Prosthetic Limb Use, Barriers, and Associated Factors among Lower Limb Amputees at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: A cross-sectional Study (2020 - 2025)

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Abstract

Introduction: Lower limb amputation (LLA) is a global health issue affecting millions of people worldwide. Globally, an estimated 1.5 million people undergo amputations every year and needs access to prosthetic services. This surgical intervention leads to a significant change of an individual's life that has a very intricate relationship with psychosocial, social, economic, and physical adjustments. Restoring functional mobility and independence through prosthetic limb rehabilitation is therefore a cornerstone of post-amputation care.

Methods: An institution-based cross sectional study was conducted at Tikur Anbesa Hospital, Ethiopia. Data collection was carried out through Reviewing medical charts & telephone calls with participants to complete self structured questionnaires. Descriptive and binary Regression analysis were performed to analyse data using Statistical Package for Social Science (SPSS)26.

Results: A total of 106 patients were included in the study.86 (81.1%) were male with Median age of respondents 50.50 (IQR) of 32.75 - 64 years. 86.8% of the amputations were unilateral, with Below knee(39.6%) and Above knee (56.6%). 55(51.9%) of the participants get a prosthesis. The average time between amputation and fitting of a definitive prosthesis was 7.79 months(SD +/- 5.32 months).The three most reported barriers for not receiving a prosthesis were long waiting time, unsuitable amputation stump and lack of awareness about available prosthetic options.On Regression analysis only level of amputation found to be associated with prosthetic fitting.

Conclusions: While progress is evident, persistent barriers and disparities in prosthetic rehabilitation demand urgent action. By addressing these, Ethiopia can enhance mobility, independence, and quality of life for amputees, fostering social reintegration and reducing the broader socioeconomic burden of limb loss. This study serves as a foundation for evidence-based reforms, ultimately advancing equitable assistive technology access in resource-limited settings.

Keywords: Lower Limb Amputation, Prosthetic fitting, Sustained User, Barriers, Tikur Anbesa Hospital, Addis Ababa, Ethiopia

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ABBREVIATION:

AEA -……..Above-Elbow Amputation
AKA -……..Above-Knee Amputation
BEA -……..Below-Elbow Amputation
BKA -……..Below-Knee Amputation
CKD -…….Chronic Kidney Disease
DM -…….. Diabetes Mellitus
HDA -……..Hip Disarticulation Amputation
HTN -……..Hypertension
LOS -……..Length of Stay
OB -…….. Obesity
PAD -……..Peripheral Arterial Disease
PS -…….Prosthetic Surgery
RA -……Re-amputation
RS -…….Revision Surgery
SDA -……..Shoulder Disarticulation Amputation
SMK -…….Smoking History
TASH …….. Tikur anbessa specialized hospital
VC -……Vascular Surgery
WC -……..Wound Closure

1 - Introduction

1.1. Background

Lower limb amputation (LLA) is a global health issue affecting millions of people worldwide. Factors such as diabetes, peripheral vascular disease, infections, trauma and Traditional medical practices contribute to Lower limb amputation.

Globally, an estimated 1.5 million people undergo amputations every year and needs access to prosthetic services. This need is growing in low- and middle-income countries (LMICs)[1].This surgical intervention leads to a significant change of an individual's life that has a very intricate relationship with psychosocial, social, economic, and physical adjustments[2].

Restoring functional mobility and independence through prosthetic limb rehabilitation is therefore a cornerstone of post-amputation care.
However, despite evidence that using a prosthesis can improve quality of life and reduce mortality for amputees, the World Health Organization (WHO) estimates that only 5-15% of amputees who need prosthetic devices in LMICs have access to them[1].

In Ethiopia, lower limb amputations are commonly performed for trauma, diabetic foot complications, traditional bone setter sequeles, and peripheral arterial diseases[3]. We couldn't find national figure about total number of amputees. However Hospital based study in Tikur Anbessa, largest tertiary hospital in Ethiopia, reported amputation contribute to 3.8% of procedures done in orthopedics department. Lower limb amputations contribute to 87.9% procedures[4].

However, there is a paucity of data regarding prosthetic fit rate & barriers. Additionally, patient- and surgery-related predictors have not been thoroughly investigated.
Understanding prosthetic limb use and its barriers in a tertiary Ethiopian hospital context is essential for improving rehabilitation services. Such data are also important for national policymakers aiming to strengthen assistive technology services in line with the WHO Standards for Prosthetics and Orthotics.

Therefore, this study aims to assess prosthetic limb fitting, the barriers encountered, and the associated factors among lower limb amputees treated at Tikur Anbessa Specialized Hospital over the study period(2020-2025).

1.2. Statement of problem

Lower limb amputation is a life-changing experience that affects nearly every aspect of a person's life — from physical mobility to emotional well-being and social participation[6]. In Ethiopia, as in many other low- and middle-income countries, the number of people living with limb loss is increasing, mainly due to road traffic accidents, traumatic injuries, diabetes, and vascular diseases. Although prosthetic limbs can restore independence and improve quality of life, many people who undergo amputation never receive one, or struggle to use it effectively[1].

Even with the existence of rehabilitation centers and prosthetic workshops, access to timely and appropriate prosthetic fitting remains limited. Many patients face long waiting times, costs, lack of trained professionals, and transportation challenges. Others may not be fully aware of the benefits of prosthetic rehabilitation. These barriers often leave amputees dependent on crutches or caregivers, restricting their mobility and ability to work, and contributing to emotional distress and social isolation[7].

At Tikur Anbessa Specialized Hospital — the largest tertiary and teaching hospital in Ethiopia — numerous lower limb amputations are performed each year. However, little is known about how many of these patients eventually receive a prosthesis, when they are fitted, or what factors influence whether they get it and continue using it. Without this information, it is difficult to improve referral systems, follow-up care, or national rehabilitation strategies.

1.3. Significance of the study

This study will contribute to understanding the use of prosthetic limbs and the barriers faced by lower limb amputees in Ethiopia's largest tertiary hospital, Tikur Anbessa Specialized Hospital. By analyzing patient data from 2020 to 2025, the research will provide clear evidence on how many amputees receive prosthetic limbs, the timing of fitting, the barriers and the factors influencing their fit. Establishing these trends will help reveal gaps in current rehabilitation practices and guide improvements in service delivery.

This study will attempt to identify barriers that prevent amputees from benefiting from prosthetic technology. Understanding these challenges may allow healthcare providers and hospital administrators to design

more effective referral systems, streamline rehabilitation pathways, and strengthen patient education and counseling.

At the policy level, the study may provide essential evidence to support the development of national rehabilitation strategies and assistive technology programs that align with the World Health Organization's *Standards for Prosthetics and Orthotics*. The insights gained may also contribute to building a stronger local evidence base for future research on amputee outcomes, prosthetic design, and community reintegration.

Ultimately, this study aims to contribute to improving the quality of life for amputees in Ethiopia by promoting equitable access to prosthetic services and helping ensure that every individual who undergoes an amputation has the opportunity to regain mobility, independence, and dignity.

2 - Literature review:

2.1. Overview & Burden of lower limb amputation

Lower limb amputation is a major surgical procedure performed to remove a non-viable or severely damaged limb, most commonly as a result of trauma, diabetes Mellitus, peripheral vascular disease, or chronic infection[8].

Globally, it is estimated that 65 million people live with limb amputations, and 1.5 million people undergo amputations every year, with 60% being Lower limb amputations (LLA)[9].Also, two-thirds of people with amputation live in low resourced settings[9] and it is estimated that 5 million of the amputee population live in Africa, of which around 75% are lower limb amputees[9].

The prevalence of limb loss in the U.S. is high, with nearly 2 million individuals living with amputations.This burden is expected to increase, particularly in aging populations, with projections indicating that the prevalence could double by 2050 due to rising rates of peripheral vascular disease and diabetes among older adults[10].

In Africa, studies have shown that trauma and diabetic complications are the leading causes of lower limb amputation[11].Similarly, In Ethiopia studies have reported trauma, particularly from road traffic injuries, as the dominant cause, followed by infection and diabetic foot

gangrene[12].The incidence of traumatic amputations in Ethiopia was reported as roughly **193 per 100,000s** which gives a sense of annual burden though it focuses on traumatic cause only[13].

2.2 Importance of Prosthetic Limb Rehabilitation

Lower-limb amputations are a common cause of disability[14].This health condition has a profound impact on daily functioning: pain,depression, changes in body image and mobility limitations are common problems[14].

The use of prosthetic limbs plays a crucial role in restoring mobility, independence, and social participation after amputation[14].Recent studies have suggested that prosthetic attainment (PA) and ambulation after a lower extremity amputation independently improves long-term survival as well[15].

The rehabilitation process includes several stages of varying duration - preoperative phase; pre-prosthetic stage; and prosthetic training.The pre-prosthetic rehabilitation should be initiated as soon as possible and is mainly aimed at range of motion and strength, residual-limb shaping, non prosthetic mobility skills (transfers and wheelchair mobility), independence in basic activities of daily living (ADL), and training with early walking aids[16].

2.3 Prosthetic Limb Utilization

The rate of prosthetic limb use varies widely across regions. Studies from high-income countries show that up to **80–90% of lower limb amputees** are fitted with prostheses and continue to use them[15, 17-21]. In Contrast,this rate is much lower in LMICs.For instance,Studies done in Tanzania,Rwanda & Ethiopia mentioned prosthetic limb use/fit rate ranges from 20-40%[4, 22, 23]. The research conducted in Ethiopia, encompassing both upper and lower limb amputations, indicates that the rate of prosthetic fitting is 34%[4]. However, this investigation does not address the Barriers/challenges, and factors associated with the likelihood of prosthetic limb fit.

2.4 Barriers to Prosthetic Limb Access and Use

Lower limb amputations (LLAs) place a substantial burden on affected individuals, primarily through their negative impact on mobility, which

often leads to dependence on others for basic activities of daily living[24].Effective and comprehensive rehabilitation plays a critical role in helping people with amputations regain functional independence and re-engage in social, community, and work-related activities[24].Despite its impact, access to prosthesis has multifaceted Barriers/challenges in LMICs.

A study done in Columbia, reported the barriers identified into 3 categories. The 1st were health system barriers which include lack of appointments & delay in authorization by professionals.The 2nd category were patient related barriers which includes lack of transportation, lack of knowledge, lack of family support and health related problems. The 3rd category were health professional related[25].

Another Study done in south Africa on barriers and facilitators to utilization of rehabilitation services amongst persons with lower-limb amputations identifies several factors. This Factors were Long travel distances and poor transport access, Lack of information and referral from health workers, inability to afford transport or caregivers, Pain, fatigue, and depression decreased motivation and Social stigma[7].

A study done in Sierra leone also lists barriers to accessing services included poor transportation access, high service fees, rural living, gender and a lack of government support. Insufficient funding and supplies, skilled staff shortages and a lack of local training programmes were also frequently reported barriers to providing rehabilitation services[26].

In Ethiopia, Upto our knowledge there is no published studies that have directly examined patient-level barriers and challenges to prosthetic limb use/fit.

2.5 Factors Associated with Prosthetic Limb fit

The likelihood of prosthetic limb use is determined by a combination of sociodemographic, clinical, and surgical factors[27-29].

Age as a factor influencing prosthesis prescription has been studied. Studies demonstrate that increasing age is associated with a decreased likelihood of receiving a prosthesis following amputation[27, 28].For instance, a study done in USA states, for every 10-year increase in age, there was approximately a 53.8% decrease in the probability of receiving a prosthesis[27].

Beyond age, clinical comorbidities and functional status also plays a vital roles in the decision-making for prosthetic prescription/fitting[28].

Clinical conditions such as peripheral vascular disease (PVD), systemic sepsis, renal failure, congestive heart failure (CHF), psychoses, and neurological disorders significantly also decrease the likelihood of prosthetic prescription[28].

Level of amputation also associated with prosthetic fit rate[29].A study done in USA states transtibial amputation had the highest rate followed by Transmetatarsal and Transfemoral[29].

Identifying this factors could be used in a preamputation assessment to determine the like hood of prosthetic fit[27].It is also essential to better appreciate the factors, particularly any modifiable factors that might be targeted in rehabilitation interventions[29].

Conceptual framework:

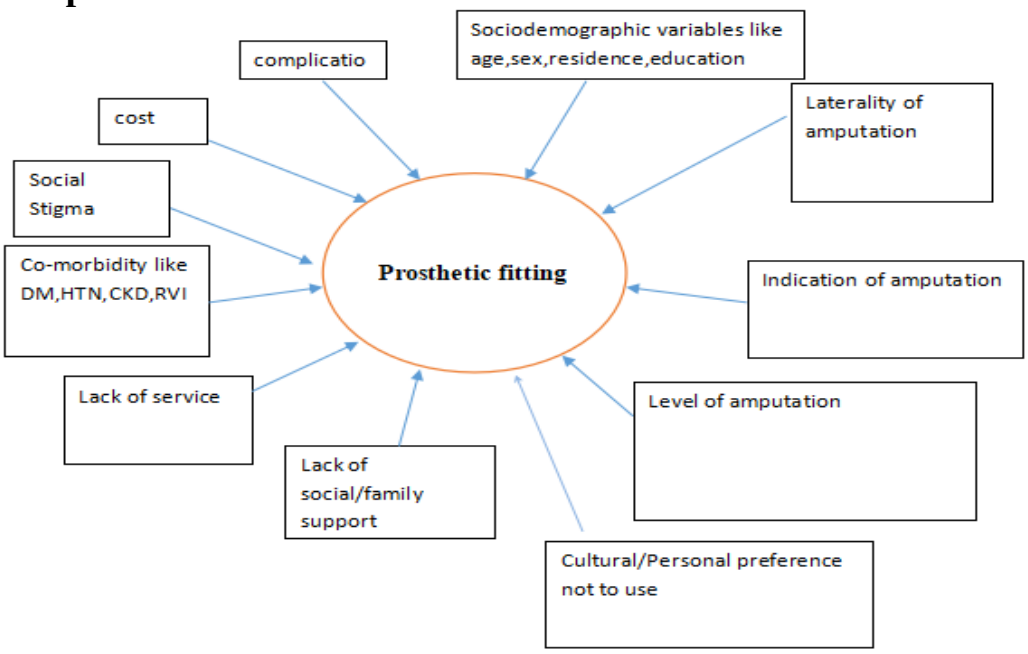


Figure 1: Conceptual framework indicating possible relationship between Dependent and independent variables

3, Objectives

3.1. General objectives

- To assess prosthetic limb use/fitting, barriers, and associated factors among lower limb amputees treated at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia from 2020 to 2025.

3.2. Specific objectives

- To determine the proportion of lower limb amputees at TASH who received a prosthetic limb
- To determine the average time interval between amputation and prosthetic fitting among lower limb amputees
- To determine the proportion of amputees demonstrate sustained use of prosthetic limb
- To identify barriers in accessing prosthetic limb
- To identify factors associated with Prosthetic limb fitting among lower limb amputees at TASH

4, Materials and Methods

4.1. Study Area and Period

This study was conducted at Addis Ababa University orthopedics and trauma surgery department of Tikur Anbesa hospital (from jun 2020 to jun 2025). Addis Ababa is the capital city of Ethiopia. It is the only tertiary care center in Ethiopia that has a catchment population of over 100 million.

The hospital's health service covers the outpatient department, inpatient services, critical care, and emergency intervention unit, and different clinics, such as antenatal care clinics, delivery services, tuberculosis, ART, ophthalmology clinics and others.The Hospital treats over 500,000

outpatients and more than 21,000 inpatients annually, making it the largest referral hospital in Ethiopia.

Importantly, **prosthetic and orthotic services are available within the main hospital**, allowing amputees to receive assessment, fitting, adjustment, and follow-up care on site.

4.2. Study design:

A Cross Sectional study was conducted, among adult cases that underwent major lower limb amputation during study period.

4.3. Population:

4.3.1 Source population

The source population was all patients who underwent major lower limb amputations at orthopedics and trauma surgery department in Tikur Anbesa hospital during the study period

4.3.2 Study population:

All patients who underwent major lower limb amputation during study period, eligible for inclusion criteria

4.4. Inclusion and Exclusion criteria

4.4.1. Inclusion criteria

- Age 18yr and above at the time of study period
- Patients who underwent major lower limb amputation during the specific 5 year period
- Patietns who are at least 6 months post amputation
- Those with complete documentation(Sociodemographic profile,clinical note and operation note)
- Reachable for follow-up via phone to obtain prosthetic-use information

4.4.2. Exclusion criteria

- Patient not reachable by telephone after three attempts made on different days

4.5. Sample size and Sampling technique

4.5.1. Sample Size

The sample size for this study will be determined by using a single population proportion equation.

Previous study done in Rwanda on the status and use of prosthetic devices by persons with lower limb amputation Rwanda in 2019 mentions that prosthetic fit rate is 39.7%.So, P will be 0.397, margin of error (d) 0.05 and 95% confidence-interval critical value (Zά/2=1.96) and substituting the values gives

$$n=\frac{(Z_{\frac{\alpha}{2}}^{2})P(1-P)}{d^2} = \quad n_o = \frac{(1.96)^2\ 0.397(1-0.397)}{(0.05)^2} = 0.918/0.0025 = 367.2$$ **but,** assuming 10 % non-response rate, the sample size will be: n=367 + 10 %=367+36.7=403.7

4.5.2. Sampling technique

Because the total number of eligible major lower-limb amputees at TASH between 2020 and 2025 is expected to be lower than the calculated sample size, a convenient sampling technique will be employed.

4.6. Study Variables

4.6.1. Dependent variables

- Prosthetic limb use
- Time for amputation to prosthetic fit
- Barriers to prosthetic access
- Factors associated with prosthetic limb access

4.6.2. Independent Variables

- Sociodemographic variables(Age,Sex,Educational level,Occupation,Residence)
- Comorbidities
- Cause of amputation
- Level of amputation
- Complications
- Barriers and challenges variables (cost,lack of service,long distance,lack of family/social support,personal preference not to use prosthesis,Social Stigma)

4.7. Data collection

4.7.1 Socio demographic and clinical data

Data were collected using self structured questionnaire & checklist. The questionnaire was designed in English,translated into Amharic, and back translated. The tool consists of Sociodemographic characterstics,clinical & surgical characterstics & prosthesis related information. Some questions were designed as partly open ended with follow up questions,particularly in barrier section. Data sources include the operating room registry, patients' medical charts, electronic records, and patient interviews conducted via phone.Prior to full scale data collection, Pilot study & necessary modifications done. The data collection process was facilitated using the Kobo Collect tool.

4.7.2. Data Quality Assurance

All data collection tools (questionnaires and checklist) was standardized.Data collection was performed by final year orthopedics resident. The completeness of each data set was checked on daily bases to minimize errors.

4.8. Data processing and Analysis

Data was checked for completeness cleaned manually, entered and analyzed using the statistical package for social science (SPSS). Frequencies and cross tabulations was used to summarize descriptive statistics. Statistically significance association was measured by univariate and multivariate analysis (logistic regression), odds ratio at 95% confidence interval, P-value < 0.05 will be considered as statistically significant.

4.9. Ethical statement

Ethical clearance and approval for the study was obtained from Institutional Ethics Review Board of Health Institute, Addis Ababa University. Permission was obtained from AAU administration and privacy will be maintained.

4.10. Dissemination plan and use of the result

The findings of this study will be presented to the department of Department of Orthopedics and Trauma surgery for public defense. Summary report will be submitted to AAU and result will also be communicated to clinicians who treat the patient to identify factors that

could be focused on to improve outcome in this setting. Effort will be made to publish the findings in peer reviewed journals.

4.11. Operational definitions

1-**Major limb amputation:**

- refers to the surgical removal of a limb at or proximal to ankle joint. This includes amputations at the following levels: This can include:

- **Hip Disarticulation:** Amputation through the hip joint.
- **Above-Knee Amputation (AKA):** Amputation of the lower limb above the knee joint.
- **Knee Disarticulation**:Amputation through the knee joint.
- **Below-Knee Amputation (BKA):** Amputation of the lower limb below the knee joint but above the ankle.

2-**Level of amputation:**

- are defined based on the anatomical location where the limb is surgically removed. This can include

- **Hindquarter Amputation (Hemipelvectomy):** Amputation that removes half of the pelvis along with the entire lower limb.
- **Hip Disarticulation:** Amputation at the level of the hip joint, removing the entire lower limb.
- **Above-Knee (Transfemoral) Amputation:** Amputation through the femur, above the knee joint.
- **Knee Disarticulation:** Amputation at the level of the knee joint.
- **Below-Knee (Transtibial) Amputation:** Amputation through the tibia, below the knee joint.
- **Syme Amputation**:Amputation through Ankle joint.

3- **Indication of amputation:**

- includes a specific set of clinical criteria or conditions that justify the need for a surgical removal of a limb or part of it. This can include:

- **Trauma:** Irreparable damage to the limb, such as from accidents or injuries, where the limb cannot be salvaged.
- **Infection:** Severe, uncontrollable infections, such as gangrene, osteomyelitis, or necrotizing fasciitis, where the infection cannot be controlled by antibiotics or other treatments.
- **Peripheral Arterial Disease (PAD):** Critical limb ischaemia due to advanced PAD leading to non-healing ulcers, severe pain, or tissue death (necrosis).
- **Malignancy:** Presence of malignant tumors or cancers in the limb that cannot be treated effectively with other methods and pose a significant risk to the patient's life.
- **Congenital Conditions:** Severe congenital deformities where the limb is non-functional or poses a risk to the patient's overall health.
- **Chronic Pain**: Intractable pain in the limb that is resistant to other forms of treatment, significantly impairing the patient's quality of life.
- **Failed Limb Salvage Procedures:** When previous attempts at limb salvage, such as revascularization or reconstruction, have failed, necessitating amputation.

4-Surgical complication: includes any adverse events or conditions that occur as a direct result of the surgical procedure. This can include:

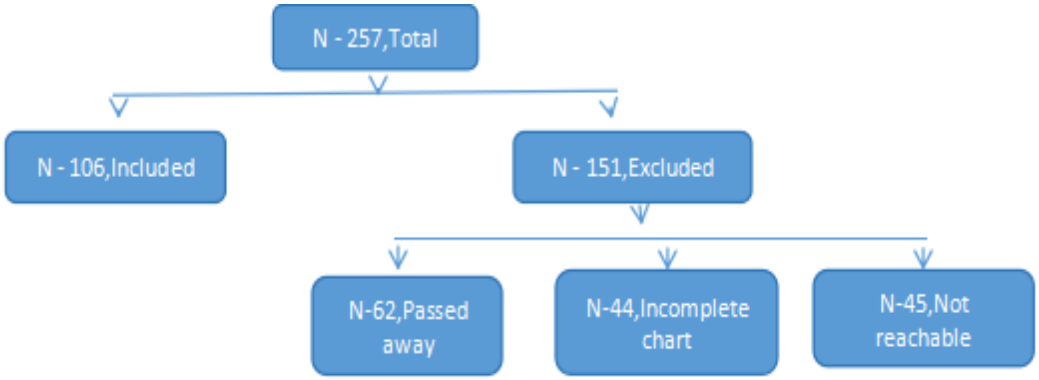
- **Infection(SSI):** Includes local wound infections, deep infections involving the bone (osteomyelitis), and systemic infections.
- **Wound Dehiscence:** breakdown(opening) of the wound edges.
- **Phantom Pain:** Pain perceived in the area where the limb was amputated, which can significantly affect the patient's quality of life.
- **Stump Gangrene:** dead, non-viable tissue in the amputated limb stump due compromised blood flow.
- **Pain**: can be phantom pain,neuropathic pain or pain due to other causes

5-An individual was defined as having received a prosthesis if a provisional or final prosthesis was fit.

6-Sustained Prosthetic limb Use - person continues to use their prosthetic limb consistently after fit.

5,Results

During the study period, a total of 257 major lower limb amputation cases were operated in the orthopedics department of Tikur Anbesa hospital.Out of these, 106 found to fulfill the inclusion criteria and included .



Sociodemographics Characterstics

Of the 106 study participants with LLA,86 (81.1%) were male.The Median age of respondents were 50.50 with inter-quartile range (IQR) of 32.75 - 64 years.The majority 84(79.2%) of the patients were from Urban areas.In terms of level of education, most have primary level education(1-8) (35.8%, n=38) followed by no formal education(17.9%, n=19). Most are unemployed(57.5%, n=61) at the time of this study.

Table 1: Socio-Demographic Characterstics(n=106)	
Variables	Frequency(%)/Median(IQR)
Age(years)	50.50 (IQR 32.75 - 64)
Sex	
Male	86(81.1%)
Female	20(18.9%)
Residence	
Urban	84(79.2%)
Rural	22(20.8%)
Level of Education	
No formal education	19(17.9%)
1-8	38(35.8%)
9-10	18(17%)
11-12	15(14.2%)
College/university	16(15.1%)
Occupation	
Has job	36(34.0%)
No job	61(57.5%)
Marital Status	
Single	17(16%)
Married	76(71.7%)
Divorced	2(1.9%)
Widowed	11(10.4%)

Among those received a prosthesis, 85.5% were men. When comparing the groups to educational level,in the group that received the prosthesis 29.1% reached 1-8 grade. While in the group that didn't receive prosthesis this percentage was 43.1%. In terms of occupation, those with a job had a high percentage of prosthetic fit than those with no job, 54.5% vs 45.5%.

Table 2 - Socio-Demographic Characterstics(n=106)

Socio-demographics	Prosthesis fit			
	No		Yes	
	n	%	n	%
Sex	-	-	-	-
Female	12	23.5%	8	14.5%
Male	39	76.5%	47	85.5%
Residence	-	-	-	-
Rural	13	25.5%	9	16.4%
Urban	38	74.5%	46	83.6%
Level of Education	-	-	-	-
No education	12	23.5%	7	12.7%
1-8	22	43.1%	16	29.1%
9-10	7	13.7%	11	20%
11-12	5	9.8%	10	18.2%
College/university	5	9.8%	11	20%
Occupation	-	-	-	-
No job	36	70.6%	25	45.5%
Has job	15	29.4%	30	54.5%
Marital Status	-	-	-	-
Married	34	66.7%	42	76.4%
Unmarried	17	33.3%	13	23.6%
Age	-	-	-	-
<30	5	9.8%	13	23.6%
30-50	13	25.5%	22	40.0%
>50	33	64.7%	20	36.4%

Amputation-Related Characteristics

Among the amputees,over 86.8% of the amputations were unilateral, with Below knee(39.6%) and Above knee (56.6%) accounting for the majority.Diabetes Mellitus,HTN & Cardiac diseases were the most commonly reported comorbid conditions with frequencies 50.6%,30.9% and 13.6% respectively.In this study, the leading indication of Lower limb amputations were peripheral arterial disease (PAD), accounting for 52.8% of cases, followed by trauma at 26.4% and tumors at 12.3%.

Table 3: Amputation-Related Characterstics(n=106)	
Variables	Number/Frequency(%)
Co-morbidity	
DM	41(50.6%)
HTN	25(30.9%)
Cardiac Dis.	11(13.6%)
CVD	3(3.7%)
CKD	3(3.7%)
RVI	3(3.7%)
Others	6(7.4%)
Bilateral vision loss	
Bronchial asthma	
CLD	
Dyslipidemia	
Hypothyroidism	
Schizophrenia	
Indications of Amputation	
PAD	56(52.8%)
Trauma	28(26.4%)
Tumors	13(12.3%)
Diabetic foot ulcer	7(6.6%)
Non DM infection	2(1.9%)
Type of Amputation	
Unilateral	92(86.8%)
Bilateral	14(13.2%)
Level of Amputation	
AKA	60(56.6%)
BKA	42(39.6%)
Hip Disarticulation	2(1.9%)
Syme	1(0.9%)
Lisfranc	1(0.9%)
Post - Op Complications	
None	87(82.1%)
SSI	12(11.3%)
Wound Dehiscence	4(3.8%)
Prominent bone	3(2.8%)

Of the amputations due to trauma cause,40% received prosthesis.Of PAD causes,36.4% gets prosthesis.Regarding the level of amputation,among to

whom the prosthesis delivered, 50.9% were Above knee amputees vs 49.1% were Below knee amputees.

Table 4: Amputation-Related Characterstics(n=106)

Surgical and clinical factors	Prosthesis fit			
	No		Yes	
	n	%	n	%
Co-morbidity	-	-	-	-
Yes	27	52.9%	24	43.6%
No	24	47.1%	31	56.4%
Cause of Amputation	-	-	-	-
Trauma	-	-	-	-
Yes	6	11.8%	22	40%
No	45	88.2%	33	60%
PAD	-	-	-	-
Yes	36	70.6%	20	36.4%
No	15	29.4%	35	63.6%
DM	-	-	-	-
Yes	1	2%	6	10.9%
No	50	98%	49	89.1%
Tumor	-	-	-	-
Yes	6	11.8%	7	12.7%
No	45	88.2%	48	87.3%
Non DM Infection	-	-	-	-
Yes	2	3.9%	0	0%
No	49	96.1%	55	100%
Level of Amputation	-	-	-	-
Above knee	34	66.7%	28	50.9%
Below knee	17	33.3%	27	49.1%
Amputated limb	-	-	-	-
Unilateral	42	82.4%	50	90.9%
Bilateral	9	17.6%	5	9.1%
Post Op Complication	-	-	-	-
Yes	9	17.6%	10	18.2&
No	42	82.4%	45	81.8%

Prosthesis fitting

Out of total 106 participants,55(51.9%) were fitted with a prosthesis.The average time between amputation and the fitting of a definitive prosthesis was 7.79 months(SD +/- 5.32 months). Regarding the place of prosthetic service delivery,23(41.8%) of the participants received their prosthesis at **Tikur Anbessa Specialized Hospital**, whereas Other 25(45.5%) obtained their prosthesis from other Government centers outside TASH. A smaller proportion,7(12.7%) reported receiving their prosthetic limb from private centers.

Among participants who did not receive a prosthetic limb, multiple barriers to access were Reported. Long waiting time(25.5%) were the most frequently reported barrier.An unsuitable amputation stump for prosthetic fitting and lack of awareness about available prosthetic options were the second most frequently reported barriers, each accounting for 15.7% of Participants.13.7% reported that they are satisfied with current mobility aids(e.g crutches,wheelchair).In addition,13.7% cited lack of Social or Family support as a Barrier .Furthermore, 11.8% of respondents were not fit for prosthesis fitting due to there associated medial conditions(e.g. Bedridden patients,body weakness,Obese patients & ...).Lack of access to prosthetic services were mentioned as a barrier by 9.8% of participants.A small proportion states fear of pain/complications & financial constraints as a barrier for not obtaining a prosthesis.

Out of the 55 participants who were successfully fitted with a prosthetic limb, 44 individuals (80.0%) were sustained users, continuing to utilize their prosthesis on a regular basis. In contrast, 11 participants (20.0%) discontinued prosthesis use after fitting.

Factors Associated with Prosthetic limb fitting

Univariate analysis at 25% level of significance was run to select variable to be included into multi-variable logistic regression analysis model and from which; age,sex,educational status,occupation,residence,level of amputation,cause of amputation/trauma,cause of amputation/dm,cause of amputation/PAD,Amputated limb(unilateral/bilateral) and comorbidity(HTN) were found to be significantly associated with prosthetic fit(yes/no).

However, on multi-variable regression analysis,after adjusting other covariates,**only level of amputation** were found to have significant associated with prosthetic fit at 5% level of significance.

Accordingly,the odds of being fitted with a prosthesis were significantly lower among above-knee amputees compared to below-knee amputees (AOR = 0.266, 95% CI: 0.083–0.852, p = 0.026).

Graph - 1: Patient Reported Barriers

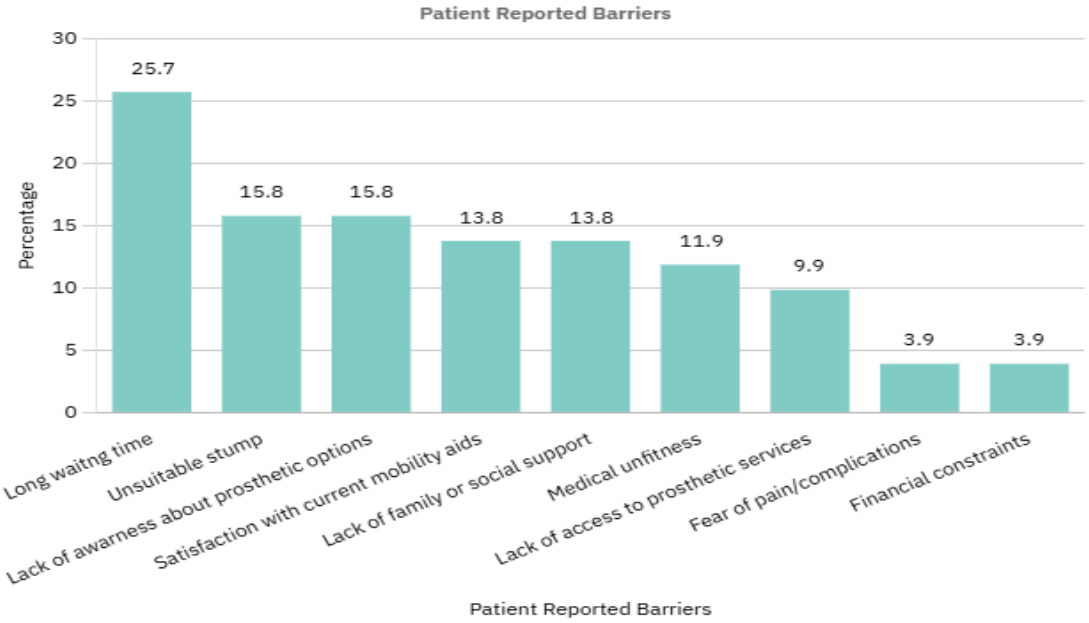


Table 5:Factors associated with prosthetic limb use/fit(n=106)

Variables	Crude-Odds ratio(COR)(95% CI)	Adjusted-Odds ratio(AOR)(95% CI)	P - Value
Age2	O.448(0.256, 0.784)	0.432(0.157, 1.189)	0.104
Sex(1)	0.553(0.206, 1.489)	0.841(0.215, 3.296)	0.804
Educational status	1	1	
Educational status(1)	0.265(0.065, 1.085)	0.526(0.82, 3.356)	0.497
Educational status(2)	0.331(0.096, 1.140)	O.447(0.094, 2.122)	0.311
Educational status(3)	0.714(0.713, 2.954)	0.289(0.040, 2.102)	0.220
Educational status(4)	0.909(0.202, 4.101)	0.839(0.133, 5.275)	0.851
Occupation(1)	0.347(0.156, 0.775)	0.657(0.212, 2.044)	0.469
Residence(1)	0.572(0.221, 1.482)	O.289(0.079, 1.060)	0.061
Level of amputation			
Above knee	**0.519(0.236, 1.138)**	**0.266(0.083, 0.852)**	**0.026***
Below knee	**1**	**1**	
Cause of amputation/trauma	5.00(1.824, 13.704)	3.986(0.834, 19.040)	0.083
Cause of amputation/Diabetics	6.122(0.711, 52.737	12.589(0.829, 191.084)	0.068
Cause of amputation/PAD	0.238(0.105, 0.538)	1.251(0.253, 6.173)	0.783
Uni/Bi	2.143(0.667, 6.888)	1.769(0.346, 9.050)	0.493
Presence of comorbidity/HTN	0.428(0.169, 1.082)	0.266(0.064, 1.101)	0.266

6, Discussion

Lower limb amputation has a profound impact on daily functioning: pain,depression, changes in body image and mobility limitations[14].
The use of prosthetic limbs plays a crucial role in restoring mobility, independence, and social participation after amputation[14].This study provides a valuable insight into Sociodemographic profile,amputation related characterstics,prosthetic fit rate,Barrier to prosthetic access & factors determining prosthetic fit in a resource limited setup,specifically Tikur anbessa tertiary specialized hospital.

Sociodemographic and amputation related characterstics

The Study population was predominantly male (81.1%), with a median age of 50.5 . This male predominance is consistent with studies done in Rwanda (68.8% - median age 49.1) & Scotland(64%)[19, 23] . The median age 50.5 Suggests a working age population which has an economic implication.The urban residency of 79.2% of participants is higher than Rwanda's (18.5%) [23] which is may be due to rural patients are inaccessible through phone, potentially limiting their inclusion in the study . Low educational level (no formal education(17.95%) & primary level only(35.8%)) and high unemployment (57.5%), aligned with findings from LMICs[22, 23].

Amputation characterstics reveal that 86.8% are unilateral amputations with Above knee accounting 56.6% and below knee amputations 39.6%. This distribution shows similarity with the study done in Columbia (transfemoral 62.3%).In contrast Studies done in Rwanda & Tanzania shows near equal proportion between below knee & above knee amputtes[22, 23].The studies done in Scotland & USA shows high transtibial proportion than transfemoral amputations[19, 29]. Possible explanation for this difference can be many patients in our setting presented with advanced disease condition, leaving surgeons with no choice but to perform higher-level amputations[4] .

Peripheral arterial disease (PAD) emerged as the leading indication (52.8%), followed by trauma (26.4%).This finding contrast with previous studies done in our country & other study from Tanzania in which trauma is the leading cause[4, 12, 22].However our study align with study done in USA,where PAD is the main cause in 54% of cases & Trauma in 45% of cases[10].

Prosthesis fitting & Barriers

Prosthesis fitting occurred in 51.9% of participants . This fitting rate is higher than reports from LMICs for example a study done in Tanzania reports 21.9%[22] . Another study from Rwanda states 39.7% prosthesis fit rate[23].This Rate is, but below than high income countries in which reaches up-to 80 - 90%[21, 29, 30].

Most fitting were at government center(87.3%) highlighting reliance on government centers & over burden like most LMICs[31].

In our study the Average time between amputation to prosthetic fitting was 7.79 months(SD +/- 5.32 months) which is shorter than what reported on a study from rural South Africa with average waiting time 1 year after amputation[32]. However this duration is longer than what reported in high income countries . For example a study from Finland documented average fitting time 117 days[15], while study from USA reported 53% of participants were fitted at 4 month & up-to 92% at 1 year[29] and another USA based report showing average waiting time of 130days[30]. Despite the fact that shorter time between LLA surgery and prosthesis provision result in a more active and sustained recovery[30], these differences reflect unequal access to prosthetic services across settings, with limited resources and service availability contributing to longer delays in rehabilitation[33, 34].

Out of 55 participants - 44 individuals (80.0%) were sustained users**.** In contrast, 11 participants (20.0%) discontinued prosthesis use after fitting. This result is comparable with a study done in Nigeria, states abandonment rate is 27%[35]. we recommend future studies to identify possible causes of abandonment.

Various Barriers that hinder prosthesis access were identified.The most Frequently reported barrier was long waiting time (25.5%), underscoring the limitations within prosthetic delivery system.

Long waiting times are a well documented barrier in LMICs, where low trained personnel,limited manufacturing capacity & centralized services often delays the rehabilitation process[5].This finding is aligned with the finding in Columbia, revealed that 21.3% of participants cited limited availability of appointments, while 19.6% mentioned delays in authorization by professionals as significant barriers[25].

Unsuitable amputation stump(15.7%) & lack of awareness about available prosthetic options(15.7%) were the second most common reported barrier.Unsuitable stumps may result from poor surgical techniques,post op complications,joint contractures & Stump pains[36, 37].This finding emphasize the importance of optimal surgical technique & early initiation of prosthetic rehabilitation.

Lack of awareness about prosthetic options reflects a gap in patient education & counseling about the rehabilitation phases[5, 25, 37].

A notable proportion reported satisfaction with current mobility aids such as crutches,wheelchairs and lack of social or family support stand out, with similarities in various studies[7, 25, 26].

Among the less prevalent but relevant barriers,related health problems(medical unfitness),lack of access to prosthetic service,Fear of pain/complications and financial constraint were mentioned.

Factors associated with prosthetic limb fitting

In our study, after adjusting for other covariates, only level of amputation was found to have significant association with prosthetic fitting at 5% level of significance.Accordingly the odds of fitting with a prosthetic limb is significantly lower in above knee amputees than below knee amputees.Above knee amputees were 73% less likely to be fitted than below knee amputees.This aligns with a USA-based prospective study of dysvascular amputees, where transfemoral cases showed markedly reduced fitting rates (57% vs. 93–100% for transtibial/foot levels at 12 months)[29].Another USA based study also revealed that amputation level was significantly positively associated with prosthetic prescription (TF hazard ratio [HR]: 0.46, $p < 0.001$, and ankle HR: 1.41, $p < 0.001$) compared with TT amputation[38].This may be due to the fact that above knee amputtes require more energy for ambulation & the need for advanced prosthetic options since the knee joint is absent. Future efforts are needed to address these issues[28].

7,Conclusion

This study provides a valuable insight into Sociodemographic profile,amputation related characterstics,prosthetic fit rate,time interval between amputation & prosthetic fit,barrier to prosthetic access & factors determining prosthetic fit in a resource limited setup,specifically Tikur anbessa tertiary specialized hospital.

In this study more than half of the participants(51.9%) were received a prosthetic limb,a rate higher than reports in other LMICs but still lower than the rate in developed countries.The average time to prosthetic fitting also longer than developed countries reports.Taken together,this findings demonstrate clear inequity in rehabilitation services,indicating substantial gap remains & significant effort needed to improve the quality of rehabilitation services.
Long waiting time was the most frequently reported barrier to prosthetic access, followed by unsuitable amputation stumps and lack of awareness about available prosthetic options. These barriers point to systemic limitations in prosthetic service delivery, gaps in perioperative surgical optimization, and inadequate patient counseling. A proportion of participants also cited satisfaction with alternative mobility aids and lack of social or family support, emphasizing that prosthetic uptake is also influenced by psychosocial determinants.

Multivariable analysis demonstrated that the level of amputation was the only factor independently associated with prosthetic fitting. Above-knee amputees were less likely to receive a prosthesis compared to below-knee amputees. This finding is consistent with international literatures and reflects higher functional demands, increased energy expenditure, and the need for more advanced prosthetic components.

Overall, the study highlights both encouraging progress and persistent gaps in prosthetic rehabilitation services. Addressing these Barriers is essential to improve functional outcomes, quality of life, and social reintegration of amputees in Ethiopia and similar settings.

References

1. *Prosthesis product narrative by ATscale 2030.*
2. Priyanka Saini1, B.V., Megha Gakhar3, Dr. Manisha Athwal4 *Lower Limb Amputation and Its Psychosocial Impact: A Review of Body Image, Mobility and Life Quality.* 2025.
3. Sume, B.W. and S.A. Geneti, *Determinant Causes of Limb Amputation in Ethiopia: A Systematic Review and Meta-Analysis.* Ethiop J Health Sci, 2023. **33**(5): p. 891-902.
4. esmelealem, S., *PATTERNS, INDICATIONS, AND OUTCOMES OF MAJOR LIMB AMPUTATIONS AT TIKUR ANBESA HOSPITAL, ETHIOPIA: A RETROSPECTIVE COHORT STUDY (2019-2024).* 2024.
5. *WHO STANDARDS FOR PROSTHETICS AND ORTHOTICS.*
6. Saini, P., *Lower Limb Amputation and Its Psychosocial Impact: A Review of Body Image, Mobility and Life Quality. 2025.*
7. Ennion, L. and A. Johannesson, *A qualitative study of the challenges of providing pre-prosthetic rehabilitation in rural South Africa.* Prosthet Orthot Int, 2018. **42**(2): p. 179-186.
8. Godlwana, M.L., *Global Trends in Incidence of Lower Limb Amputation: A Review of the Literature.* 2008.
9. McDonald, C.L., et al., *Global prevalence of traumatic non-fatal limb amputation.* Prosthet Orthot Int, 2021. **45**(2): p. 105-114.
10. Ziegler-Graham, K., et al., *Estimating the prevalence of limb loss in the United States: 2005 to 2050.* Arch Phys Med Rehabil, 2008. **89**(3): p. 422-9.
11. *Regional Assessment of Lower limb Amputations in sub-Saharan Africa; a Prospective Cohort Study Protocol* 2025.
12. Gebreslassie, B., K. Gebreselassie, and R. Esayas, *Patterns and Causes of Amputation in Ayder Referral Hospital, Mekelle, Ethiopia: A Three-Year Experience.* Ethiop J Health Sci, 2018. **28**(1): p. 31-36.
13. Wei, B., et al., *Global, regional and national burden of traumatic amputations from 1990 to 2021: a systematic analysis of the Global Burden of Disease study 2021.* Front Public Health, 2025. **13**: p. 1583523.
14. De-Rosende Celeiro, I., L. Simon Sanjuan, and S. Santos-Del-Riego, *Activities of daily living in people with lower limb amputation: outcomes of an intervention to reduce dependence in pre-prosthetic phase.* Disabil Rehabil, 2017. **39**(18): p. 1799-1806.
15. AINEN, T.P., *Primary survival and prosthetic fitting of lower limb amputees.* 1989.
16. Esquenazi, A. and R. DiGiacomo, *Rehabilitation after amputation.* J Am Podiatr Med Assoc, 2001. **91**(1): p. 13-22.
17. *Amputee rehabilitation and prosthetics services for people of all ages with limb loss and limb difference.*
18. Schaffalitzky, E., et al., *Understanding the benefits of prosthetic prescription: exploring the experiences of practitioners and lower limb prosthetic users.* Disabil Rehabil, 2011. **33**(15-16): p. 1314-23.

19. Davie-Smith, F., et al., *The impact of gender, level of amputation and diabetes on prosthetic fit rates following major lower extremity amputation.* Prosthet Orthot Int, 2017. **41**(1): p. 19-25.
20. *Amputee_Coalition-Annual-Report-2023.pdf.*
21. Puhalski, E.M., *How Are Transfemoral Amputees Using Their Prosthesis in Northwestern Ontario?* 2008.
22. Hando, D.J., *Factors Influencing the Health-Related Quality of Life Among Lower Limb Amputees: A Two-Center Cross-Sectional Study.* 2023.
23. Ngarambe, R., et al., *The status and use of prosthetic devices by persons with lower limb amputation in Rwanda.* Afr J Disabil, 2022. **11**: p. 1081.
24. Sansam, K., et al., *Predicting walking ability following lower limb amputation: a systematic review of the literature.* J Rehabil Med, 2009. **41**(8): p. 593-603.
25. al, L.g.e., *Sociodemographic-and-clinical-characteristics-and-barriers-of-the-health-system-in-amputated-patients-with-or-without-prostheses.* 2024.
26. Allen, A.P.T., et al., *Barriers to accessing and providing rehabilitation after a lower limb amputation in Sierra Leone - a multidisciplinary patient and service provider perspective.* Disabil Rehabil, 2022. **44**(11): p. 2392-2399.
27. Mundell, B.F., et al., *Predictors of Receiving a Prosthesis for Adults With Above-Knee Amputations in a Well-Defined Population.* PM R, 2016. **8**(8): p. 730-7.
28. Kurichi, J.E., et al., *Clinical factors associated with prescription of a prosthetic limb in elderly veterans.* J Am Geriatr Soc, 2007. **55**(6): p. 900-6.
29. Webster, J.B., et al., *Prosthetic fitting, use, and satisfaction following lower-limb amputation: A prospective study.* The Journal of Rehabilitation Research and Development, 2012. **49**(10).
30. Miller, T.A., et al., *Factors that influence time to prosthesis receipt after lower limb amputation: A Cox proportional hazard model regression.* PM R, 2023. **15**(4): p. 474-481.
31. Marino, M., *Access to Prosthetic Devices in Developing Countries: Pathways and Challenges.* 2015.
32. Pienaar, E. and S. Visagie, *Prosthetic use by persons with unilateral transfemoral amputation in a South African setting.* Prosthet Orthot Int, 2019. **43**(3): p. 276-283.
33. Kombe, E., et al., *A qualitative synthesis to explore clinician and user experiences of accessing prosthetic and orthotic services in low- and middle-income countries using the three-delays model as a framework.* Disabil Rehabil, 2025: p. 1-15.
34. Wyss, D., et al., *Priorities in lower limb prosthetic service delivery based on an international survey of prosthetists in low- and high-income countries.* Prosthet Orthot Int, 2015. **39**(2): p. 102-11.
35. TN, U., *Factors Influencing the Adoption, Non-Adoption and Abandonment of Lower Limb Prostheses among Amputees in Selected Hospitals in Owerri, Imo.* 2024.
36. Glapa, K., R. Hoffmann, and B. Greitemann, *[Indications for stump corrections].* Orthopade, 2021. **50**(1): p. 24-31.
37. *BRIGHAM AND WOMEN'S HOSPITAL Department of Rehabilitation Services Physical Therapy ; Standard of Care: Lower Extremity Amputation.*

38. Resnik, L. and M. Borgia, *Predicting prosthetic prescription after major lower-limb amputation.* J Rehabil Res Dev, 2015. **52**(6): p. 641-52.

Annexes

ANNEX ONE: DATA COLLECTION TOOL AND CONCENT FORM

A. Data collection tool and consent form English Version

Addis Ababa University college of Health Science Department of Orthopedics and traumatology

English Version Consent Form containing page

Serial no_____ Card no _____ Name of study participant: _____

I have been requested to participate about this study, which plans to assess Prosthetic Limb Use, Barriers, and Associated Factors among Lower Limb Amputees at Tikur Anbesa Specialized hospital Orthopedics and Traumatology center, Addis Ababa, Ethiopia:

With full understanding of the situations that I agreed to give the informed consent voluntarily to the researcher to use my medical records taken for the research study. Moreover, I have had the opportunity to ask questions about the project and I have received clarification to my satisfaction. I was also told that results would be reported timely to the requesting sectors.

I agree that I am contributing to the research of my fellows by participating in this project. I have asked some questions and clarification has been given to me. I have given my consent freely to participate in the study, and I approve my agreement with my signature.

Participants' sign: _____ Date _____Principal Investigator's sign: _____ Date_____

At what time the data collected while the patient is around having his/her medical record_____

B: Questionnaires

Tikur Anbessa Specialized Hospital

Questionnaire on Prosthetic Limb Use,Barriers and Associated factors among Lower Limb Amputees

Study Title: Prosthetic limb use,Barriers and Associated factors among lower limb amputees at TASH: A Cross sectional study

Section I: Socio-demographic information

1. Patient Id -
2. Age: _____ years
3. Sex: ☐Male ☐Female
4. Marital Status: ☐Single ☐Married ☐Divorced ☐Widowed
5. Educational Status: ☐No formal education ☐1-8 ☐8-10 ☐10-12 ☐ College/University
6. Occupation: _____
7. Residence: ☐Urban ☐Rural

Section II: Clinical and Surgical Data

1. Level of amputation:

☐Hindquarter ☐Hip Disarticulation ☐Above knee ☐Through knee ☐Below knee ☐Other: _____

2. Cause of amputation:

☐Trauma ☐Diabetes ☐Tumor ☐Infection ☐Peripheral vascular disease ☐ Cong, deformity ☐Traditional Bone setter sequels ☐Others:

3. Date of amputation: _____
4. Affected limb: ☐Right ☐Left ☐Bilateral
5. Presence of comorbid illness: ☐Yes ☐No If yes, specify: _____

☐ DM	☐ HTN	☐Cardiac dis.
☐ CVD	☐ CKD	☐RVI
☐ Malignancy	☐ Other	

6. Post Op Complications ☐Yes ☐No If yes, specify: _____

☐SSI ☐Wound dehiscence ☐Stump gangrene ☐Other

Section III: Prosthetic Limb Use

1. Have you ever received a prosthetic limb? ☐Yes ☐No If No, why not?

☐Lack of access to prosthetic services

☐High cost / financial constraints

☐Amputation stump not healed / unsuitable

☐Lack of awareness about prosthetic options

☐Cultural or personal preference not to use one

☐Fear of pain or complications

☐Lack of family or social support

☐Other ……

2. When did you first receive your prosthesis? (Months after amputation) _____

3. Where did you get your prosthesis fitted? ☐TASH ☐Other Gov't center ☐Private Center ☐Other: _____

4. Are you currently using the prosthetic limb? ☐Yes ☐No

5. If No, what are the reasons for not using it? (tick all that apply)

☐Poor fit/discomfort ☐Pain or skin problem ☐Weight of prosthesis ☐ Difficulty walking ☐Damage or need of repair ☐Lack of training/support ☐Financial constraints ☐Other: ___

Section IV: Challenges and Barriers

1. Do you experience any difficulties while using your prosthesis?

☐Yes ☐No If Yes, what are they? (check all that apply):

- ☐Pain/discomfort at stump
- ☐Wound At stump
- ☐Socket looseness or tightness
- ☐Difficulty walking on uneven ground
- ☐Cosmetic dissatisfaction
- ☐Lack of maintenance service
- ☐Financial burden for repair
- ☐Social stigma or embarrassment
- ☐Transportation difficulty
- ☐Other: _____

3. Were you trained on how to use the prosthesis? ☐Yes ☐No

4. Have you received follow-up care or adjustment since fitting? ☐Yes ☐ No