ORIGINAL RESEARCH

Validation of Chichewa Short Musculoskeletal Function Assessment (SMFA) questionnaire: A cross-sectional study

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Abstract

Background
The Short Musculoskeletal Function Assessment (SMFA) tool measures function and quality of life in patients with musculoskeletal conditions.
Objective
This study aimed to translate and adapt culturally the SMFA into *Chichewa,* and assess its clinimetric properties.
Methods
The translated *Chichewa* version was administered to 53 patients with musculoskeletal disorders. To assess repeatability, an additional 20 patients answered the questionnaire twice over a time interval of two weeks. Internal consistency, floor and ceiling effects, and repeatability were tested; construct validity was assessed with the World Health Organization Quality of Life Assessment tool (WHOQOL-BREF).
Results
There was good internal consistency for both Dysfunction and Bothersome indices (Cronbach's alpha 0.90) and good construct validity between both indices with the WHOQOL-BREF. Pearson's correlation coefficient and intraclass correlation coefficient (ICC) for repeatability for the Dysfunction Index were 0.941 and 0.922 (95% CI: 0.772, 0.971) respectively, and 0.877 and 0.851 (95% CI: 0.629, 0.941) for the Bothersome Index respectively.
Conclusion
The translated *Chichewa* SMFA is a valid tool for populations that speak the *Chichewa* language.

Keywords: Short Musculoskeletal Function Assessment Questionnaire, SMFA, *Chichewa*, clinimetric measures, quality of life

Introduction

Trauma and musculoskeletal impairment (TMSI) conditions are the most common cause of severe long-term pain and physical disability worldwide [1]. TMSI conditions vary in clinical presentation and include both acute and chronic disorders. Examples include low back pain, different types of arthritis, and musculoskeletal injuries such as fractures and sprains.

In the 2010 World Health Organization Global Burden of Disease (WHO-GBD) study, musculoskeletal disorders accounted for 21.3% of Years Lived with Disability (YLDs) globally[2]. Low back pain (LBP) was the leading cause of YLDs, whereas neck pain was the fourth cause [2]. Although most musculoskeletal disorders do not directly lead to mortality, they limit individuals' activities and capacity to live independent lives. Hence, their impact on quality of life is significant, leading to loss of productivity for the individuals and society. The World Health Organisation has recognized the significant contribution of musculoskeletal problems towards the total burden of disease as can be seen by their endorsement of the Bone and Joint Decade from 2000-2010 [3]. Most musculoskeletal impairment (MSI) conditions are associated with increasing age and lifestyle. The increasing number of older people globally [4], the epidemiological shift of disease pathology and the escalating burden of trauma in low- and middle- income countries mean that these conditions will increase, and so will their resulting burden in these countries. Malawi has a population of approximately 18 million with 83% of the population living in rural areas [5]. The country has one of the lowest Gross National Income (GNI) per capita in the world at 320 USD [6]. In 2009 injuries were responsible for 5.1% of all Disability

Adjusted Life Years (DALYs) in Malawi [7]. The common musculoskeletal disorders endure for long periods, even if their limit on function is less than some other diseases. As a result, musculoskeletal disorders ranked as the third leading cause of years lived with disability (YLD) in Malawi in 2016, with 909 YLD per 100,000 [8]. This was in contrast to other non-communicable diseases with 1714 YLD per 100,000 and mental disorders, with 1555 YLD per 100,000. In 1990, musculoskeletal disorders had ranked fifth, when nutritional deficiencies (1167 YLD) and malaria/neglected tropical diseases (985 YLD) were more prominent[8]. In 2016, musculoskeletal disorders ranked thirteenth as a cause of DALYs (929 DALYs per 100,000) [8].

There is need to understand the effect of TMSI on the quality of life in developing countries such as Malawi which are experiencing an increase in trauma and musculoskeletal impairment. A standardized simple assessment of the function of people with musculoskeletal disorders could help to determine the impact of the disease on the individual's daily life. Results from musculoskeletal function assessment over the course of a disease will also help to optimize interventions to improve function or prevent progression of the disease and long-term disability. The Short Musculoskeletal Function Assessment (SMFA) is a tool designed to measure function in patients with a broad range of musculoskeletal disorders and may be used for assessment of the health status of the patient or impact of treatment [9]. It is widely used in English-speaking countries. However, it is now recognized that if questionnaires are to be used across cultures, they must not only be translated well but must also be adapted for a particular culture to maintain content validity of the instrument [10]. Thus, there are several non-English versions of the SMFA that have been cross-culturally adapted, and their validity and reliability have been studied, proving to be consistent across gender and age categories [11-14]. However, to our knowledge, there is no*Chichewa* version of the SMFA adapted for the Malawian community. *Chichewa* is the language of the Chewas, the biggest population group in Malawi, and is spoken by around two-thirds of the population especially in the populous central and southern regions and is also spoken in parts of Zambia and Mozambique [15]. The literacy rate for adults (aged ≥15 years) in Malawi is 64% with 42% of the population being literate in *Chichewa* only [5], hence the need to use a *Chichewa* version of the SMFA when assessing musculoskeletal function status. This paper describes the validation of the SMFA *Chichewa* version in Malawi.

Methods

This study was done in two stages. Firstly, the English version of the SMFA questionnaire was translated into *Chichewa*. Secondly, the clinimetric properties of the translated version were assessed. The World Health Organization Quality of Life (WHOQOL) assessment tool was used to assess the construct validity of the *Chichewa* SMFA. The WHOQOL-BREF was the only quality of life assessment tool that was previously translated and validated in *Chichewa* [16]. Written informed consent was obtained from all patients who took part in the study. Ethics approval was obtained from the College of Medicine Research Ethics Committee (COMREC) and the University of California San Francisco Medical Center Institutional Review Board.

Description of the tools

The SMFA is a 46-item self-reported functional status questionnaire, which has two parts: the Dysfunction and Bothersome indices [9]. The Dysfunction Index consists of 34 questions that assess the functional status of the patients, whereas the Bothersome Index has 12 questions that allow patients to evaluate how bothered they are by their functional problems. The Dysfunction Index questions are grouped into four categories: daily activities, emotional status, hand and arm function, and mobility. The Bothersome Index questions assess how much one is bothered in areas of recreation or leisure, work, sleep and rest. All items are rated on a 5-point scale with a score of 1 indicating no problem, or not at all bothered, and a score of 5 indicating unable to do something or extremely bothered. The total scores for each sub scale are then standardized using the formula: *(Actual raw score – lowest possible score / possible raw score range) x 100*. The standardized scores for each subscale or index range from 0 to 100 with higher scores indicating poor function.

Translation Process

The translation process followed a standardized procedure[10]. Firstly two bilingual translators with *Chichewa* as their mother tongue translated the English questionnaire independently into *Chichewa*. Differences from these two translations were resolved by consensus between the translators, and one *Chichewa* questionnaire was accepted. Secondly, the accepted *Chichewa* version was translated back into English by another set of two independent translators, with no prior knowledge of the contents of the SMFA questionnaire. These back-translated forms were compared with the original form to ensure that they had the same content. A committee then reviewed the translated questionnaire to ensure that the wording was clear, that there were no vague sentences, the words meant the same, and that they had experiential equivalence. Experiential equivalence means that activities of daily living in the translated version of the questionnaire reflected activities of daily living in Malawian culture. The committee consisted of three orthopaedic surgeons, two research assistants, and two lay people from the community. The translated questionnaire was then pre-tested on a purposive sample of 20 non-study participants with different musculoskeletal problems before administering them to the study population, as recommended by Beaton et.al. [10]. The aim of pre-testing was to explore how the participants interpreted the items on the questionnaires and whether they understood the meaning of the questionnaire items but also to probe the meaning of their responses. Only a few minor corrections on some words were made after the pre-testing.

Study setting and participants

The final translated *Chichewa* version of the SMFA and the WHOQOL-BREF were administered to 53 participants to assess the clinimetric properties of the translated version of the SMFA. Another sample of 20 participants separate from the initial population answered the questionnaire twice at an interval of 2 weeks apart to test for repeatability. The respondents were consecutive patients with either traumatic or non-traumatic musculoskeletal problems presenting at Queen Elizabeth Central Hospital's orthopaedic wards or

outpatients clinic, from October 2015 to March 2016. Queen Elizabeth Central Hospital, which is located in the city of Blantyre, is a tertiary care facility and the main teaching hospital in the country. Orthopaedic patients come from within Blantyre or are referred from any of the 13 districts in the southern region of the country. Outpatient clinics are done once a week. Sample size determination was based on guidelines for the process of cross-cultural adaptation of self-report measures[10].

Statistical analysis

The initial population of 53 respondents completed 99.9% of all SMFA and WHOQOL-BREF questions, while the test-retest population of 20 respondents answered 97.9% of questions. Given their small number, unanswered questions were disregarded in statistical analysis. To aid in the investigation, the SMFA was categorized into its two documented subscales: the Dysfunction Index and the Bothersome Index, consisting of 34 and 12 questions respectively. Each response was scored and raw scores for each patient's Dysfunction Index were calculated by summing up scores for questions 1 to34. Raw scores for each patient's Bothersome Index were calculated by summing up scores for questions 35 to 46. The data from these separate subscales were analyzed using IBM SPSS Statistics version 23 to determine validity, internal consistency, floor/ceiling effects, and repeatability.

Construct validity

Construct validity was utilized to determine that the *Chichewa* translated SFMA measured quality of life similarly to a previously validated *Chichewa* translated measure of general health. To measure this, Pearson correlation was calculated for the Dysfunction Index and Bothersome Index with the WHO-QOL domain scores for overall health, physical, psychological, social, and environment. The WHOQOL-BREF is a 26-item shorter version of the WHOQOL-100, and is divided into four domains namely: physical, psychological, social and environmental[17]. The closer the R-value is to 1 indicates increasing convergence between the two measurement tools. By convention, strong, good, moderate, and weak correlations were defined as >0.70, 0.50-0.70, 0.30-0.50 and <0.30, respectively.

Internal consistency

Internal consistency is utilized to determine the homogeneity of an individual subscale. Essentially, this value demonstrates that a group of questions is evaluating the same construct [18]. To measure this, Cronbach's alpha was calculated for each subscale. A Cronbach's alpha >0.70 was accepted as being significant [18].

Floor/ceiling effects

To determine if floor and ceiling effects were present, the percentage of patients who achieved the best scores and those who achieved the worst scores for both indexes were determined for each subscale using the initial population. Floor or ceiling effects were considered to be present if 15% of respondents or greater reported either the worse or best possible scores, respectively [18].

Repeatability

To assess repeatability, questionnaires were analyzed to determine their agreement—the extent to which scores from different time points resemble each other—and reliability, which measures how easily patients can be distinguished from each other on repeated testing. For these analyses, the test-retest population was utilized. The sum of the scores for the SMFA subscales was determined at each of the two time points. To assess agreement, the mean difference of the sums between time points was calculated, along with their respective 95% confidence intervals (CI). Scores were considered to be statistically similar if the confidence interval contained zero. Reliability was evaluated by determining the Pearson's correlation coefficient and the intraclass correlation coefficient (ICC) between sums (or index scores) at the two time points. The ICCs were determined using the two-way random effects model with agreement type, along with their corresponding 95% confidence interval. A significant correlation was demonstrated by an ICC value of 0.70 or higher [18].

Results

Demographics

In the initial population, 53 patients were included and 20 patients were included in the test-retest population. The mean age was 36.5 years in the initial population and 43.4 years in the test-retest population. Of respondents in the test-retest population, 18 (90%) were males. All patients in the test-retest population had fractures whereas 62.1% of the initial population had fractures. Demographic details for both populations are shown in Table 1.

Table 1: Patient demographics

	Initial Population (N=53)	Test-Retest Population (N=20)
Average Age (SD)	36.5 (14.6)	43.4 (17.2)
Gender: N (%)		
Male	28 (52.8)	18 (90)
Female	25 (47.2)	2 (10)
Education Level: N (%)		
Did not attend	0 (0)	2 (10)
Primary	13 (24.5)	9 (45)
Secondary	9 (17)	6 (30)
College/University	4 (7.5)	3 (15)
Not disclosed	27 (50.9)	0 (0)
Injury: N (%)		
Femur fracture	11 (20.8)	7 (35)
Tibia/Fibula fracture	12 (22.6)	5 (25)
Radius/Ulna Fracture	6 (11.3)	1 (5)
Back Pain	5 (9.4)	0
Ankle fracture	4 (7.4)	0
Joint Dislocation	5* (9.4)	0
Other	10# (18.9)	7^ (35)

*=Joint dislocation includes: 2 hip, 2 elbow, and 1 ankle dislocations.
#=Other includes: stiff knee, joint pain, shoulder pain, clavicle swelling, knee fracture, bilateral leg swelling, thumb fracture, lower extremity amputation, painful fore-

arm, and bilateral lower extremity tendon injury.
^=Other includes: pelvic fracture, amputated hand, maimed lower extremity, gunshot wound to femur, bilateral lower extremity fractures, chronic osteomyelitis, and a review of previous femur operation.

The majority of patients found the questions in *Chichewa* clear and easy to understand. Question 15 regarding how difficult it is for one to drive did not apply to the majority (75%) of respondents, as they do not drive cars. Question 2 regarding how difficult it is to open medicine bottles or jars was adapted because, in Malawi, medicines are dispensed in packets rather than bottles or jars. Accordingly, the respondents were asked to say how difficult it is for them to open other small bottles or jars.

Internal consistency

Cronbach's alpha was 0.90 for both the Dysfunction and Bothersome indices (Table 2).

Floor/ceiling effects

The Bothersome Index of the SMFA had 9.4% (5/53) respondents reporting the best possible functioning score. No patient reported the best possible score in the Dysfunction Index. No respondents reported the worse functioning score on any of the indices (see Table 2).

Table 2: Questionnaire internal consistency, floor/ceiling effect, repeatability

	SMFA	
Subscales	Dysfunction Index	Bothersome Index
Internal Consistency		
Cronbach's Alpha	0.90	0.90
Floor/Ceiling Effect: N (%)		
Floor Effect	0/53 (0)	0/53 (0)
Ceiling Effect	0/53 (0)	5/53 (9.4)
Repeatability*		
Baseline Average (SD)	94.7 (17.3)	35.1 (5.9)
Follow-up Average (SD)	91.0 (18.0)	33.7 (5.4)
Mean Difference (95% CI)	-3.65 (-3.65, -0.65)	-1.45 (-2.78, -0.12)
Pearson's Coefficient	0.941	0.877
ICC (95% CI)	0.922 (0.772, 0.971)	0.851 (0.629, 0.941)

*For repeatability, the units for baseline and follow-up averages are different for each subscale. For the two indices of the SMFA, the average is the average sum of each patient's responses to all questions in that subscale.

Construct validity

There was moderate to good correlation between the Dysfunction and Bothersome indexes of the SMFA and each of the WHOQOL-BREF domains (Table 3).

Table 3: Construct validity SFMA with WHOQOL-BREF

	WHOQOL-BREF: Domains				
SFMA	General Health	Physical	Psychological	Social	Environment
Dysfunction Index (R)	-0.61 (p=0.0002)	-0.43 (p=0.043)	-0.39 (p=0.0684)	-0.43 (p=0.0474)	-0.57 (p=0.0272)
Bothersome Index (R)	-0.51 (p=0.0256)	-0.39 (p=0.0412)	-0.42 (p=0.0433)	-0.34 (p=0.0754)	-0.48 (p=0.0392)

Repeatability

All data for repeatability is listed in Table 2. The Dysfunction Index of the SMFA had a mean difference of -3.65 (95% CI: -6.65, -0.65), while the Bothersome Index had a mean difference of -1.45 (95% CI: -2.78, -0.12). The Pearson's correlation coefficient and ICCs for Dysfunction Index were 0.941 and 0.922 (95% CI: 0.772, 0.971) respectively. For the Bothersome Index, Pearson's correlation coefficient was 0.877 and the ICC was 0.851 (95% CI: 0.629, 0.941).

Discussion

The findings in this study demonstrated sufficient validity, repeatability and internal consistency indicating that the *Chichewa* version of the SMFA is a valid and reliable tool that can be used to assess function in patients with musculoskeletal conditions. Translation and cross cultural adaptation of assessment tools is important to ensure validity.

The good internal consistency of the *Chichewa* SMFA with a Cronbach's alpha of 0.90 for both the Dysfunction and the Bothersome Indexes demonstrates that the *Chichewa* questions were evaluating the same construct, thus each category in the translated version maintained its homogeneity. Our findings are comparable to those found in the initial validation of the SMFA where the Cronbach's alpha was 0.95 and 0.92 at baseline for Dysfunction and Bothersome Index respectively [9]. The internal consistency results from the Dutch, Brazilian, Swedish and Chinese SMFA validation studies [11-14] also compare satisfactorily with our results.

There were no floor effects for both indices and only a small ceiling effect for the Bothersome Index. The proportion of ceiling effects in our study is less than what was found in the Dutch validation study[12] where the Bothersome Index had ceiling effects of 14.2%. Swiontkowski et al. reported no floor effects and less than 5% ceiling effects in the initial validation study [9]. Although the ceiling effects in our study were higher than in the study by Swiontkowski et al., they are still lower than the accepted limit of 15%. One explanation for the ceiling effects can be the possibility that a proportion of patients had successful treatment and were just coming to the clinic for regular follow up, without having any limitation in function and hence scored best possible scores. Duration from time of injury or onset of symptoms was not recorded in this study and therefore further analysis to substantiate this hypothesis could not be done.

There was good correlation between the SFMA scores and the *Chichewa* version of WHOQOL-BREF general health scores. This finding highlights that there was a degree of external consistency of the *Chichewa* SFMA to measure overall

general health. There was also moderate correlation between the SFMA and the WHO-QOL environment subsection. Of note, however, there was borderline correlation between the dysfunctional index of the SMFA and the psychological-domain of the WHOQOL-BREF at 0.39 and Bothersome Index and physical and social domains was 0.39 and 0.34 respectively. These findings suggest that the *Chichewa* SFMA cannot be used to measure specific domains of psychological, social, and physical domains. Future studies using the *Chichewa* version SFMA should be cautious in attempting to associate findings beyond the general overall health of subjects, specifically to the psychological or social domains. The *Chichewa* SFMA should be used with other validated measures to make inferences on these domains.

The test-retest reliability of the *Chichewa* SFMA between baseline and 2 weeks later was high with Pearson's correlation >0.88 and intraclass coefficients >0.85. These results are comparable with the findings in the study by Swiontkowski et al. [9].

This is the first study to evaluate the clinimetric properties of a translated *Chichewa* version of the SMFA. This study has several strengths. Firstly, although our sample size was small, our findings were comparable with other validation studies and showed that the *Chichewa* version of the SMFA is a valid tool that can be used to assess musculoskeletal function in patients with similar conditions as our study population. Secondly, the test-retest respondents answered the questions two weeks apart. Marx et al.[19] found no statistically significant differences in test-retest reliability of health status instruments between the time intervals of 2 days or 2 weeks among orthopaedic patients with knee disorders. The time interval in our study was adequate to minimize the possibility of recall bias and not too long to allow for significant change in disease status; so the responses were likely to be stable.

The study had some limitations. The majority of participants in both populations were treated for fractures, most of which were lower limb fractures. This dominance of fractures may limit the generalizability of the findings to other non-traumatic musculoskeletal conditions. Additional studies with wider variation of musculoskeletal disorders should be performed to examine the generalizability of our results. Another limitation is that there was uneven distribution of gender in the test-retest population which may have affected the results as some studies have suggested that gender may have a significant impact on both general and health related quality of life [20, 21]. Presence of comorbidities was not assessed in this study. Consequently, dysfunction may have been caused by other comorbidities rather than musculoskeletal conditions. Data on comorbidities would also have helped assess divergent validity.

Conclusion

In conclusion, our findings have shown that our *Chichewa* version of the SMFA is a valid and reliable tool that can be used to assess musculoskeletal function in populations who speak the *Chichewa* language.

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Conflict of interest

All authors declare that they have no conflict of interest.

Ethical approval

This article does not cite any animal-based studies. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards**.** The study was approved by the College of Medicine Research Ethics Committee (COMREC).

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