

Summer 7-4-2023

## Functional Outcomes of the Graduated Length Prosthetic Protocol for Bilateral Transfemoral Amputee Prosthetic Rehabilitation

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### Recommended Citation

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**CONCORDIA UNIVERSITY, ST. PAUL**

**ST. PAUL, MINNESOTA**

**COLLEGE OF KINESIOLOGY**

**Functional Outcomes of the Graduated Length Prosthetic Protocol for Bilateral  
Transfemoral Amputee Prosthetic Rehabilitation**

**A GRADUATE PROJECT**

**SUBMITTED TO THE GRADUATE FACULTY**

**in partial fulfillment of the requirements**

**for the degree of**

**MASTER OF SCIENCE IN PROSTHETICS AND ORTHOTICS**

**by**

**MACKENZIE PIPES**

**St. Paul, Minnesota**

**JUNE 2023**

### **Abstract**

The aim of this paper was to evaluate the functional outcomes of the Graduated Length Prosthetic Protocol (GLPP) in individuals with bilateral transfemoral amputations. The GLPP is a rehabilitation program designed to facilitate a successful transition to full-length prostheses, enhance independence, and improve functional outcomes for bilateral transfemoral amputees. This study utilized a prospective design to assess the effectiveness of the GLPP compared to traditional rehabilitation strategies.

Literature was reviewed to determine the current limitations in research regarding bilateral transfemoral amputee prosthetic rehabilitation. The Concordia University St. Paul online library was utilized to obtain access to current published research. Studies included in the literature review were peer-reviewed and included case-studies, survey-based studies, and gait comparisons between full-length and shortened bilateral transfemoral prosthesis users. Review of the available literature suggests that the use of shortened prostheses is an integral step in prosthetic rehabilitation for bilateral transfemoral amputees, however, further research needs to be conducted on the functional outcomes between those that do not begin their rehabilitation with shortened prostheses and how individuals functionally progress through a rehabilitation program such as the GLPP.

The results of this study will contribute to the understanding of the functional outcomes of the GLPP. By comparing the GLPP group to the control group, the study aimed to determine whether the GLPP leads to improved functional outcomes in terms of mobility, balance, and ADLs. The findings will provide valuable insights for rehabilitation

professionals and contribute to the development of evidence-based rehabilitation guidelines for individuals with bilateral transfemoral amputations.

Keywords: *graduated length prosthetic protocol, functional outcomes, bilateral transfemoral amputees, rehabilitation, prosthetic use, independence.*

**Table of Contents**

Chapter 1: Introduction.....1

Chapter 2: Methodology .....5

Chapter 3: Discussion.....9

References.....12

Appendices.....14

## Chapter 1: Introduction

As a result of physical deconditioning, comorbidities, and a lack of sufficient training, bilateral transfemoral amputees are often restricted to wheelchair use as a means of ambulation. It is well known that individuals with lower extremity amputation must output greater energy to successfully ambulate similarly to their able-bodied counterparts in conjunction with acknowledging the risk of falls due to altered proprioception. When comparing these individuals to their able-bodied counterparts, they face a 300% greater energy cost at the same distance traveled and often reduce the speed at which they ambulate to compensate for greater energy expenditure (Hoffman et al., 1997). These factors combined pose an overwhelming challenge to bilateral transfemoral amputees that can be extremely discouraging to new amputees. However, the effect of graduated rehabilitation has been explored in this population to encourage a successful transition to full-length prostheses with the intention of increasing independence and functional outcomes when compared to those participating in a traditional or unstructured rehabilitation program.

Rehabilitation is an essential part of a successful transition to functional life post-amputation. An amputee's rehabilitation experience may be greatly impacted by the facility type as each location differs significantly on the services they provide. In general, there are three different facilities a patient may pursue rehabilitation at: a skilled nursing facility (SNF), inpatient rehabilitation facility (INF), or at home (Pasquina et al., 2015). The AMA Journal of Ethics emphasizes the importance of quality rehabilitative care as successful prosthetic use leads to "higher levels of employment, increased quality of life" as well as a decrease in secondary health related issues (Pasquina et al., 2015). Although the importance of a rehabilitation program

is understood, there are still currently no specific guidelines for standards of care for prosthetic management.

When considering specific prosthetic rehabilitation programs, current research is limited to survey-based data, case-studies, and gait comparisons often between bilateral transfemoral amputees using reduced-length prostheses and full-length prostheses with a mechanical and microprocessor-controlled knee (MPK). A case study by Fiodorenko-Dumas et al. (2021) found that step width was most similar to healthy gait when walking with stubby prostheses, which helps maintain a stable base of support and reduce the risk of a fall. Stubbies, or foreshortened prostheses, are “custom fitted and are usually made up of standard sockets, no articulated knee joints or shank, with modified rocker bottoms or Sach feet turned backward to prevent the individual from falling” (Amputee Coalition, 2008). They are often prescribed shortly post-op as a means of training the amputee for full-length prostheses but can be used long-term as a permanent means of ambulation. Stubby use is a great way to help prevent contractures early on and provides much more stability to the user as they are shorter than standard full-length prosthetics and do not contain a knee or ankle joint. However, Carrol et al. (2018) found that stubby users found functional tasks to be significantly more difficult compared to full-length users completing the same tasks. As a result of the study group consisting of experienced full-length users, the ease of completing the tasks can more accurately be attributed to greater experience in the full-length user group (Carrol et al., 2018). These studies suggest that the role of gradually increasing the length of bilateral trans-femoral prostheses during rehabilitation may be beneficial to the amputee.

The current research suggests a trend towards utilizing the GLPP for successful rehabilitation for bilateral transfemoral amputees. The GLPP highlights four key phases of rehabilitation that have shown a subjective increase in prosthetic use. Those phases are completed sequentially and include building confidence, walking on reduced-length prostheses, a graduated increase in height, and walking in full-length prostheses (Irolla et al., 2013). In a study completed by Irolla et al. (2013), self-reported data was gathered to evaluate the efficacy of this rehabilitation style. Subjects reported that short length prostheses helped build their confidence, taught them how to fall, and helped build endurance. In addition, participants reported greater prosthetic use after the GLPP and participation in functional activities. However, this study did not compile objective data to compare walking and balance between subjects, had no measurement of functional outcomes to compare between groups of phases, and relied on participants' recollection of past events to compare quality of life before and after administration of the GLPP. This study is impactful for the bilateral transfemoral amputee community, however, because it is one of the few studies that show the impact of a specific rehabilitation process.

### **Research Question**

The purpose of this study was to evaluate the functional outcomes of transfemoral bilateral amputees using the GLPP for prosthetic rehabilitation. The hypothesis of this study was that the individuals participating in the GLPP saw greater improvement in time to proficient use of full-length prostheses along with greater functional improvements between phases compared to traditional rehabilitation programs.



**Conclusion**

Bilateral transfemoral amputees often face challenges in ambulation due to physical deconditioning, comorbidities, and limited training. They experience higher energy costs and reduced ambulation speed compared to able-bodied individuals. Graduated rehabilitation programs, such as the GLPP, have been explored to enhance functional outcomes and independence. Quality rehabilitative care and successful prosthetic use lead to improved employment, quality of life, and reduced health issues. However, there are currently no specific guidelines for standards of care for prosthetic management for bilateral transfemoral amputees. Limited research exists on specific prosthetic rehabilitation programs, with most studies relying on surveys, case studies, and gait comparisons. The GLPP, comprising four phases, has shown subjective benefits in building confidence, endurance, and prosthetic use. However, objective data and comparisons are lacking. This study aims to contribute objective data to support the current studies on the benefits of a structured rehabilitation program for bilateral transfemoral amputees.

## **Chapter 2: Methodology**

### **Participants**

Participants will be recruited through physical therapists working at local rehabilitation facilities, including SNFs, IRFs, and hospitals. Eligibility criteria include the following: bilateral transfemoral amputee aged 18-65, less than 5 years since becoming a bilateral amputee, limited prior experience with prostheses, and the cognitive ability to participate in a rehabilitation program with the goal of becoming proficient with full-length prostheses. Ideally, all participants will be relatively new bilateral amputees that have not yet tried to ambulate with full-length prostheses. However, participants that are interested in the GLPP as an option for rehabilitation after experiencing failure with alternative rehabilitative treatments will be included in the study. Although bilateral transfemoral amputations are less common, the study would benefit from a study group of at least 50 participants to maintain reliability when accounting for loss of participants throughout the study.

### **Instruments**

The main purpose of this study is to collect objective data on the functional outcomes of the GLPP to compare to the functional outcomes of participants undergoing traditional rehabilitation strategies. Functional outcome measures will include the following tests to be administered by a physical therapist: the 6 Minute Walk Test and the Berg Balance Scale (Table 1). The 6-minute walk test evaluates the participant on endurance and aerobic capacity which can be helpful to determine changes in distance and speed walked. The Berg Balance Scale will be used to analyze the participants ability to safely balance while completing a task. The Locomotor Capabilities Index (Table 2) will also be administered to patients to analyze locomotor capabilities. Additionally, since the GLPP factors in measures of psychological and social

success, all participants will be asked to complete a self-report survey at the same time intervals. Surveys administered will be the Trinity Amputation and Prosthesis Experience Scales (TAPES) (Table 3) and an activities of daily living questionnaire adapted from Lee et al. (2016) (Table 4). Part 1 of the TAPES will be used to analyze the participants acceptance of their amputation and of the prosthesis. Part 2 of the TAPES will be used to analyze participants perception of their abilities to complete more rigorous activities. The adapted activities of daily living questionnaire will be used to analyze participants confidence in completing their ADLs with or without their prosthesis.

### **Procedures**

Participants will be divided into two group: those that are rehabilitating with the GLPP and those that are not rehabilitating with the GLPP. Each group of participants will be evaluated on functional outcome measures prior to beginning their rehabilitation and at 2-month intervals throughout their rehabilitation. Participants in the GLPP group will also be evaluated on the functional outcome measures after each phase of the GLPP is completed. The study will follow participants until they are proficient with the use of full-length prostheses or until they conclude their rehabilitation.

### **Design & Statistical Analysis**

Data will be collected from patient demographics, functional outcome measures, and surveys and entered into Microsoft Excel. The data will be analyzed for any missing values, outliers, or possible errors before running any statistical tests. Descriptive statistics will be calculated for each data set which includes the use of t-tests to compare the measures before,

during, and after the rehabilitation program for each group. A t-test will also be used to compare measures between each subject group.

### **Ethical Considerations**

Consideration must be taken to protect the rights and well-being of the participants. Informed consent will be obtained from all participants before they are included in the research study. Participants will be advised of the purpose of the study, the procedures, and the potential risks associated with the study. They will be reminded that their participation is voluntary with the option to withdraw from the study at any point. As with any rehabilitation program, participants may be asked to complete tasks they are not comfortable completing or may be subject to scenarios where balance may be compromised. Participants will be reminded to opt out of any functional evaluation they do not feel comfortable or confident completing. Additionally, questions asked within the TAPES may make participants feel uncomfortable or may trigger unexpected emotional states. Participants will be reminded that they may skip any questions they do not feel comfortable answering. Data will be stored on secure servers and results of the study will not be published with identifiable data unless consent is granted from the participant.

### **Conclusion**

Participants for the study will be recruited through physical therapists working at local rehabilitation facilities, including SNFs, IRFs, and hospitals. The eligibility criteria include being a bilateral transfemoral amputee aged 18-65, having less than 5 years since becoming a bilateral amputee, limited prior experience with prostheses, and the cognitive ability to participate in a rehabilitation program aiming to become proficient with full-length prostheses. The study aims to collect objective data on the functional outcomes of the GLPP compared to traditional

rehabilitation strategies. Measurements will be obtained using specific instruments and tests such as the 6-minute walk test, the Berg Balance Scale, the Locomotor Capabilities Index, the Trinity Amputation and Prosthesis Experience Scales (TAPES) and an adapted activities of daily living questionnaire. Data will be entered into Microsoft Excel, cleaned for errors, and analyzed using descriptive statistics and t-tests. Informed consent will be obtained, participants' comfort and well-being will be prioritized, and data will be securely stored with confidentiality. Identifiable data will only be published with participant consent.

### **Chapter 3: Discussion**

This research aims to establish functional outcome measures of the GLPP with the use of therapist administered evaluations and self-report surveys. Current research is limited to subjective data and does not include measures between phases of the GLPP to determine how the amputee functionally benefits from the separate phases of the GLPP. Determining the effect of a structured rehabilitation that gradually introduces bilateral transfemoral amputees to full-length prostheses has the potential to rehabilitate patients more efficiently with the goal of promoting independence and greater quality of life.

#### **Practical Applications**

The data collected from this study will be used to analyze the relationship between the rehabilitation strategy applied and its effect on selected outcome measures. It is anticipated that as participants progress throughout their rehabilitation, outcomes will progress in areas such as the distance walked in six minutes, the participant's balance when standing and asked to complete tasks, and the participant's ability to perform ADLs. Ideally, the structure of the GLPP will increase the rate of progression in these areas more rapidly compared to participants not rehabilitating with the GLPP, which would prove significant for the well-being of bilateral transfemoral amputees. This population experiences limitations related to proficiency in regard to ambulating with full-length prostheses, and a rehabilitation structure that gradually strengthens and prepares the amputee for full-length prostheses has the potential to offer a solution to these limitations.

#### **Limitations**

This study faces inherent limitations due to its unique population of participants. Participants will need to be recruited from a large radius as bilateral transfemoral amputations

are not as common of an amputation. This may lead to inconsistencies with how the GLPP is administered. Participants of this study will also not be randomly assigned to the GLPP group and the control group. This could introduce potential confounding variables and limit the ability to draw causal conclusions regarding the effectiveness of the GLPP. Additionally, external variables such as participant comorbidities may require the patient to take time away from rehabilitation or slow their progress down compared to healthy subjects which may confound the results of the study.

### **Recommendations for Further Research**

Future research related to bilateral transfemoral amputees should address the limitations present in this study. Longitudinal research would be beneficial for this population to further analyze the long-term effects of the GLPP and how it affects long term use of prostheses.

### **Conclusion**

This study aims to evaluate the functional outcomes of the GLPP in individuals with bilateral transfemoral amputations. The findings will provide valuable insights into the effectiveness of the GLPP as a rehabilitation program for this population. It is anticipated that the results of the study will show that the GLPP has the potential to improve functional outcomes, including mobility and balance with increased endurance, improved confidence, and better overall prosthetic use for participants completing the GLPP. The study contributes to the existing body of knowledge by shedding light on the functional outcomes associated with the GLPP and emphasizing the importance of a structured and progressive rehabilitation approach.

Rehabilitation professionals can consider implementing the GLPP in their practice, tailored to individual patient needs and capabilities. Ultimately, the goal of the GLPP and similar rehabilitation programs is to enhance independence, improve functional outcomes, and

ultimately enhance the quality of life for individuals with bilateral transfemoral amputations.

Continued research and advancements in this field will contribute to the ongoing refinement and optimization of prosthetic rehabilitation strategies, ultimately benefiting the individuals who rely on prostheses for mobility and participation in daily activities.



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**Appendices**

**Table 1** The Berg Balance Test

**BERG BALANCE TEST**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Age: \_\_\_\_\_ Sex: \_\_\_\_\_ Diagnosis: \_\_\_\_\_

Contact no.: \_\_\_\_\_ Address: \_\_\_\_\_

Location: \_\_\_\_\_ Rater: \_\_\_\_\_

S.N.	Item Description	Date				
		Score [0-4]				
1	Sit to stand					
2	Standing Unsupported					
3	Sitting Unsupported					
4	Standing to sitting					
5	Transfers					
6	Standing with eyes closed					
7	Standing with feet together					
8	Reaching forward with outstretched arms					
9	Retrieving object from ground					
10	Turning to look behind					
11	Turning 360 degrees					
12	Placing alternate foot on stool					
13	Standing with one foot in front					
14	Standing on one foot					
	Total					

Interpretation

- 0–20 : Wheelchair bound
- 21–40 : Walking with assistance
- 41–56 : Independent

**Table 2** The Locomotor Capabilities Index

The common question is "Whether or not you wear your prosthesis at the present time, would you say that you are able to do the following activities with your prosthesis on?"	No (0)	Yes, If Someone Helps Me (1)	Yes, If Someone Is Near Me (2)	Yes, Alone, With Ambulation Aids (3)	Yes, Alone, Without Ambulation Aids (4)
1. Get up from a chair	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Pick up an object from the floor when you are standing up with your prosthesis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Get up from the floor (eg, if you fell)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Walk in the house	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Walk outside on even ground	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Walk outside on uneven ground (eg, grass, gravel, slope)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Walk outside in inclement weather (eg, snow, rain, ice)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Go up the stairs with a hand-rail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Go down the stairs with a hand-rail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Step up a sidewalk curb	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Step down a sidewalk curb	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Go up a few steps (stairs) without a hand-rail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Go down a few steps (stairs) without a hand-rail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Walk while carrying an object	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

NOTE. In the standard LCI,<sup>6,9</sup> items are scored according to a 4-level ordinal scale: the LCI-5 levels 3 and 4 are merged in a unique level (3, yes, alone).

**Table 3** The Trinity Amputation and Prosthesis Scales Revised

**T**rinity  
**A**mputation  
 and  
**P**rosthesis  
**E**xperience  
**S**cales -  
**R**evised

**What is this survey about?**

This questionnaire looks at different aspects of having a prosthesis. The information gathered will be used to improve our understanding of aspects of prosthesis use and to assist in the development of better services for prosthesis users.

**Who should complete the questionnaire?**

The questionnaire should be completed by the person with a prosthesis. However, if the person needs help to complete the questionnaire, the answers should be given from his/her point of view – not the point of view of the person who is helping.

**How to complete the questionnaire?**

Please answer every item as honestly as you can. For each question, please tick clearly inside one box using a black or blue pen. Don't worry if you make a mistake; simply cross out the mistake and put a tick in the correct box.

There are no right or wrong answers.

**Your answers will be treated in strictest confidence**

The TAPES-R can be freely copied and downloaded for teaching, clinical and/or research purposes ([www.psychoprosthetics.ie](http://www.psychoprosthetics.ie)). Salient psychometric data are published in Gallagher, P. & MacLachlan, M. (2000) Development and psychometric evaluation of the Trinity Amputation and Prosthesis Experience Scales (TAPES). *Rehabilitation Psychology*, 45, 130-154. Data relating to the revised TAPES (TAPES-R) can be located in Gallagher P, Franchigioni F, Giordano A, MacLachlan M. (2010) Trinity Amputation and Prosthesis Experience Scales: A Psychometric Assessment Using Classical Test Theory and Rasch Analysis (TAPES). *American Journal of Physical Medicine and Rehabilitation*. 89 (6): 487-496.

Preliminary information on using the TAPES with people with acquired upper limb amputation is available in 'A guide to the TAPES' (p7) and in: Desmond, D. M., & MacLachlan, M. (2005). Factor structure of the trinity amputation and prosthesis experience scales (TAPES) with individuals with acquired upper limb amputations. *American Journal of Physical Medicine & Rehabilitation*, 84(7), 506-513.

This is a questionnaire designed to investigate different aspects of having a prosthesis.  
Please answer every item as honestly as you can. There are no right or wrong answers.  
Your responses will remain confidential.

1. Client Name: \_\_\_\_\_
  
2. Client date of birth: \_\_\_\_\_
  
3. Are you male... [  ]  
female.. [  ]
  
4. How long ago did you have your amputation?  
\_\_\_\_\_ years \_\_\_\_\_ months (If you have had more than one amputation surgery  
please refer to your first amputation surgery).
  
5. How long have you had a prosthesis?  
\_\_\_\_\_ years \_\_\_\_\_ months
  
6. How long have you had the prosthesis that you wear at the moment?  
\_\_\_\_\_ years \_\_\_\_\_ months
  
7. What type of prosthesis do you have? *(Please tick the appropriate box)*  

Below-Knee [ <input type="checkbox"/> ]	Below-elbow [ <input type="checkbox"/> ]
Through-Knee [ <input type="checkbox"/> ]	Through-elbow [ <input type="checkbox"/> ]
Above-Knee [ <input type="checkbox"/> ]	Above-elbow [ <input type="checkbox"/> ]
Other (please specify) _____	
  
8. What was your amputation a result of? *(Please tick the appropriate box)*  

Peripheral Vascular Disorder [ <input type="checkbox"/> ]
Diabetes [ <input type="checkbox"/> ]
Cancer [ <input type="checkbox"/> ]
Accident [ <input type="checkbox"/> ]
Other (please specify) _____

**Part I**

Below are written a series of statements concerning the wearing of a prosthesis. Please read through each statement carefully. Then **tick the box** beside each statement, which shows how strongly you agree or disagree with it.

	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>Not applicable</b>
<b>1.</b> I have adjusted to having a prosthesis.....	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
<b>2.</b> As time goes by, I accept my prosthesis more.....	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
I feel that I have dealt successfully with this trauma					
<b>3.</b> in my life .....	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
<b>4.</b> Although I have a prosthesis, my life is full .....	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
<b>5.</b> I have gotten used to wearing a prosthesis.....	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
<b>6.</b> I don't care if somebody looks at my prosthesis .....	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
<b>7.</b> I find it easy to talk about my prosthesis .....	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
<b>8.</b> I don't mind people asking about my prosthesis .....	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
I find it easy to talk about my limb loss in					
<b>9.</b> conversation .....	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
<b>10.</b> I don't care if somebody notices that I am limping ...	[ 1]	[ 2]	[ 3]	[ 4]	[ ]
A prosthesis interferes with the <u>ability</u> to do my					
<b>11.</b> work.....	[ 4]	[ 3]	[ 2]	[ 1]	[ ]
Having a prosthesis makes me more dependent on					
<b>12.</b> others than I would like to be .....	[ 4]	[ 3]	[ 2]	[ 1]	[ ]
Having a prosthesis limits the <u>kind</u> of work that I					
<b>13.</b> can do .....	[ 4]	[ 3]	[ 2]	[ 1]	[ ]
Being an amputee means that I can't do what I					
<b>14.</b> want to do .....	[ 4]	[ 3]	[ 2]	[ 1]	[ ]
Having a prosthesis limits the <u>amount</u> of work that					
<b>15.</b> I can do.....	[ 4]	[ 3]	[ 2]	[ 1]	[ ]

The following questions are about activities you might do during a typical day. Does having a prosthesis limit you in these activities? If so, how much? *Please tick the appropriate box.*

	<b>Yes, limited a lot</b>	<b>Limited a little</b>	<b>No, not limited at all</b>	
<b>(a)</b> Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports..... [ 2]	[ 2]	[ 1]	[ 0]	
<b>(b)</b> climbing several flights of stairs..... [ 2]	[ 2]	[ 1]	[ 0]	
<b>(c)</b> running for a bus..... [ 2]	[ 2]	[ 1]	[ 0]	
<b>(d)</b> sport and recreation..... [ 2]	[ 2]	[ 1]	[ 0]	
<b>(e)</b> climbing one flight of stairs..... [ 2]	[ 2]	[ 1]	[ 0]	
<b>(f)</b> walking more than a mile..... [ 2]	[ 2]	[ 1]	[ 0]	
<b>(g)</b> walking half a mile..... [ 2]	[ 2]	[ 1]	[ 0]	
<b>(h)</b> walking 100 metres..... [ 2]	[ 2]	[ 1]	[ 0]	
<b>(i)</b> working on hobbies..... [ 2]	[ 2]	[ 1]	[ 0]	
<b>(j)</b> going to work..... [ 2]	[ 2]	[ 1]	[ 0]	[ Not applicable]



Please tick the box that represents the extent to which you are satisfied or dissatisfied with each of the different aspects of your prosthesis mentioned below:

	<b>Not satisfied</b>	<b>Satisfied</b>	<b>Very Satisfied</b>
(i) Colour.....	[ 1 ]	[ 2 ]	[ 3 ]
(ii) Shape.....	[ 1 ]	[ 2 ]	[ 3 ]
(iii) Appearance.....	[ 1 ]	[ 2 ]	[ 3 ]
(iv) Weight.....	[ 1 ]	[ 2 ]	[ 3 ]
(v) Usefulness.....	[ 1 ]	[ 2 ]	[ 3 ]
(vi) Reliability.....	[ 1 ]	[ 2 ]	[ 3 ]
(vii) Fit.....	[ 1 ]	[ 2 ]	[ 3 ]
(viii) Comfort.....	[ 1 ]	[ 2 ]	[ 3 ]

Please circle the number (0-10) that best describes how satisfied you are with your prosthesis?

0    1    2    3    4    5    6    7    8    9    10

Not at all Very Satisfied

Satisfied

Part II

(For the following questions, please tick the appropriate boxes)

1. On average, how many hours a day do you wear your prosthesis? \_\_\_\_\_ hours

2. In general, would you say your health is:

Very Poor [ 1]      Poor [ 2]      Fair [ 3]      Good [ 4]      Very Good [ 5]

3. In general, would you say your physical capabilities are:

Very Poor [ 1]      Poor [ 2]      Fair [ 3]      Good [ 4]      Very Good [ 5]

4(a) Do you experience residual limb (stump) pain (pain in the remaining part of your amputated limb)?      No [ 0] .... (If no, go to question 5)

Yes [ 1] .... (If yes, answer part (b), (c), (d) and (e))

(b) During the last week, how many times have you experienced stump pain? \_\_\_\_\_

(c) How long, on average, did each episode of pain last? \_\_\_\_\_

(d) Please indicate, the average level of stump pain experienced during the last week on the scale below by ticking the appropriate box:

Excruciating	Horrible	Distressing	Discomforting	Mild
[ 5]	[ 4]	[ 3]	[ 2]	[ 1]

(e) How much did stump pain interfere with your normal lifestyle (eg. work, social and family activities) during the last week?

A Lot	Quite a Bit	Moderately	A Little Bit	Not at All
[ 5]	[ 4]	[ 3]	[ 2]	[ 1]

5. (a) Do you experience phantom limb pain (pain in the part of the limb which was amputated)?

No [ 0 ] .... (if no, go to question 6)

Yes [ 1 ] .... (If yes, answer part (b), (c), (d), and (e))

(b) During the last week, how many times have you experienced phantom limb pain? \_\_\_\_\_

(c) How long, on average, did each episode of pain last? \_\_\_\_\_

(d) Please indicate the average level of phantom limb pain experienced during the last week on the scale below by ticking the appropriate box:

Excruciating	Horrible	Distressing	Discomforting	Mild
[ 5 ]	[ 4 ]	[ 3 ]	[ 2 ]	[ 1 ]

(e) How much did phantom limb pain interfere with your normal lifestyle (e.g. work, social and family activities) during the last week?

A Lot	Quite a Bit	Moderately	A Little Bit	Not at All
[ 5 ]	[ 4 ]	[ 3 ]	[ 2 ]	[ 1 ]

6. (a) Do you experience any other medical problems apart from stump pain or phantom limb pain? No [ 0 ]

Yes [ 1 ] (If yes, answer part (b), (c), (d), (e),(f) and (g))

(b) Please specify what problems you experience \_\_\_\_\_

(c) During the last week, how many times have you suffered from these medical problems? \_\_\_\_\_

(d) How long, on average, did each problem last? \_\_\_\_\_

(e) Please indicate the level of pain experienced as a result of these problems during the last week on the scale below by ticking the appropriate box:

Excruciating	Horrible	Distressing	Discomforting	Mild
[ 5 ]	[ 4 ]	[ 3 ]	[ 2 ]	[ 1 ]

(f) How much did these medical problems interfere with your normal lifestyle (e.g. work, social and family activities) during the last week?

A Lot	Quite a Bit	Moderately	A Little Bit	Not at All
[ 5]	[ 4]	[ 3]	[ 2]	[ 1]

(g) Do you experience **any other pain** that you have not previously mentioned?

No [ 0]

Yes [ 1]

If yes, please specify \_\_\_\_\_

7. Did you complete this questionnaire: (please tick the appropriate box)

on your own? [ ]

with assistance? [ ]

8. Date of Completion: \_\_\_\_\_

**Please check that you have answered all the questions.  
Thank you for all your help.**

**Table 4** Adapted activities of daily living questionnaire

<p>Please mark the disability in your daily activities during the last week from 0 (no problem) to 5 (incapable). Please note that '3' means you need to use assisting aids or obtain help from other people. 0; no problem, 1; slow but no difficulty, 2; mildly difficult but do not need help or assistance, 3; moderately difficult and sometimes need help or assistance, 4; severely difficult and mostly need help or assistance, 5; incapable of performing the activity (Lee et al., 2016).</p>	
<p>Getting in/out of bed</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>	<p>Preparing a meal</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>
<p>Sitting on/getting up from the floor</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>	<p>Sitting on/rising from a chair</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>
<p>Dressing</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>	<p>Standing</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>
<p>Walking</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>	<p>Using the toilet</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>
<p>Walking up/down stairs</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>	<p>Picking an object off the floor</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>
<p>Getting in/out of a car</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>	<p>Working</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>
<p>Sitting upright</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>	<p>Doing hobbies</p> <p><input type="checkbox"/> 0   <input type="checkbox"/> 1   <input type="checkbox"/> 2   <input type="checkbox"/> 3   <input type="checkbox"/> 4   <input type="checkbox"/> 5</p>