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ORIGINAL ARTICLE

Rasch Analyses of the Wheelchair Use Confidence Scale

Brodie M. Sakakibara, PhD,[a,b] William C. Miller, PhD, FCAOT,[a,b,c] Paula W. Rushton, PhD[d]

From the [a]Graduate Program in Rehabilitation Sciences, Faculty of Medicine, University of British Columbia, Vancouver, British Columbia; [b]Rehabilitation Research Program, Vancouver Coastal Health Research Institute, Vancouver, British Columbia; [c]Department of Occupational Sciences and Occupational Therapy, Faculty of Medicine, University of British Columbia, Vancouver, British Columbia; and [d]School of Rehabilitation, Faculty of Medicine, University of Montreal, Montréal, Québec, Canada.

Abstract

Objectives: To compare the functioning of the 101-point response format of the Wheelchair Use Confidence Scale (WheelCon) with shortened 11-point formats, and to evaluate the scale's measurement properties using principal components and Rasch analyses.

Design: Secondary analysis of cross-sectional data.

Setting: Community.

Participants: Volunteer participants were manual wheelchair users (N=220) ≥19 years of age, with ≥6 months' experience with daily wheelchair use and no cognitive impairment.

Interventions: None.

Main Outcome Measure: 65-item WheelCon.

Results: The 11-point response format outperformed the original 101-point format. Principal component analyses confirmed the presence of 2 dimensions: mobility efficacy and self-management efficacy. Thirteen items in the mobility efficacy subscale and 8 items in the self-management efficacy subscale fit the Rasch Rating Scale model. Five items misfit the model developed using the 21 items from both subscales. In each of the 13- and 8-item subscales, and the 21-item short form, the 2 lowest and highest scores had internal consistency reliability estimates <.70; all other scores had reliability estimates >.70.

Conclusions: The WheelCon is composed of 2 dimensions. The recoded measurements using a 0-to-10 response scale from the 13-item mobility and 8-item self-management efficacy subscales have good reliability, as do the measurements from the 21-item WheelCon Short Form. The use of the subscales, the short form, or both, depends on the context in which they are being considered. Research to establish the reliability and validity of the measurements using the 0-to-10 response format is warranted.

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The Wheelchair Use Confidence Scale (WheelCon)[1] is a newly developed measurement scale that assesses self-efficacy with manual wheelchair use in 6 conceptual areas, including (1) the physical environment (34 items); (2) activities performed (11 items); (3) knowledge and problem solving (8 items); (4) advocacy (4 items); (5) social situations (7 items); and (6) emotions (1 item).[1] For each item, individuals are asked, "As of now, how confident are you …?" Each item is rated on a 0 (not confident) to 100 (completely confident) point response scale. A mean score is calculated, with higher scores indicating higher self-efficacy. Evidence using classical test theory methods indicates that the WheelCon measurements are both reliable and valid in manual wheelchair users.[2] Furthermore, research using the WheelCon has shown that lower self-efficacy is associated with lower levels of participation frequency[3,4] and life-space mobility[5] in wheelchair users aged ≥50 years.

Despite foundational research supporting the WheelCon's measurement properties, and the scale's effective use in research and clinical settings,[2-9] further evaluation of the WheelCon's measurement properties using contemporary measurement methods (ie, Rasch analyses[10]) may address current limitations with the existing scale. For example, during the development of

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the WheelCon,[1] items were created that inquire about beliefs pertaining to both physical (eg, move over carpet) and nonphysical (eg, problem solve how to get to a destination when there is an unexpected detour) abilities to use a wheelchair. Although these items are conceptually different, they are used together to derive a total score. Quantitative investigation into the WheelCon's dimensionality through the use of factor analysis or item response modeling has yet to be performed. Next, because the WheelCon measurements have high internal consistency reliability (Cronbach $\alpha = .92$),[6] there may be redundant items that could be eliminated. Identifying and eliminating redundant items will reduce the administrative and responded burden, which may in turn increase the WheelCon's use, particularly in the clinical setting. Furthermore, the use of a 101-point response format with the WheelCon may be resulting in biased measurement. Evidence shows that individuals, especially older adults, have difficulty using response formats with many response options.[11,12] An inability to differentiate between adjacent options leads to respondent bias arising from increases in subjectivity.[13] A shortened response format, therefore, may improve measurement precision relative to the original format and may be tested using item-response procedures.

The purpose of this study was to compare the functioning of the WheelCon's 101-point response format with that of shortened response formats, examine the dimensionality of the WheelCon, identify items not conforming to the Rasch Rating Scale model as well as redundant items that could be considered for elimination, and determine the standard errors of measurement and reliability estimates for the entire range of scores.

We hypothesized that a shortened response format would outperform the original response format. We also hypothesized that the WheelCon with a shortened response format would result in more than 1 dimension with fewer items and good internal consistency reliability (Cronbach $\alpha \geq .70$) throughout the range of scores.

Methods

Study design and participants

Data from this cross-sectional study (study 1; n = 146) were combined with data from another study (study 2; n = 74)[2] using the same inclusion/exclusion criteria: community-dwelling manual wheelchair users; ≥19 years of age; ≥6 months' experience with daily wheelchair use; communicates in English or French; and no cognitive impairment (ie, score ≥23 on the Mini-Mental State Examination).[14] The samples from both studies comprised volunteer participants drawn from British Columbia, Ontario, Quebec, and Nova Scotia, Canada between 2010 and 2012.

Participants were recruited using letters of information sent by clinicians, wheelchair vendors, or both. Study information was also provided to advocacy and community groups. Individuals who consented to participate met with a trained research assistant to complete the questionnaires. Participants also had the option to complete the English questionnaires online. The ethics boards from all relevant institutions approved this study.

List of abbreviations:

PCA **principal component analysis**
WheelCon **Wheelchair Use Confidence Scale**

Wheelchair Use Confidence Scale

Slightly different versions of the WheelCon were used in studies 1 and 2. The 65-item version 3.0 was used in study 1, and the 63-item version 2.4 was used in study 2.[2] In this study, the 60 similar items in both versions of the WheelCon were retained for analyses, as were the 5 new items in the WheelCon version 3.0.

Response format category collapsing

Bandura[15] advocates the use of either 0- to 100-point or 0- to 10-point response formats with self-efficacy measures. In order to compare the functioning of the original 101-point response format with shorter 11-point response formats, the original dataset was rescored using 2 modified 11-point response formats (ie, 0 was retained as a distinct option in one format: 0 = 0…91−100 = 10; 100 was retained as a distinct option in the other format: 0−9 = 0…100 = 10), and the functioning of each was analyzed individually.

Data analyses

Descriptive statistics were used to characterize the sample. Results from categorical variables were calculated as percentages, and continuous variables as means and SDs. The Barthel Index[16] was used to assess functional independence.

Response format functioning

Two criteria were used to evaluate the response format functioning of each of the 65 items in the WheelCon. First, the Rasch Rating Scale model's[17] item-by-response option outfit statistics were examined. Outfit statistics >2.0 were considered misfitting and an indication that the response option was being used in an unexpected manner.[18] Second, average measure values were inspected to determine the extent to which the response options were properly ordered (ie, higher response options should manifest higher self-efficacy).[18] The format with the fewest misfitting and unordered response options was used in subsequent analyses.

Evaluating Rasch assumptions: unidimensionality

Two separate principal component analyses (PCAs) with varimax rotation[19] were used to investigate the dimensionality of the 60 similar items in the 2 WheelCon versions, as well as the 5 new items in the WheelCon version 3.0. The use of varimax rotation was selected because the items in the WheelCon assess beliefs pertaining to both physical and nonphysical abilities to use a wheelchair. Although similar in that self-efficacy is being assessed, conceptually the beliefs are different, and independent, situation-specific dimensions. Before conducting PCA, we examined the correlation matrix to confirm that more than 20% of the interitem correlations were >.30, which indicated the presence of an underlying factor structure.[19] A Kaiser-Meyer-Olkin Measure of Sampling Adequacy value >.70 was also used as an indicator of adequate interitem correlation.[18]

Items not meeting the minimal loading value of .35, calculated using the formula $5.15/\sqrt{(n-2)}$,[19] were considered for elimination. Items that loaded only on 1 dimension in which all other items were conceptually different were also considered for elimination.[19] Those items having the strongest loading on a dimension in which all other items were conceptually different, but also loaded on other dimensions (ie, factorially complex), were retained in all dimensions for analyses.[19]