

Quality of Life among Patients with Lower Limb Amputation

Fatma Mostafa Mahrous

Lecturer in Medical-Surgical Nursing Department, Faculty of Nursing, Ain Shams University, Egypt

Abstract

Background: Lower extremity amputation is a surgical procedure resulting in important anatomical, functional, psychological, and social consequences that can influence the quality of life of these patients. This study was aimed to evaluate the quality of life (QOL) of patients with limb amputation and identify the factors affecting the quality of life among patients with limb amputation. The study was conducted at Orthopedics and Surgical Department in El-Demerdash Hospital at Ain Shams University Hospitals. A sample of purposive of 100 adult male and female patients who met the inclusion criteria was included. **Design:** It was a descriptive exploratory design. **Tools** (a) Structured interview questionnaire (SIQ) was used to collect personal data, (b) short form (36) health status questionnaires: this part was utilized to assess the quality of life among Egyptian patients with amputation. **The results of this study:** illustrated that males constituted 59% of the participants in this study and females 41%. Most participants experienced a change in the quality of life. There is a statistically significant difference between total QOL aspects and each of the following: age, gender, educational level, and type of work. This study concluded that the quality of life automatically drops after losing any important part of one's body. The most affected aspects are the physical and mental ones and this is very frequent in amputation. This study recommended that replication of the study on a larger sample from different geographical areas should be done to achieve more general results.

Keywords: Quality of life; lower limb amputation

1. Introduction

The World Health Organization (WHO) defines health as a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity. Therefore, a holistic measurement of patient's health must also fulfill an estimation of well-being which can be assessed by measuring the improvement in the quality of life. Quality of life is defined as individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns (The World Health Organization Quality of Life assessment (WHOQOL) 1995).

Amputation is a surgical method by which a part or the whole extremity is being removed. Anatomical loss is also manifested by the consequential loss of the function, change of the distribution of body mass, coordination disorder and psychosocial disorders. The most common causes of surgical amputations are the complications caused by diabetes (diabetic foot) including a number of vascular complications in the form of ischemia and peripheral artery disease (Wan Zaidi *et al.* 2012). Different types of prostheses and good training to use them properly enable the lower extremity amputees to walk normally and carry out their daily activities independently.

Chitragari *et al.* (2014) define QOL as a broad range of human experiences related to one's overall well-being. It implies value based on subjective functioning in comparison with personal expectations and is defined by subjective experiences, states, and perceptions. Quality of life (QOL) is a very important domain in amputated patients. Kazemi (2013) in discussing highlighted health related quality of life (HRQL), refers to the subjective perceptions of the effect of a disease or its treatment on one's health and overall QOL. It includes physical, psychological, and social dimensions of health as assessed by the patient. HRQOL can be used to describe the effects of disease and injury on the QOL and the effect of clinical interventions on health and general well-being. Studies have also shown QOL to be highly related to both physical and social aspects of an amputee's life. Therefore, quality of life (QOL) is an important issue for the large number of patients who may need to adapt to severe and chronic disability due to trauma (Fleury *et al.* 2013).

Amputation can lead people to lose their self-esteem, independence, and/or even employment. In fact, the psychosocial adjustment to limb loss has been compared to coping with the loss of a loved one and it is not uncommon for a person who has experienced an amputation to become depressed (Petrovic-Oggiano *et al.* 2010). Amputation itself is a change in body structure but has a great influence on many activities, participation in activities, and quality of life (Zidarov, Swine & Gauthier-Gagon 2009). On the other hand, amputation causes a variety of physical and psychosocial challenges including alterations in body image and lifestyle, changes in self-concept, impairments in physical functioning, using prosthesis, and feeling pain (Penn-Barwell 2011; Bosis-Zivanovic *et al.* 2012).

Significance of the Study

The highest number of lower extremity amputations is performed due to complications caused by a vascular disease in the old age, often followed by more comorbidities which further complicate the rehabilitation

treatment and impede the normal functioning of a patient (Feinglass *et al.* 2012). Additional problems that amputees are faced with are phantom pain, stump pain and numerous infections (Petrovic-Oggiano *et al.* 2010; Chalya *et al.* 2011). Proper personal hygiene, every day activities, getting in and out of cars and normal functioning are often difficult or impossible because the patients are faced with the loss of independence and need to depend on others, which considerably contributes to a poor physical, psychological, social and financial aspect of their lives (Wan *et al.* 2011; Hirsh *et al.* 2010).

1.1 Aim of the Study:

The aim of this study was to evaluate the quality of life (QOL) of patients with limb amputation and identify the factors affecting the quality of life among patients with amputation.

1.2 Research Questions:

The following research questions were formulated to achieve the aim of the study.

- (a) What is quality of life among patients with limb amputation?
- (b) What are the factors affecting the quality of life among amputation patients?

2. Subject and methods:

Technical design:

2.1 Research Design:

It was a descriptive exploratory design.

2.2 Research Setting:

The study was conducted at Orthopedics and Surgical Department in El-Demerdash Hospital at Ain Shams University Hospitals.

2.3 Subjects:

Sample of purposive of 100 male and female patients aged between 18 and 60 years was admitted to the hospital and diagnosed with limb amputation. These patients were adults of both sexes who had undergone primary amputation of the lower extremity at the level of foot, lower leg, or upper leg and were aged between 18 and 60 years. They gave their consent to participate in the study. Participants were to be excluded from the current study if they had shown any current musculoskeletal injuries.

2.4 Tools of Data Collections:

They were designed by researchers based on literature review; they have included two parts.

I. Part 1: The Structured Interview Questionnaire (SIQ)

It was developed by the researcher based on review of literature (Fleury *et al.* 2013). To record patient's socio-demographic data; it was comprised of data related to patient's age, sex, level of education, marital status, and occupation. Also, the part of "patient's medical data" was formulated to assess the patient's health history, for example, site of amputation, causes, and comorbidity associated with treatment.

II. Part 2: Short Form (SF-36) Health Status Questionnaires

It used to assess quality of life. The SF-36 was developed by Ware and translated into Arabic by researchers (Ware & Sherburne 1992). It consists of 36 questions (items) measuring physical and mental health status in relation to eight health concepts: physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health. The values of each sub score are computed on a scale from 0 to 100. The raw scale scores from global quality of life were linearly converted to a range of 0 (worst possible health status or quality of life) to 100 (best possible health status or quality of life). The score of the subgroups and all eight scales, as well as the final global score, of the SF-36 range between 0 and 100, indicating that the lower the score the more the disability and the higher the score the less the disability.

Operational design:

It was include preparatory phase, content validity, reliability, pilot study and field work.

2.5 Preparatory phase:

An official permission was obtained from the hospital administrative authority after explaining the aim of the study. The researchers met the selected patient preoperatively. The purpose and nature of the study were explained and the patient consent was obtained.

2.6 Content validity and reliability:

The developed questionnaires tools were reviewed by five panels of experts in medical surgical nursing in order to ensure content comprehensiveness, clarity, relevancy, and applicability. The test-retest reliability coefficient for the total SF-36 was 86.5. The questionnaires were translated from English into Arabic to help the patient understand them.

2.7 A pilot study:

A pilot study was carried out on 10 patients to test feasibility, objectivity, and applicability of the study tools. Based on the results of the pilot study, the needed refinements and modifications were made.

2.8 Field work:

Data collection for this study was started at April 2016 until May 2017.

An official permission was obtained from the hospital administrative authority after explaining the aim of the study. The researchers met the selected patient preoperatively. The purpose and nature of the study were explained and the patient consent was obtained. Baseline data, which were established using the structured interview questionnaire and SF-36 sheet for measuring the quality of life for patients, were read and were also explained. The patients' answers were recorded by the researchers. Each participant was interviewed individually and the data collection time for each patient lasted for almost 15 to 30 minutes.

2.9 Administrative design:

An official permission was obtained from the hospital administrative authority after explaining the aim of the study.

2.10 Ethical Consideration:

The aim of the study was explained to patients and a written/oral consent will be obtained before asking them to participate in the study after ensuring the confidentiality of the collected information, and the patient was free to withdraw at any time of the study.

2.11 Statistical Analysis:

The data were analyzed using SPSS (version 12). The QOL scores, the clinical results, and the demographic characteristics of the participants were summarized using the descriptive statistics of frequency, mean, standard deviation, and percentages as appropriate. Mann-Whitney U test was used to compare both overall and domain QOL scores of male and female participants. Pearson's correlation test was used. Statistical significance was considered at P- value < 0.05.

3. Results:

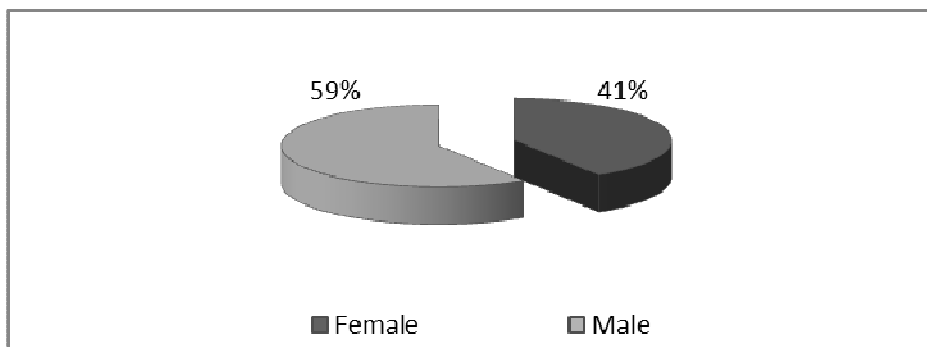


Figure 1. Percentage Distribution of Studied Sample in Relation to Gender (n =100).

This figure indicates that more than half of the sample (59%) was male and nearly two-fifths of the sample was female (41%).

Table 1. Distribution of Socio-demographic Characteristics of the Study Sample

Characteristics	Male (n=59)		Female(n=41)		Total (n=100)	
	No	%	No	%	No	%
Age in years						
<40	13	22.03	2	4.87	15	15
40–49	19	32.20	17	41.46	36	36
50–59	26	44.06	22	53.65	48	48
59+	1	1.69	0	0	1	1
Mean ± SD	48.20±12.92		47.61±9.86		47.82±11.53	
Marital status						
Single	3	5.08	1	2.43	4	4
Married	45	76.82	25	60.97	70	70
Divorced	6	10.16	2	4.87	8	8
Widowed	5	8.47	13	31.70	18	18
Educational level						
Illiterate	13	22.03	8	38.1	21	21
Primary	16	27.11	15	23.8	31	21
Secondary	25	42.37	15	23.8	40	40
High	5	8.47	3	14.3	8	8
Type of work						
Mental	19	32.20	11	26.82	31	32
Physical	40	67.79	30	73.17	69	68
Residence						
Urban	29	49.15	19	46.34	48	48
Rural	30	50.84	22	53.65	52	52
Living accommodation						
With family	41	69.49	39	95.12	80	80
With relatives	18	30.50	2	4.87	20	20
Alone	0	0	0	0	0	0
Monthly income						
Satisfaction	23	33.98	14	34.14	37	37
Unsatisfaction	36	61.01	27	65.85	63	63

This table presents that more than half of the females (53.65%) and about two-fifths of the males (44.06%) in age group ranged from fifty to less than sixty years with means 47.61 and 48.20, respectively. Regarding their marital status, most of the males (76.82%) and most of the females (60.97%) were married. For the level of education, nearly two-fifths of the males (42.37%) and over one-third of the females (38.1%) are illiterate. In relation to type of work, most of the males and most of the females (67.79 and 73.17%) are having jobs that require physical efforts. Regarding residence, most of the males and females (50.84% and 53.65%, resp.) are from rural areas. Most of the males and females (69.49 and 95.12%) live with their families. Finally, regarding income, more than half of the males and females (61.01% and 65.85%, resp.) have unsatisfactory income.

Table 2. Distribution of Clinical Characteristics of the Sample

Characteristics	Male (n=59)		Female(n=41)		Total (n=100)	
	No	%	No	%	No	%
Causes of amputation						
Vascular	18	30.50	16	39.02	34	34
Diabetes	30	50.84	21	51.21	51	51
Accident	11	18.64	3	7.31	14	14
Others	0	0	1	2.43	1	1
Comorbidity						
Yes	29	49.15	16	39.02	45	45
No	30	50.84	25	60.97	55	55

This table shows that amputations in more than half of the males (50.84%) and more than half of the females (51.21%) were caused by disease of diabetes while nearly in one-third of males and females (30.50 and 39.02) they were caused by vascular disease. Finally, as for comorbidity, more than half of the sample has no

comorbid disease.

Table 3. Measurement of Central Tendency and Distribution of Quality of Life among Sample

Variable	Male (n=59) Mean (SD)	Female(n=41) Mean (SD)	P value
Role physical (RP)	34.56 (30.60)	30.51 (29.78)	0.630
Physical functioning (PF)	46.82 (23.95)	35.62 (25.56)	0.026*
Bodily pain (BP)	41.74 (23.22)	43.15 (24.13)	0.872
Energy/fatigue/vitality	68.05 (16.09)	62.12 (18.03)	0.781
Mental health (MH)	50.42 (12.67)	46.31 (20.13)	0.532
Role emotional	53.10 (35.65)	64.21 (31.15)	0.034*
General health	57.13 (14.17)	52.12 (16.25)	0.802
Physical component summary (PCS)	65.53 (13.51)	53.32 (14.23)	0.042*
Mental component summary (MCS)	63.22 (14.72)	60.31 (15.31)	0.712

*No significance at $P > 0.05$

This table shows that male participation in physical component summary (mean=65.53 and 53.32, $P=0.042$), physical functioning (46.82 and 35.62, $P=0.026$) and emotional role (53.10 and 64.21, $P=0.034$) scored significantly higher than female participation respectively.

Table 4. Correlation of Some Research Variables and Dimensions of Quality of Life among Patients

Research variable	Quality of life dimensions (SF-36)	
	Physical component	Mental component
Age		
<40 years	0.283	-0.021*
≥40 years	-0.580	0.561
Gender		
(i) Male	0.065	0.216
(ii) Female	0.028*	0.042*
Marital status		
(i) Married	0.293	0.05*
(ii) Not married	0.314	0.282
Residence		
(i) Rural	0.20	0.07
(ii) Urban	0.462	0.49
Educational level		
i) Illiterate	0.315	0.154
(ii) Literate	0.213	0.104*
Causes of amputation		
(i) Vascular	0.54	0.48
(ii) Nonvascular	0.49	0.62
Site of amputation		
Lower limb	0.044*	0.034*

*Significance at $P < 0.05$

This table shows that female subjects had significantly higher mean scores than male in relation to physical component and mental component ($r=0.028, 0.042, P \leq 0.05$, resp.). Also there are positive correlation between marital status (married) and mental components ($r=0.05, P < 0.05$, resp.) this may be attributed to husband/family provided social support. In relation to age, there are statistically significant negative relations with mental health. Regarding site of amputation, also there are significant statistics in relation to lower limb and physical component & mental component (0.044, 0.034, $P < 0.05$, respectively). No statistically significant relation is found among them regarding educational level, residence and causes of amputation.

4. Discussion:

Amputation has become one of the common problems in the present society. A number of people have one or both limbs amputated and the situation moves to an increase worldwide. Traumatic amputation is a catastrophic work injury and often a major cause of disability (Chalya *et al.* 2011). Individuals with an amputation have to adapt to several losses and changes to their lifestyle, social interactions, and identity ((Fleury *et al.* 2013;

Knežević *et al.* 2015). Therefore, the current study aims to assess QOL and to determine the factors affecting QOL of patients with amputation.

Our study showed that males constituted 59% of the participants in this study and females 41%. The majority of amputations were in the lower limb. This supports findings from previous studies that lower limb amputations are more common among males than females (Hirsh *et al.* 2010). Also The Global Lower Extremity Study Kazemi *et al.* (2013) stated that the incidence of LLA is similar in females and males in some regions and higher in females compared to males in other regions although the overall incidence is higher in males than females.

In this study, the mean age of amputation due to diabetes, trauma, and vascular disease was 47.84 years, respectively. The results are comparable to other studies which showed that the majority of patients are males with range of 14–65 years (mean age: 33.29 years) which means that it most commonly involves the reproductive age group (Petrovic-Oggiano *et al.* 2010; Muhammad *et al.* 2016). Desmond (2007) showed that the majority of the patients ranged from 11 to 52 years old. In addition, results of Marzen-Groller & Bartman (2005) indicated that the majority (75%) of amputations occur in people who are aged more than 65 years.

Diabetes mellitus was found to be the leading cause of amputation in this study. This result is similar to those previous studies performed by Johannesson *et al.* (2009), which reported that individuals with diabetes have a significantly elevated rate of amputation when compared to individuals without diabetes. Increasing amputation rates among individuals with diabetes have been attributed to the fact that the persons with diabetes have poor level of knowledge about diabetes and diabetic foot care. This had contributed to an increase in the average age at which amputation occurs. In contrast, a study by Moxey *et al.* (2010) found that 39% of patients who underwent major amputations within the time span of five years in England had a primary diagnosis of diabetes, and 43% had a diagnosis of CVD, with just 13.9% of procedures being secondary to injury or trauma. These results support the findings that 54% of all existing cases of limb loss in the USA are secondary to vascular disease, two-thirds of which also involve a comorbid diagnosis of diabetes (Ziegler-Graham *et al.* (2008). In addition to the current literature, amputations also result from military combat or other types of violence (Sinha *et al.* 2011). This study also reveals that the majority of all participants' amputation occurred in lower limb. This result is similar to those of previous studies performed by Ziegler-Graham *et al.* (2008) and National Amputee Statistical Database (2009) indicated that lower limb amputation is significantly more common than amputation of the upper limb; also it revealed that amputations of lower limbs occur in significantly greater numbers than do amputations of upper limbs.

People with lower limb amputation had worse QOL as compared to the general population. Results of the current study supported that amputation continued to be associated with poorer quality of life over some dimension for male and female. These were demonstrated by physical functioning activities, physical role, and bodily pain. This finding is consistent with previous research; Demet *et al.* (2003) study revealed that upper limb amputees' high reported QOL (compared to lower limb amputees) is primarily related to their responses pertaining to "physical disability, pain, and energy level." Dunn (1996) found that younger amputees are significantly more at risk of developing depression than older amputees on account of activity restriction.

This result is similar to those of previous studies performed by Zidarov *et al.* (2009) which report that all participants had poor scores of physical functions (ability to go outside and overall fitness) at baseline and remained poor at three-month follow-up. The study results of Sinha *et al.* (2011) among limb amputated patients are on the same line. This finding is considered to be the most important factor influencing the physical health component of QOL, whereas the employment status and comorbidities impacted mainly the mental health component of QOL in amputees.

In the present study, no statistically significant relations are detected among (SF-36) dimension scores, causes of amputation, and residence. This is not surprising and can be referred to from the small size of the sample. Results of this study also show that there are statistically significant relations between age and mental health component. These results are comparable to those of a study by Dunn (1996) which finds that when amputation occurred in young person, higher levels of depression are reported. Another study on recent and long-term amputees, who belong to either young or old age group, found that, in older group, the longer the time since amputation is, the fewer the psychological symptoms and less depression are exhibited. Younger amputees had increased psychological symptoms and increased rate of depression. Younger amputees appear to be anxious, sensitized, vigilant persons who had difficulty in integrating their present life. Frank, *et al.* (1984) and Shabaan *et al.* (2006) also report that there is a statistically significant association between psychological status and patient age. In the recent literature, another study done by Goals (2012) over 113 patients during the period following accident, illness, or injury found that age, gender, and cause of amputation are significantly associated with the psychological status.

Moreover, the result of the present study revealed that there is a statistically significant difference between marital status and psychological aspect. This may be attributed to social support from family. Regarding patient sex, this study shows that there is a statistically significant difference between sex and total patient's

QOL. This is consistent with a study by Williams *et al.* (2004) which prove that being a female is a significant predictor of greater symptoms of depression at six months after amputation. In addition, some longitudinal studies have failed to observe significant changes in psychosocial outcomes over time among persons with amputations. This distribution is in agreement with another study carried out by Dunn (1996) who reveals that younger individuals with upper or lower limb amputations have a higher QOL in several domains, including emotional reactions and social isolation. In the same line a study carried out by Deans *et al.* (2008) which examined QOL in 75 individuals with above- or below-knee amputations, indicated that QOL in the physical domain is affected the most in this patient group.

5. Conclusion

Based on the findings of the present study, it can be concluded that the quality of life automatically drops after losing any important part of one's body. The most affected aspects are the physical and mental ones and this is very frequent in amputation. The age, gender, place of amputation, and marital status are found as statistically significant factors with physical and psychological components, while there was no statistically significant difference among QOL aspects, educational level, and type of work, residence, and living accommodation.

People with lower limb amputation had worse QOL as compared to the general population. Diabetes mellitus was found to be the leading cause of amputation in this study.

There is no statistically significant relations are detected among (SF-36) dimension scores, causes of amputation, and residence.

6. Recommendations

The following recommendations are inferred from the discussion:

- It is recommended that the participants receive a structured rehabilitation program which is appropriate to the specific needs of people with limb amputation in order to be able to find out its impact on their functional status and QOL.
- Also replication of the study on a larger sample from different geographical areas should be done to achieve more general results.

Acknowledgment

The authors would like to express their sincere gratitude to the hospital staff and patients included in the study who helped facilitate the conduction of this study.

References

- Bosic-Zivanovic, D., Medic-Stojanoska, M. & Kovacev-Zavasic, B. (2012). The quality of life in patients with diabetes mellitus type 2. *Vojnosanit Pregl*, 69(10):858-63.
- Chalya, P.L., Mabula, J.B., Dass, R.M., Kabangila, R., Jaka, H. & McHembe, M.D. (2011). Surgical management of Diabetic foot ulcers: a Tanzanian university teaching hospital experience. *BMC Res Notes*, 4:365.
- Chitragari, G., Mahler, D. B., Sumpio, B. J., Blume, P. A., & Sumpio, B. E. (2014). Prosthetics options available for the diabetic lower limb amputee. *Clinic in Podiatric Med and Surg*, 31(1), 173-185.
- Deans, A. K., McFadyen, S.A. & Rowe, P. J. (2008). "Physical activity and quality of life: a study of a lower-limb amputee population," *Prosthetics and Orthotics International*, vol. 32, no. 2, pp. 186-200.
- Desmond, D. M. (2007). "Coping, affective distress, and psychosocial adjustment among people with traumatic upper limb amputations," *Journal of Psychosomatic Research*, vol. 62, no. 1, pp. 15-21.
- Dunn, D. (1996). "Well-being following amputation: salutary effects of positive meaning, optimism, and control," *Rehabilitation Psychology*, vol. 41, no. 4, pp. 285-302.
- Feinglass, J., Shively, V.P., Martin, G.J., Huang, M.E., Soriano, R.H. & Rodriguez, H.E. (2012). How 'preventable' are lower extremity amputations? A qualitative study of patient perceptions of precipitating factors. *Disabil.Rehabil.*, 34(25):2158-65.
- Fleury, A.M., Salih, S.A. & Peel, N.M. (2013). Rehabilitation of the older vascular amputee: a review of the literature. *GeriatrGerontol Int.*, 13(2):264-73.
- Frank, R. G., Kashani, J. H., Kashani, S. R., Wonderlich, S. A., Umlauf, R. L. & Ashkanazi, G. S. (1984). "Psychological response to amputation as a function of age and time since amputation," *British Journal of Psychiatry*, vol. 144, no. 5, pp. 493-497.
- Goals, C. L. (2012). Adaptive self-regulation and psychosocial adjustment to lower limb amputation: a longitudinal study [Ph.D. thesis].
- Hirsh, A.T., Dillworth, T.M., Ehde, D.M. & Jensen, M.P. (2010). Sex differences in pain and psychological functioning in persons with limb loss. *J Pain*, 11(1):79-86.
- Johannesson, A., Larsson, G., Ramstrand, N., Turkiewicz, A., Wirén, B. & Atroshi, I. (2009). "Incidence of lower-limb amputation in the diabetic and nondiabetic general population: a 10-year population-based cohort

- study of initial unilateral and contra.lateral amputations and reamputations,” *Diabetes Care*, vol. 32, no. 2, pp. 275–280.
- Kazemi ,H., Ghassemi, S., Fereshtehnejad, SM., Amini ,A., Kolivand, PH.&Doroudi ,T. (2013). Anxiety and depression in patients with amputated limbs suffering from phantom pain: a comparative Study with non-phantom chronic pain. *Int J Prev Med.*, 4(2):218-25.
- Knežević A., Salamon,T., Milankov, M.& Ninković, M. (2015). Assessment of Quality Of Life in Patients After Lower Limb Amputation. *Med Pregl.* LXVIII (3-4): 103-108.
- Marzen-Groller, K. & Bartman, K. (2005). “Building a successful support group for post-amputation patients,” *Journal of Vascular Nursing*, vol. 23, no. 2, pp. 42–45.
- Moxey,P., Hofman,D., Hinchliffe,R., Jones,M., Thompson,B. & Holt,J. (2010).“Epidemiological study of lower limb amputation in England between 2003 and 2008,” *British Journal of Surgery*, vol. 97, no. 9, pp. 1348–1353.
- Muhammad, A., Muhammad, Z., Nor,Y.& Fazah ,A.(2016). Quality of Life among Lower Limb Amputees in Malaysia. *Procedia - Social and Behavioral Sciences* 222,440-457. Available online at <http://www.sciencedirect.com> (2016)
- National Amputee Statistical Database (2009). “The amputee statistical database for the United Kingdom 2006/07,” Edinburgh: Information Services Division, NHS Scotland.
- Peek ,ME.(2011). Gender differences in diabetes-related lower extremity amputations. *Clin.Orthop.Relat Res.* 2011;469(7):1951-5.
- Penn-Barwell, J. G. (2011). Injury. Outcomes in lower limb amputation following trauma: A systematic review and meta-analysis. *Injury*, 42(12), 1474 to 1479.
- Petrovic-Oggiano, G., Damjanov, V., Gurinovic, M. & Glibetic, M. (2010). Physical activity in prevention and reduction of cardiovascular risk. *Med Pregl.* 63(3-4):200-7.
- Shaban, M. C., Fosbury, D. Kerr, J. & Cavan, D. A. (2006). “The prevalence of depression and anxiety in adults with Type 1 diabetes.” *Diabetic Medicine*, vol. 23, no. 12, pp. 1381–1384.
- Sinha,R., van den Heuvel, W. J. A. & Arokiasamy, P. (2011). “Factors affecting quality of life in lower limb amputees.” *Prosthetics and Orthotics International*, vol. 35, no. 1, pp. 90–96.
- The World Health Organization Quality of Life assessment (1995). Position paper from the World Health Organization. *Soc. Sci .Med*, 41(10), 1403-1409.
- Wan Zaidi, W. A. A., Baharudina, A., Jamaluta, Y., MohdNor, B., Zulkaplia, F. H., & Hanapiah, F. A. (2012). Quality of life amongst HIV positive patients in Malaysian HIV shelter homes. *Procardia-Social and Behavioral Sciences*, 35, 213-220.
- Wan, C., Tu X, Messing, S., Li X, Yang ,Z.& Zhao, X. (2011).Development and validation of the general module of the system of quality of life instruments for chronic diseases and its comparison with SF-36. *J Pain Symptom Manage*, 42(1):93-104.
- Ware, Jr. J. E. & Sherburne, C. D. (1992). “The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection,” *Medical Care*, vol. 30, no. 6, pp. 473–483.
- Williams, D. M., Ehde, D. G., Smith, J. M. , Czerniecki, A. J., Hoffman, & L. R., Robinson, R.M. (2004). “A two-year longitudinal study of social support following amputation,” *Disability and Rehabilitation*, vol. 26, no. 14-15, pp. 862–874.
- Zidarov, D., Swaine, D. & Gauthier-Gagnon, C.(2009). “Quality of life of persons with lower-limb amputation during rehabilitation and at 3-month follow-up,” *Archives of Physical Medicine and Rehabilitation*, vol. 90, no. 4, pp. 634–645.
- Ziegler-Graham, E. J., MacKenzie, P. L., Ephraim, T. G., Travison,R. & Brookmeyer, K.(2008). “Estimating the prevalence of limb loss in the United States: 2005 to 2050,” *Archives of Physical Medicine and Rehabilitation*, vol. 89, no. 3, pp. 422–429.