Author's response to reviews

Title: Multidimensional structure of the Groningen Frailty Indicator in community-dwelling older people.

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Author's response to reviews: see over
Dear Professor Cameron,

Thank you for considering our manuscript entitled, “Multidimensional structure of the Groningen Frailty Indicator in community-dwelling older people”, for publication in *BMC Geriatrics*. We are pleased that we get the opportunity to revise our manuscript.

We appreciated the helpful comments and suggestions of the reviewers. In this cover letter, we will give a point-by-point response to their concerns. We have addressed these comments in the manuscript, changes are displayed in bold.

We hope you find our revised manuscript appropriate for publication in *BMC Geriatrics* journal. Thank you for your consideration and we look forward to hearing from you.

Yours sincerely,

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Comments of reviewer 1: Martine T Puts

1 - The total sample consisted of 1508 older adults, and you used a subsample of 119 persons to examine test-retest reliability, how was the subsample of 119 persons selected? Were they a random sample of the total sample? Please clarify.

Our response: In total, 1508 older adults filled in the GFI questionnaire. This total sample consists of two samples: main sample (n=1389) and smaller sample (n=119) (as shown in Table 1). The main sample was approached by local health authorities. The smaller sample was approached by community centers. We have clarified the selection of the samples in the Method section.

2 - With regard to the statistical analysis, could you clarify the missing data section? In the section it is described that those with more than 5 items on the GFI missing were excluded, and it is mentioned that 17 persons are excluded for these reason. However, in the next sentence, you describe that 1277 have no missing data, 194 missed one GFI item, 27 had 2 items missing, 4 had three missing and 6 had 4 or 5 items missing. So it seems that at most 6 persons should have been excluded?

Our response: In the total data, 17 persons were excluded from analyses because they had missing scores on 6 or more items. In the next sentence, the number of missing values were given for the analyzed sample (in which all subjects had less than 6 missing values). I agree that we did not described it clearly. We adjusted the sentence to be more clear.

Comments of reviewer 2: Nienke M de Vries

Major compulsory revisions:

1 – (a) The GFI is not the only frailty instrument that measures frailty on multiple dimensions. I would like to see a discussion in the introduction on how other measurement instruments deal with the multidimensionality of frailty? In addition, it is not clear to me what the purpose of measuring frailty is in relation to the multidimensionality. (b) It is stated that the detrimental consequences of frailty can be prevented when early onset symptoms are recognized. Please explain what consequences can be prevented and which interventions can be applied (add references). (c) Furthermore, It is not clear to me why an overall sum score is a problem. When an overall sum score indicates frailty, clinicians can easily see what domains are problematic.

Our response: (a) Several scales has been developed to measure frailty on multiple dimensions. Mostly, these multidimensional screening instruments use dichotomous scoring systems. They consider a person as either frail or not frail, regardless of the origin of the problems in the different domains. We added information to the Background section to clarify this point.

(b) Multiple interventions have been developed to targeting frail elderly people, like exercise training, lifestyle interventions, nutritional interventions, and psychosocial interventions. These interventions may result in a reduction in hospital and institution use, improvement in physical function and
physical fitness, reduction of falls, and an increase in well-being and life satisfaction (Beswick et al., 2008; Daniels et al., 2008; Eklund & Wilhelmson, 2009).

e) Frailty is generally seen to be multidimensional in nature. It is of great value to assess the contribution of the specific dimensions when a scale considers multiple dimensions. Therefore, we investigated the possibilities of the GFI to identify problems in these specific dimensions.

2 - Please indicate on what clinimetric properties the GFI has been tested in previous research.

Our response: The GFI has been tested by Peters colleagues (2012) on feasibility, reliability, construct validity and discriminant validity. Their study supports the feasibility, reliability and validity of the GFI. We added this information to the Background section.

3 - Please describe in- and exclusion criteria of the study sample. Were, for example, cognitively impaired older adults excluded?

Our response: Inclusion criteria of the study sample were: (1) age 65 years and older, and (2) community dwelling. Older adults with cognitive impairments were not explicitly excluded. In this type of research, it is hard to exclude respondents with cognitive impairments. However, we think it is unlikely that severe cognitively impaired older adults were included. We assume that filling in a questionnaire and sending it back, is a cognitive task by itself.

4 - Please define multidimensionality, scalability and convergent validity. Is it correct that scalability can also be referred to as 'structural validity' (conform the cosmin checklist: Mokkink et al. 2010) and that multidimensionality is being studied by determining the internal consistency of the identified subscales? This is not clearly described and terminology is not being used consistently (sometimes ‘factor structure’ is used) Changing the terminology, could also be considered.

Our response: We changed the terminology and definitions of the measurement properties according to Mokkink et al. (2010): we changed the term ‘multidimensionality’ and ‘factor structure’ into ‘structural validity’, and we changed the term ‘convergent validity’ into ‘criterion validity’. Structural validity is defined as the degree to which the scores are an adequate reflection of the dimensionality of the construct to be measured. Criterion validity is defined as the degree to which the scores are an adequate reflection of a “gold standard”. Scale analysis of the GFI was applied using Mokken item response theory model of monotone homogeneity (Mokken & Lewis, 1982). Mokken scale analysis tests the homogeneity of the subsets of items of test batteries that are multidimensional by construction (Hemker et al., 1995). We added the definitions of the used terminology in the Methods section.

5 - Considering convergent validity, hypotheses about the expected relationships between the GFI and other measures should be stated. Furthermore, it is stated that the questionnaires used to determine
convergent validity are gold standards. Please indicate for what construct they are gold standards (frailty or individual dimensions).

**Our response:** We added the hypotheses about the expected relationships between the GFI subscales and the related scales. These related scales are considered to be golden standards of the individual dimensions. These scales were found to be valid and reliable to assess physical functioning, loneliness and the presence of anxiety and depressive states.

6 - All analyses done indicate that the subscale Health Problems is a weak scale in the GFI. Please describe the consequences of this finding for the GFI and its’ clinical use.

**Our response:** For clinical use, it is relevant to notice easily in which domain a frail person experience problems. The subscale Health Problems is a weak scale in the GFI due to the heterogeneity of items within this subscale. The heterogeneity of the items is due to the heterogeneity of health related problems in aging (Spirduso, 1997). Therefore, the weaker scale properties were expected. Still, our analyses showed that the items 5-10 together constitute a subscale. So, for clinical use it will say that we can screen problems in the Health Problem domain.

7 - Again, I would like to see a more specific comparison with other frailty instruments in the discussion. Is there agreement on the included dimensions? Also relate the findings to literature on frailty in general. How do these results relate to what is known on frailty?

**Our response:** We added information about different models of frailty and refer to the conceptualization of the multiple domains of frailty (Mitnitski et al 2001; Walston et al., 2006; Gobbens et al., 2010). Nevertheless, there is no agreement about the included dimensions in frailty instruments. In addition, research on geriatric syndromes like frailty mostly failed to be implemented into clinical practice, because the lack of an adequate framework to implement complex interventions (Vliek et al., 2008). We suggest the results of our research can improve the adequacy of screening on frailty and will offer specific indications for intervening in the early onset of frailty.

8 - The conclusion to consider someone only as frail when a person has a sum score of # 4 on the GFI and reports problems in all three domains of frailty is remarkable. Older adults do not necessarily have to experience problems in all frailty related domains to be considered frail. Please explain.

**Our response:** On further consideration, we agree with this comment. We defined frailty as a decline in reserve capacity in different domains of functioning. In accordance with this definition, we must attenuate our conclusion. We consider a person to be frail when he or she experience problems in at least two domains of frailty. Consequently, we suggest screening results of frailty need not only report the sum score, but also specify the domain(s) in which older adults are at risk. In this way, the assessment of the GFI may contribute to a better understanding of the screening of frailty.
9 - It is stated that this study did not assess sensitivity in detecting change of the GFI. Does this mean that the GFI is also proposed to be used as an evaluative measurement instrument?

**Our response:** The GFI is designed and only been used (so far) as a screening instrument. However, several screening instruments are also used as evaluation instruments. The potential of the GFI as an evaluative measurement instrument is not investigated yet. We would suggest to test the potential of the GFI as an evaluative measurement instrument. We rephrased the concerned sentences to make our statement more clear.

**Minor essential revisions:**

10 - First paragraph: change the sentence ‘due to an accelerated aging of the population’. Please change the word accelerated and specify the population.

**Our response:** We changed the sentence “Due to an accelerated aging of the population, …” into “Due to the rapidly increasing number of older people worldwide, …”.

11 - Many paragraphs in the methods section contain information that should be described in the results section.

**Our response:** We have moved the paragraph containing the characteristics of the study sample to the results section.

12 - No conclusions on ‘the severity’ of problems can be drawn based on the GFI (first paragraph).

**Our response:** We agree with this comment. We deleted this sentence (“The severity of problems in Psychosocial Functioning is not increasing with age, while frail older adults do experience increasing severity of problems in Daily Activities as well as in Health Problems with increasing age.”).

13 - Describing frailty measurement instruments as ‘screening acceleration of age-related decline in functional capacity’ is not correct (second paragraph).

**Our response:** We agreed with this commend and have adjusted this sentence.

**Comments of reviewer 3: Ali Montazeri**

1 - The manuscript reports on the multidimensional structure of the Groningen Frailty Indicator in community-dwelling and in general it reads well. I feel the paper merits publication without any revision since the authors reported well on the study limitations. The only problem with this manuscript relies on its conclusion. I think the authors should revise the conclusion based on their findings. At present it does not read well!
Our response: We have revised our conclusion. We consider a person to be frail when he or she experience problems in at least two domains of frailty. Consequently, we suggest screening results of frailty need not only report the sum score, but also specify the domain(s) in which older adults are at risk.

Associate editors comments:

1 – Copyediting: We advise you to seek the assistance of a fluent English speaking colleague, or to have a professional editing service correct your language.

Our response: Our manuscript has been copy edited by a professional editing service (Exact Science Communications) to improve the quality of written English.

2 – Acknowledgment: Please add an acknowledgment section.

Our response: We added an acknowledgment section in which we acknowledge anyone who contributed towards the article.

3 - Figure cropping: It is important for the final layout of the manuscript that the figures are cropped as closely as possible to minimize white space around the image.

Our response: We changed the layout of figures according to the final layout of the manuscript as described on http://www.biomedcentral.com/info/ifora/figures.

References:


