

RELIABILITY AND DISCRIMINATORY VALIDITY OF THE PRELIMINARY VERSION OF WHEELCHAIR COMPONENTS QUESTIONNAIRE FOR USERS.

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ABSTRACT

Secondary school aged wheelchair users at a boarding school for students with disabilities in a low resource area were invited to complete a preliminary version of Wheelchair Components Questionnaire for users (WCQu). The WCQu is a patient reported outcomes measure with 10 domain related questions and 7 extended questions. Each question concerns a wheelchair component and consist of a visual analogue score rating with an accompanying explanatory comment. A total of 48 participants completed the WCQu once, and 26 participants successfully completed the WCQu a second time four days later. Very few participants' wheelchairs included the components in the seven extended questions so reliability could only be determined for the 10 domain specific questions. Data was tested for suitability for use with parametric statistical tools. ANOVA using data from 48 participants indicated that the WCQu was able to discriminate between wheelchair types. The interclass correlation coefficient (ICC) for mean scores from participants who completed the questionnaire twice showed test re-test reliability for the domain specific questions. Results indicate that the WCQu is a reliable and sensitive tool to enable user feedback to manufactures and stakeholders in low resource areas.

BACKGROUND

Outcomes studies are necessary for more appropriate and financially responsible provision of wheelchairs (Borg & Khasnabis, 2008; WHO, 2015). Wheelchairs significantly raise quality of life for disabled persons yet it is estimated that 20 million people in low-resource settings are in need of wheelchairs (WHO 2011). Objective data is needed to enable appropriate wheelchair development and provision specifically in low-resource settings, where organizations and clinicians must evaluate seating options in the face of limited resources and strong tension between quality and cost (Borg & Khasnabis, 2008). Currently, there is a lack of research that includes the user/customer opinion in mobility devices, which may contribute to the high incidence of inappropriately fitted equipment (Mortenson, Miller, & Auger, 2008; Stanley, Stafford, Rasch, & Rodgers, 2003). User perception of wheelchair design and condition are essential to their

production and improvement, however most patient reported outcomes measures for wheelchair users are aimed primarily at assessing quality of life rather than the wheelchair itself, and the user's input on his or her wheelchair may be blurred by other factors impacting quality of life (Mortenson, et al., 2008). For example the modified Barthel Index and Functional Independence Measure assess independence, the Functional Mobility Assessment evaluates aspects of mobility; Wheelchair User's Functional Assessment evaluates quality of life (Stanley et al. 2003). Even the Quebec User Evaluation of Satisfaction with assistive Technology provides a broad overview with no opportunity for wheelchair users to give feedback on their wheelchair's components, design and function (Demers, Weiss-Lambrou, & Ska, 2002).

The preliminary version of the Wheelchair Components Questionnaire for users (WCQu) was designed as a patient-reported outcomes measure that will enable wheelchair users to provide feedback on their satisfaction with the function of the components of their wheelchair. It was based on the WCQ for condition, a professional report outcomes measure on the maintenance condition of wheelchair components (Rispin, 2016).

To be of general use, a questionnaire must be validated for reliability and discriminatory validity. The ability to discriminate differences of interest to the research question indicates discriminatory validity, and interclass correlation scores of above 0.7 are considered to indicate acceptable test re-test reliability (Kottner et al., 2011).

PURPOSE

The purpose of this study was to investigate the following research questions.

1. Is the ICC value comparing the mean scores for the test and re-test higher than 0.7?
2. Does the preliminary version of the WCQu have good discriminatory power?
 - a. Is the data distribution of the visual analogue scores suitable for use with powerful parametric statistical analysis tools such as analysis of variance (ANOVA)?
 - b. Does two way ANOVA and Tukey simultaneous comparison of means have the power to discriminate between wheelchair types by

indicating a significant difference in mean scores for different wheelchair types?

METH ODS

Ethics approval

Study protocol was approved by the researcher’s university Institutional Review Board, and by the organizations providing rehabilitation services to the participants. Participants, or their guardians, provided written consent and underage participants provided written assent.

Participants and wheelchairs

Participants in this study were wheelchair users in secondary school at a boarding school for students with disabilities in a low resource area. English was the language of schooling and to attend secondary school, students had passed a rigorous English proficiency test, however, English was often not the language spoken in casual conversations or at home.

Wheelchairs in use had been provided based on types available to clinicians serving the students at this site. These were a mix of wheelchairs including folding transport wheelchairs made in China, the Whirlwind Rough Rider, the three-wheeled Motivation all terrain wheelchair, the Free Wheelchair Mission Generation 2 wheelchair, the Hope Have KidChair, wheelchairs provided by the Association of the Physically Disabled of Kenya, and donated refurbished wheelchairs made in the USA. Wheelchairs were coded into categories of types having 5 or more wheelchairs represented in the study.

The Wheelchair Components Questionnaire for users

Table 1: Questions of the preliminary version of the WCQu. Each one also included the phrase “from below F, (I am very dissatisfied) to above A, (it’s perfect for me. I love it!).”

Domain Specific	Extended
Rate the seat, include cushions	Rate the lap belt and/or harness
Rate the seat back, include cushions	Rate the head support
Rate the frame	Rate the trunk supports
Rate the uprights and handles (canes)	Rate the hip supports
Rate the front rigging and foot support	Rate the anti-tip device
Rate the casters	Rate the tray
Rate the wheels and push rims	Rate the arm rests
Rate the wheel locks (brakes)	Rate the abductor and/or adductor
Rate the wheelchair overall	

The preliminary version of the WCQu consists of a total of 17 questions regarding wheelchair components (Table 1). Ten questions are domain specific and were intended for use as a standalone questionnaire. These are components found on almost all wheelchairs. The

remaining seven questions are extended questions regarding components not present on many wheelchairs. A ten cm visual analogue scale with emoticons and school grade like anchors was utilized. With each question an opportunity to provide a qualitative explanatory comment was included.

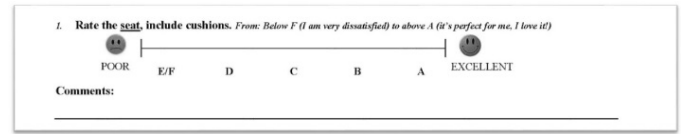


Figure 1. An example of a question on the WCQu.

Procedure

Through announcements provided by the secondary school leadership, all wheelchair using students at the school were invited to come to the dining area to take the WCQu two different occasions at least four days apart. On each occasion, the study was explained and those present in the room were invited to participate or not as they chose. Participants’ age, gender, diagnosis and wheelchair type were recorded. Instructions to the questionnaire were read aloud. Participants were asked to complete their own questionnaire while researchers circled the room to answer questions and collect completed forms. Participants who completed the questionnaire on the first occasion were invited to return for the second administration.

Analyses

Quantitative data for participants’ scores was obtained by measuring the length of the visual analogue line from the left hand side to the mark made by the participant, and results were put into a spread sheet. Data was tested for normalcy using the Anderson Darling test. Two way ANOVA and Tukey’s simultaneous comparison of means was completed for scores from all items of questionnaire data. For ICC, complete sets of data from both test and re-test sessions is necessary, so data from participants with incomplete question items in either take was removed from analysis. ICC was calculated. MiniTab and SPSS statistical analysis programs were utilized.

RESULTS

Fifty two students were invited to participate. Four of those invited chose not to participate. Forty-eight participants completed the WCQu at least once (29M, 20F, mean age 17.7 SD 2.8) diagnoses were as follows: 12 muscular dystrophy, 11 spinal cord injury, 9

osteogenesis imperfecta, 5 cerebral palsy, 4 spina bifida, 3 secondary to infectious disease, 4 other. Wheelchair for types with more than five representative were as follows: 16 Chinese made folding transport chair; 9 Motivation all terrain chairs; 5 Whirlwind RoughRider chairs; 10 wheelchairs made for use in low resource areas including 3 Free Wheelchair Mission, 3 APDK, 2 HopeHaven, and 2 by Free Chair Foundation; 6 US made wheelchairs including 2 Quickie, 2 Zippy, 1 Invacare and 1 Lomax chair. Types for four wheelchairs were not recorded and these were not included in ANOVA analysis.

Anderson Darling analysis indicated the data from preliminary version of the WCQu scores was statistically normal and suitable for use with parametric statistical analysis tools. ICC and ANOVA were done only for domain specific questions because few wheelchair users had wheelchairs which included the components covered in the extended questions. ICC analysis can only be done for data sets that are complete for both test and retest. Two participants only completed the questionnaire once and so were excluded from ICC analysis. Of the 46 participants present at both sessions, 20 did not complete one or more of the domain related questions either in the first or in second sessions resulting in data not usable for ICC analysis; therefore 26 participants were included in the ICC analysis. Evaluation of the domain specific question items resulted in an Intra-class correlation coefficient values of 0.937 with a confidence interval of 0.927 to 0.985.

ANOVA analysis indicated the 48 participants who completed the questionnaire at least once. Results indicated that this version of the WCQu was able to discriminate between wheelchair types ($F(4,729)=26.6, P<0.001$) and Tukey simultaneous comparison of means indicated that highest ratings went to Motivation all terrain chairs and lowest rating to Chinese made folding transport chairs (Figure 2). ANOVA indicated that the WCQu was also able to distinguish between components ($F(8,729)=4.7, P<0.001$) with highest ratings for frame and uprights, and lowest ratings for casters, footrest, seat and brakes.

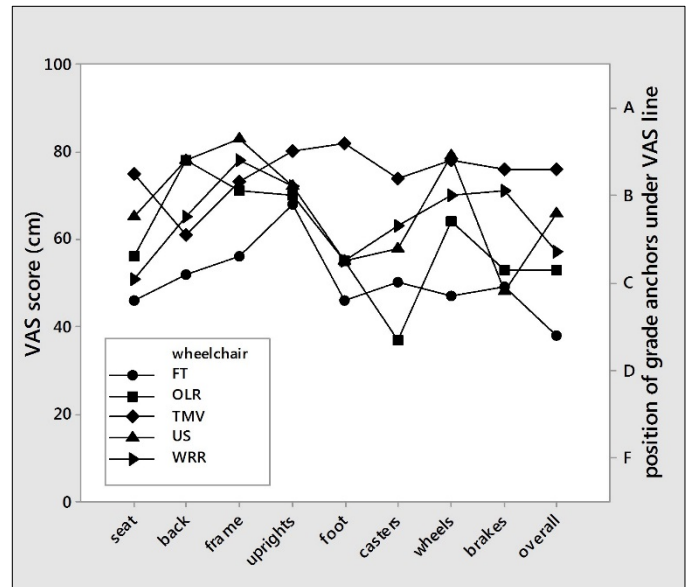


Figure 2. ANOVA interaction plot for wheelchair types. The position of the school grade anchors indicating the wheelchair users' perceived grades is given on the secondary Y axis.

DISCUSSION and LIMITATIONS

Test re-test reliability validation was achieved for the domain specific questions of the preliminary version of the WCQu with an ICC score above 0.7. However, we were not able to confirm reliability of the extended questions because few of the wheelchairs included those parts. Plans are underway to roll the extended questions into the domain specific question and revalidate the WCQu in that format. For example, the trunk supports and head supports would be included in a question which asked the user to rate the back and the parts of the wheelchair supporting their head and trunk. The need for this is reinforced by the fact that many of the 26 participants who did not complete all of the same questions in the initial test and the re-test sessions neglected to complete the final question asking them to rate the wheelchair overall. This may have been because the extended questions which many could not complete were between the bulk of the domain related questions and the final domain related question. Folding the extended questions into the domain related questions would avoid this difficulty.

Although English is the language of schooling, some of the participants were not familiar with the names of their wheelchair parts. For example, they would call the casters the "small legs" in the language they commonly spoke with one another. The English terms for wheelchair components may differ in between countries

and cultures. Future studies include the simplification of the language in the questionnaire; for example, the question on casters could be reworded to something like, Rate the casters (small front wheel/s)”.

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CONCLUSION

Good reliability and discriminatory ability indicates that the domain related questions of the preliminary version of the WCQu provide a patient report outcomes measure which, unlike most other measures for wheelchair users, enable wheelchair users to give feedback on specific wheelchair components. In a clinical setting, the rating and accompanying explanation could enable repair of a component that the client might not have mentioned without the WCQu. Equally important, the results of this questionnaire can be made available to manufactures and providers. Ratings and comments can shed light on problems to be addressed by design changes.

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