Does satisfaction with the manual wheelchair have an impact on the quality of life in spinal cord injury?

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Abstract

Customized wheelchairs are an integral component of comprehensive rehabilitation and community integration for spinal cord injury (SCI) survivors, while inappropriate wheelchairs negatively impact their functional independence, mobility and quality of life (QOL). With this in mind, this study aimed to determine the effects of manual wheelchair users' satisfaction on QOL in SCI. This cross-sectional study, which included 112 SCI, was conducted at the Paraplegic Centre, Hayatabad, Peshawar, over 6 months using "Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST)" and "World Health Organisation Quality of Life (WHOQOL-BREF)" as study tools. QUEST showed a significant positive correlation with physical health (rs=0.375; p< 0.001), social relationships (rs=0.234; p=0.013), and environmental health (rs=0.462; p<0.001) of QOL except for psychological health, and similarly, overall health and overall QOL was positively impacted. Furthermore, overall health and environmental, social relationships, and physical domains of QOL were statistically significantly impacted by the QUEST device and service aspects. A moderate level of satisfaction among participants for both devices and services was observed, which also impacts their physical, environmental, and social domains of QOL. Therefore, steps from the key stakeholders are required to provide satisfactory appropriate wheelchairs to patients so their QOL can be improved.

Introduction

Mobility, one of the main rehabilitation goals for SCI patients, impacts their quality of life (QOL), maximum independence in activities of daily living (ADL), and optimal community reintegration.[1] SCI leads to paralysis, which is the most common and evident manifestation,[2] compelling sufferers to significantly rely on mobility aids,[3] particularly wheelchairs, which serve as an essential and main source of mobility.[4] Manual wheelchairs (MWs) are widely regarded as the most popular wheeled mobility aid among SCI patients that enable their users' independence in life, engage in social activities, access services, and improve QOL.[5] These mobility devices create opportunities for their users, and their appropriateness enables them to participate in desired activities, roles, and responsibilities. Because of the injury and associated secondary complications, the QOL of people with SCI is comparatively lower than that of the general population.[6,7] The benefits offered by a wheelchair, whether they pertain to a person's mobility, community involvement, societal integration,[8] QOL,[9] self-esteem, or functional independence, are only feasible when the equipment is satisfactory for its user.[10] As it has ramifications for both the user and society as a whole, the appropriate wheelchair prescription, therefore, serves as the primary objective.[11] Earlier studies focused mainly on its design, price, delivery, and abandonment, with the least focus given to the fact that the device must be custom-made to the user's satisfaction to attain its objectives to their maximum potential. Therefore, quantification of a wheelchair user's satisfaction and its impact on QOL in SCI is of utmost importance.

Low-income countries like Pakistan struggle with quality wheelchairs, customization options, and rehabilitation services due to unique topography, socioeconomic imbalances, and inadequate infrastructure, making wheelchair acquisition and maintenance difficult.[12] The current literature only contains a single study comparing manual and motorized wheelchairs, which is difficult to locate.[13] Taking this into account, this study aims to ascertain the effects of MW users' satisfaction on QOL in people with SCI.

Materials and Methods

This cross-sectional study was conducted at the Paraplegic Centre, Hayatabad, Peshawar, Pakistan. From July to December 2022, a total of 112 SCI paraplegics (males and females), using customized manual wheelchairs (MWs) for at least a month were included via convenience sampling. Those with neurological problems other than SCI and tetraplegics were not made part of the study. The sample size was calculated using the correlation sample size formula=$[(Z\alpha + Z\beta)/C]\ 2 + 3$.

The study protocol was approved by the ethical review committee of the institute (Ref: DIR/KMU-EB/WU/000808, Dated: 11/12/2020). Informed consent was obtained from the study population, and the required information was recorded using a structured questionnaire where QUEST and WHOQOL-BREF were used for satisfaction with MWs and QOL, respectively.

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Ethics approval: the Ethics Committee approved this study (Ref: DIR/KMU-EB/WU/000808, Dated: 11/12/2020). The study conforms with the Helsinki Declaration of 1964, as revised in 2013, concerning human and animal rights.

Informed consent: all patients participating in this study signed a written informed consent form for participating in this study.

Patient consent for publication: written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

Availability of data and materials: all data generated or analyzed during this study are included in this published article.

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Satisfaction levels between 1 to 2.33 were considered low while the scores 2.34 to 3.67 and 3.67 to 5 were considered moderate and high respectively.[14] Furthermore, occasional wheelchair users were considered the ones that tend to use their wheelchairs 'less than once a month, 2 or 3 times a month," while those with a frequency greater than that were considered regular users.

For data analysis, SPSS (version 21®) was used. The Shapiro-Wilk test was used to determine data normality. Descriptive statistics such as frequency and percentages were used for data and the mean along with standard deviation/ median with an interquartile range where appropriate were used for numerical data. The association between categorical variables was determined using the Chi-square or Fisher exact test. Differences were calculated using Student independent t-test or Mann-Whitney statistics, where applicable. Similarly, one-way ANOVA with post-hoc Tukey test and Kruskal-Wallis tests were run for data with more than two categories. Various correlations were determined using Pearson and Spearman rank correlations based on the data distribution. A p-value of <0.05 was considered significant.

Results

The study includes participants with ages ranging between 17 and 65 years averaging at a mean of 31.14±10.94 years. More than half (n=61, 54.50%) of the participants were males. The majority of the participants had no formal education with 56 (50.30%) belonging to middle-income families with the thoracic spine injury being the most common site. The median time since the onset of SCI was 36.00 (60.00) months. Almost two-thirds (n=73, 65.18%) had sustained complete injury. Background and spinal cord injury-related characteristics were compared across gender and the details are summarized in Table 1.

In general, the calculated mean for the QUEST subscales, namely device and services, was 3.24±0.50 and 3.25±0.59, respectively. Additionally, the overall mean for satisfaction with the wheelchair was 3.24±0.68. Approximately 75% of the participants expressed a moderate level of satisfaction with their wheelchairs, while 20% reported a high level of satisfaction. The WHOQOL-BREF findings revealed that the mean scores were as follows: physical health (50.63±11.39), psychological health (51.47±7.42), social relationships (41.98±19.17), and environmental health (53.16±13.65). The association between outcome variables and background characteristics was determined. There was a significant mean difference between gender and the device subscale of QUEST (3.14±0.64 *vs* 3.38±0.5, p=0.029) and between socioeconomic status and satisfaction in the device domain (p=0.016) among participants. A post-hoc Tukey test revealed that the upper class had a low score compared to the lower class. There was, however, no significant relationship between the age of participants and satisfaction with wheelchair use, as well as between device and service domains. Similarly, there was a statistically significant difference in satisfaction with wheelchair service and usage of the wheelchair (p=0.038). However, there was no significant difference in satisfaction with wheelchair use across neurological levels or types of injuries. Based on the data distribution, spearman rank correlation was used to determine the relationship between satisfaction and duration of injury and wheelchair usage. It was observed that the duration of SCI and wheelchair usage were negatively correlated with the device subscale (p<0.05). Moreover, in assessing the association between WHOQOL-BREF's overall health, overall QOL, and their domains with background characteristics, a statistically significant difference was observed between males and females in terms of overall QOL (p=0.004). Similarly,

Table 1. Sociodemographic and clinical characteristics association with gender.

Characteristics	Total	Gender		p
	Male, n=61	Female, n=51		
Age, median(IQR)	28.00(12.75)	28.00(9.00)	29.00(19.00)	0.174¶
Education, n (%)				
No formal education	46(41.07)	9 (14.75)	37(72.55)	0.000
Primary	25(22.32)	19(31.15)	6(11.76)	
Middle	20(17.86)	18(29.51)	2(3.92)	
Higher	21(18.75)	15(24.59)	6(11.76)	
Economic status, n (%)				
Lower	52(46.43)	28(45.90)	24(47.06)	0. 173
Middle	56(50.00)	29(47.54)	27(52.94)	
Upper	4(3.57)	4(6.56)	0(0.00)	
Duration of injury, median(IQR)	36.00(60.00)	48(72.00)	24(28.00)	0.004¶
Neurological level, n (%)				
Complete	73(65.18)	44(72.13)	29(56.86)	0.112
Incomplete	39(34.82)	17(27.87)	22(43.14)	
Type of injury, n (%)				
Thoracic	80(71.43)	47(77.05)	33(64.71)	0.107
Lumbar	32(28.57)	14(22.95)	18(35.29)	
Wheelchair usage, n (%)				
Regular	90(80.36)	50(81.97)	40(78.43)	0.643
Occasional	22(19.64)	11(18.03)	11(21.57)	
Comorbidities, n (%)				
Present	30(26.79)	11(18.03)	19(37.25)	0.032
Absent	82(73.21)	50(81.97)	32(62.75)	
Duration of wheelchair use, median(IQR)	24.00(54.00)	36(60.00)	12(33.00)	0.004¶

¶Mann Whitney statistics

the presence or absence of comorbidities was significantly associated with overall QOL (p=0.015). With regards to QUEST's items majority 53(47.32%) users in the category 'dimensions' reported being 'more or less satisfied' while for 'effectiveness' n=48, 41.96% and for 'professionalism of service' 16.96% reported being 'quite satisfied' and 'very satisfied' respectively. In the "repair and service" area, 29.46% of customers responded "not very satisfied," while 14.29% in the 'weight' category gave a 'not satisfied at all' response as shown in Figure 1. The correlation analysis showed that QUEST exhibited a significant positive correlation with physical health (r_s=0.375; p<0.001), social relationships (r_s=0.234; p=0.013), and environmental health (r_s=0.462; p<0.001) of QOL except for psychological health. Similarly, overall health and overall QOL were positively influenced. Furthermore, the QUEST device and service aspects had a statistically significant impact on overall health, as well as the social relationships, physical, and environmental domains of QOL. Conversely, overall QOL was impacted by device subscale only in the study sample (r_s= 0.445; p<0.001) as depicted in correlogram Figure 2.

Discussion

SCI patients heavily rely on wheelchairs for mobility, enabling daily activities and enduring companionship. The satisfaction found was moderate (3.24) for the wheelchair in this study, but in the Swedish population, high satisfaction levels were reported by Samuelsson *et al*.[15] Although, participants in both studies reported regular use of their wheelchairs, greater satisfaction (>80%) with the device could be attributed to factors such as effectiveness, durability and dimensions, with users being "quite" to "very satisfied," while in this study, MW users for dimensions and comfort showed "more or less satisfaction (44.6%)

Similarly, a study conducted by de Groot *et al*., found high levels of satisfaction with wheelchair-related aspects compared to services and a higher level of satisfaction with its dimensions. Moreover, an active lifestyle was found in those with higher overall satisfaction. Furthermore, the highest satisfaction 55.2% was found in effectiveness, 50.5% in simplicity of use and 45.3% in dimensions while in this study, comfort, dimensions and effectiveness were the identified components (>40%).[14] Furthermore, a study conducted by Amosun on locally manufactured wheelchairs in Tanzania reported high satisfaction with the features of the wheelchairs, where subjects expressed satisfaction with the durability (89%), and the professional services received (71%), compared to our study where customized wheelchairs were used, with overall satisfaction for both durability and professional services received was 45.60%.[16]

A study conducted in Zimbabwe reported the highest dissatisfaction (>75) with durability, followed by weight then ease of adjustment.[17] In the current study subjects were not dissatisfied, but the least dissatisfaction (<15%) that was documented was in follow-up, professional services and weight.

In a regional study by Sadiya *et al*. although it involved the most popular wheelchairs in India, *i.e.* "Karma" and "Artificial Limbs Manufacturing Corporation of India" (ALIMCO), still reported dissatisfaction, with 97% in follow-up, repairs and servicing and 94% in professional services.[18]

In this study, the mean score of the device subscale significantly differed between males and females as did the socioeconomic status. Similarly, the duration of injury and wheelchair usage were significantly negatively correlated with the device subscale. Contradictory results have been reported in the literature, a study conducted by de Groot *et al.*, found no variation in D-QUEST between gender, age and level of lesion.[14] Likewise, Amosun reported no differences between males and females in wheelchair features and service delivery.[16] Lee *et al.* in South Korea found high satisfaction for both genders in both categories

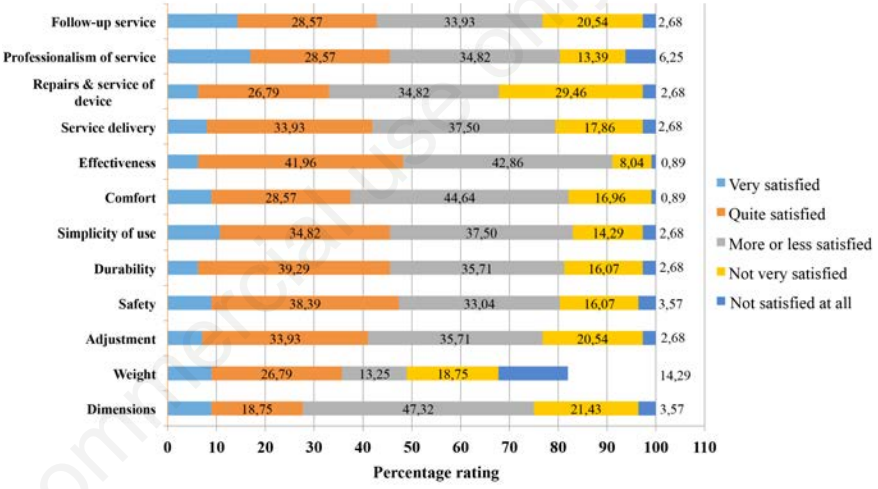

Figure 1. QUEST item ratings.

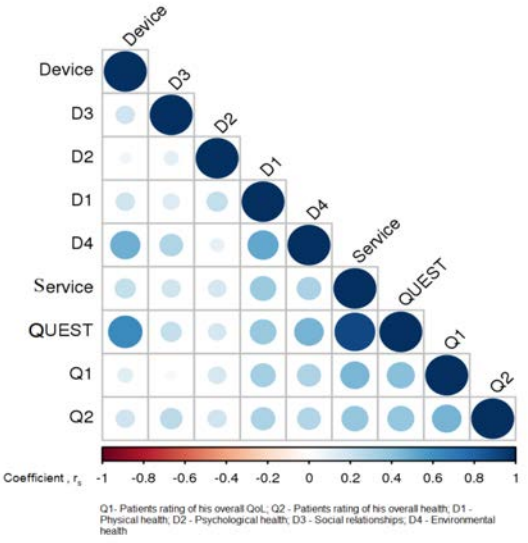

Figure 2. Correlation between QUEST and QOL.

of QUEST.[19] Furthermore, participants in the current study reported comparatively high (3.26>3.18) satisfaction with the device. Marchiori *et al.* studied not only the satisfaction scores of wheelchair users but their caregivers as well and found good satisfaction levels, with the majority like the current study being regular users. The author also reported no differences between the satisfaction scores of the occasional and regular wheelchair users similar to the age groups, sex or cause of MW use regarding global satisfaction scores and satisfaction with each parameter.[20]

Geilen *et al.* found more or less satisfaction (3.8) for MWs in Bangalore with more satisfaction seen for devices than services. Although gender, duration of the disability and a higher level of education (>0.05) were found related to satisfaction scores, females were reported to be more satisfied with the device than men (3.95>3.70). Age however was negatively correlated with QUEST. The variation is, the inclusion of customized wheelchairs in our study while Indians included children's, 3-wheeled, hospital-style and rough terrain-style wheelchairs.[21] A range of factors can be attributed to dissatisfaction including, appropriateness, provision and population characteristics both in terms of socioeconomic and SCI characteristics. For instance, a study in Brazil with a rigid frame wheelchair design reported high satisfaction (mean of 4.2).[22] Similarly, in India, where dissatisfaction with MWs was reported, the level of injury might be the cause (tetraplegics).[18]

The level and severity of SCI can impact wheelchair satisfaction. Individuals with higher-level injuries (such as tetraplegia) typically face greater challenges in terms of independence and functional limitations.[18, 23] Age-related physical limitations and comorbidities impact wheelchair mobility satisfaction and overall satisfaction.[21] Similarly, gender differences could be due to differences in body mechanics, social roles, and expectations. The duration of wheelchair use can also have an influence.[24] Wheelchair users' satisfaction can have a direct impact on overall QOL. A wheelchair that meets functional independence and allows for increased mobility can positively influence QOL. Similarly, it has a significant impact on their psychological well-being, hence contributing to positive self-esteem, self-image, and mental well-being, which are essential components of overall QOL.[8,13]

In this study, wheelchair satisfaction revealed positive impacts on environmental, physical and social domains of QOL except the psychological domain. Our findings are consistent with previously published study results. A study in Tanzania reported improved QOL as well as activity and participation with wheelchair satisfaction.[16] Similar results were also found with a low-cost wheelchair even in a multinational study where it improved QOL and independence after one year of use.[9] Recently a study conducted in Pakistan also found improvement in QOL of SCI paraplegics using both manual and motorized wheelchairs if they were satisfied with their device.[13]

A multinational study found that GEN_2 wheelchair design was better than GEN_1, however, overall health status and distance covered showed variation over time, and receiving one of two models appears to have a positive long-lasting effect on income and employment.[24] Similar to the current study Olaleye *et al.* found wheelchair satisfaction to be associated with QOL. Furthermore, the author reported a significant relationship between the functioning, psychological situation and independence domains of SCI-QOL and satisfaction with wheelchair use among the participants. However, there was no significant relationship between the MOOD domain of HRQOL and satisfaction with wheelchairs.[8] On the other hand, some studies reported no significant results. De Groot reported no association of QUEST with activity and participation.[14] Similarly, a study from China found no impact of wheelchair satisfaction on QOL in SCI. Although satisfaction with devices was higher than satisfaction with services, this is similar to the current study. The correlation of the device (QUEST) with QOL and with the psychological domain was weak but marginal but in our study significant relationship between the device subscale and overall QOL, physical health, and social and environmental health was noted.[25] A study by Lee *et al.,* reported that the parameters of device domain were associated with active lifestyle and participation.[20]

A moderate association was observed between the environmental and physical domain with QUEST but no association between services and QOL which is contradictory to our study where the association between services and physical, social and environmental health($p<0.05$) was observed.[25] The greater the involvement of patients in the process of prescribing wheelchairs, the higher their satisfaction and their functional mobility, suggesting the significance of client involvement in prescription.[26] Further studies on this topic in different setups and other types of wheelchairs are required to validate these findings. There could be several justifications for these findings. Psychological well-being is influenced by a multitude of factors beyond wheelchair users' satisfaction. Factors like social support, coping mechanisms, and personal resilience have a strong influence. Additionally, other factors such as age, cultural background, prior psychological experiences, measurement limitations, contextual factors, timeframe considerations, body image and appearance which cannot be improved due to permanent body paralysis, may also impact the relationship between wheelchair satisfaction and psychological well-being.[27] Furthermore, this study not only included regular wheelchair users but also occasional wheelchair users. This inclusion aimed to gain insights from both categories of users regarding their satisfaction levels with wheelchairs and how it can impact their QOL. Limiting the study to only regular users would introduce bias into the results, as it would provide insights from a single category of users utilizing the same type of device (customized wheelchairs). Previous studies have identified sources of occasional wheelchair usage, such as depression, social isolation, and wheelchair breakdowns.

Strength and limitations

This study incorporated customized manual wheelchairs, recognized as potentially the most optimal assistive devices for individuals with SCI when compared to standard wheelchairs. Data collection was executed by a singular researcher, mitigating the potential for bias resulting from divergent interpretations of questionnaire items by different researchers. A noteworthy limitation of the study pertains to its design and the limited sample size. The exclusion of tetraplegics from the study cohort was predominantly influenced by their comparatively restricted ability to operate manual wheelchairs effectively. Moreover, generalizability was also limited as it was conducted at a single center.

Conclusions

Customized MW (Manual Wheelchair) user satisfaction positively impacts the environmental, physical, and social domains of quality of life (QOL). To achieve this goal, it is imperative to implement special measures that ensure the satisfaction of wheelchair users. It is worth noting that even minor improvements in the QOL of wheelchair users can be immensely beneficial. Therefore, it is crucial to prioritize the satisfaction of wheelchair users by taking appropriate measures to make the device more comfortable and efficient for them, especially at the policy level. This

research addresses an important idea, customized wheelchairs, for which data is very scarce, especially in a country like Pakistan. Hence, it will add valuable data to the body of research and might provide material that can encourage future researchers to conduct studies on such an important topic.

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