

# Investigation Of Mobility Challenges Faced by Trans-Tibial Prosthesis Users



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## Abstract

**Background:** Rehabilitation and reintegration of trans-tibial amputees do not give required optimal results at times. Studies have continuous being conducted on how to identify these challenges that hamper user's optimal performance with prosthesis, so as proffer solutions to them. Insight into these challenges will help the caregivers to know the predominant ones and guide against their occurrences in susceptible amputees, to achieve a better rehabilitation and reintegration for them.

**Method:** This study used the descriptive approach to determine the occurrence level of different mobility challenges experienced by different categories of amputees. Raw data was obtained from 100 trans-tibial prosthesis users in South-East Nigeria through questionnaire and physical assessments. Tables and percentage analysis were used to present the data.

**Results:** 68% reported it was difficult to use prosthesis, while 32% reported no difficulty. The challenges/difficulties reported by amputees are pistoning effect (14.9%), poor foot clearance (33.8%), waddling gait (3.9%), pain on the stump (33.8%), and tightness of socket on the stump (21.4%). Activities achieved with the prosthesis are sitting (29.7%), standing (29.7%), running (7.7%), walking (20.6%), jumping (3.5%), all the activities (8.7%). Heaviness of the prostheses was reported as; moderate weight (48%), slightly heavy (49%), severe heaviness (3%).

**Conclusion:** Trans-tibial amputees are faced with some mobility challenges which included poor foot clearance, pain on the stump, tightness of prosthesis on the stump, pistoning effect and waddling gait in South-East Nigeria. This could be because of materials used, training given to prosthesis users or the skill level of the caregivers.

**Keywords:** Challenges; Amputee Trans-tibial prosthesis; Mobility; South-East Nigeria

## Introduction

Amputation, which is mother to prosthesis had been defined as the removal of a limb by trauma, medical illness, or surgery [1,2]. It can also be defined as loss of body part following injury or disease through surgical procedure or automatic amputation (in the case of crush injury). There could also be a congenital absence of a body part. Individuals (amputees) who had benefited from amputation will have the need to be rehabilitated and reintegrated into society to continue with their normal socio-economic activities using prosthesis [1,3-5]. A prosthesis is a device designed to substitute the function or appearance of a missing limb or body part [6]. Producing an artificial device that will take over the form and functions of a lost human leg is not an easy one because of the complexity of human structures. Therefore, an ideal prosthesis must be comfortable, easy to don and doff, light weight, durable, cosmetically pleasing, functioning

mechanically well and requires reasonable maintenance [4,7]. Studies have been conducted on how to improve material quality and technology in fabricating artificial limbs for amputees, as well as to identify the difficulties experienced by users of the artificial limbs, to get feedback that can be useful to improve the designing and fabrication of artificial limbs that will rehabilitate and reintegrate amputees into the society better [8-12].

Below-knee prosthesis users, sometimes come back to the clinic with complaints of inability to use their prosthesis conveniently and effectively, and some even end up abandoning their prosthesis, especially in developing countries like Nigeria. This study aims to identify the most prevalent challenge(s) that hinder below-knee amputees from effective use of prosthesis, and the most susceptible group(s) to each of these challenges. This, when established, will help caregivers to know the most common limiting challenges to the amputees, the most susceptible group

of amputees to the challenge(s), and work vigorously to tackle and guide against such challenge during the fabrication and entire rehabilitation processes. This will also help them to know the challenges/faults to look out for, when below-knee prosthesis come back to the clinic with complaints of inability to use prosthesis effectively [13].

Trans-tibial prosthesis is a type of lower limb prosthesis that is fitted along the length of the remaining tibia bone after amputation. It is used to rehabilitate/mobilize trans-tibia/below-knee amputees. It can also be referred to as below-knee prosthesis because it does not have a knee joint [14,15]. Trans-tibial prosthetics users at times do not function optimally, especially when not given a satisfactory prosthesis and this can affect their ability to work and general function. There is need to investigate these mobility challenges and know the most prevalent ones, to help prosthetic users and rehabilitation team to guide against

such anticipated mobility challenges and proffer solution on how to cope with them when they exist [16-18].

**Materials and Methods**

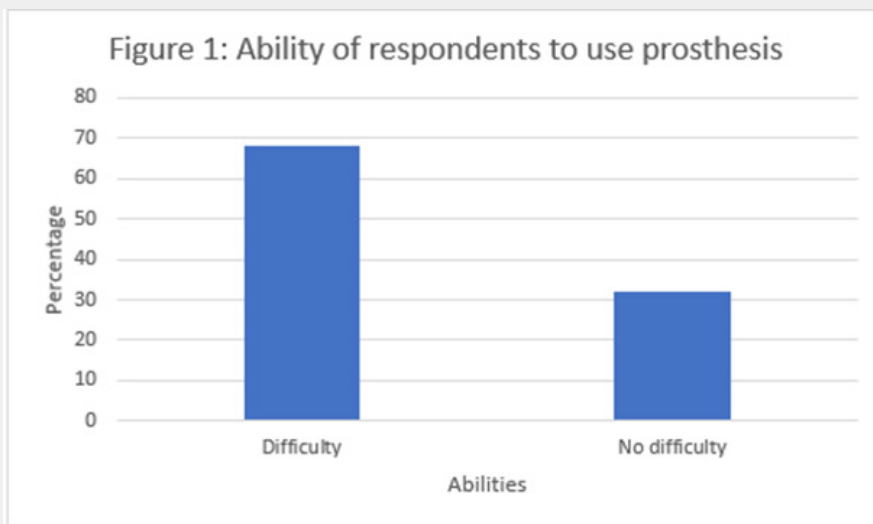
The study made use of a descriptive survey approach, which required selection of respondents from a population of amputees. Any amputee encountered, who was ready and willing to be part of the study was included. Questionnaire for data collection was designed in simple terms, printed and hard copy distributed to amputees and some of the respondents who couldn't fill out their questionnaires, were helped to do so. 100 respondents from the five states that make up the south-eastern Nigeria participated in the study.

**Results**

(Table 1).

**Table 1:** Socio-economic characteristics of respondents.

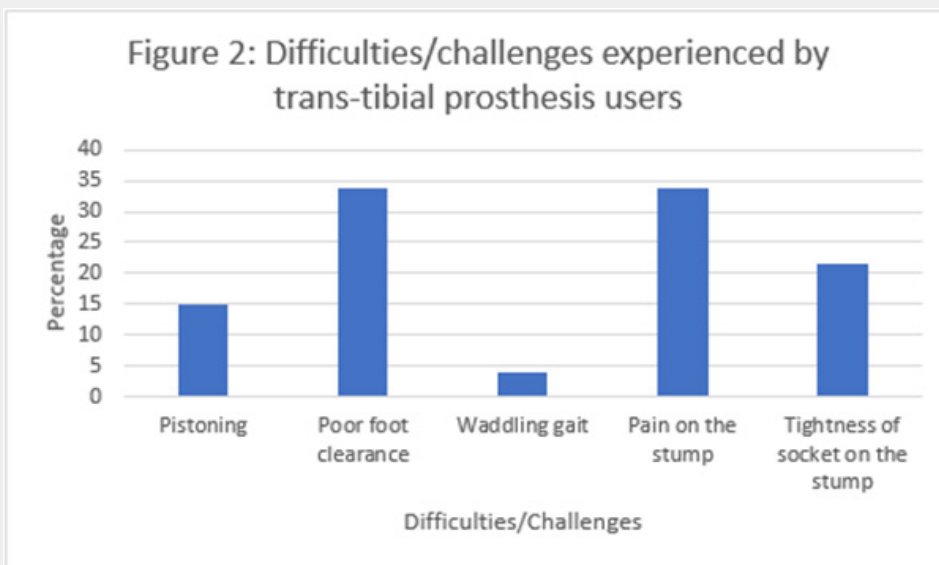
Gender		Educational qualification		Occupation		Age range	
Male	57%	Postgraduate	2%	Students	3%	20-30years	10%
Female	43%	B.Sc.	22%	Civil servants	25%	31-40years	20%
		HND	36%	Public servants	29%	41-50years	52%
		OND	17%	farmers	5%	51years and above	18%
		18%	Traders	29%			
		12%	Retirees	19%			
		3%					
Total	100%	Total	100%	Total	100%	Total	100%



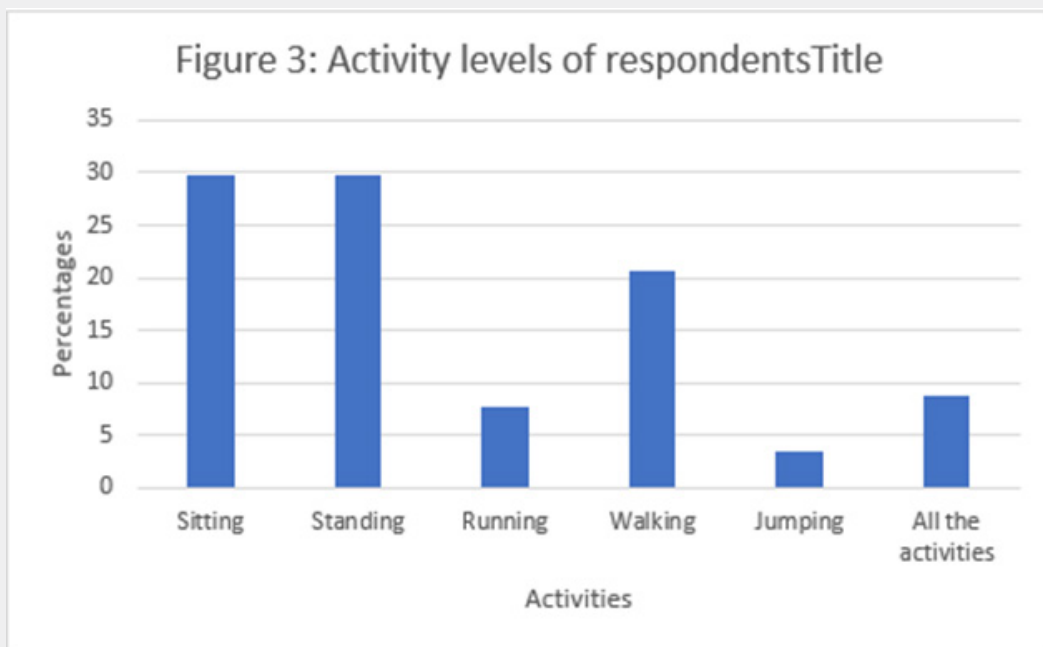
**Figure 1:** shows ability of respondents to use lower limb prosthesis, with and without difficulty. 68% reported difficulty to use prosthesis, while 32% reported no difficulty.

Table 1 shows the gender distribution of respondents, with male and female being 57% and 43%, respectively. It also shows the educational distribution of respondents as; 2% had postgraduate education, 22% are B.Sc. holders, 26% are HND holders, 17% are OND holders, 18% are O 'level holders, 12% are FSLC holders and 3% had no formal education. occupational

distribution of respondents is as follows: 3% were students, 25% were civil servants, 29% were public servants, 5% were farmers, 29% were traders and 9% were retirees. Age range distribution of the respondents is as follows; 10% were 20-30years old, 20% were 31-40years old, 52% were 41-50years and 18% were 51years and above (Figures 1-3).



**Figure 2:** shows the difficulties/challenges experienced by users of lower limb prosthesis. Pistoning effect (14.9%), poor foot clearance (33.8%), waddling gait (3.9%), pain on the stump (33.8%), and tightness of socket on the stump (21.4%).



**Figure 3:** shows activity levels of the respondents. sitting (29.7%), standing (29.7%), running (7.7%), walking (20.6%), jumping (3.5%), all of the activities (8.7%).

Material/physical characteristics of the trans-tibial prosthesis

(Figures 4-8).

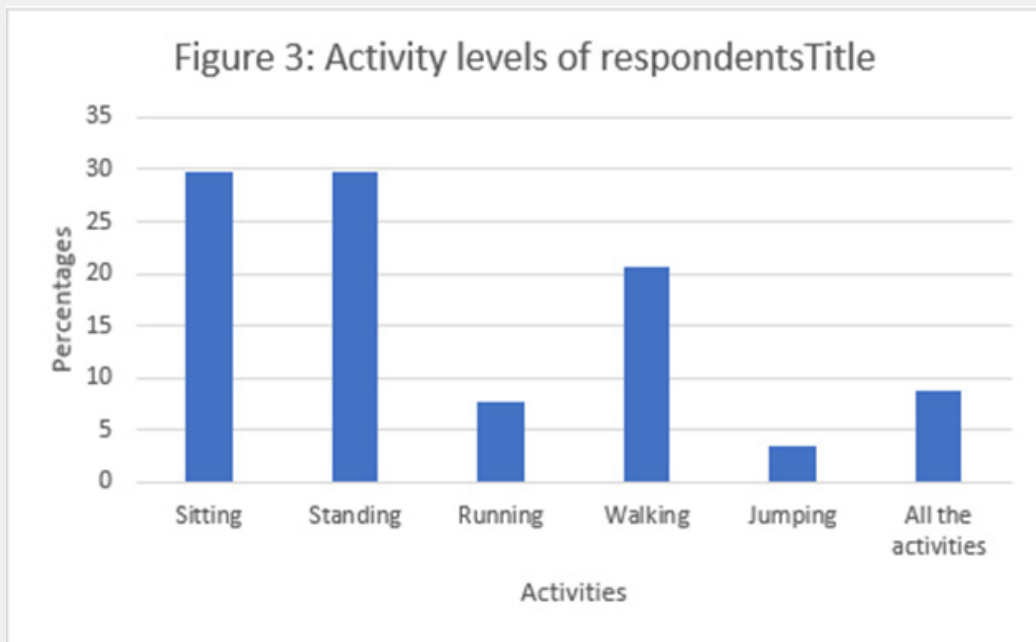


Figure 4: Shows the heaviness of the lower limb prosthesis. moderate weight (48%), slightly heavy (49%), severe heaviness (3%).

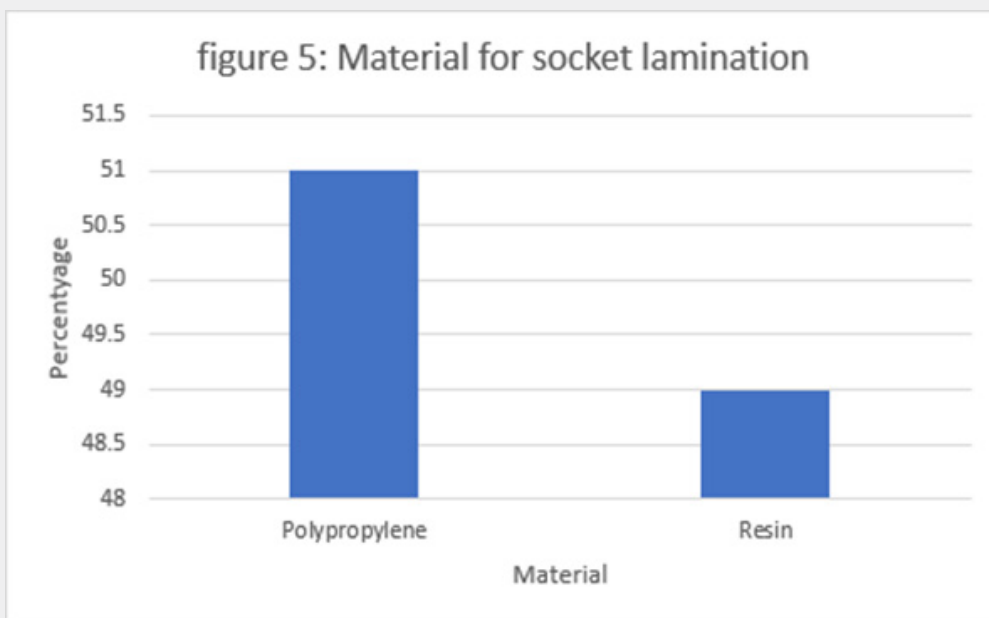
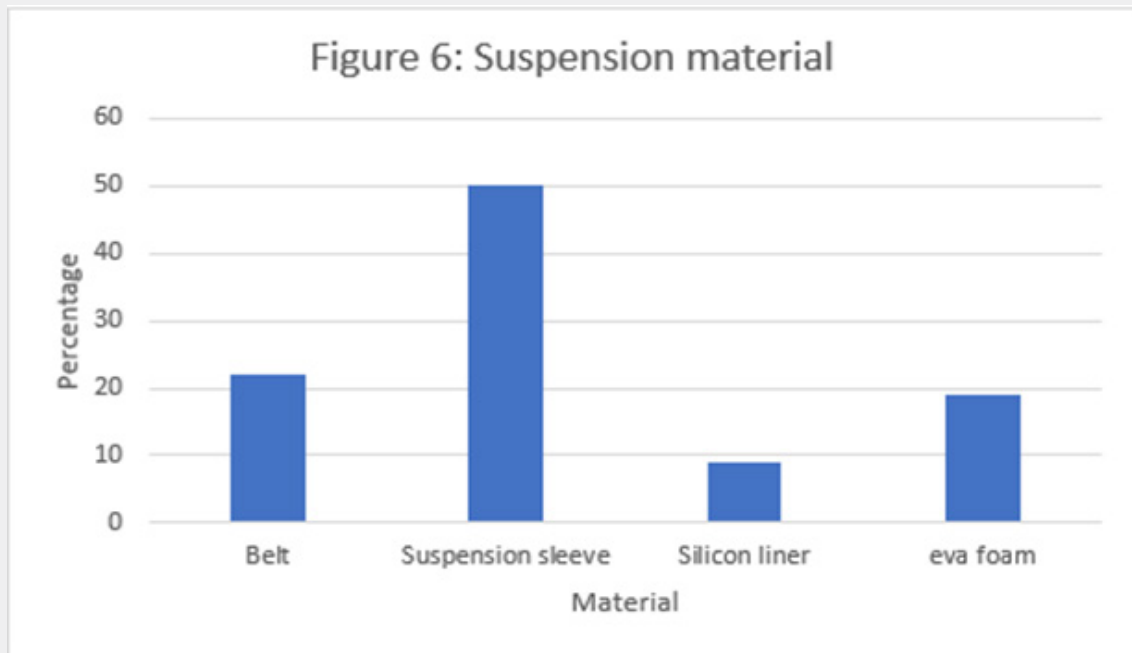
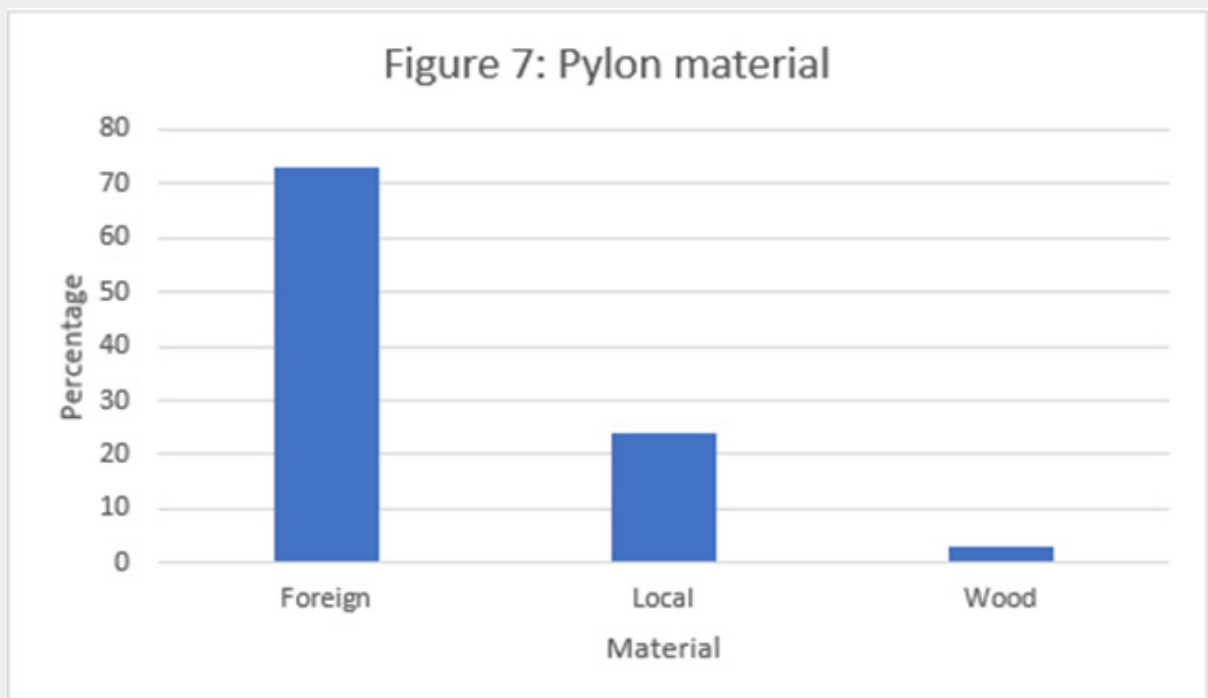


Figure 5: Shows material for prosthetic socket lamination. 51% of the sockets were laminated with polypropylene, while 49% was made with resin.



**Figure 6:** Shows the suspension material used by each of the lower limb prosthesis users. 22% of the respondents used belts, 50% used suspension sleeve, 9% used silicon liner and 19% used eva foam.



**Figure 7:** Shows the material used for the prosthesis pylon. 73% of the respondents used foreign pylon, 24% used local pylon and 3% used wood.

## Discussion

The purpose of this study is to categorize trans-tibial prosthesis users based on socio-economic demography and identify the mobility challenges faced by trans-tibial prosthesis users and classify them based occurrence frequency to know the most frequent and anticipated challenge that the caregivers should guide against or improve their design and fabrication skills to overcome them. There are more male (57%) trans-tibial prosthesis users than female (43%) which could be because of engagement of male in physical activities than female that makes them more prone to amputation. More enlightened amputees go for prosthesis, which could be attributed to their socio-economic status and access to information about prosthesis. Amputees within the age range of 41-50years and 31-40years were the highest users of prosthesis. This could be because of access to resources because most people attain economic independence at that age, coupled with active style of people at that age [19]. Public servants, traders and civil servants were the highest users of trans-tibial prosthesis, respectively. This can be attributed to their socio-economic status and active lifestyle as well [20]. (68%) of the trans-tibial prosthesis users had difficulty in using their prosthesis. Pain on the stump, poor foot clearance and tightness of the socket on the stump were the most prominent difficulties experienced by trans-tibial prosthesis users. This could be attributed to the level of expertise of the caregivers and available materials for fabrication of prosthesis [21].

The most prominent activities achieved by the trans-tibial prosthesis users are sitting, standing, and walking, respectively. Only (3%) of trans-tibial prosthesis users reported of their prosthesis being severely heavy for them. Polypropylene and resin were the materials for lamination of trans-tibial prosthesis socket. Suspension sleeve (50%) dominated as the prosthesis suspension material, while few amputees (9%) used silicon suspension, probably because of its high cost. Most of the amputees (73%) used foreign pylon, which indicates that the technology for its manufacture might not be readily available, and majority of the amputees (85%) used single axis foot.

## Conclusion

Trans-tibial amputees are faced with some mobility challenges which included poor foot clearance, pain on the stump, tightness of prosthesis on the stump, pistoning effect and waddling gait in South-East Nigeria. These most likely challenging experiences of trans-tibial prosthesis users are to be guided against in designing, fabrication and fitting of lower limb prosthesis, via; improved materials for fabrication, improved technology, and adequate skills for caregivers, to rehabilitate the amputee better and effectively.

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