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Factors Influencing Quality of Life Among Trauma-related Lower Limb Amputees

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ABSTRACT

Introduction: Lower limb amputation refers to the surgical removal of a portion or the entirety of a limb. This study assessed demographic and clinical characteristics of traumatic lower limb amputees and their QoL using the RAND SF-36 scale.
Method: A cross-sectional study was conducted among 123 traumatic lower limb amputees using prostheses. Descriptive statistics, normality testing, reliability analysis, and correlation tests were performed for eight SF-36 subscales and composite scores.
Results: Most participants were male (87%), aged 31–45 years (52%), and employed part-time (47.2%). Trans-tibial (56.1%) and trans-femoral (37.4%) amputations were most common, with right-sided involvement (61.8%) predominating. Mean Physical Component Summary (PCS) and Mental Component Summary (MCS) scores were 50.0 (SD = 7.39) and 50.0 (SD = 7.97), reflecting moderate QoL. Reliability analysis showed acceptable internal consistency (Cronbach's $\alpha = 0.746$). Education was positively associated with MCS ($r = 0.314$, $p < 0.01$), and level of amputation showed a weak positive correlation with MCS ($r = 0.198$, $p < 0.05$). No significant associations were observed between PCS/MCS and age, gender, employment status, or duration of prosthesis use.
Conclusion: Traumatic amputees using prostheses show moderate QoL, with mental health outcomes influenced by education and level of amputation. The findings of the study emphasise the need for customised rehabilitation strategies with a greater focus on psychosocial support and vocational reintegration for traumatic prosthetic users.

Keywords: Trauma, Quality, Amputation, Limb, Influence, Prosthesis.

INTRODUCTION

Lower limb amputation refers to the surgical removal of a portion or the entirety of a limb below the waist, which includes the leg, foot, or toes. Various conditions such as severe trauma, infection, congenital, peripheral artery disease, diabetes complications, or cancer may necessitate this procedure.

Trauma is the leading cause of all amputations in India. Every day, we record a number of traumatic injury cases. Amputees generally reject or adjust prostheses, suffer from pain and discomfort, and their quality of life is affected in a variety of ways(1). Life presents challenges such as pain, physical limitations, economic, emotional, and social dependency. The present study will explore the factors influencing quality of life in lower limb traumatic amputees.

Amputations due to trauma were most frequently caused by mechanical forces (10.4%), falls (36.2%), traffic injuries (15.7%), and other transportation-related injuries (11.2%). The regions with the highest rates of common traumatic amputations were East Asia and South Asia, followed by wealthy North America, Eastern and Western Europe, North Africa, and the Middle East (2,3). The prevalence of traumatic amputation is present in 204 nations and territories worldwide. India reports 2.22 million instances of traumatic amputations in 2019 (4). In India, the majority of lower limb amputations are caused by accidents. Puja Shanker et al.'s study revealed that trauma accounted for 51.5% of all amputations, with diabetic complications coming in second at 32%. Trauma following RTAs caused 22.7% of lower limb amputations. Previous research conducted in Chennai and Kolkata in 2013 confirmed the fact (5–7).

Amputees have major problems with mobility. Prosthetic limb users typically report an improved overall quality of life, but successful use depends on factors such as the level of amputation and availability of modern prosthetic technology (8). Phantom limb and residual limb pain are common in traumatic amputation. Effective pain management is essential for a higher physical quality of life (9).

Anxiety, sadness, and post-traumatic stress disorder (PTSD) are among the psychological distress conditions that traumatic amputees experience in large numbers. Support for mental health, such as treatment and counselling, can greatly improve quality of life (10,11). Amputation can lead to problems with one's body image, which can undermine one's self-worth and confidence. Enhancing body image through rehabilitation can improve psychological well-being (12).

The patient's social relationships with friends and family are crucial, as is their understanding of the importance of sustaining and enhancing physical activity levels in patients who have undergone lower limb amputations (13). Expenses related to prosthetic limbs, rehabilitation, and surgery further increase the financial burden. Stress related to finances has a negative impact on quality of life, particularly in communities with low incomes (14,15).

However, in a study of many literatures, there were no studies found that explored factors influencing the quality of life among traumatic lower limb amputees in Indian populations.

There is a significant lack of research on Indian populations with traumatic lower limb injuries in both rural and urban settings. Prior studies have mostly concentrated on amputations of the lower limb caused by a variety of other causes.

The aim of this study is to explore the general quality of life among traumatic lower limb amputees and to understand the correlation between the physical and mental health status of these individuals who use prostheses. The purpose of this study was to explore influence their general quality of life in traumatic lower limb amputees. Additionally, the study aims to comprehend the characteristics of the respondents and their physical and mental health among traumatic lower limb amputees. We hypothesized that a person who has experienced traumatic amputation would consider their quality of life to be higher if they were more physically active.

METHODS

Prosthesis users were only selected among those with traumatic lower limb amputation who were older than 18. Data collection was

completed from the Department of Prosthetics and Orthotics (Dr. Shakuntala Mishra university, Lucknow and Rehab Mitra Private Limited, Delhi). Our study is cross-sectional in nature. The study was conducted in 2023 and 2024. The study was approved by prosthetics and orthotics rehabilitation centres for the intended study. In a timely manner, we have provided a thorough explanation of the technique and questioners. We obtained the participants' demographic information, which included their name, age, gender, amputation history, cause, and level of amputation. Before commencing the study, we have requested informed consent from individuals who meet the study eligibility criteria. We gathered data using the Short Form-Health Survey (RAND-SF-36) to determine how physical restrictions and emotional difficulties affected the participants' overall quality of life. The study's inclusion criteria consist of cases of trans-femoral, knee disarticulation, trans-tibial and Syme's lower limb traumatic injury in both male and female participants who were older than 18, who had been fitted with a lower limb prosthesis. Patients with various disabilities, cancer, both upper and lower motor injury, infection, vascular issues, and pregnancy were among the exclusion criteria for the study.

The sample size formula for a mean is $n=(Z)2\cdot\sigma2/E2$, and it was used to determine the sample size in earlier research [10] with a standard deviation of 0.85 and a margin of error of 15%. At a 95% level of confidence, $Z = 1.96$ The standard deviation is $\sigma=0.85$. The 0.15 margin of error is E(16). If the margin of error is relative, it represents 15% of the average value. The formula should be composed using these values: Hence, 123 participants seem ideal for this study would be the necessary sample size. Convenience sampling was used in the study. Therefore, 123 participants in total got accepted into the study after meeting the inclusion and exclusion criteria.

The 36-item RAND short-form health survey (SF-36) was used to measure QoL. A multipurpose short-form health survey with 36 questions, the SF-36 has been used as an outcome measuring tool to evaluate amputees' quality of life (17,18). The SF-36 measures Health status is measured in eight dimensions: physical functioning, role limitations due to physical health, and role limitations due to emotional problems, energy/fatigue, emotional well-being, and social functioning, Pain and general health. For every scale, the score goes from 0 to 100, with a higher number denoting better functioning or well-being (19).

STATISTICAL ANALYSIS

Statistical method for describing demographic information, including mean and standard deviation (SD) identified for continuous variables, while percentages, and frequencies were identified for categorical variables. We used the RAND SF-36 scoring method to figure out the frequency and percentage of respondents for descriptive statistics for categorical and continuous variables. The SF-36 manual was used to figure out the physical component summary (PCS) and mental component summary (MCS) scoring (20,21). Scoring of PCS and MCS passed through a normality test using the Shapiro–Wilk test, as the data were normally distributed. We tested the internal consistency of eight RAND SF-36 subscales and found excellent reliability. We have conducted Spearman's correlation analysis to understand the relationship between quality of life and categorical or continuous variables. Correlations have been reported as significant at the 0.05 level ($p < 0.05$) and highly significant at the 0.01 level ($p < 0.01$). All statistical analyses completed using the Statistical Package for the Social Sciences (SPSS) version 25 (IBM Corp., Armonk, NY, USA).

RESULT

The demographic distribution of respondents was shown in using frequency and percentage.

Table-1 **Characteristics of Respondents**		
	Frequency	**percent**
Age in Years		
18-30	29	23.6
31-45	64	52.0
46-60	23	18.7
61-75	6	4.9
> 75	1	.8
Gender		
Male	107	87.0
Female	16	13.0
Marital status		
Single	91	74.0
Married	32	26.0
Educational Level		
No formal education	38	30.9
High school	16	13.0
Intermediate	20	16.3
Bachelor	14	11.4
Master	18	14.6
PhD/Others	17	13.8
Current Employment status		
Employed full Time	26	21.1
Employed part time	58	47.2
Self employed	28	22.8
Unemployed	10	8.1
Student	1	.8
Level of amputation		
Syme's Amputation	2	1.6
Trans-tibial	69	56.1
Knee Disarticulation	6	4.9
Trans-Femoral	46	37.4
Side of amputation		
Left	45	36.6
Right	76	61.8
Bilateral	2	1.6
Duration Of Prosthesis Use		
< 1 year	13	10.6
1-3 Years	34	27.6
4-6 Years	28	22.8
7-10 Years	23	18.7
More than 10 years	25	20.3

(Total number of respondents = 123)

We analysed the clinical and demographic variables of the respondents (N = 123) using descriptive statistics. Most of the respondents are age between 18-30 year; however, more than 52% were aged 31–45 years. The sample contains 87% of amputees were male, and 13% were female. Considering marital status, 74% were married and 26% were single. Regarding educational status, most of the

respondents,30.9% lack formal education, while just 14.6% hold a master's degree, 13.8% have doctorates or their equivalents, 11.4% a bachelor's degree, and 13% have completed high school. The majority of employer work part-time, 47.2% followed by self-employment 22.8% and full-time employment 21.1% with lower percentages of people jobless, 8.1% and students 0.8%. The most common amputations done to respondents were trans-tibial, 56.1% and trans-femoral, 37.3% with knee disarticulation, 4.9% and Syme's amputation, 1.6% being less prevalent. The most affected side is the right, 61.8% followed by the left, 36.6% and bilateral amputations are uncommon,1.6%. The majority of respondents, 27.6% have been using a prosthesis for 1-3 years, followed by those who have been using it for 4-6 years 22.8%, with smaller groups consisting of new users, 10.6% and long-term users, 20.3%. The Sample characteristics are presented in the table 1.

Table-2 **Descriptive Statistics for continuous variables**		
N-123	**Mean**	**Std. Deviation**
Age of respondent	3.0732	0.83146
PCS	50	7.39685
MCS	50	7.97568

The descriptive statistics (table-2) of the study including mean (M) and standard deviation (SD) of continuous variables. The values of Age of respondents (M= 3.0732, SD= 0.83146) for PCS (M= 50, SD= 7.39685) and MCS (M=50, SD=7.97568). The Average score of mean reflects the overall quality of life in terms of physical and mental health; A higher score of standard deviation indicates more variations in QOL among respondents. Descriptive Statistics are presented in table-2.

Table-3 **Tests of Normality**

	Kolmogorov- Smirnov[a]	**Shapiro-Wilk**	**Kolmogorov-Smirnov[a]**	**Shapiro-Wilk**
	Statistic	**Sig.**	**Statistic**	**Sig.**
PCS	0.063	.200*	0.981	0.089
MCS	0.069	.200*	0.99	0.486
*** Significance level (p > 0.05)**				

We used the Shapiro-Wilk and Kolmogorov-Smirnov tests to determine normality in PCS and MCS scores. The p-values (p > 0.05) indicate that the PCS and MCS scores are normally distributed.

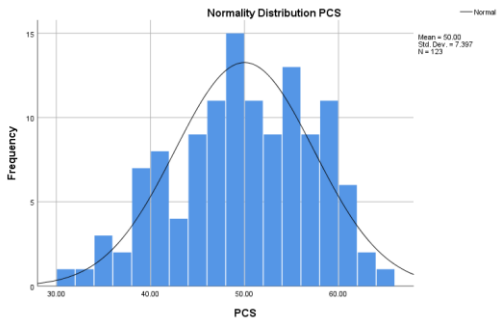

Figure-1

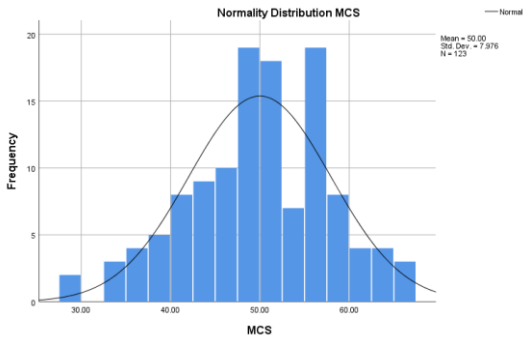

Figure-2

The test of normality presented in table-3. Figures-1 and Figure -2 display the PCS and MCS score histograms for the study sample (N=123). The mean score for both is 50.00, and the standard deviations are 7.397 and 7.976, respectively. The bell-shaped curves

in both distributions indicate normality, with most of the PCS and MCS scores lying within the 50–55 range. The PCS histogram has a few less extreme values than the MCS histogram. Both distributions are not very skewed, which means that parametric tests can be used for further analysis. These results show that the sample's physical and mental health summary vary constantly.

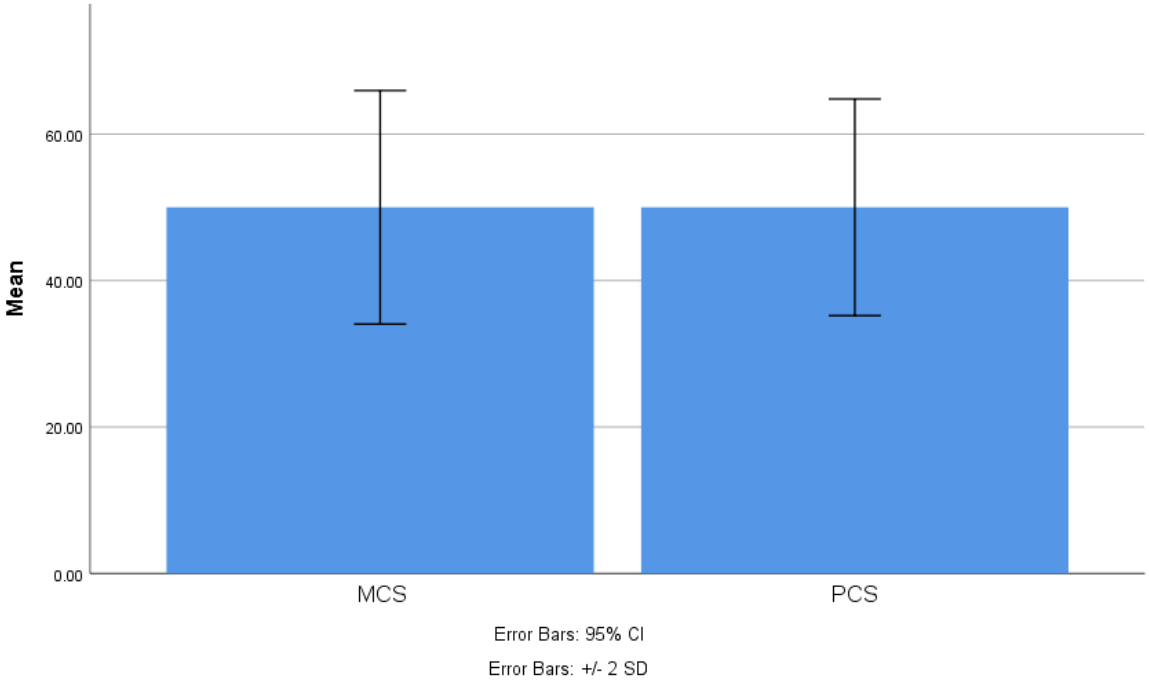

Figure-3

We can see the mean scores for the Mental Component Summary (MCS) and the Physical Component Summary (PCS) along with their 95% confidence intervals (CIs) and ±2 standard deviations (SDs) (Figure-3). The study population's average physical and mental health outcomes were comparable. Both ratings indicate a modest quality of life, falling between 40 and 50. According to the results, rehabilitation programs are required to improve the traumatic amputee's quality of life.

Table-4 **Reliability Analysis**

Variables	Cronbach's Alpha	Number of Items
PF	.837	10
RP	.640	4
BP	.756	2
GH	.205	5
VT	.640	4
SF	.421	2
RE	.555	3
MH	.660	5
ALL	.746	8

***Range value is above 0.70**

The internal consistency of eight subscales of RAND SF-36 items ranges from 0.205 (General Health) to 0.837 (Physical function). These values indicate that the individual items within the domain assess each construct independently and assess different aspects of a domain which may not be necessarily related to each other.

However, the overall internal consistency of the scale is 0.746 indicating that the good to excellent internal consistency between the domains assessed by the scale.

***Table-5* Correlations analysis**

Variables	1	2	3	4	5	6	7	8	9	10
Age of respondent	1									
Gender of respondent	-.180*	1								
Marital status of respondent	-.410**	0.046	1							
Education of respondent	-0.123	-0.047	0.057	1						
Current employment status of respondent	-0.086	0.156	.384**	-0.098	1					
Level of amputation	-.272**	-0.111	.304**	0.171	0.154	1				
Side of amputation	0.003	-0.067	.189*	0.051	0.031	0.14	1			
Duration of prosthesis Use	.318**	0.024	-0.077	0	0.024	-0.091	0.007	1		
PCS	-0.114	-0.005	0.045	0.137	0.026	0.014	-.185*	-0.013	1	
MCS	-0.155	0.035	0.086	.314**	-0.108	.198*	-0.167	-0.134	0.103	1

*** Correlation is significant at the 0.05 level (p < 0.05).**
**** Correlation is significant at the 0.01 level (p < 0.01).**

From above correlation table-5 the relationship between the respondents' demographics and their physical and mental health summary. We found a weak negative but non-significant correlation between age and PCS (r = -0.114), MCS (r = -0.155). The gender has negligible and non-significant correlation exists between gender and PCS (r = -0.005), MCS (r = 0.035) score. The marital status has a weak positive but non-significant correlation with the PCS (r = 0.045) and MCS (r = 0.086) scores. A weak positive but not significant correlation was found between education and PCS (r = 0.137), while a moderate positive correlation (P < 0.01) was found between education and MCS (r = 0.314). We found a negligible and non-significant correlation between current employment status (r = 0.026) and PCS, and a weak negative and non-significant correlation between employment status (r = -0.108) and MCS. The level of amputation (r. = 0.014) showed a negligible and non-significant correlation with PCS. But A weak positive correlation (p < 0.05) was found between the level of amputation (r = 0.198) and MCS. A weak negative correlation (p < 0.05) was found between the amputation side (r = -0.185) and PCS. we found a weak negative and non-significant correlation between the side of amputation (r = -0.167) and MCS. We also found a negligible and non-significant correlation (r = -0.013) between PCS, MCS, and the duration of prosthesis use. However, the relationship between PCS and MCS is a weak correlation (r = 0.103, not significant). It implies that the sample's mental and physical health components are typically independent.

DISCUSSION

The aim of this research was to determine how demographics and other factors affect the general quality of life of traumatic lower limb amputees. We summarise in detail those factors that are influencing quality of life.

Age and Gender

Physical and mental health results do not significantly influence with respondent age

and gender. A slight negative association between age and PCS and MCS outcomes was identified in the study, indicating that age had little influence on these outcomes. Another study by Priyadharshan et al. (2022) and Gallagher et al. (2004) looked at lower limb amputees and found that there was no significant link between age and mental health (8,22). Study suggests that age may not directly affect mental health, which is in line with our results.

Marital Status

Our study suggests that marital status may not significantly impact mental health or overall quality of life, suggesting other factors like individual resilience, social support, and personal satisfaction are more essential.

Education

Our study found a weak positive but not significant correlation between education and Physical Component Summary (PCS) scores ($r = 0.137$), while a moderate positive and significant correlation was observed between education and Mental Component Summary (MCS) scores ($r = 0.314$, $P < 0.01$). These findings align partially with Magnusson et al. (2019), who reported that the length of education positively correlated with quality of life across all domains. This supports the idea that education enhances psychological well-being by equipping individuals with coping mechanisms and access to resources. Additionally, Magnusson et al. observed that individuals with no education had the lowest psychological QOL scores, underscoring the vital role of education in improving mental health and overall QOL (23,24).

Employment

Our results indicate a negligible and non-significant correlation between current employment status and PCS ($r = 0.026$), as well as a weak negative and non-significant correlation with MCS ($r = -0.108$). These findings suggest that employment, while important for financial stability or social status, may not directly impact emotional well-being or physical health. This aligns with Magnusson et al.'s conclusion that the psychological and environmental aspects of QOL are more closely linked to income levels, housing conditions, and access to health and rehabilitation programs. Our findings emphasise the need to prioritise support for individuals with disabilities who face unemployment, inconsistent incomes, or limited educational opportunities, particularly those residing in urban slums. Customised interventions focusing on education, mental health support, and rehabilitation access could significantly enhance their overall quality of life (23).

Level of Amputation

There is a little positive association between amputation level and mental health but not much impact on physical health. It means that with physical limitations, people with higher-level amputations might improve their mental health by strengthening their psychological barriers. Gallagher et al. (2004) in their study revealed that the cause of amputation, level of amputation, and gender did not significantly affect any of the QOL areas, doesn’t follow our result (8).

Side Of Amputation

The side of amputation greatly impact physical health results, most often due to changes in efficiency or mobility.

Duration Of Prosthesis Use

The duration of prosthetic use does not significantly impact either physical or mental health, suggesting that the benefits of prosthetic use may accumulate over time. Gallagher et al. (2004) observed a substantial correlation between the duration of living with the prosthesis and each of the physical health, social relationships, and environment scales on the WHOQOL (8,25), which supports the findings of our study.

Mental Health and Physical Health

In our study Mental and physical health are essential for overall quality of life, but there's no correlation between their scores. which means that in some populations, these domains can work independently. It indicates that improvements in one area, like physical health, may not always predict changes in another, like mental health. It emphasises how quality of life has multiple aspects and how various factors, such as social support, the environment, or individual coping methods, may have an impact on one's physical and mental health. Enhancing overall quality of life may require addressing both areas independently. A related study by Sinha *et al. (*2014) (26), shows social adjustment had a greater impact on the mental than the physical aspects of quality of life (MCS and PCS). Functional limitation negatively impacts PCS and MCS, but it more significantly impacts PCS. *Alessa et al. (2022) did a different study and found a strong link between the psychological adjustment dimensions and the level of satisfaction with the prosthesis, which was measured by the PCS and MCS aspects of QOL. Alessa et al. (2022) found a significant negative correlation between activity restriction and both PCS and MCS (27).* Deans *et al.* (2008) did a study and found a strong link between physical activity and perceived quality of life, especially in the physical and psychological domains of the WHOQOL-Brief questionnaire. This suggests that support networks and social relationships may play a bigger role (13).

In order to achieve purpose of the study, we hypothesised that those who are more physically active after suffering traumatic amputations will feel that their quality of life is higher. This idea is partially supported by the results. It is believed that physical activity improves physical health is supported by favourable effects on the Physical Component Summary (PCS), which have been demonstrated to be positively influenced by characteristics such as education and employment. The Mental Component Summary (MCS) was most strongly impacted by education and amputation level, although we hypothesise that physical activity indirectly supports mental health by enhancing social interaction, resilience, and independence. These findings highlight the value of comprehensive rehabilitation strategies that include exercise to enhance mental and physical health outcomes.

The implication of study emphasises the importance of education and side and levels of amputations in influencing quality of life. Although most demographic factors have no significant effect on PCS or MCS, they are still essential factors for a complete quality of life assessment, and future research could examine how these variables interact to better understand how they affect physical and mental health outcomes together.

CONCLUSION

Our study revealed that age, gender, side of amputation, and prosthesis use had a negative impact on mental health; marital status, education, current employment status, and side of amputation have a positive impact on physical health. Our findings partially support the hypothesis. Education and the level of amputation were the two variables that had the biggest effects on mental health. The study also suggests that education greatly improves mental health outcomes and that people who have had higher levels of amputation may become more psychologically adaptable. Study emphasise the need for customised rehabilitation strategies with a greater focus on psychosocial support and vocational reintegration for traumatic prosthetic users.

Declaration by Authors

Ethical Approval: Approved

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