Database of Knowledge Translation Tools
Assessment Summary

1. The Prosthetic Limb Users Survey of Mobility, Lower Extremity Amputations (PlusM)

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2. Instrument Description and Administration Instructions

Purpose of the PlusM:
- The Prosthetic Limb Users Survey of Mobility™ is a self-report instrument for measuring mobility of adults with lower limb amputation.
- It has been rigorously developed using modern psychometric methodology and is intended for use in clinical practice and research.
- PLUS-M™ instruments are based on a set of 44 calibrated questions called an item bank.
- Two fixed-length instruments (7 and 12 items) and a computerized adaptive test (CAT) are available for use in clinics and research settings.

Type of assessment: Patient-reported outcome measure

Administration instructions: "Please respond to all questions as if you were wearing the prosthetic leg(s) you use most days. If you would normally use a cane, crutch, or walker to perform the task, please answer the questions as if you were using that device."

Please choose "unable to do" if you:
- Would need help from another person to complete the task,
- Would need a wheelchair or scooter to complete the task, or
- Feel the task may be unsafe for you

Scoring: A T-score refers to the Plus-M development sample (n=1091). Scoring table is included in the assessment form.
- T-scores obtained with the 12-item short form are highly correlated to those based on all 44 items in the PLUS-M item bank (R = 0.96).
- A T-score is a standardized score with a mean of 50 and a standard deviation (SD) of 10.
- A higher T-score indicates a higher level of mobility.
- The highest possible T-score is 76.6; the lowest possible T-score is 17.5
- A T-score of 60 has a level of mobility ~1 standard deviation above the mean.
- A T-score of 40 has a level of mobility ~2 standard deviation below the mean.
- Information on scoring can be found at http://plus-m.org/about.html
Note: Information about scoring incomplete tests is also available.

ICF Domain: Activity level

Construct: Locomotor capability when using a prosthesis, range from short distance indoor to advanced outdoor activities

3. Clinical Bottom Line

Indications for use: Assessment of change over time (i.e. outcome measure) for people who have above and below-knee amputations *and are using prosthetic limbs.*

Considerations:
- The PLUS-M has demonstrated fewer ceiling effects than other measures of mobility post-amputation, including the Locomotor Capabilities Index (LCI, LCI-5, etc). Therefore, may be a better measure, particularly with higher functioning individuals. Additional items that may improve measurement in higher functioning patients are walking while people bump into you, walking on an unlit street or sidewalk, keeping up with others when walking, walking across a slippery floor, walking down a steep gravel driveway, hike about 2 miles on uneven surfaces including hills.
- The PLUS-M has excellent test-retest reliability, therefore could be used across health-care settings. Results of tests could also be shared between settings to understand the level of function and impact of entire episode of rehabilitation.

Knowledge Expert group recommendation:
The PLUS-M (English and Norwegian translations) are recommended for use in clinical practice.
- Appropriate for inpatient rehabilitation, outpatient rehabilitation, and other community settings.
- Patients should be learning to ambulate with a prosthesis, or already ambulating with a prosthesis
- Can be used as an outcome measure and should administered at least twice (once at admission and once at discharge) and optimally once in between.

4. Interpretation of Results

Standard Error of Measurement (SEM – in T Score):
- Above and below knee amputation (Hafner, Morgan et al. 2016)
    - CAT (device): 2,79
    - 12-Item Short Form: 1,93
    - 7-Item Short Form: 2,02

Minimum Detectable Change (MDC – in T Score):
- Above and below knee amputation (Hafner, Morgan et al. 2016)
    - CAT: MDC_{90}: 6,42, MDC_{95}: 7,65
    - 12-Item Short Form: MDC_{90}: 4,50, MDC_{95}: 5,36
    - 7-Item Short Form: MDC_{90}: 4,69, MDC_{95}: 5,59

Minimal Clinical Important Difference (MCID): Not established

Normative Values:

Comparison of T-score between Norwegian and U.S. sample (Schwanborg 2016)

	Norwegian sample		US sample	
	Mean	SD	Mean	SD
Total sample	52.5	11.1	50.3	9,8
< 43 years old	59.9			
> 64 years old	49.0	10.9	47.2	9.2

Cut-off scores: *Mean scores for patients who experienced falls(Sawers and Hafner 2020) (Sawers et al., 2019)*

- Above and below knee amputees (Dysvascular (n=7) and non dysvaskular (n=33); age mean (SD) 48.7(14.6); sex M 33, F 19)
    - No falls, Plus-M mean (SD): 58.5 (9.05)
    - 1 fall, Plus-M mean (SD): 56.2 (6.35)
    - $\geq$ 2 falls, Plus-M mean (SD): 49.2 (6.71)

5. Clinical Utility

Cost: Free

Equipment required: No equipment required

Number of items: There are 2 short forms, a 7-item and a 12-item short form.

Time to administer: 2 – 3 minutes to administer and 1-2 minutes to score.

Training required: No training required

6. Application to specific patient diagnoses

Populations reviewed in this summary: Above and below knee amputation.

7. Psychometric Properties

Reliability:
- Test-Retest Reliability
    - Lower limb ambulation (Hafner, Morgan et al. 2016)
        - CAT (device): *Excellent test-retest reliability (ICC = 0.92)*

        - 12-Item Short Form:
            - Electronic mode: *Excellent test-retest reliability (ICC = 0.95)*
            - Mixed mode: *Excellent test-retest reliability (ICC = 0.95)*
            - Paper mode: *Excellent test-retest reliability (ICC = 0.97)*
        - 7-Item Short Form:
            - Electronic mode: *Excellent test-retest reliability (ICC = 0.94)*
            - Mixed mode: *Excellent test-retest reliability (ICC = 0.80)*
            - Paper mode: *Excellent test-retest reliability (ICC = 0.97)*

- **Internal Consistency**
  - Norwegian Translation (Schwanborg 2016): *Excellent* internal consistency (Cronbach's alpha = 0.97)

Validity:

- Face Validity: PLUS-M was developed using focused groups (n=37) feedback. Participants described mobility as a confluence of factors that included characteristics of the individual, activity, and environment. They identified themes were defined as individual characteristics, forms of movement, and environmental situations. Prosthetic mobility was conceptualized as movement activities performed in an environmental or situational context.(Hafner, Gaunaurd et al. 2017)
- Concurrent Validity
  - Lower limb amputation:(Amtmann, Bamer et al. 2018)
    - *Excellent correlation* between the Computerized Adaptive Test (CAT) and the PLUS-M short-forms (r = .90)
    - *Excellent correlation* between the Medical Outcomes Study SF-12 and SF-6 (r=0.98)
- Convergent Validity
  - Non-vascular lower limb ambulation(Clemens, Gailey et al. 2018)
    Adequate correlation with the Timed Up and Go (total time) (r=0.56, p<0.001)
- Cross-cultural validity: Translation followed a formal translation process.(Eremenco, Cella et al. 2005) Forward translators where Norwegian prosthetists, not residents of the USA. The Norwegian translation of PLUS-M is approved by the developer and published on the PLUS-M website (Schwanborg 2016)
- Discriminative validity:(Schwanborg 2016)
  - Scores discriminate between
    - Males and females, p value = 0.001
      - Males: T-score: 54 SD: 10.4
      - Females: T-score: 49.6 SD: 12.2
    - Younger (<60) and older participants (>60), p < 0.001
      - Younger: T-score: 57.1, SD: 9.8
      - Older: T-score: 50.2 SD: 11.1
    - Below and above knee amputees, p = 0.002
      - Below knee: T-score: 54.0 SD: 10.9
      - Above knee: T-score: 50.1 SD: 11.0
    - Amputation due an accident vs. cardio-vascular disease, p <0.001
      - Accident: T-score: 57.2 SD: 9.7
      - Cardiovascular disease: T-score: 46.3 SD: 10.4

Construct Validity

- Above and below knee amputation(Hafner, Gaunaurd et al. 2017)
  - *Excellent* correlation with PEQ-MS Prosthesis Evaluation Questionnaire-Mobility Subscale (rho=0.78, p<0.001),
  - *Excellent* correlation with ABC (Activities-Specific Balance Confidence Scale) (rho=0.81, p<0.001),
  - *Excellent* correlation with PROMIS (Patient Reported Outcomes Measurement Information System-Physical Function) (rho = 0.81, p < 0.001).
  - *Adequate* correlation with AMP (Amputee Mobility Predictor) scores (rho=0.54, p<0.001)
  - *Adequate* correlation with TUG (Timed Up and OG) times (rho=-0.56, p<0.001)

Floor and ceiling effects:
- o Norwegian Plus-M (Schwanborg 2016)
    - Ceiling effect 10.7% (37 respondents)
    - Floor effect 1,7% (6 respondents)
- o English Plus-M (Hafner, Gaunaurd et al. 2017)
    - No evidence of floor or ceiling effects were observed for PLUS-M (i.e., only two participants scored the maximum T-score).

8. Documentation and Clinical Decision-Making Tips:

Sample goals: Can be used to identify appropriate goals for a PSFS goal. For example, the items that were more challenging can be included as PSFS goals.

Also consider including the test result and the MDC in the goal. For example, "Patient to demonstrate improved mobility with his prosthesis by increasing the PLUS-M score from a 32 to a 38."

Components to include in documentation: Include T-Score and percentile at admission and discharge. An interpretation of the T-Score should also be provided, including how the score would compare to average and possible fall risk. Specific items that were reportedly challenging could be included.
If possible, also include responses on each item, raw score, and T-Score in the documentation.

9. Links to other relevant resources:

Websites:
- PLUS-M website: http://plus-m.org/ OBS ikke www i adressen!
- Norwegian (and other) translations: http://plus-m.org/translations.html
- Norwegian description (Master's project) on the PLUS-M translation: https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2575261

Copy of the instrument: http://plus-m.org/translations.html

10. Samples and References:

Samples
(Hafner, Gaunaurd et al. 2017) Construct validity of the Prosthetic Limb Users Survey of Mobility (PLUS-M) in adults with lower limb amputation
(n=199, mean age=55.4±14.3 years, 71.4% male) Similar proportions of traumatic and dysvascular amputation, 41.2% and 43.7%. 75% had transtibial- and 18.1% transfemoral amputation (some ancle and knee, 5.5%)

(Hafner, Morgan et al. 2016) Psychometric evaluation of self-report outcome measures for prosthetic applications. (All arms of study n=201 67.2% male. Amputation level, above knee 34.8% below knee 65.2%)

(Schwanborg 2016) Assessment of the mobility of Norwegian lower limb prosthetic users and translation and validation of the Prosthetic Limb Users Survey (PLUS-M). Master's Thesis.
(n=359, age below 35 4.7%, 36-49 12% 50-64 29.2%, 64+ 52.1%, 70.2% male. Amputation level below knee 66.3% above knee 33.7%. Dysvascular 30.1%, accident 41.5%.

(Amtmann, Bamer et al. 2018) Amtmann & al. 2018 A comparison of computerized adaptive testing and fixed-length short forms for the Prosthetic Limb Users Survey of Mobility (PLUS-M™).
(total n (two studies)=199, mean age =55.17/60.96 ± 14.44/11.

(Sawers and Hafner 2020) Sawers & al. Using Clinical Balance Tests to Assess Fall Risk among Established Unilateral Lower Limb Prosthesis Users: Cutoff Scores and Associated Validity Indices.

(Clemens, Gailey et al. 2018) Clemens & al, 2018: The Component Timed-Up-and-Go test: the utility and psychometric properties of using a mobile application to determine prosthetic mobility in people with lower limb amputations
(n= 118 Non-vascular cause of lower limb amputation. Mean age 48 (±13.7) years. 54% (n = 64) of subjects were male. Average of 10 years post amputation.)

References
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5. Clemens SM, Gailey RS, Bennett CL, Pasquina PF, Kirk-Sanchez NJ, Gaunaurd IA. The Component Timed-Up-and-Go test: the utility and psychometric properties of using a mobile application to determine prosthetic mobility in people with lower limb amputations. *Clinical rehabilitation.* 2018;32(3):388-397.
6. Eremenco SL, Cella D, Arnold BJ. A comprehensive method for the translation and cross-cultural validation of health status questionnaires. *Evaluation & the health professions.* 2005;28(2):212-232.
7. Hafner BJ, Morgan SJ, Askew RL, Salem R. Psychometric evaluation of self-report outcome measures for prosthetic applications. *Journal of rehabilitation research and development.* 2016;53(6):797-812.