Clinical and non-clinical factors affecting quality of life in lower limb amputees

Sarah Day, University of Strathclyde

Wa'el Qa'dan, University of Jordan

Introduction:

Amputation is one of the most common disabilities [1]. It is defined as the removal of a total or partial body part [2]. Amputees in general, including lower limb amputees, experience multiple challenges which may highly affect the quality of their life in comparison with normal population [2, 3].

Quality of life (QOL) has been defined by the World Health Organisation Quality Of Life (WHOQOL) group" as individuals' perceptions of their position in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns" [4]. QOL is described as a multi-dimensional concept [5, 6, and 7]

incorporating life satisfaction, morale, and happiness which are best assessed by the person himself [8].

Measuring QOL facilitates clinical decision-making as QOL in amputees reflects their satisfaction about their prostheses [9]. It also facilitates identification of the clinical, surgical, and prosthetic options available for the patient, and enables observing variations in response to treatment [10]. Measuring quality of life provides a complete and clear view of patient care [10].

There are many ways to measure QOL. These include -among others- Short Form 36 (SF-36) [11], Sickness Impact Profile (SIP) [11], Profile of Mood States short form (POMS-sf) [11], Prosthesis Evaluation Questionnaire (PEQ) scales [11], and Trinity Amputation and Prosthesis Experience Scales (TAPES) [4]. PEQ is widely used [11, 12, 13, 14, and 15] because of its focus on amputation and prosthesis related quality of life [5, 6] and functional outcomes [6], its validity [5, 6], and its temporal stability [6].

PEQ is composed of 9 scales -each of which is composed of several questions- and other individual questions. These 9 scales evaluate many factors, namely; ambulation, appearance, frustration, perceived response, residual limb health, social burden, prosthetic sounds, utility, and wellbeing [16].

Several studies suggest that other factors may also affect the quality of life of amputees but are not evaluated in the PEQ. These may include gender [17,18, 19, and 20], age of the amputee [7, 19, and 20], level of amputation [5, 7, 17, and 19], aetiology of amputation [21], age of the amputee at the time amputation surgery was done [7, 18,and 22], amputee's expectations after amputation [22], comorbidities [23], and use of assistive devices [7, 23].

Other factors which were not mentioned in previous studies are also expected to have an effect on quality of life of amputees. These may include occupation, education, amputee dependence, life changes after amputation, and amputee's participation in amputation surgery decision making.

The current study is designed to test which of these factors may have an effect on the quality of life of lower limb amputees at the trans-tibial and trans-femoral level.

Methods:

This study was designed to test the effects of 15 factors on the Quality Of Life (QOL) in lower limb amputees by filling the Prosthesis Evaluation Questionnaire (PEQ). The factors to be tested were gender, age, education level, comorbidities, age of the

amputee at the time amputation surgery was done, aetiology, amputation level, length of the residual limb, participation in amputation surgery decision making, occupation before and after the amputation surgery, prosthetic use expectations, prosthetic components, time of prosthesis use per day, use of walking aids with the prosthesis, and dependence of the amputee.

Subjects:

Sample size:

This study evaluates fifteen clinical and non-clinical factors that may affect amputees' quality of life, and uses Exploratory Factor Analysis (EFA) for statistical analysis. As a rule of thumb, 10 subjects per factor is the minimum number to get interpretable results by EFA [24], and thus 150 amputees is the minimum number of subjects needed.

Subject recruitment:

Amputees were recruited from different places in the Hashemite Kingdom of Jordan, namely; Royal Medical Services, Ibn Sina private centre, Holy lady of peace centre, Al-Basheer governmental hospital, Al-Hussein centre for mobility disabilities, and Hazar private centre.

Amputees were not contacted until permissions were taken from all data collection sites. Amputees also filled and signed a consent form prior to their participation in the study.

Inclusion criteria:

Amputees included were:

1- Older than 18 years

2- Trans-tibial and trans-femoral unilateral amputees only

3- Using their prosthesis for at least 3 months prior to data collection time

Evaluation tools:

Arabic version of the Prosthesis Evaluation Questionnaire (PEQ) [25] was used. PEQ is valid, reliable, and has been used widely in amputees' quality of life research. A short questionnaire was added to the Arabic version of PEQ. The short questionnaire is composed of questions regarding the factors evaluated in the study (Appendix A). The factors included in the questionnaire were: gender, age of the amputee at the time of the study, education level, comorbidities, age of the amputee at the time amputation surgery was done, level of amputation, aetiology of the amputation, length of the residual limb, participation in amputation surgery decision making, occupation before and after the

amputation surgery, prosthetic use expectations, prosthetic components, time of prosthesis use per day, use of walking aids with the prosthesis, and dependence of the amputee. **Data collection:**

Data collection took place in the centres mentioned previously after taking permissions to do so. The researchers of the study helped amputees matching the inclusion criteria to fill the short questionnaire (added to the Arabic version of PEQ), the researchers also helped explain any unclear questions in the PEQ to the amputees.

Data extraction:

Questions of the Arabic version of PEQ come in the form of visual analogue scale of 100 mm length. Transparent ruler is used to measure amputees' responses to PEQ answers.

Data analysis:

Exploratory factor analysis is used to determine which factors have greater effect on the QOL of amputees. Exploratory factor analysis incorporates extraction of factors and rotation. Factors considered more effective are those with relatively higher Eigen values generated after the test. This is judged by a look at a scree plot.

Excel (Microsoft, USA) is used in data entry and organisation. SPSS 19 (SPSS Inc, USA) is used in statistical analysis.

Results:

The researchers of the study were able to contact and provide the questionnaire of the study to 79 amputees, of which 24 questionnaires were excluded as some of them were incompletely filled or filled in a wrong way. The final number of questionnaires used in this study was 55. The questionnaires were filled by 42 trans-tibial and 13 trans-femoral amputees, mean age 54.3 ± 15.8, 45 males and 10 females. The cause of amputation was Peripheral Vascular disease (PVD) in 30 amputees, trauma in 24 amputees, and malignancy in one amputee. The amputees had several comorbidities including hypertension, chronic obstructive lung disease, heart diseases, and renal failure. Demographic data of amputees and factors details are provided in (Table 1).

As the number of questionnaires filled by the amputees recruited (55) was smaller than the number required to test the 15 factors, and as ten subjects per factor are needed to get interpretable results (mentioned in the methods under "sample size" heading), only six factors were to be considered in the analysis. Upon reviewing the 15 factors originally

intended to be analysed, six factors were the most common factors asked about in clinical practice forms. These six factors were accordingly chosen to be tested. The tested factors are: age of the amputee at the time amputation surgery was done, aetiology, age of the amputee at the time of the study, comorbidities, gender, and level of amputation.

Kaiser-Meyer-Olkin (KMO) and Bartlett's tests are used as a first step in statistical analysis to test if the sample is adequate [24]. Adequate samples usually result in KMO test of more than .5 and Bartlett's test of less than .05. The results of Kaiser-Meyer-Olkin (KMO) and Bartlet's tests were .563 and .000 respectively which shows that the sample size was adequate although the number of amputees was 55 instead of 60 (Table 2). Extraction by principal component analysis showed that the factors explained the variance by this order (from greater to smaller variance explained): age of the amputee at the time amputation surgery was done, aetiology, age of the amputee at the time of the study, comorbidities, gender, and level of amputation. The factors that explained most of the variance (82.2%) are age of the amputee at the time amputation surgery was done , age of the amputee at the time of the study, aetiology, and comorbidities (Table 4 and 5). This is also augmented by a look at the scree plot.

Selected factors rotation and extraction (which are the final two steps of EFA) resulted in the selection of only three factors. The sample size was tested again using KMO

and Bartlett's tests for sample adequacy and the results were .597 and .000 respectively (Table 6). The selected factors after rotation and extraction (which again explain most of the variance),are; age of the amputee at the time amputation surgery was done, aetiology, and age of the amputee at the time of the study (table 7, 8, 9 and Figure 2).

Discussion:

It is important to firstly note that the sample size in this study is small and thus it is not safe to generalize the results of this study. Additionally, EFA results show only which factors have greater effect on QOL of amputees without specifying the nature of the effect.

The three factors that were found to explain most of the variance in this study were age of the amputee at the time amputation surgery was done, aetiology, and age of the amputee at the time of the study. As in a previous study [22], age of the amputee at the time amputation surgery was done was found to affect the QOL of amputees. This factor plays a high role in QOL of the amputee. This is expected to be so because of the time available for the amputee to adapt to the disability accompanied with loss of the limb. Amputations at younger age gives more time for the amputee to be more effective in using his prosthetic limb.

Aetiology on the other hand, may have dual opposing possibilities. Long lasting diseases leading to amputation, as in the case of PVD, give time for the amputee to consider amputation and prosthetic rehabilitation as a new beginning for becoming functional. On the other hand, these diseases diminish the wellbeing of the amputees and leave them suffering from general weakness and disability, leading to lower quality of life scores. On the contrary to this, disease and incidents leading to sudden amputation, as in trauma, may result in severe psychological trauma to the amputees [26], making their compliance to prosthesis and their ability to accept the prosthesis much less than other patients [27]. This occurs although traumatic amputees are generally stronger and much more able to be functional.

The third high factor is the age of the amputee at the time of the study. This is in agreement with a previous study [22]. This can be explained by the role that the older the person (and of course the amputee [19]), especially after 55 years of age [26], the weaker he/she is, and thus the less able the amputee is to control the prosthesis. This makes older amputees, in general, less able to benefit from their prosthetic limbs, making their QOL less.

The forth and the least explaining factor in this study is comorbidities. This may be due to the low number of amputees in this study with comorbidities. Only twenty amputees in this

study were having other diseases accompanying amputation. Of those, 13 were having only one other disease with amputation, which may be the reason why comorbidities explained the least variance among the four factors, although comorbidities are expected to cause a great effect on the QOL of amputees.

Gender and level of amputation were the least variance explaining factors and were excluded by rotation and extraction. This agrees with the findings of previous studies [4, 22 and 23] which showed no or minimal effects of gender and level of amputation on QOL of amputees.

Conclusions:

It is crucial to note that generalization of the conclusions of this study is unsafe due to the small sample size. Further research with much larger samples is advised.

1- Clinical and non-clinical factors, namely; age of the amputee at the time amputation surgery was done, aetiology, and age of the amputee at the time of the study were found to be loading more on the quality of life than other factors.
2- Exploratory factor analysis is a successful method to investigate which factors explain most of the variance in the data presented.

Study limitations:

1- The small sample size: the original study was aiming to investigate the effects of 15 factors on the QOL of amputees. These factors are: gender, age, education level, comorbidities, age of the amputee at the time amputation surgery was done, aetiology, amputation level, length of the residual limb, participation in amputation surgery decision making, occupation before and after the amputation surgery, prosthetic use expectations, prosthetic components, time of prosthesis use per day, use of walking aids with the prosthesis, and dependence of the amputee. This necessitates the recruitment of at least 150 amputees. Unfortunately, this number of amputees was not available at the time of this study.

2- The limited time period: the permissions to collect data from the data collection sites were limited to a 6 months period, which limited the number of amputees recruited. A longer period of time in data collection may aid in recruiting a greater number of amputees.

3- The lengthy and boring –according to amputees- questionnaire: most of the amputees in this study stated that the questionnaire is either lengthy, boring, or both. They all stated that a questionnaire with fewer questions (fewer pages) would be favorable. This may have resulted in the big number of excluded questionnaires.

Future work:

As addressed in study limitations, the small sample size and the lengthy questionnaire were drawbacks for this study. A future study with much greater sample size is to be done so that more factors can be tested and more accurate conclusions can be made. Additionally, developing a concise form of the Prosthesis Evaluation Questionnaire is advised so that the data collection process is not lengthy anymore. Depending on improvements in the aforementioned two points, the factors that are found to be affecting QOL of amputees greatly can be considered in the PEQ.

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A- . **Appendix A: The short questionnaire**

Date	

Information about the amputee					
Name of amputee					
Gender	Male			Female	
Date of birth					
Education	-Tawjihi	Tawjihi	Bsc	MSC	PhD
Comorbidities					

Information about amputation			
Date of amputation			
Level of amputation	BK	AK	
Aetiology			
Length of stump	short	Medium	Long
Participation in amputation surgery decision making		Yes	No

Amputee's life changes	
Occupation before amputation	
Post amputation expectations	
Occupation after amputation	

Information about prosthesis and mobility			
Prosthetic components	Socket	Knee	Foot

Prosthesis use time per day		
Use of walking aids	Yes	No
Dependence	Dependent	Independent