Prosthetic Limb Users Survey of Mobility (PLUS-M™) Version 1.0

Short Forms Users Guide

May 5, 2014

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Prosthetic Limb Users Survey of Mobility (PLUS-M™) short forms were developed under funding from the National Center for Medical Rehabilitation Research (NCMRR), National Institute of Child and Human Development (NIH grant number HD-065340, PI: Hafner).

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Questions about PLUS-M™ Short Forms

If you have questions about PLUS-M™ short forms or their use in clinical care or research, please contact the University of Washington Center on Outcomes Research in Rehabilitation (UWCORR):

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Brief Overview of the Prosthetic Limb Users Survey of Mobility (PLUS-M™)

Construct: PLUS-M™ instruments measure prosthesis users' mobility (i.e., their ability to move intentionally and independently from one place to another). Individual PLUS-M™ questions assess respondents' perceived ability to carry out specific activities that require use of both lower limbs. PLUS-M™ questions cover movements that range from basic ambulation (e.g., walking a short distance indoors) to complex activities (e.g., hiking for long distances over uneven ground). PLUS-M™ response options reflect the degree of difficulty with which respondents report they can carry out these activities.

Intended applications: PLUS-M™ instruments are intended for use in research and clinical care.

Intended population: PLUS-M™ instruments are intended for use with adults (age 18+) with unilateral, lower limb amputation who have experience using a prosthesis.

Formats: PLUS-M™ instruments are based on a set of 44 calibrated questions called the PLUS-M™ item bank. The PLUS-M™ 7- and 12-item short forms included in this guide are subsets of questions in the PLUS-M™ item bank. All items on the PLUS-M™ 7-item short form are also included in the PLUS-M™ 12-item short form. A PLUS-M™ Computer Adaptive Test (CAT) is under development and will offer an optimal combination of high measurement precision and low administrative burden. (Please see www.plus-m.org for updates on the PLUS-M™ CAT).

Administration and scoring time: PLUS-M™ short forms require 2-3 minutes to administer and 1-2 minutes to score.

Score: PLUS-M™ instruments each provide a T-score that ranges from 17.5 to 76.6.

Score interpretation: PLUS-M™ T-scores are referenced to the PLUS-M™ development sample (n=1091 lower limb prosthesis users) described in this manual. A T-score has a mean of 50 and a standard deviation (SD) of 10. A PLUS-M™ T-score of 50 represents the mean mobility reported by the development sample. A higher PLUS-M™ T-score corresponds to greater mobility. Individual PLUS-M™ T-scores may also be compared to those reported by the development sample or to those reported by subgroups (by level of amputation, etiology of amputation, gender, and age) within the development sample. Development sample data is included in the PLUS-M™ Short Form Users Guide.

Languages: PLUS-M™ instruments are available in English.

Introduction

The Prosthetic Limb Users Survey of Mobility (PLUS-M™) is a self-report instrument for measuring mobility of adults with unilateral, lower limb amputation. It has been rigorously developed using modern psychometric methodology and is intended for use in clinical practice and research. This guide will assist you in the selection of a PLUS-M™ short form, administration and scoring of the instruments, and interpretation of the scores.

PLUS-M™ instruments measure prosthetic users' mobility (i.e., the ability to move intentionally and independently from one place to another). PLUS-M™ questions assess respondents' perceived ability to carry out actions that require use of both lower limbs, ranging from household ambulation to outdoor recreational activities. The described activities relate to two primary forms of movement, locomotion (i.e., movement in a continuous, repeatable pattern) and/or postural transitions (i.e., movement from one position to another or one type of activity to another). Activities described by PLUS-M™ questions are often qualified by language that describes the setting or situation in which the activity would be performed (e.g., walking down stairs *with* a railing). Unintentional movements (e.g., falls) and movements performed with the physical assistance of another person (e.g., assisted transfers) are not intended to be measured with this instrument. Further, PLUS-M™ instruments are not intended to measure mobility with seated or wheeled assistive devices (e.g. a wheelchair).

All PLUS-M™ questions begin with "Are you able to…," followed by a description of the activity. No time frame is provided and respondents' current perception of their mobility is implied. PLUS-M™ responses reflect the difficulty with which the respondents' report they could perform the activity. Response options include "without any difficulty," "with much difficulty," "with some difficulty," "with a little difficulty," and "unable to do." It is important to note that PLUS-M™ questions assess respondents' reported *ability* to perform activities rather than individuals' actual *performance* of that activity.

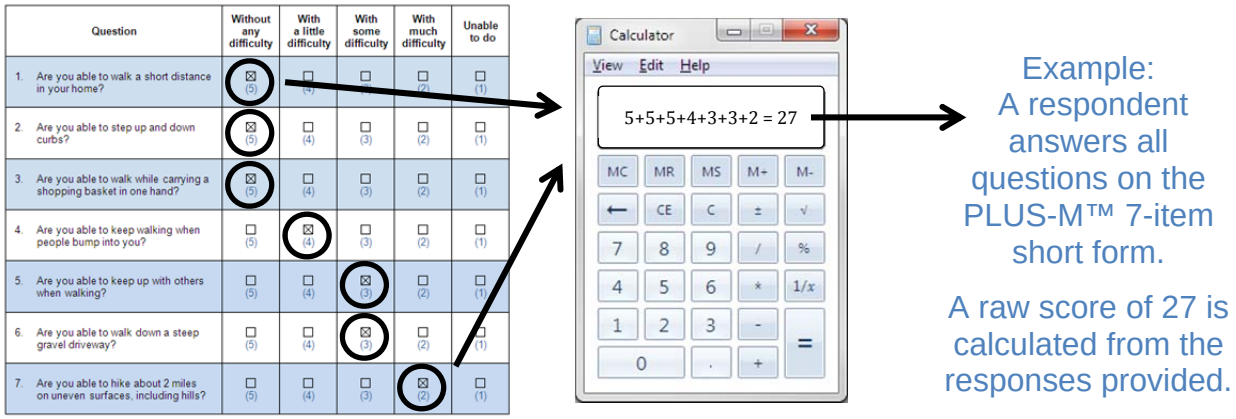
Although PLUS-M™ instruments have been purposefully developed to be used with a range of prosthesis users (see "Development Sample"), it has not yet been thoroughly tested across the entire population of persons with limb loss. Psychometric functioning of PLUS-M™ instruments with persons with bilateral lower limb loss, persons with both lower and upper limb loss, or persons with less than six months experience using a prosthesis has not yet been investigated and validity of a PLUS-M™ score in persons with these characteristics cannot be assumed. PLUS-M™ users are encouraged to check for updates to PLUS-M™ instruments, scoring guides, or additional evidence of validity at www.plus-m.org.

Scoring Complete PLUS-M™ Short Forms

This section of the guide describes how to score PLUS-M™ short forms when all of the questions on the short form have been answered. If any questions have been skipped by the respondent, please refer to the section of this guide titled "Scoring Incomplete PLUS-M™ Short Forms."

Scoring a PLUS-M™ short form will produce a T-score. *Raw scores*, which are obtained by summing responses to each question, should only be used to look up PLUS-M™ *T-scores* using the tables in this manual. Only PLUS-M™ T-scores should be reported. T-scores are valid and comparable measures of mobility, but raw scores are not. To obtain a PLUS-M™ T-score, follow the steps below:

Step 1: Calculate the Raw Score. Each PLUS-M™ question has five response options. Responses to each question are scored from 1 to 5 (i.e., without any difficulty = 5, with a little difficulty = 4, with some difficulty = 3, with much difficulty = 2, unable to do = 1). To find the raw score, sum the values of the responses to each question on the short form. Use of a calculator is recommended. Raw scores range from 7 to 35 for the 7-item short form and from 12 to 60 for the 12-item short form.



Example:
A respondent answers all questions on the PLUS-M™ 7-item short form.

A raw score of 27 is calculated from the responses provided.

Step 2: Choose the Appropriate Conversion Table. Each PLUS-M™ short form has a unique conversion table. Only the table that corresponds to the selected short form will produce the correct PLUS-M™ T-score. Choose the conversion table that corresponds to the short form you administered (e.g., choose the 7-item conversion table if you administered the 7-item short form).

PLUS-M™ 7-item Short Form (v1.0) T-score Conversion Table

Raw Score	T-score	SE	Percentile
7	23.3	4.8	0.4%
8	27.0	3.9	1.1%
9	29.3	3.6	1.9%
10	31.1	3.4	3.0%
11	32.8	3.2	4.3%
12	34.4	3.0	5.9%
13	35.8	2.8	7.8%
14	37.2	2.7	10.0%
15	38.4	2.7	12.3%
16	39.6	2.6	15.0%
17	40.8	2.6	17.8%
18	41.9	2.6	20.9%
19	43.0	2.6	24.3%
20	44.2	2.6	28.0%
21	45.3	2.6	31.9%

Raw Score	T-score	SE	Percentile
22	46.4	2.6	36.1%
23	47.6	2.6	40.5%
24	48.8	2.6	45.1%
25	50.0	2.7	49.9%
26	51.2	2.7	54.9%
27	52.5	2.8	59.9%
28	53.9	2.9	65.1%
29	55.3	3.1	70.1%
30	56.8	3.2	75.1%
31	58.3	3.4	79.8%
32	60.0	3.4	84.2%
33	62.2	3.6	88.9%
34	65.2	4.0	93.5%
35	69.9	5.1	97.7%

Record the PLUS-M™ T-score here. ↓↓↓↓

PLUS-M™ T-score

Step 3: Look Up the T-Score. Look up the PLUS-M™ T-score that corresponds to the raw score you calculated in Step 1 on the conversion table. To document the PLUS-M™ T-score, enter it in the field provided (located next to the selected conversion table). If any questions have been skipped by the respondent, score the survey using the instructions found under "Scoring Incomplete PLUS-M™ Short Forms."

Raw Score	T-score	SE	Percentile
22	46.4	2.6	36.1%
23	47.6	2.6	40.5%
24	48.8	2.6	45.1%
25	50.0	2.7	49.9%
26	51.2	2.7	54.9%
27	52.5	2.8	59.9%
28	53.9	2.9	65.1%
29	55.3	3.1	70.1%
30	56.8	3.2	75.1%
31	58.3	3.4	79.8%
32	60.0	3.4	84.2%
33	62.2	3.6	88.9%
34	65.2	4.0	93.5%
35	69.9	5.1	97.7%

Record the PLUS-M™ T-score here.

↓↓↓↓

PLUS-M™ T-score
52.5

Example:
The raw score of 27 on the 7-item short form produces a PLUS-M™ T-score of 52.5 on the 7-item conversion table.

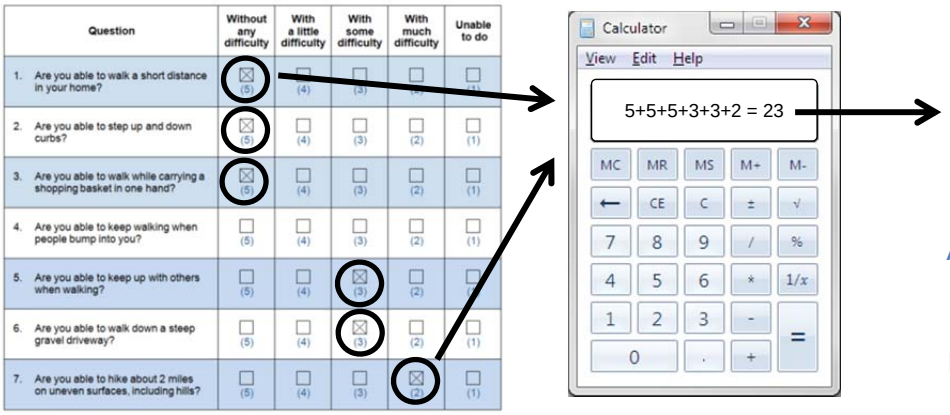
Note: the table also indicates the respondent reports higher mobility than 59.9% of the PLUS-M™ development sample.

Scoring Incomplete PLUS-M™ Short Forms

This section of the guide describes how to score PLUS-M™ short forms when questions on the short form have been skipped. If all questions have been answered by the respondent, please refer to the section of this guide titled "Scoring Complete PLUS-M™ Short Forms."

PLUS-M™ T-scores can be *approximated* if a respondent skips one or more questions. Scoring PLUS-M™ short forms with fewer than half of the responses completed is not recommended. Therefore, first verify that at least 4 questions on the PLUS-M™ 7-item short form or at least 6 questions on the PLUS-M™ 12-item short form have been answered. Then, follow the steps below to estimate a T-score.

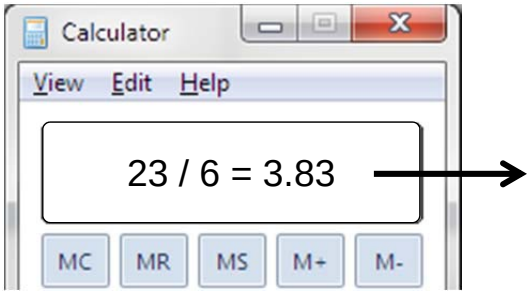
Step 1a: Calculate the Interim Raw Score. Sum the values of responses to all questions that were answered on the short form (see Step 1, above for more detail). This is your interim raw score.



Example:
A respondent skips question 4 on the PLUS-M™ 7-item short form.

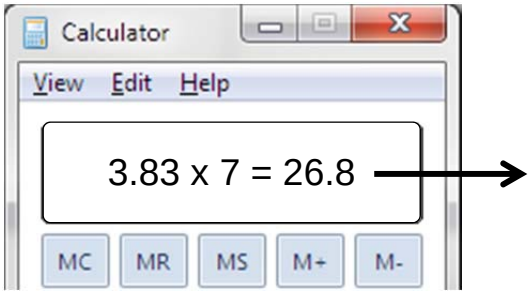
An interim raw score of 23 is calculated from the other six responses provided.

Step 2a: Calculate the Mean Score. Divide the interim raw score (Step 1a) by the number of items that were answered. This is your mean score.



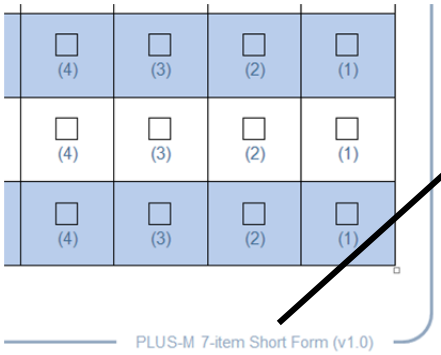
Example:
The interim raw score of 21 that was obtained from the six provided responses produces a mean score of 3.83.

Step 3a: Calculate an Adjusted Raw Score. Multiply the mean score (Step 2a) by the total number of items on the short form (i.e., 7 or 12). If the score is not an integer (i.e., whole number), round up to the next highest integer. This is your adjusted raw score.



Example:
The mean score of 3.83 produces an adjusted raw score of 27 (i.e., an adjusted raw score of 26.8 rounds up to 27).

Step 4a: Choose the Appropriate Conversion Table. Each PLUS-M™ short form has a unique conversion table. Only the table that corresponds to the selected short form will produce the correct PLUS-M™ T-score. Choose the conversion table that corresponds to the short form you administered (e.g., choose the 7-item conversion table if you administered the 7-item short form).



PLUS-M™ 7-item Short Form (v1.0) T-score Conversion Table

Raw Score	T-score	SE	Percentile
7	23.3	4.8	0.4%
8	27.0	3.9	1.1%
9	29.3	3.6	1.9%
10	31.1	3.4	3.0%
11	32.8	3.2	4.3%
12	34.4	3.0	5.9%
13	35.8	2.8	7.8%
14	37.2	2.7	10.0%
15	38.4	2.7	12.3%
16	39.6	2.6	15.0%
17	40.8	2.6	17.8%
18	41.9	2.6	20.9%
19	43.0	2.6	24.3%
20	44.2	2.6	28.0%
21	45.3	2.6	31.9%
22	46.4	2.6	36.1%
23	47.6	2.6	40.5%
24	48.8	2.6	45.1%
25	50.0	2.7	49.9%
26	51.2	2.7	54.9%
27	52.5	2.8	59.9%
28	53.9	2.9	65.1%
29	55.3	3.1	70.1%
30	56.8	3.2	75.1%
31	58.3	3.4	79.8%
32	60.0	3.4	84.2%
33	62.2	3.6	88.9%
34	65.2	4.0	93.5%
35	69.9	5.1	97.7%

Record the PLUS-M™ T-score here.

↓↓↓↓

PLUS-M™ T-score

Step 5a: Look Up the T-Score. Look up the PLUS-M™ T-score that corresponds to the adjusted raw score you calculated in step 3a. Note that the standard error (SE) associated with an approximated PLUS-M™ T-score may be greater than that shown in the table. To document the PLUS-M™ approximated T-score, enter it in the field provided (located next to the selected conversion table). If all questions have been answered by the respondent, score the survey using the instructions found under "Scoring Complete PLUS-M™ Short Forms."

Raw Score	T-score	SE	Percentile
22	46.4	2.6	36.1%
23	47.6	2.6	40.5%
24	48.8	2.6	45.1%
25	50.0	2.7	49.9%
26	51.2	2.7	54.9%
27	52.5	2.8	59.9%
28	53.9	2.9	65.1%
29	55.3	3.1	70.1%
30	56.8	3.2	75.1%
31	58.3	3.4	79.8%
32	60.0	3.4	84.2%
33	62.2	3.6	88.9%
34	65.2	4.0	93.5%
35	69.9	5.1	97.7%

Record the PLUS-M™ T-score here.

↓↓↓↓

PLUS-M™ T-score
52.5

Example:
The adjusted raw score of 27 produces a PLUS-M™ T-score of 52.5 on the 7-item conversion table.

Note: the table also indicates the respondent reports higher mobility than 59.9% of the PLUS-M™ development sample.

Interpreting PLUS-M™ T-Scores

The PLUS-M™ T-score is a standardized score with a mean of 50 and a standard deviation (SD) of 10. A higher PLUS-M™ T-score represents a higher level of mobility. The highest possible PLUS-M™ T-score is 76.6 (i.e., when a respondent reports "without any difficulty" for all 44 questions in the PLUS-M™ item bank). The lowest possible T-score is 17.5 (i.e., when a respondent reports "unable to do" for all 44 questions in the PLUS-M™ item bank). T-scores are also comparable across all PLUS-M™ instruments. This means that a PLUS-M™ score obtained by a respondent using the 7-item short form may be compared directly to a score obtained by a respondent using the 12-item short form.

PLUS-M™ T-scores are centered on 50. A T-score of 50 is equivalent to the mean score reported by lower limb prosthesis users included in the PLUS-M™ development study (see "Development Sample"). Based on a normal distribution of PLUS-M™ T-scores, 50% of individuals with unilateral lower-limb amputation are expected to have a T-score of 50 or higher. A respondent that receives a T-score of 60 has reported a level of mobility approximately 1 standard deviation *above* the mean. Therefore, approximately 84% of the people in the PLUS-M™ development sample reported lower mobility than that respondent (Figure 1).

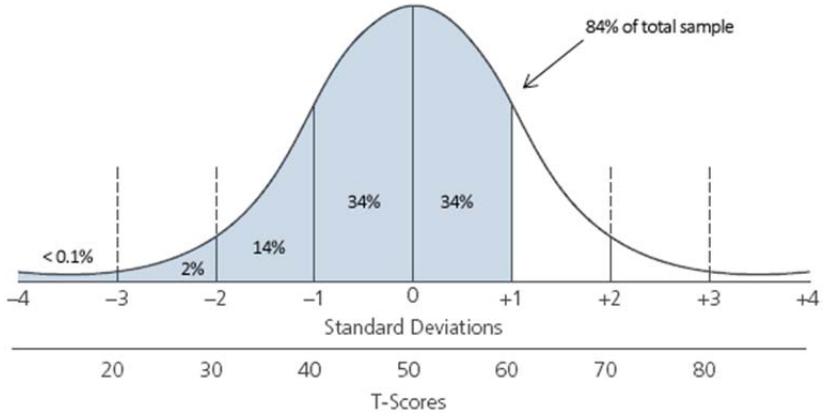


Figure 1 – A PLUS-M™ T-score of 60 indicates that approximately 84 percent of persons in the development sample reported lower mobility, as reflected by the shaded area.

Conversely, a respondent that receives a T-score of 40 has reported their mobility to be about one standard deviation *below* the mean. This means that only about 16% of the PLUS-M™ study sample reported their mobility to be lower than that respondent (Figure 2).

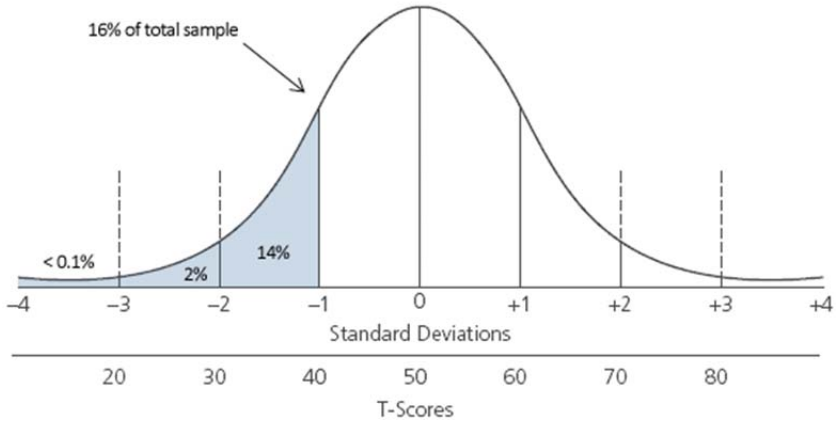


Figure 2 – A PLUS-M™ T-score of 40 indicates that approximately 16 percent of persons in the development sample reported lower mobility, as reflected by the shaded area.

Selecting PLUS-M™ Instruments

The PLUS-M™ item bank contains 44 questions. Two fixed-length formats (i.e., PLUS-M™ short forms) are available: a 7-item short form and a 12-item short form. All items on the PLUS-M™ 7-item short form are included in the PLUS-M™ 12-item short form. T-scores obtained with use of either PLUS-M™ short form are highly correlated with T-scores obtained with use of all 44 PLUS-M™ questions ($r > 0.96$). Both PLUS-M™ short forms may therefore be used with confidence in most situations. PLUS-M™ short forms generally require about two (7-item) or three (12-item) minutes to administer. They require about one (7-item) or two (12-item) minutes to score.

The PLUS-M™ 7-item short form provides acceptable measurement precision (i.e., standard error less than 3.0) for most purposes. The PLUS-M™ 12-item short form provides greater measurement precision than the PLUS-M™ 7-item short form, particularly with prosthetic users with relatively low or higher-than-average mobility.

Selection of a PLUS-M™ instrument should be based on the importance of the decision(s) that will be made from the obtained T-score(s). The greater the consequences of the decision to be made, the more important it is to select an instrument with greater measurement precision. The PLUS-M™ 12-item short form is recommended in situations where mobility is a primary outcome (e.g., comparative effectiveness studies) or when important treatment decisions are to be made (e.g., prosthetic component selection). The PLUS-M™ 7-item short form provides adequate measurement precision (and lowers the respondent and administration burden, relative to the 12-item short form) in situations where mobility is a secondary outcome (e.g., epidemiological studies) or when patients' health is being monitored (e.g., outcomes databases).

PLUS™
Mobility Short Forms v1.0

Name: _____ **Date:** _____

Instructions: We want to know how well you can move around using your prosthetic leg. Please respond to all questions as if you were wearing the prosthesis you would normally use to perform the task.

If you choose not to do an activity because it is not safe for you to do, please choose "unable to do." If you normally use a device that helps you walk or balance (e.g., a cane, crutch, or walker) while performing the task, please answer the questions as though you were using that device. Do not answer questions as if you are sitting in a wheelchair or receiving support from another person.

Please mark one box per row.

Question	Without any difficulty	With a little difficulty	With some difficulty	With much difficulty	Unable to do
1. Are you able to walk a short distance in your home?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
2. Are you able to step up and down curbs?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
3. Are you able to walk across a parking lot?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
4. Are you able to walk over gravel surfaces?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
5. Are you able to move a chair from one room to another?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
6. Are you able to walk while carrying a shopping basket in one hand?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
7. Are you able to keep walking when people bump into you?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
8. Are you able to walk on an unlit street or sidewalk?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
9. Are you able to keep up with others when walking?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
10. Are you able to walk across a slippery floor?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
11. Are you able to walk down a steep gravel driveway?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
12. Are you able to hike about 2 miles on uneven surfaces, including hills?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)

Scoring the PLUS-M™ 12-Item Short Form

PLUS-M™ short forms are scored with a T-score. To find the T-score, sum scores for all responses on the short form. This is the raw score. Do not use the raw score for any purpose other than to look up the T-score using the conversion table below. If any questions on the short form are unanswered, refer to the PLUS-M™ Short Form Users Guide for instructions on scoring *incomplete* short forms.

PLUS-M™ 12-item Short Form (v1.0) T-score Conversion Table

Raw Score	T-score	SE	Percentile
12	21.8	4.4	0.2%
13	25.2	3.4	0.7%
14	27.2	3.1	1.1%
15	28.7	2.9	1.6%
16	30.0	2.7	2.3%
17	31.2	2.5	3.0%
18	32.2	2.3	3.8%
19	33.2	2.2	4.6%
20	34.1	2.1	5.5%
21	34.9	2.1	6.5%
22	35.6	2.0	7.6%
23	36.4	2.0	8.6%
24	37.1	1.9	9.8%
25	37.7	1.9	11.0%
26	38.4	1.9	12.3%
27	39.0	1.9	13.6%
28	39.7	1.9	15.1%
29	40.3	1.9	16.6%
30	40.9	1.9	18.1%
31	41.5	1.9	19.8%
32	42.1	1.9	21.5%
33	42.7	1.9	23.3%
34	43.3	1.9	25.2%
35	43.9	1.9	27.2%
36	44.5	1.9	29.3%

Raw Score	T-score	SE	Percentile
37	45.2	1.9	31.5%
38	45.8	1.9	33.7%
39	46.4	1.9	36.1%
40	47.1	1.9	38.5%
41	47.7	1.9	41.1%
42	48.4	1.9	43.7%
43	49.1	2.0	46.4%
44	49.8	2.0	49.1%
45	50.5	2.0	51.9%
46	51.2	2.0	54.8%
47	52.0	2.1	57.8%
48	52.7	2.1	60.8%
49	53.6	2.1	63.9%
50	54.4	2.2	67.0%
51	55.3	2.3	70.2%
52	56.3	2.4	73.4%
53	57.3	2.5	76.7%
54	58.4	2.6	79.9%
55	59.6	2.8	83.2%
56	61.0	2.9	86.4%
57	62.5	3.1	89.5%
58	64.5	3.3	92.6%
59	67.1	3.8	95.6%
60	71.4	4.9	98.4%

Record the PLUS-M™ T-score here.

↓↓↓↓

PLUS-M™ T-score

For T-scores with standard error (SE) greater than 3.0, use of the PLUS-M™ CAT (www.plus-m.org) is recommended to obtain better measurement precision. Percentile indicates the percent of the PLUS-M™ development sample that reported lower mobility than is reflected by the corresponding T-Score. For more information on interpretation of PLUS-M™ T-scores, please refer to the PLUS-M™ Short Form Users Guide.

PLUS™
Mobility Short Forms v1.0

Name: _____ **Date:** _____

Instructions: We want to know how well you can move around using your prosthetic leg. Please respond to all questions as if you were wearing the prosthesis you would normally use to perform the task.

If you choose not to do an activity because it is not safe for you to do, please choose "unable to do." If you normally use a device that helps you walk or balance (e.g., a cane, crutch, or walker) while performing the task, please answer the questions as though you were using that device. Do not answer questions as if you are sitting in a wheelchair or receiving support from another person.

Please mark one box per row.

Question	Without any difficulty	With a little difficulty	With some difficulty	With much difficulty	Unable to do
1. Are you able to walk a short distance in your home?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
2. Are you able to step up and down curbs?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
3. Are you able to walk while carrying a shopping basket in one hand?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
4. Are you able to keep walking when people bump into you?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
5. Are you able to keep up with others when walking?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
6. Are you able to walk down a steep gravel driveway?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)
7. Are you able to hike about 2 miles on uneven surfaces, including hills?	☐ (5)	☐ (4)	☐ (3)	☐ (2)	☐ (1)

Scoring the PLUS-M™ 7-Item Short Form

PLUS-M™ short forms are scored with a T-score. To find the T-score, sum scores for all responses on the short form. This is the raw score. Do not use the raw score for any purpose other than to look up the T-score using the conversion table below. If any questions on the short form are unanswered, refer to the PLUS-M™ Short Form Users Guide for instructions on scoring *incomplete* short forms.

PLUS-M™ 7-item Short Form (v1.0) T-score Conversion Table

Raw Score	T-score	SE	Percentile
7	23.3	4.8	0.4%
8	27.0	3.9	1.1%
9	29.3	3.6	1.9%
10	31.1	3.4	3.0%
11	32.8	3.2	4.3%
12	34.4	3.0	5.9%
13	35.8	2.8	7.8%
14	37.2	2.7	10.0%
15	38.4	2.7	12.3%
16	39.6	2.6	15.0%
17	40.8	2.6	17.8%
18	41.9	2.6	20.9%
19	43.0	2.6	24.3%
20	44.2	2.6	28.0%
21	45.3	2.6	31.9%

Raw Score	T-score	SE	Percentile
22	46.4	2.6	36.1%
23	47.6	2.6	40.5%
24	48.8	2.6	45.1%
25	50.0	2.7	49.9%
26	51.2	2.7	54.9%
27	52.5	2.8	59.9%
28	53.9	2.9	65.1%
29	55.3	3.1	70.1%
30	56.8	3.2	75.1%
31	58.3	3.4	79.8%
32	60.0	3.4	84.2%
33	62.2	3.6	88.9%
34	65.2	4.0	93.5%
35	69.9	5.1	97.7%

Record the PLUS-M™ T-score here.

↓↓↓↓

PLUS-M™ T-score

For T-scores with standard error (SE) greater than 3.0, use of the PLUS-M™ 12-item short form or the PLUS-M™ CAT (www.plus-m.org) is recommended to obtain better measurement precision. Percentile indicates the percent of the PLUS-M™ development sample that reported lower mobility than is reflected by the corresponding T-Score. For more information on interpretation of PLUS-M™ T-scores, please refer to the PLUS-M™ Short Form Users Guide.

Development Sample

Development sample characteristics are presented to facilitate interpretation of PLUS-M™ T-scores. These data may serve as expected or typical values for persons with unilateral, lower limb amputation. Data used to develop scoring for PLUS-M™ instruments were collected in a cross-sectional study of prosthesis users. Demographics and descriptive statistics are presented for the entire study sample (n=1091), as well as subgroups by gender, age, etiology of amputation, and level of amputation.

Data collection methods

Data was collected from prosthetic users with different levels and etiology of limb loss. Respondents in each of four subgroups (described under "target sample") were sought for participation in the study. Participants were recruited using flyers/posters in prosthetic clinics and hospitals, advertisements in consumer magazines, and postings on list-servs, websites, and social networks.

Target sample: Lower limb prosthesis users with:

- transtibial amputation and traumatic etiology
- transfemoral amputation and traumatic etiology
- transtibial amputation and dysvascular etiology
- transfemoral amputation and dysvascular etiology

Inclusion criteria:
18+ years of age
Ability to read English
Unilateral lower limb amputation (at or above the ankle and below the hip)
Traumatic or dysvascular etiology of amputation
Regular use of a prosthesis to stand, transfer, or walk

Exclusion criteria: Amputation in one or both arms

Surveys were administered by computer (i.e., online), paper, or phone, depending on respondent's preference. Surveys included all of the questions in the PLUS-M™ item bank, as well as demographic questions, and additional questions about respondents' health, mobility, and balance.

PLUS-M™ Development sample characteristics

Data were collected from 1091 unique respondents between January and October, 2012. Demographics (Table 1), socioeconomic status (Table 2), health status (Table 3), and other characteristics (Table 4) of the study sample are provided.

Table 1 – PLUS-M™ development sample - demographics

Characteristic	Transfemoral Dysvascular (n=120)		Transtibial Dysvascular (n=367)		Transfemoral Trauma (n=266)		Transtibial Trauma (n=338)		Total Sample (n=1091)	
	n	%	n	%	n	%	n	%	n	%
Gender										
Male	86	72%	261	71%	183	69%	238	70%	768	70%
Female	34	28%	106	29%	81	30%	99	29%	320	29%
Race/Ethnicity										
Non-Hispanic White	96	80%	285	78%	205	77%	285	84%	871	80%
Non-Hispanic Black	16	13%	43	12%	26	10%	14	4%	99	9%
Hispanic	3	3%	25	7%	21	8%	19	6%	68	6%
Other	4	3%	12	3%	12	5%	18	5%	46	4%

Table 2 – PLUS-M™ development sample - socioeconomic status

Characteristic	Transfemoral Dysvascular (n=120)		Transtibial Dysvascular (n=367)		Transfemoral Trauma (n=266)		Transtibial Trauma (n=338)		Total Sample (n=1091)	
	n	%	n	%	n	%	n	%	n	%
Education										
High school graduate or less	48	40%	116	32%	65	24%	90	27%	319	29%
Some college or tech school	45	38%	149	41%	90	34%	132	39%	416	38%
College graduate	16	13%	66	18%	65	24%	73	22%	220	20%
Advanced degree	11	9%	35	10%	43	16%	42	12%	131	12%
Employment										
Employed	15	13%	63	17%	108	41%	159	47%	345	32%
Homemaker	2	2%	7	2%	8	3%	15	4%	32	3%
Student	3	3%	4	1%	13	5%	12	4%	32	3%
Retired	48	40%	115	31%	50	19%	60	18%	273	25%
On disability	48	40%	163	44%	71	27%	67	20%	349	32%
Unemployed	4	3%	14	4%	14	5%	24	7%	56	5%
Individual Income										
<$25,000	68	57%	213	58%	111	42%	124	37%	516	47%
$25,000-$39,000	26	22%	79	22%	45	17%	63	19%	213	20%
$40,000-$54,999	11	9%	26	7%	35	13%	38	11%	110	10%
$55,000-$69,999	7	6%	13	4%	21	8%	35	10%	76	7%
$70,000-$84,999	2	2%	14	4%	16	6%	26	8%	58	5%
$85,000-$99,999	0	0%	4	1%	16	6%	14	4%	34	3%
$100,000+	4	3%	10	3%	14	5%	30	9%	58	5%

Table 3 – PLUS-M™ development sample - health status

Characteristic	Transfemoral Dysvascular (n=120)		Transtibial Dysvascular (n=367)		Transfemoral Trauma (n=266)		Transtibial Trauma (n=338)		Total Sample (n=1091)	
	n	%	n	%	n	%	n	%	n	%
Health Conditions										
Asthma	13	11%	25	7%	19	7%	39	12%	96	9%
Arthritis	34	28%	110	30%	58	22%	74	22%	276	25%
Cancer	11	9%	18	5%	7	3%	11	3%	47	4%
Diabetes	56	47%	294	80%	10	4%	28	8%	388	36%
Digestive problems	9	8%	28	8%	12	5%	13	4%	62	6%
Heart trouble	41	34%	112	31%	9	3%	16	5%	178	16%
HIV or AIDS	1	1%	3	1%	1	0%	2	1%	7	1%
Kidney disease	9	8%	72	20%	3	1%	1	0%	85	8%
Liver problems	4	3%	7	2%	5	2%	1	0%	17	2%
Stroke	6	5%	18	5%	3	1%	2	1%	29	3%

Table 4 – PLUS-M™ development sample - other characteristics

Characteristic	Transfemoral Dysvascular (n=120)		Transtibial Dysvascular (n=367)		Transfemoral Trauma (n=266)		Transtibial Trauma (n=338)		Total Sample (n=1091)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age at time of survey (years)	61	12	59	11	51	14	51	14	55	13
Age at amputation (years)	56	15	54	12	34	16	34	16	43	18
Time since amputation (years)	5	6	5	5	18	17	17	16	12	14
Prosthesis use per day (hours)	10	5	12	4	13	4	14	3	12	4

PLUS-M™ T-Scores and percentile ranks

PLUS-M™ T-scores for development sample respondents are provided to facilitate interpretation of PLUS-M™ scores. Mean, 25th percentile, 50th percentile (median), 75th percentile, standard deviation, and range of T-scores are provided for the total sample (Table 5), males (Table 6), females (Table 7), persons under 35 years of age (Table 8), persons between 36 and 50 years of age (Table 9), persons between 51 and 65 years of age (Table 10), and persons over 65 years of age (Table 11).

Table 5 – PLUS-M™ T-scores and percentiles (total sample)

PLUS-M T-Score	Transfemoral Dysvascular (n=120)	Transtibial Dysvascular (n=367)	Transfemoral Trauma (n=266)	Transtibial Trauma (n=338)	Total Sample (n=1091)
Mean	42.9	47.4	50.5	55.9	50.3
25th Percentile	37.2	41.7	45.1	49.5	43.7
50th Percentile (median)	42.6	47.2	50.1	55.4	50.0
75th Percentile	49.7	53.3	55.3	61.8	56.3
Standard Deviation (SD)	9.0	8.9	8.1	9.3	9.8
Range (min – max)	17.5 – 67.0	21.9 - 73.6	25.7 - 76.6	31.8 - 76.6	17.5 - 76.6

Table 6 – PLUS-M™ T-scores and percentiles (males)

PLUS-M T-Score	Transfemoral Dysvascular (n=86)	Transtibial Dysvascular (n=261)	Transfemoral Trauma (n=183)	Transtibial Trauma (n=238)	Total Sample (n=768)
Mean	43.9	48.5	51.3	57.3	51.4
25th Percentile	37.6	42.7	45.7	50.8	44.9
50th Percentile (median)	44.6	48.0	50.9	57.0	51.2
75th Percentile	49.8	54.6	56.0	63.5	57.6
Standard Deviation (SD)	8.4	8.7	8.1	9.3	9.8
Range (min – max)	24.1 – 67.0	21.9 - 73.6	25.7 - 76.6	31.8 - 76.6	21.9 - 76.6

Table 7 – PLUS-M™ T-scores and percentiles (females)

PLUS-M T-Score	Transfemoral Dysvascular (n=34)	Transtibial Dysvascular (n=106)	Transfemoral Trauma (n=81)	Transtibial Trauma (n=99)	Total Sample (n=323)
Mean	40.3	44.6	48.7	52.8	47.7
25th Percentile	34.2	39.4	43.7	47.1	41.6
50th Percentile (median)	39.6	43.7	48.6	53.8	47.6
75th Percentile	45.8	49.7	52.5	58.1	54.3
Standard Deviation (SD)	9.9	8.6	7.7	8.4	9.4
Range (min – max)	17.5 - 62.8	25.4 - 73.2	33.3 - 68.5	35.4 - 76.6	17.5 - 76.6

Table 8 – PLUS-M™ T-scores and percentiles (persons under 35 years old)

PLUS-M T-Score	Transfemoral Dysvascular (n=4)	Transtibial Dysvascular (n=5)	Transfemoral Trauma (n=43)	Transtibial Trauma (n=55)	Total Sample (n=107)
Mean	53.7	50.6	52.8	59.4	56.1
25th Percentile	48.8	44.8	47.4	52.6	48.1
50th Percentile (median)	50.7	44.9	52.9	58.1	54.9
75th Percentile	55.6	47.5	57.5	67.4	62.2
Standard Deviation (SD)	9.2	12.9	7.4	10.0	9.6
Range (min – max)	46.3 – 67.0	42.2 - 73.5	38.4 - 76.6	36.1 - 76.6	36.1 - 76.6

Table 9 – PLUS-M™ T-scores and percentiles (persons 36-50 years old)

PLUS-M T-Score	Transfemoral Dysvascular (n=12)	Transtibial Dysvascular (n=70)	Transfemoral Trauma (n=69)	Transtibial Trauma (n=92)	Total Sample (n=243)
Mean	48.1	49.6	51.1	55.9	52.3
25th Percentile	40.8	42.9	44.4	50.0	45.6
50th Percentile (median)	47.8	51.2	49.9	55.2	51.7
75th Percentile	53.0	55.5	58.1	60.8	58.7
Standard Deviation (SD)	8.6	9.4	9.0	9.2	9.6
Range (min – max)	37.4 - 62.8	22.1 - 71.3	33.3 – 71.0	34.6 - 76.6	22.1 - 76.6

Table 10 – PLUS-M™ T-scores and percentiles (persons 50-65 years old)

PLUS-M T-Score	Transfemoral Dysvascular (n=53)	Transtibial Dysvascular (n=179)	Transfemoral Trauma (n=113)	Transtibial Trauma (n=139)	Total Sample (n=484)
Mean	40.8	47.8	49.9	55.0	49.6
25th Percentile	34.9	42.2	45.0	48.7	42.7
50th Percentile (median)	40.2	47.8	50.0	55.1	49.6
75th Percentile	47.4	53.6	55.7	61.3	55.7
Standard Deviation (SD)	8.2	8.8	8.2	8.8	9.6
Range (min – max)	17.5 - 60.3	25.4 - 73.6	25.7 - 68.5	31.8 - 76.6	17.5 - 76.6

Table 11 – PLUS-M™ T-scores and percentiles (persons over 65 years old)

PLUS-M T-Score	Transfemoral Dysvascular (n=51)	Transtibial Dysvascular (n=112)	Transfemoral Trauma (n=41)	Transtibial Trauma (n=52)	Total Sample (n=256)
Mean	43.0	45.1	48.7	54.7	47.2
25th Percentile	37.3	40.3	44.7	47.2	41.4
50th Percentile (median)	42.8	44.6	49.5	54.9	47.0
75th Percentile	49.8	49.6	52.2	60.0	52.7
Standard Deviation (SD)	8.9	8.0	5.9	9.6	9.2
Range (min – max)	24.1 - 63.7	21.9 - 66.4	33.0 - 62.8	33.9 - 76.6	21.9 - 76.6

PLUS-M™ T-score interpretation using development sample data

Interpretation of PLUS-M™ T-Scores may be aided by comparison to scores reported by the subgroups within the development sample (e.g., persons with transtibial amputation and traumatic etiology). Comparison to the development sample allows individual scores to be interpreted in context of persons with similar levels and etiologies of limb loss. Figure 3 (next page) allows PLUS-M™ users to cross-reference PLUS-M™ T-Scores with an estimated location within the reference sample.

Example: A respondent with a transtibial amputation due to trauma receives a PLUS-M™ T-Score of 55. Figure 3 indicates that this score is higher than approximately 65% of the total reference sample (black dashed line), but higher than about 42% of those who have a similar level and etiology of amputation. Thus, this respondent has lower mobility than most of those with this level and etiology of amputation, even though their T-Score is similar to the mean of the sample noted in Table 7.

Figure 3 - Distribution of PLUS-M™ T-Scores by Sample Group