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ORIGINAL RESEARCH

Preliminary test-retest reliability of the Wheelchair Satisfaction Questionnaire

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ABSTRACT

Purpose: Economic realities in lower-and-middle-income countries (LMICs) present an increased need for outcome measures for wheelchair efficacy, as these measures enable optimized use of funds. As the provision level of wheelchairs is low in these areas, and many wheelchairs are inappropriate for their intended users, use of funds based on evidence is especially necessary. The Wheelchair Satisfaction Questionnaire (WSQ) was designed to be a snapshot of a wheelchair user's level of satisfaction with their wheelchair. The WSQ is comprised of 16 visual analogue scale questions. Each question includes an option for a qualitative explanatory comment. The current study examined initial test-retest reliability of the WSQ.

Materials and methods: The WSQ was administered twice to the same set of wheelchair users who were secondary students at a school for students with disabilities. A demonstration was given to the participants to explain how to mark the analogue scale. Participants were instructed to answer each item honestly and without peer input. A one-week time span separated test and retest. Scores for both sessions were entered into SPSS. An interclass coefficient of 0.70 or above indicates acceptable test-retest reliability

Results: The ages of participants ranged from 13 to 24, with a mean age of 17.86 years. Sixty-five participants completed the questionnaire fully in both test and retest and were included in this study. A high degree of reliability was found between scores from both tests. The interclass coefficient was $r(63) = .863$, $p = .01$, indicating statistically significant agreement between test and retest.

Conclusion: The results support the WSQ as a reliable measure, confirming the WSQ as a reliable tool for user feedback on wheelchair function. Because the WSQ is designed to provide user feedback with enough granularity to give data on particular aspects of wheelchair structure and function, data can facilitate repair and modifications to wheelchair parts. Studies using the WSQ to assess specific wheelchair types could indicate consistent patterns of user satisfaction and dissatisfaction, revealing relevant design issues. The WSQ is designed to give wheelchair users a voice that can empower user centred modification and design changes to facilitate improved health, opportunity, and social interaction.

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Wheelchair; outcome measure; face validity; content validity; questionnaire; patient reported outcome (PROM)

➤ IMPLICATIONS FOR REHABILITATION

- Results from the WSQ could enable manufacturers to utilize user feedback to improve the design of wheelchairs for use in LMIC's, and providers could be better-informed in the selection of wheelchair types for specific environments.
- The WSQ could provide immediate user feedback to inform wheelchair modification and selection to best serve a particular user.
- The WSQ could be used in clinical settings over time to collect longitudinal data from wheelchair users, which could identify the most commonly perceived reasons for user dissatisfaction in a particular clinical setting.

Introduction

Worldwide, approximately 10% of individuals live with disability. Of these, 10% demonstrate the need for a wheelchair. Only 5–15% of those individuals have a suitable wheelchair [1]. Many of the 15% with wheelchairs are known to have inadequate wheelchairs. Hospital transport chairs not intended for long-term use are often used inappropriately long term. Other chairs that have deteriorated, broken, or are not appropriate for the user's disability are often also in use [2]. Without mobility-related independence, people experience health consequences and diminished community involvement [3]. Individuals in these less-resourced environments are particularly likely to have wheelchairs that are not appropriate to either their needs or environments [4].

The World Health Organization's Guidelines on the provision of Manual Wheelchairs emphasize proper fit, safety, durability, and suitability [5,6]. Functional needs vary too greatly for one model or type to suffice for all users. Useful wheelchairs must be appropriate to both user and environment [7]. Durability is crucial in wheelchairs designed for use in less-resourced environments [8]. Tools are available and durability studies have been conducted [9,10]. The aspect of mobility is also important, and several tools are available to directly or indirectly assess the mobility provided by a wheelchair [10]. Feedback from wheelchair professionals is

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essential and a tool is available for that purpose [11] However, sole reliance on third-party observation omits a crucial and fundamental aspect necessary for accurate conceptualization: It is essential to gather data from wheelchair users and obtain feedback from them [12].

Research on wheelchair suitability is vitally important for the establishment of adequate wheelchair provision. Feedback from wheelchair users can enable necessary modifications of their wheelchair and for other individuals who use wheelchairs of a similar type. If there is a consensus among users of a wheelchair of a certain type in larger studies, data from the WSQ can influence modification to the wheelchair design at the manufacturing level. There are user report outcomes for mobility and assistive technology. The most commonly used is the QUEST; however, it is not wheelchair specific, so the resulting data cannot be used to analyse specific aspects of wheelchair parts or function, such as footplate or cushion function, or mobility in small spaces [3]. Another commonly encountered user report measure is the Functional Mobility Assessment, and as the name implies, is a measure of user mobility and is not intended to give data specific to wheelchair parts. In addition, those with greater physical challenges are very likely to have lower FMA scores even if they are satisfied with their wheelchairs. If assistive devices, including wheelchairs, are to be improved, data about user satisfaction related to specific aspects of wheelchair function are essential [12].

The Wheelchair Satisfaction Questionnaire (WSQ) was developed to provide feedback from wheelchair users on their satisfaction with their wheelchair [12]. (The WSQ can be accessed at https://www.letu.edu/global-initiatives/wheels/wsq.html.) Face validity and content validity were established in 2018. Two studies were undertaken, one in Vancouver, British Colombia, and one in Kenya, Africa. These studies indicated preliminary face validity and content validity of the WSQ. Means and standard deviations for each question on the follow-up questionnaire (WSQ-F) indicated good face validity [12]. Burns and Kho [13] recommend item generation, item reduction, formatting and pretesting in the development of questionnaires. All were applied in the development of the WSQ. Boynton's [14] guidelines for piloting and data checking were also used in its design. The WSQ addresses issues pertinent to the World Health Organizations Guidelines on the provision of Manual Wheelchairs [6] in its specific question items including fit, safety, durability, and environmental suitability. As it is user-informed and treats explicit aspects of the user's wheelchair, it serves to complement existing tools [3].

The WSQ is comprised of 16 questions. Eight questions address wheelchair parts as they apply to the body parts of the user; three questions address aspects of moving with or in and out of the wheelchair, two questions address how well the wheelchair facilitates interactions with others and work, one addresses satisfaction with the appearance of the wheelchair, and one overall satisfaction with the wheelchair. No questionnaire can include all possible aspects of wheelchair function, yet if a questionnaire is long, it often will not be used. The need for clarity and brevity meant that not all aspects of wheelchair function are included in the WSQ. Rather the WSQ sought to include key aspects of function common to all users. Wording was chosen with attention to clarity and simplicity. This was thought to be especially important for cross cultural English speakers, and for possible future translation into other languages. One focus of the WSQ was to provide an equal playing field for people who represent every level of physical challenge. Many measures of mobility will produce lower scores for those with more physical challenges. We felt it was important to enable each person to give feedback on their satisfaction with their wheelchair irrespective of their level of disability. To that end, the questionnaire is user centric, not only in its focus, but also the wording of many of the questions is based around the users' body and daily life.

The WSQ is also designed to facilitate effective analysis. Strong parametric statistical analysis methods best reflect responsiveness to difference; thus, the questionnaire employs a visual analogue scale. Questions present a 100-mm horizontal line to be marked with a perpendicular line. Each question accommodates explanatory comments, allowing for increased responsiveness of mixed methods patient report studies [15]. Continuous data were thus obtained. Emoticons bracket each parametric line, and typical school grades undergird each anchor. The WSQ instructs placement of a vertical mark anywhere on the line to indicate the score for each question. For each question, participants are asked to provide a full sentence to explain the reason behind their score. This adds to the ability of the WSQ to spark user driven modifications. For example, if the score for the footplate is low indicating lack of user satisfaction, the comment can explain that the footplate is loose or unsteady.

Reliability establishment (or stability of measurement) is essential for any outcome tool. Test-retest reliability is obtained by the administration of the same measurement to the same sample group with a period of time between the two tests. Correlation of the two sets of scores is used to determine reliability [13]. The goal of the current study was to establish test-retest reliability for the WSQ as a completely user-informed outcome measure for wheelchair satisfaction. In test retest studies, an Interclass Correlation Coefficient score of 0.70 or above is considered to indicate reliability.

Methods

Study design

All participants were wheelchair users who were students who attended the Joytown Secondary School in Thika, Kenya, a residential school for students with disabilities. The questionnaire was completed in English, as all participants were fluent in English and had passed the Kenya Certificate of Primary Education exam, and English was the language of education at the school. The questionnaire was completed in a group setting. Participants were given a verbal reminder to answer each question honestly and without peer input. A demonstration was given to the participants by one of the researchers *via* a white board to explain how to mark the analogue scale. Research team members and Kenyan assistants were present to answer questions. Participants completed the WSQ twice. The test and re-test sessions were separated by one week and were administered using the same protocol. Analysis began with the research team measuring the distance from the base of the visual analogue line to the mark indicating satisfaction level for each question for each iteration. Scores for both sessions were entered into SPSS. The scores for each person for the first and second sessions were compared by calculating the interclass correlation coefficient (ICC).

Results

The ages of participants ranged from 13 to 24, with a mean age of 17.86 years. Thirty-four participants were female; 39 were male. Four diagnoses represented the majority of participants: Muscular Dystrophy (21.9%), Cerebral Palsy (16.4%), Spina Bifida (15.1%), and Osteogenesis Imperfecta (13.7%). All students at the school

who had used a manual wheelchair for at least six months were eligible for the study and were invited to participate. Of the 73 participants, 8 participants' questionnaires were excluded after the first session since they had not completed every question. The remaining 65 participants completed the questionnaire fully in both test and retest. The Interclass Correlation Coefficient for scores for each individual in the first and second iterations of the study was $r(63) = 0.863$, $p = .01$.

Discussion

The ICC results indicate that the WSQ is a reliable outomes measure. This study and our earlier studies [12] support the WSQ as a reliable and valid measure for wheelchair users to provide feedback on their satisfaction with their wheelchair. Because the WSQ is intended specifically for wheelchair users, our study participants were long-term wheelchair users. We also had a larger sample size than many reliability studies for rehabilitation outcomes due to the setting of the study at a boarding school for students with disabilities. This data indicated a high degree of reliability in the context of our study site and participants.

User-informed data sets related to wheelchair satisfaction are relevant in all settings, but are particularly germane in low- and middle-income countries (LMICs). In these areas, both provision and suitability are abiding issues affecting daily functioning and quality of life for individuals with disabilities requiring the use of a wheelchair, since these individuals have historically been omitted from the process of selection and proper fit of a wheelchair to their bodies and environments. LMICs present challenges not typically associated with higher-resource areas, and the perspective of wheelchair users in these locations should be pre-eminent in determinations made on their behalf. Environmental issues, including terrain and transportation concerns, are pivotal in the determination of which chair will best serve an individual. Therefore, the WSQ has the potential to improve quality of life and functioning for wheelchair users in those settings. When used in larger scale studies at a certain location, data collected from the WSQ can inform providers and manufacturers of wheelchair performance of particular chairs in specific geographic areas. When used on an individual clinical basis, WSQ data enables valid feedback from the wheelchair user to inform modification or replacement of their wheelchair. For instance, pressure sores commonly result from poor fit of a user to their wheelchair. This issue of skin integrity compromise is one that presents discomfort and risk of infection to individuals. Each component of a wheelchair affects skin integrity [16]. The WSQ can serve to both elucidate current chair issues with the goal of remediation and predict (thus preventing) future issues related to improper fit [16,17].

Beyond physiological issues related to unsuitable wheelchairs, individuals in LMICs experience social stigma and environmental barriers, which contribute to decreased social interaction and mobility [1,18]. Individuals living with lower limb immobility-related disability in LMICs should not be further restricted by unnecessary external barriers. Poor fit to the body of the user [17], designs poorly suited to environment, and inappropriate materials for the environment all represent unnecessary hindrances to the individual. These can be remediated with sufficient and pertinent data [18,19]. The WSQ can contribute to this body of information [12].

The participants in this study had a broad spectrum of mobility function, yet all were able to complete the WSQ. This would seem to support the WSQ as a tool available to wheelchair users of a wide variety of disability levels. As anticipated, the WSQ data was, in fact, suitable for use with parametric statistical tools.

The WSQ is intended to provide a reliable tool which gives wheelchair users a voice that enables improved wheelchair provision. This study indicates that the tool is reliable in the setting of our study.

Limitations and future research

Limitations of the current study include participant age range and geographic representation. Ideally, a sample might reflect a multinational population or wider age range for broader perspective. Recommended future research utilizing the WSQ should include participants from other ages and cultures. Additional studies are needed with other populations. One of the limitations of the WSQ, as it now stands, is that it can only be completed by wheelchair users who are able to read and write well enough to complete a written questionnaire. Further work could be done to validate a version of the WSQ intended to be completed with the help of an assistant or parent. Further investigation is also needed for the cultural adaptation of school grades as anchors for the visual analogue scale. When local school grades are used as anchors for the visual analogue scale, they give an almost intuitive understanding of the scale; however, this is only the case when they are consistent with local grading systems. Language is also a limitation. At the present time, the WSQ is only available in English. It is hoped that the deliberate focus on clear language in the questions will also facilitate translation. A Spanish language translation of the WSQ is underway.

Conclusion

The results support the WSQ as a reliable outcomes measure. Because the WSQ provides user feedback on particular aspects of wheelchair structure and function, the efficacy of individual components can be underscored. Studies using the WSQ to assess specific wheelchair types could indicate consistent patterns of response, revealing relevant design issues. The WSQ enables wheelchair users to give wheelchair-specific feedback: thus, they gain a voice that allows better representation and benefit.

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