification system because they have staging properties. By adding illustrations to the scales, a clear image concerning basic mobility and walking can now be obtained for each patient.”
3. Line 264: Content validly is more than selecting items from a broad spectrum of items, The authors also used expert opinion to help select items for the scale with this face validity it adds to content validity.

Answer:
The following sentence was added as suggested:
“In addition, by dividing the items into the categories of basic mobility and walking, and allowing each item to have a closer fit to the Rasch model, the scales are likely to be both measuring a single dimension with different difficulty and satisfying the construct validity. Use of expert opinions to help selecting items for the scale also adds validity. However, further supporting evidence through subsequent studies will need to be considered.”

Conclusion
1. Line 286: the authors should add a caveat to their conclusions that once validated these scales could be used..... This statement requires much more validation work on the scale in different setting, populations and cultures before it can be considered true.

Answer: The following sentence was added to the sentence as suggested:
“The authors are currently performing additional validity and reliability studies to enable the scale to be used in international geriatric care settings.”

Major Compulsory Revisions
Introduction
1. Line 97: is it the individual who agrees with an item or is it that the person is assessed /rated on a particular item and rated as passing.... Or is it the rater who places an individual as passing a particular item... This concept should be in line with the ideals of your manuscript and should match better.

Answer: The sentence was changed as below as suggested:
“so that an individual who performs a particular item also performs items of a lower rank-order”

2. Line136: to specify” conditions” this word this could be misinterpreted as medical conditions
rather than abilities that I believe the authors meant.

Answer: As suggested, “The 19 items were then modified into 33 items which specified performance in relation to mobility, walking and transfer.”

3. Line 155 were the items “asked” or actually assessed with a rate of pass/fail yes/no using the binary question’ it now appears that the items are questions in a questionnaire. Do the authors mean “Each item was assessed/rated yes or no using the binary response options to construct a Guttmann type scale...”

Answer: This sentence was changed as suggested below:
“Each item was assessed/rated “yes” or “no” using the binary response options to construct a Guttmann-type scale.”

4. Line174-177: Do the authors mean 300 samples or a sample of 300. What was the initial sample size that the 300 were drawn from?

Answer: This part was changed as suggested as below:
“For this analysis, a sample of 300 items was randomly selected from the eligible sample for scale development (n=1164).”

Additionally, for those readers not informed on Rasch analysis, the authors might like to state why they chose a sample of 300- beyond that the fit is dependent on sample size. In Rasch a smaller sample is often warranted as we are looking for non-significant results, the criteria used for fit in Rasch, as opposed to other statistical techniques where the large the sample the better as they are looking for insignificant results and significance is dependent on sample size. This should be clearer for the reader. Additionally is 300 a suitable size for this analysis what is it based on

Answer: Based on the suggestions, following sentence was changed as below:
We used the references below:

“If we use the total sample, most of the items appear to not fit the Rasch model because fit
statistics is dependent on the sample size [1].

Taking into account the relationship between sample size and significance of mean-square statistics, the authors decided to use the sample size of 300” [2].

References (added)
2. Rasch Power Analysis: Size vs. Significance: Infit and Outfit Mean-Square and Standardized Chi-Square Fit Statistic [http://www.rasch.org/rmt/rmt171n.htm]

5. Line 192 the missing person data -where these people similar in characteristics to the rest of the sample or were the responses of the sample a biased being only from a better group of patients. A statement to the effect that although the group with missing data was removed their characteristics were similar to those with full data is needed just for completeness.

Answer: The following sentence was added as suggested in the Result section:
“Those persons with missing data did not differ significantly in terms of sex, age group and study location, according to the chi-square test.”

Results
1. Lines 200 to 203 seem to be more methods than results and some of the text is actually in the methods section
Answer: This part has been moved to the Methods section as suggested.

2. Line 211-215: the two groups, development and validation, did not differ by sex- did they differ by age groupings?

On calculating age group difference, we found a miscalculation of the average age of the validation group by including non-eligible persons (younger than 65 years old); this was corrected. This does not affect the following Rasch analysis and DIF analysis because those non-eligible samples were already deleted from the analysis. The following sentence was changed as suggested:

“We tested the characteristics of the newly developed scale using the sample for scale validation.”
There were 1706 elderly persons using an institutional service (average age, 85 years) and 1554 elderly persons using a day care service (average age, 81 years) from whom we obtained the data for validation. There were more institutionalized elderly persons in the sample for scale validation, but the percentage according to sex did not differ significantly between the two groups. For the age category, the sample for validation was younger (average age, 82 years) compared with the sample for development (average age, 84 years) because the former included more elderly persons in the age group between ages 64 and 75 years.”

Discussion
1. Line 267-268. Because items fit the Rasch model does not provide enough evidence for validity. That the items fit the Rasch models adds evidence for internal validity of the scale but there is not enough evidence for validity. I suggest the authors see Streiner and Norman 3rd edition chapter 10. Validity is about inference an important point for this scale. Inferences have to hold true in a wider sense than a single study for a single population as is stated by the authors in their limitations. Construct validity cannot be satisfied through a single study. The authors have indeed provided evidence for validity, but the statement that they have satisfied construct validity is over stated. This is probably the wrong choice of wording. Construct validity is an ongoing process and includes predictive, known groups, convergent divergent validity dependent on the nomenclature the authors wish to use.

Answer:
The following sentence was changed below as suggested:
“In addition, by dividing the items into the categories of basic mobility and walking, and allowing each item to have a closer fit to the Rasch model, the scales are likely to be both measuring a single dimension with different difficulty and satisfying the construct validity. Use of expert opinions to help selecting items for the scale also adds validity. However, further supporting evidence through subsequent studies will need to be considered.”

Figure 1 Basic Mobility
2. As each of the items is for an individual person the word do should be replaced by does.

Answer: Changed as suggested.
3. Is it correct that the very 1st stage of the person is “1” not a “0” if the person does not change lying position? Does the person have to pass the first item to be in that stage? It is a bit confusing to have the stage picture does not change lying position with a ‘1’ what would be the stage then for the person if they can not change position?

Answer: to make the interpretation of the Figures easier, an example of the staging was added to the Result section as below:

“For example, as seen in Figure 1, stage 1 of the basic mobility scale is not being able to change in and out of a lying position independently. If the person is able to change position but does not maintain a sitting position, they are assessed as stage 2.”

Figure 2 Walking.
1. The item walking is not the same as the item that is stared in the table that item is going out of the home without assistance. This is not walking. For clarity the authors should put in brackets beside the item d450b walking. The iICF d450 is Walking Moving along a surface on foot, step by step, so that one foot is always on the ground, such as when strolling, sauntering, walking forwards, backwards, or sideways. Inclusions: walking short or long distances; walking on different surfaces; walking around obstacles. It is confusing having going out of the home without assistance as it does not imply walking. Do you mean d4501 Walking long distances Walking for more than a kilometre, such as across a village or town, between villages or across open areas. Could the authors clarify this.

Answer: Thank you for finding this problem.
Indeed, the items d450a and d450b are “Walking with assistance from a person” and “Walking without assistance”, respectively, as in the appendix table. This was corrected in Table 2. Looking at the original Japanese version it was “walking without assistance”. Therefore, the description of Figure 2 “walking” is corrected to “Walking without assistance”.

Reviewer 2 Dr. Helena Burger

1. Abstract – 3507 subjects (line 36) is not the sum of 1790 and 1719 (line 212)
Answer: The number of the validation sample was corrected because we had included those persons below 65 years of age. The abstract and results section were corrected accordingly.

Abstract section
“The order of item difficulty was validated using 3260 elderly persons.”

Result section
“There were 1706 elderly persons using an institutional service (average age, 85 years) and 1554 elderly persons using a day care service (average age, 81 years) from whom we obtained the data for validation.”

2. Introduction:
a. line 84 – probably ..a linkage between ICF and existing….. not between existing measures for ADL and HRQoL

Answer: This sentence was corrected as suggested.
“The other approach is to create linkage between the ICF and existing measures of activities of daily living (ADLs) and health-related quality of life (HRQoL).”

b. line 93 the functioning of elderly instead of elderly functioning
Answer: This sentence was corrected as suggested as below:
“Each scale includes five thresholds that enable staging of the functioning of elderly persons.”

3. Methods:
a. line 153 – delete could

Answer: Deleted as suggested.

4. Discussion:
a. Lines 223 - 225 – how can case manager assess whether the patient is more likely to experience an improvement….
Answer: This sentence was overstated and therefore deleted as suggested.

b. line 246 – from this scale is not possible to know possibilities for improvement

Answer: This part was omitted as suggested, and to avoid redundancy, the remaining part was moved to the beginning of the Discussion section as below:

“The ICF-based classification developed in the present study has wide applicability. First, patients can be assigned to one stage in each scale. Staging offers standardization of rehabilitation and care management, because patients of the same group in a certain level would require a similar amount and types of resources. This was achieved by hierarchically rearranging the ICF items and constructing Guttman-type scales according to item difficulty.”

c. line 260 – add an example

Answer: An example was added as suggested, “such as “Maintain sitting position without assistance”, “Walking without assistance””.

d. line 261 – what about language

Answer: Following sentence was added as suggested. “Because we used ICF as a basis for our taxonomy, these scales may be used internationally. However, the contextual difference in language across countries should be taken into account for international application.”

e. line 275 – change fonts of the word “of”

Answer: Changed as suggested.

5. Conclusion:

a. line 280 – add for elderly

Answer: Changed as suggested.
b. line 286 – is different from what they wrote in lines 260 – 261.

Answer: line 286 was omitted as suggested and added this sentence.

“The authors are currently performing additional validity and reliability studies to enable the scale to be used in international geriatric care settings.”

6. Figure 3: Mobility and walking scale – with four chosen ICF codes it is not possible to distinguish between category four and five.

Answer: This problem was noted in the study limitation as below.

“Our study does have some limitations. First, the location statistics of two ICF items used as thresholds, namely, ‘Going out using public transportation (d4702)’ and ‘Climbing up stairs (d4551),’ were very near each other, which results in weak discriminative power, as shown in Figure 3.”