BACPAR TOOLBOX OF OUTCOME MEASURES

Version 2

Mary Jane Cole

Jane Cumming

Nancy Golland

Sue Hayes

Chantal Ostler

Judy Scopes

Louise Tisdale

Version 2

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Contents

Preface

The current project group and the BACPAR executive committee would like to acknowledge the work done by the first outcome measure group to produce the original version of the BACPAR Toolbox: Katherine Atkin, Mary Jane Cole, Jane Cumming and Maggie Donovan-Hall. The majority of the introduction to Version 1 is retained to outline the background to this ongoing project.

The authors continue to welcome feedback from users of the Toolbox. This can be done to any member of the BACPAR executive committee who will forward relevant comments to the project group.

Introduction to Version 2

With an ever-increasing choice of Outcome Measures (OMs) it is even more important that we, as Physiotherapists, know why we use the OMs we do. It is also important that we know what the results may tell us about our patient's progress and/or the effectiveness of our treatment programmes and interventions. The full background to this on-going project was outlined in the introduction to Version 1 (February 2010) of the Toolbox and the majority of that introduction is retained below.

A second working group was set up in October 2012 whose main aim was to update the evidence for the use of OMs in prosthetic rehabilitation as outlined in that version. In addition, and in response to feedback and requests from BACPAR members, the remit of the work was widened to include OMs that may be used in the pre-prosthetic or acute phase following a lower limb amputation. Work was also progressed looking at OMs that may be used with non-limb wearers, and also specific "predictor" OMs that may be used to predict successful prosthetic use or outcomes. Results from these last two work-streams will be included as they become available.

The Toolbox will continue to be presented as a series of Evidence-based Notes. The changes were made in light of evidence published since the last Toolbox version was released. All additions were agreed by the project group using the same criteria as stated in the Version 1 and it may be useful to emphasise the importance of these.

The CSP advocate the following, amongst other things, in their Quality Assurance Standards: 9.4.2 An appropriate measure is used to evaluate the effect of physiotherapeutic intervention(s);
1.   The measure chosen is published, standardised, valid, reliable and responsive
2.   The measure used is the most relevant to the service user's problems to evaluate the change in the service user's health status
3.   The measure is acceptable to the service user
4.   The metric is used in an appropriate way for that specific measure (possibly at the start and end of treatment and at appropriate intervals including follow up)

An Appendix giving definitions for some of the most commonly used psychometric/clinimetric terms is also included in this version. Examples using the OMs included here are given to help give some context to the terms.

Background (Original Introduction to Version 1)

As health professionals working in amputee rehabilitation we are all aware that we should be using outcome measures to demonstrate that we are providing an effective intervention. The use of outcome measures can help us illustrate to our patients how they are progressing and working towards their personal goals. In recent years there have been increasing pressures to use outcome measures and produce standardised data within in our daily practice (DH 2008) so that our services can be scrutinised and assessed by our users and outside agencies. It is often found that there are limitations with some of the outcome measures in terms of reporting and collating results for benchmarking purposes. However, there are a growing number of different outcome measures and it is often difficult to select which ones we should be using. Outcome measures that have been selected in the past and widely used may not necessarily have been shown to be the best tools under closely scrutiny. As these pressures are relatively new to some of us, the BACPAR Executive committee felt it was a priority to develop a national consensus of outcomes for use with our population.

Our services are coming under ever-increasing external scrutiny. This was a process which was started with the journey towards a world class health care system as mapped out in the NHS plan 2000 (DH 2000). Further white papers, command papers and enabling reports have been published since then and the emphasis now is to provide quality healthcare (DH 2008 (2)) as outlined by Lord Darzi. More specific to us, is the improved Allied Health Professional (AHP) service offer published also in 2008 (DH 2008).

The Secretary of State for Health stated in his introduction to this Department of Health document

"We need to make services as accessible as possible and maximise the skills and competencies of our workforce, and we need to provide practitioners with tools to measure the quality of service they deliver in order that they can continue to improve those services."

The BACPAR Executive met in Spring 2009 at the CSP and one of the many questions addressed was "What are the most pressing issues facing the physiotherapy profession (and AHPs) and the CSP and why?" These were deemed to be:

1. Commissioning – the process of ensuring that the health and care services provided effectively meet the needs of the population. The commissioning cycle will include the use of quality metrics in order to improve quality. (E.g. Therapy outcome measures and quality of well being scales, patient reported outcome measures or PROMS etc).

2. Standardised datasets – which inform service improvement and benchmarking. We already have the 18 week waiting initiative. (NHS 2008)

The BACPAR Executive recognised that there was a need to gain consensus for standardised outcome measures and that the membership should be involved in the process. A working group was set up in order to facilitate the process.

There are some basic requirements that any particular outcome measure needs to meet in order to be included in our final recommendations (Jerosch-Herold, 2005). These are that a particular outcome measure is

- Valid for the purpose and the population – **validity**
- Sensitive to small but clinically important changes in status – **responsiveness**
- Highly reproducible – **reliability**

These factors depend on the population and setting in which they are applied.
Other considerations are practicalities

- Portability

- Cost

- Ease of use, including time to complete

- Acceptability of the measures

Our objectives are to

- Gain baseline information

- Assess progress

- Inform treatment planning

- Demonstrate effectiveness of intervention

- Have confidence in results

There are two types of outcome measures, general and specific. General measures allow comparison with other groups of users and with populations without health conditions. These may be less sensitive to change and specific issues of concern in particular populations. Specific measures are particular to a population and may be more relevant to users and clinicians interests. However they may miss unexpected findings.

Outcome measures can also be divided into self-report or observed and it is recommended that both are utilised in patient assessment. Many outcome measures may display what are known as floor and ceiling effects. Thus, although satisfying all other requirements, they may be applicable to only part of the rehabilitation process. This needs to be ascertained prior to application to an individual or to a population of interest.

Central to all our work are our users of the services and OMs must be linked to agreed rehabilitation goals. Goals tend to be related to mobility, function, psychological aspects, safety, pain, socket comfort and QOL. Equally important is users' satisfaction with our services and any government targets.

Gaining a consensus decision on outcome measures would allow for data comparison, benchmarking, and informing prescription to contribute to eliminating a postcode service, research and service development.

References

Condie E, Scott H, Treweek S (2006). Lower limb prosthetic outcome measures: a review of the literature 1995 to 2005. *Journal of Prosthetics and Orthotics* 18:1S:13-45

DH 2000: The NHS Plan. A summary.
http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4010198

DH 2008: Framing the contribution of allied health professionals: delivering high-quality healthcare: www.dh.gov.uk (DH_089513)

DH 2008 (2). High quality care for all: NHS Next Stage Review final report
http://www.csp.org.uk/director/members/newsandanalysis/policyinfocus/qualitycounts.cfm

Jerosch-Herold, 2005. *An evidence based approach to choosing outcome measures: a checklist for the critical appraisal of validity, reliability and responsiveness studies.* BJ Occ Therapy 2005:68(8)

NHS 2008. Information management handbook for AHP services. The Access Partnership for the Department of Health 18 weeks programme and AHP leadership teams. Published on the NHS 18 week website: http://www.18weeks.nhs.uk/Content.aspx?path=/achieve-and-sustain/AHP-services/information-management-handbook

Other useful resources:

AHP Services Improvement Programme: www.dh.gov.uk (DH_086913)

Connecting for health - data services: www.connectingforhealth.nhs.uk

Measuring for Quality Improvement: http://www.ic.nhs.uk

Charting the future.

http://www.csp.org.uk/director/members/practice/practiceinitiatives/chartingfuture.cfm

Standardised data collection
http://www.csp.org.uk/director/members/practice/informationmanagementandinformationtechnology/standardiseddatacollection.cfm

18 weeks: http://www.18weeks.nhs.uk/Content.aspx?path=/

Recommendations for Version 2

Prosthetic Outcome Measures

A review of the literature focusing on prosthetic rehabilitation was undertaken. Only one relevant Systematic Review (Hawkins et al 2014) has been published since Version 1 of the toolbox. The review was published in the Annals of Surgery in January 2014 and looked at functional and Quality of Life (QoL) measures used after major lower limb extremity amputation. It was authored by three surgeons and one physician from Boston. The instruments were classified as those measuring function or QoL and also identified as being general or amputee-specific. A grading of ++++ indicated extensively validated with excellent reliability and validity, and +++ indicated adequately/reasonably valid for the main purpose although checking of assumptions of minor improvements may be desirable. Their main findings that are relevant to this update are:

- 14 instruments were graded +++ and above

- No general QoL measures have been validated with a LLA population

- TAPES was graded lower than some other QoL measures and included in the top 14 (i.e.++)

- PEQ was graded +++ but the previous project group did not recommend its inclusion in Version 1 because of it being too lengthy

- Although the SIGAM was graded +++ with good reliability, there is sparse validity data available and therefore not recommended in this version

- The review supported the use of walking tests with the TUG and 2 and 6MWTs all receiving a grading of +++ with multiple references, see below for recommendations of inclusion

- No instruments measuring balance were mentioned, however several references were found separately from this review, again see below for recommendations for inclusion

Therefore the recommendations for the Version 2 of the Toolbox for use with prosthetic limb-users are as follows:

1. Keep all existing OMs but add references to update the evidence for:

   - TAPES

   - TUG

   - AMP

2. Add three further OMs to complement the self-reported functional tests already included. All are observed performance tests, easy to administer and have published evidence to support their use with LLAs. They are:

   - Timed walk tests (2MWT & 6MWT) – Refs (Resnik, Borgia 2011; Brooks, Parsons et al. 2001; Brooks, Hunter et al. 2002; Gremeaux, Damak et al. 2012; Parker, Kirby et al. 2010; Lin, Bose 2008; Pin 2014)

   - L-Test (a modified version of the TUG) – Ref (Deathe, Miller 2005)

- Berg Balance Score – Refs (Major, Fatone et al. 2013; Wong 2013; Wong, Chen et al. 2013; Donoghue, Stokes 2009)

A full "Evidence Note" will be produced for each of the above in the same style as the others.

Acute /Pre-prosthetic Outcome Measures

A narrative review was also undertaken by the project group on the use of outcome measures for lower limb amputees (LLAs) in the acute or pre-prosthetic phase. The results of that review were published in the Spring 2014 BACPAR Journal. While there was some evidence for the Functional Independence Measure (FIM), it was felt that the current evidence was not strong enough to recommend the inclusion of it or any other specific OM into the Toolbox for this population. The other OMs included in this Toolbox all have good evidence with larger sample sizes. In addition the FIM requires training before using it and is recommended as an MDT tool so does not fit the "easy to use" criteria.

References

Hawkins, A.T., Henry, A.J., Crandell, D.M., Nguyen, L.L., (2014) A systematic review of functional and quality of life assessment after major lower extremity amputation. Annals of Vascular Surgery 28(3) pp. 763-780

Other references will be detailed in the appropriate OM section.

Evidence-based Guidance Notes

Name of outcome measure

Activities-specific Balance Confidence Scale – UK (ABC-UK)

What is it?

The ABC-UK is a self-report, quality of life outcome measure, relating balance confidence to functional activities.

Justification for inclusion in the BACPAR recommended toolbox of outcome measures

No cost.

Easy to use and interpret.

Validated with unilateral, lower limb amputees.

Test-retest reliability and internal consistency are high and there is evidence of construct and concurrent validity.

Where can I find it?

Copy attached.

When to use it

The ABC-UK can be used at any time during prosthetic rehabilitation – e.g. to inform treatment planning or to monitor change in balance confidence after intervention or after discharge.

How to use it

The patient is asked to rate their confidence from 0 to 100% on 16 increasingly challenging tasks, with 0% having no confidence and 100% meaning complete confidence. It takes about 5-10 minutes for a patient to complete.

If at least 75% of the items (12 of the 16) are answered, the total score can still be calculated.

The sub-scores are summed and divided by 16.

How to interpret it

A change in ABC score of +/- more than 6 points would indicate that a real change has occurred.

A score of 80 on the ABC is comparable to many higher functioning older adults. Those scoring less than 80 have room for improvement in balance confidence.

How to apply it

Could set treatment goals around achieving a specific change in ABC-UK score.

When monitoring patients post-discharge from Physiotherapy, could use a decrease in 6 or more points on the ABC-UK score as an indicator that a patient requires more Physiotherapy input.

References

Miller, W.C., Deathe, B. (2004) A prospective study examining balance confidence among individuals with lower limb amputation. Disability and Rehabilitation 26:14/15:875-881.

Miller, W.C., Deathe, B., Speechley, M. (2003) Psychometric Properties of the Activities-Specific Balance Confidence Scale Among Individuals With a Lower-Limb Amputation. Archives of Physical Medicine and Rehabilitation 84: 656-661.

Miller, W.C., Deathe, B., Speechley, M. (2002) Balance Confidence Among People With Lower-Limb Amputations. Physical Therapy 82:9:856-865.

Myers, A.M., Fletcher, P.C., Myers, A.H., Sherk, W. (1998) Discriminative and Evaluative Properties of the Activities-specific Balance Confidence (ABC) Scale. Journal of Gerontology 53A:4:M287-M294.

Parry, S.W., Steen, N., Galloway, S.R., Kenny, R.A., Bond, J. (2001) Falls and confidence related quality of life outcome measures in an older British cohort. Postgraduate Medical Journal 77:103-108.

Powell, L.E., Myers, A.M. (1995) The Activities-specific Balance Confidence (ABC) Scale. Journal of Gerontology 50A:1:M28-M34.

Activities-specific Balance Confidence Scale-UK

(from Parry et al, 2001)

For each of the following activities, please indicate your level of self confidence by choosing a corresponding number from the rating scale 0% to 100%, with 0% meaning you have no confidence and 100% meaning you feel completely confident

How confident are you that you can maintain your balance and remain steady when you....

1.....walk around the house? _____%

2.....walk up or down stairs? _____%

3.....bend over and pick up a slipper from the floor at the front of a cupboard? _____%

4.....reach for a small tin of food from a shelf at eye level? _____%

5.....stand on your tip toes and reach for something above your head? _____%

6.....stand on a chair and reach for something? _____%

7.....sweep the floor? _____%

8.....walk outside the house to a parked car? _____%

9.....get into or out of a car? _____%

10...walk across a car park to the shops? _____%

11...walk up or down a ramp? _____%

12...walk in a crowded shopping centre where people walk past you quickly? _____%

13...are bumped into by people as you walk through the shopping centre? _____%

14...step onto or off an escalator while holding onto the handrail? _____%

15...step onto or off an escalator while holding onto parcels such that you cannot hold onto the handrail? _____%

16...walk outside on slippery pavements? _____%

Total score _____

Name of outcome measure

Amputee Mobility Predictor with a prosthesis (AMPPRO)

What is it?

The AMPPRO is an observed outcome measure designed to be used with lower limb amputees with a prosthesis. It is based on Tinetti's Performance-Oriented Assessment of Mobility Problems (POMA) and Duke Mobility Skills Profile (DMSP). The AMPPRO evaluates functional ability by assessment of transfers, sitting and standing balance and gait skills.

Justification for inclusion in the BACPAR recommended basket of outcome measures

No cost

Easy to use

Validated with unilateral, lower limb amputees

Test-retest reliability and interrater reliability are high and there is evidence of construct and concurrent validity

Where can I find it?

Copy attached.

When to use it

The AMPPRO can be used to identify areas for further improvement in rehabilitation, and is able to detect improvements in function, so can be used early in the rehabilitation programme, and then again at discharge from Physiotherapy, or could be used at discharge from Physiotherapy, and then again at a review appointment to monitor progress.

How to use it

The average time taken to administer the AMPPRO is about 15 minutes. Equipment required for testing is: a stopwatch, 2 chairs, a 12" ruler, a pencil, a 4" high obstacle (preferably 18-24" long) and a set of stairs with 3 steps. A 12 foot walkway needs to be marked out.

The following article provides a detailed methodology, but the instrument itself explains each task that the subject is required to perform. Gailey, R.S, Roach, K.E, Brooks Applegate, E, Cho, B, Cunniliffe, B, Licht, S, Maguire, M, Nash, M.S (2002) The Amputee Mobility Predictor: An Instrument to Assess Determinants of the Lower Limb Amputee's Ability to Ambulate. Archives of Physical Medicine and Rehabilitation 83:613-627.

Each item is summed. The total score achievable is 47.

How to interpret it

A higher score indicates greater functional ability. There is evidence that the AMPPRO can discriminate among the Medicare Functional Classification Levels (MFCL), or K codes (the American version of the English 'A' codes). Cut-off values for these have been suggested by Gailey (2006), but they have not been validated, so at present it would not be appropriate to link the score achieved on the AMPPRO with a mobility grade.

How to apply it

Could set treatment goals around achieving a specific change in AMPPRO score. It can be used to inform the rehabilitation process, or be indicative of the need for top-up Physiotherapy if a score has decreased.

Updated Evidence

A study published in 2011 by Resnik et al aimed to calculate MDC (minimal detectable changes) for a range of measures used in amputee rehab. The MDC was presented in absolute values for: 2MWT (34.3m), 6MWT (45m), TUG (3.6s), and **AMP (3.4pts**). One of the main limitations for this study was that it included veterans only.

References

Gailey, R.S (2006) Predictive Outcome Measures Versus Functional Outcome Measures in the Lower Limb Amputee. Journal of Prosthetics and Orthotics 18:1S; 51-60.

Gailey, R.S, Roach, K.E, Brooks Applegate, E, Cho, B, Cunniliffe, B, Licht, S, Maguire, M, Nash, M.S (2002) The Amputee Mobility Predictor: An Instrument to Assess Determinants of the Lower Limb Amputee's Ability to Ambulate. Archives of Physical Medicine and Rehabilitation 83:613-627.

Resnik, L. and Borgia, M., (2011). Reliability of outcome measures for people with lower-limb amputations: distinguishing true change from statistical error. Physical Therapy, 91(4), pp. 555-565.

Amputee Mobility Predictor (AMP)

Name		Date & time		Hosp no.	
Level of amputation:			**Side of amputation:**		

Activity	How to rate		Score	
Sitting balance – sit forward with arms crossed	Unable to sit upright indep 60 secs	= 0		
	Able to sit upright 60 secs	= 1		
Sitting reach – reach forward to grasp a ruler held by tester 12" beyond extended arms of subject	Does not attempt	= 0		
	Unable to grasp or requires UL support	= 1		
	Reaches forward & grasps object	= 2		
Chair to chair transfer – 2 chairs at 90°	Unable or requires assistance	= 0		
	Independent but unsteady	= 1		
	Independent, steady & safe	= 2		
Stand up from chair – arms folded across chest	Unable without help	= 0		
	Able, uses arms / assistive device	= 1		
	Able, without using arms	= 2		
Attempt to rise from chair – arms folded across chest	Unable without help	= 0		
	Able – requires more than 1 attempt	= 1		
	Able to rise on 1st attempt	= 2		
Immediate standing balance (1st 5 secs)	Unsteady (staggers, moves foot, sways)	= 0		
	Steady with support	= 1		
	Steady without support	= 2		
Standing balance (30 secs)	Unsteady	= 0		
	Steady with support	= 1		
	Standing without support	= 2		
Single limb standing balance – time the duration of single-limb standing			Right	Left
	Unsteady	= 0		
	Steady with support 30 secs	= 1		
	Steady no support 30 secs	= 2		
Standing reach – reach forward to grasp ruler held by tester 12" beyond extended arms of subject	Does not attempt	= 0		
	Unable to grasp or requires support	= 1		
	Reaches forward & grasps item, no support	= 2		
Nudge test – feet as close together as possible. Tester pushes on subject's sternum 3 times	Begins to fall	= 0		
	Staggers, grabs, catches self or uses assistive device	= 1		
	Steady	= 2		
Eyes closed	Unsteady or uses support	= 0		
	Steady no support	= 1		

			Right	Left
Pick object off floor – pencil is placed midline 12" in front of feet	Unable Requires support No support required	= 0 = 1 = 2		
Sitting down – arms folded across chest	Unsafe Uses arms, assistive devise or not smooth Safe smooth motion	= 0 = 1 = 2		
Initiation of gait – immediately after told to "go"	Any hesitancy or multiple attempts to start No hesitancy	= 0 = 1		
Foot advancement and clearance – walk 12 feet twice	Foot does not advance a min. of 12 inches Foot advances a minimum of 12 inches Foot does not completely clear floor Foot clears floor	= 0 = 1 = 0 = 1	Right	Left
Step continuity	Stopping or discontinuity Steps continuous	= 0 = 1		
Turning 180 degrees returning to chair	Unable to turn More than 3 steps 3 steps or less with or without walking aid	= 0 = 1 = 2		
Variable cadence – walk 12 feet 4 times with varying speed/cadence	Unable to vary cadence Assymmetrical variance in cadence Symmetrical increase in cadence	= 0 = 1 = 2		
Stepping over an obstacle – 4" high obstacle placed in walking path	Unable to step over box Catches foot, interrupting stride Steps over box without interrupting stride	= 0 = 1 = 2		
Stairs (with at least 2 steps) Ascending	Unsteady, unable One step at a time Step leg over leg , no hands	= 0 = 1 = 2		
Stairs (with at least 2 steps) Descending	Unsteady, unable One step at a time Step leg over leg , no hands	= 0 = 1 = 2		
Assistive device used for 2 or more of the items	Bed bound Wheelchair Walker Crutches Stick or quad None	= 0 = 1 = 2 = 3 = 4 = 5		
Total score		**47**	**/ 47**	

Observer	Print: Sign:

© 1999 Advanced Rehabilitation Therapy, Inc. Miami, Florida

Name of outcome measure

Houghton Scale of prosthetic use in people with lower-extremity amputations

What is it?

The Houghton scale is a self report outcome measure which relates to function and use. It measures function of lower limb prosthetic users in terms of wearing time, use during walking, use of walking aids and perception of stability walking with the prosthesis

Justification for inclusion in the BACPAR recommended basket of outcome measures

No cost.

Quick and easy to use and interpret.

Permission for use requested from John Wiley & sons (2.10.09) awaiting reply.

Condie, et al (2006) found it has:

- content and face validity

- poor to good construct validity, dependant on the comparison measure

- some responsiveness to change

- some floor and ceiling effects

- good test retest reliability

- adequate internal consistency

- recommended for routine clinical use

Where can I find it?

Copy attached, original reference supplied.

When to use it

From early stage prosthetic rehabilitation but a ceiling effect has been demonstrated if completed by a full time wearer, or indoor and outdoor walker with high functional outcome.

How to use it

There are 4 questions which offer alternative answers which are scored. The result is a score 0 – 12.

How to interpret it

Higher scores indicate greater performance, greater use and greater confidence. A change of 1 point or more does represent a clinically relevant change, although items 1 – 3 are more responsive than item 4 in early stage rehabilitation. Devlin et al (2004) found that the scale is able to discriminate between transfemoral and transtibial amputees.

How to apply it

Able to set treatment goals for all items.

Could inform changes in prosthetic componentry.

References

Condie, E., Scott, H., Treweek, S. (2006) Lower limb prosthetic outcome measures: a review of the literature 1995 to 2005. Journal of Prosthetics and Orthotics 18:1S:13-45.

Devlin, M., Pauley, T., Head, K., Garfinkel, S. (2004) Houghton scale of prosthetic use in people with lower-extremity amputations: reliability, validity and responsiveness to change. Archives of Physical Medicine and Rehabilitation: 85: 1339-44.

Houghton AD, Taylor PR, Thurlow S, Rootes E, McColl I. (1992) Success rates for rehabilitation of vascular amputees: implications for pre-operative assessment and amputation level. British Journal of Surgery: 79:752-5.

Miller, WC., Deathe, AB., Speechley, M. (2001) Lower extremity prosthetic mobility: a comparison of 3 self report scales. Archives of Physical Medicine and Rehabilitation: 82: 1432-40.

Uellendahl, JE. (2006) Barriers to clinical application: a prosthetist's view.

Houghton Scale of prosthetic use in people with lower-extremity amputations

HOUGHTON SCALE QUESTIONS			
1. Do you wear your prosthesis:	Less than 25% of waking hours (1-3 hrs)	0	
	Between 25% and 50% of waking hours (4-8 hrs)	1	
	More than 50% of waking hours (more than 8 hrs)	2	
	All waking hours (12 -16 hours)	3	
2. Do you use your prosthesis to walk:	Just when visiting the doctor or limb-fitting centre	0	
	At home but not to go outside	1	
	Outside the home on occasion	2	
	Inside and outside all the time	3	
3. When going outside wearing your prosthesis, do you:	Use a wheelchair	0	
	Use 2 crutches, 2 canes (sticks) or a walker	1	
	Use one cane / stick	2	
	Use nothing	3	
4.When walking with your prosthesis outside, do you feel unstable when:			
a. Walking on a flat surface	Yes	0	
	No	1	
b. Walking on slopes	Yes	0	
	No	1	
c. Walking on rough ground	Yes	0	
	No	1	
	Total score		

Houghton AD, Taylor PR, Thurlow S, Rootes E, McColl I. Success rates for rehabilitation of vascular amputees: implications for pre-operative assessment and amputation level. BrJ Surg 1992;79:752-5.

Name of outcome measure

Locomotor Capabilities Index 5 (LCI-5)

What is it?

The LCI is a self-report outcome measure that forms part of the Prosthetic Profile of the Amputee Questionnaire. The LCI assesses a lower limb amputee's perceived capability to perform 14 different locomotor activities with a prosthesis. It has two subscales – basic and advanced. The LCI-5 is a newer version of the LCI, with a 5-level scale.

Justification for inclusion in the BACPAR recommended basket of outcome measures

No cost.

Easy to use and interpret.

Validated with lower limb amputees.

Test-retest reliability, construct validity and internal consistency are good.

It has been shown to reduce the ceiling effect of the LCI by 50%.

Where can I find it?

Copy attached.

When to use it

The LCI-5 was originally developed for follow-up, but can be used at any time during prosthetic rehabilitation – e.g. to set treatment goals, to monitor change after intervention or after discharge.

How to use it

The LCI-5 can be self-administered, completed by face-to-face interview or via telephone interview. It takes 5 minutes to complete. The total maximum score is 56, with maximum subscores available of 28.

How to interpret it

Higher scores reflect greater locomotor capabilities with the prosthesis, and less dependence on assistance.

How to apply it

Used at specific time points during the rehabilitation process it can assist goal setting around achieving improvements in ability and decreasing assistance. It can provide feedback to patients and increase motivation to continue to improve locomotor capability. It can also contribute to the decision making process around discharge, indication for top-up of rehabilitation or adjustment of prosthetic components.

It has been reported that subjects scoring 6 or less on the 'advanced' subscale may be at risk of eventual non-use of the prosthesis in the years after discharge.

References

Condie, E, Scott, H and Treweek, S (2006) – Lower Limb Prosthetic Outcome Measures: A Review of the Literature 1995 to 2005. Journal of prosthetics and Orthotics 18:1S:13-30.

Franchignoni, F, Orlandini, D, Ferriero, G, Moscato, T.A (2004) Reliability, Validity, and Responsiveness of the Locomotor Capabilities Index in Adults With Lower-Limb Amputation Undergoing Prosthetic Training. Archives of Physical Medicine and Rehabilitation 85:743-748.

Franchignoni, F, Giordano, A, Ferriero, G, Munoz, S, Orlandini, D, Amoresano, A (2007) Rasch analysis of the Locomotor Capabilities Index – 5 in people with lower limb amputation. Prosthetics and Orthotics International 31:4:394-404.

Gaultier-Gagnon, C, Grise, M-C (2006) Tools to Measure Outcome of People with a Lower Limb Amputation: Update on the PPA and LCI. Journal of Prosthetics and Orthotics 18:1S:61-67.

LOCOMOTOR CAPABILITIES INDEX-5

Name :_____**Hospital Number :**_____

Whether or not you wear your prosthesis, at the present time, would you say that you are "able" to do the following activities <u>WITH YOUR PROSTHESIS ON?</u>

Scale descriptors:

0 = No 1 = Yes with help   2 = Yes with supervision   3 = Yes alone with aid(s) 4 = Yes alone, no aids   (Circle one number for each item)

ITEM	SCALE				
1.Get up from a chair	0	1	2	3	4
2. Walk in the house	0	1	2	3	4
3. Walk outside on even ground	0	1	2	3	4
4. Go up the stairs <u>with</u> a handrail	0	1	2	3	4
5. Go down the stairs <u>with</u> a handrail	0	1	2	3	4
6. Step up a sidewalk curb	0	1	2	3	4
7. Step down a sidewalk curb	0	1	2	3	4
Basic Activities Score	**/28**				
1. Pick up an object from the floor (when you are standing up with your prosthesis)	0	1	2	3	4
2. Get up from the floor (e.g. if you fell)	0	1	2	3	4
3. Walk outside on uneven ground (e.g. grass, gravel, slope)	0	1	2	3	4
4. Walk outside in inclement weather (e.g. snow, rain, ice)	0	1	2	3	4
5. Go up a few steps (stairs) <u>without</u> a handrail	0	1	2	3	4
6. Go down a few steps (stairs) <u>without</u> a handrail	0	1	2	3	4
7. Walk while carrying an object	0	1	2	3	4
Advanced Activities Score	**/28**				
TOTAL SCORE	**/56**				

Name of outcome measure

The Trinity Amputation and Prosthesis Experiences Scales (TAPES)

What is it?

The TAPES aims to examine psychosocial issues related to adjustment to a prosthetic, specific demands of wearing a prosthetic and potential sources of maladjustment.

The TAPES measures both physical and psychosocial aspects of adjustment (i.e. medical factors include experience of residual limb pain, phantom limb pain).

There are three parts to the questionnaire:

- **Background information:** this section measures some useful demographic data (i.e. type of artificial limb used etc.), but it is likely that you will already have this information and you will not need to complete it.
- **Part 1:** this section contains a multidimensional scale containing three key areas of measurement themes [1) psychosocial adjustment, 2) activity restriction, and 3) prosthetic satisfaction] and has a total of nine subscales.
    1. Psychosocial adjustment: this section contains 15 items that relate to four separate subscales (1. general adjustment, 2. social adjustment (items 6-9), 3. adjustment to limitation & 4. optimal adjustment). High scales on the sub-scales relate to adjustment (i.e. scoring in a positive direction).
    2. Activity restriction: this section contains 12 items relating to four subscales (1. athletic activity restriction, 2. social restriction, 3. mobility restriction & 4. Occupational restriction). High scores are indicative of activity restriction (i.e. scoring in a negative direction).
    3. Prosthetic satisfaction: this section only has one component with high scores relating to satisfaction with the prosthesis)
- **Part 2:** is a general health and pain questionnaire containing 8 questions. The first 3 questions related to prosthetic use and general health and are single items. The next two questions contain five items and relate to residual limb pain (Q4) and phantom limb pain (Q5). Question 6 relates to other medical problems and contains 7 items. The last two questions relate to the completion of the questionnaire.

Justification for inclusion in the BACPAR recommended basket of outcome measures

Importance of understanding both physical and psychosocial aspects related to limb loss and wearing a prosthesis.

Good theoretical and empirical foundation promotes its use a supplement to clinical assessment and use a research tool.

Good history of previous use in both clinical and research contexts.

Good reliability and validity.

Easy to administer and interpret very clear guidelines and a website.

No cost.

Where can I find it?

www.tcd.ie/psychoprosthetics

When to use it

It is suggested that it is used in the context of a multidimensional assessment of adjustment to a prosthetic limb (Gallagher & MacLachlan 2004).

Can be used longitudinally to assess adjustment and contains a very clear monitoring sheet.

How to use it

You don't have to use the entire scale and can select specific sub-sections.

It is recommended that you look at individual sub-scales and do not compute a total score.

It is a self-report (self-complete) measure with 54 items taking approximately 15 minutes to complete

How to interpret it

For psychosocial adjustment - High scores on these subscales are indicative of adjustment.

For activity restriction - High scores on these subscales are indicative of activity restriction.

For satisfaction with prosthesis - High scores on these subscales are indicative of satisfaction with prosthesis.

Be cautious of reverse scoring in item 1 as high scores can be positive and negative.

How to apply it

Reassessment over time can demonstrate change in psychosocial adjustment, activity restriction and satisfaction with the prosthesis. If these changes aren't positive, it may be used to inform referral for input from a Counsellor, Physiotherapist or Prosthetist respectively. It could inform goal-setting for any of these disciplines. It can also contribute to the decision making process around discharge.

Updated evidence

A modified TAPES-R questionnaire is now thought to be more convenient to use and is available to download and use for free from the TAPES website. (Gallagher, Franchignoni et al. 2010) carried out a retrospective study using LLAs who had already completed a TAPES questionnaire in the UK and RoE. The sample of 498 people were prosthetic users and the results from the returned questionnaires were used to investigate the internal consistency of the measure using both factor analysis and a Rasch analysis. The factor analysis supported the 3 subscales, however the Rasch

analysis suggested some restructuring with removal of some items, rewording of one and a reduction of the rating scales. All the scales and subscales showed acceptable internal consistency and a hierachy along the measured construct.

References

Gallagher, P., & MacLachlan, M. (2004). The trinity amputation and prosthesis experience scales and quality of life in people with lower-limb amputation. Archives of Physical Medicine and Rehabilitation, 85(5), 730-736.

Gallagher, P., & MacLachlan, M. (2000). Development and psychometric evaluation of the trinity amputation and prosthesis experience scales (TAPES). Rehabilitation Psychology, 45(2), 130-154.

Gallagher, P., Franchignoni, F., Giordano, A. and MacLachlan, M. (2010). Trinity Amputation and Prosthesis Experience Scales: a psychometric assessment using classical test theory and Rasch analysis. American Journal of Physical Medicine & Rehabilitation, 89(6), pp. 487-496.

Name of outcome measure

Timed Up and Go test (TUG)

What is it?

The TUG test is a quantitative and standardised measure of most of the manoeuvres required for 'basic mobility'.

Justification for inclusion in the BACPAR recommended toolbox of outcome measures

No cost.

Easy to use and interpret.

Shown to have good inter-rater reliability and adequate concurrent validity in measuring physical mobility of unilateral amputees.

Where can I find it?

Example instructions attached.

When to use it

The TUG can be used at any time during prosthetic rehabilitation – e.g. to inform treatment planning or to monitor change in basic mobility after intervention or after discharge.

How to use it

The subject is timed as they stand up from a chair, walk 3m, turn and return to the chair. The score is simply the time taken to complete the circuit.

How to interpret it

Reduction in score (time to complete) indicates improvement in 'basic mobility'. Any increase in score during or following rehabilitation should prompt further investigation of factors such as confidence, socket comfort, fitness, co-ordination or balance, and may indicate need for additional intervention.

Findings can contribute to evaluation of clinical effectiveness if comparisons are made during rehabilitation.

There is some suggestion that 15 seconds is a cut-off for TUG to indicate high risk fallers in the non-amputee elderly population; where identification of falls risk factors would require further detailed assessment (a similar cut-off has not been established for amputees).

Limitations should be kept in mind: TUG has a ceiling effect for fit elderly or young amputees, with a plateau around 7 to 10 seconds; further work is needed to establish the TUGs responsiveness to change in the amputee population.

How to apply it

Used at specific time points during the rehabilitation process it can assist goal setting around achieving improvements in TUG, and can provide feedback to patients and increase motivation to continue to improve mobility. It can also contribute to the decision making process around discharge, indication for top-up of rehabilitation or adjustment of prosthetic components.

Scores/ trends may be compared within and across levels of amputation, age or pathologies to set realistic expectations or give a picture of an individual's progress.

Updated evidence

A study published in 2011 by Resnik et al aimed to calculate the minimal detectable change (MDC) for a range of measures used in amputee rehab. The MDC was presented in absolute values for: 2MWT (34.3m), 6MWT (45m), **TUG (3.6s)**, and AMP (3.4pts). One of the main limitations for this study was that it included veterans only.

References

Condie E, Scott H, Treweek S (2006). Lower limb prosthetic outcome measures: a review of the literature 1995 to 2005. Journal of Prosthetics and Orthotics 18:1S:13-45.

Deathe A, Miller W (2005). The L Test of functional mobility: measurement properties of a modified version of the Timed "Up & Go" Test designed for people with lower-limb amputations. Physical Therapy 85:7:626-35.

Eekhof JA, De Bock GH, Schaapveld K, Springer MP (2001). Functional mobility assessment at home: Timed up and go test using three different chairs. Canadian Family Physician 47:1205-1207.

Mathias S, Nayak USL, Isaacs B (1986). Balance in elderly patients: the "Get-up and Go" test. Archives of Physical Medicine and Rehabilitation 67:6:387-389.

Podsiadlo D, Richardson S (1991). The timed "Up & Go": a test of basic functional mobility for frail elderly persons. Journal of the American Geriatric Society 39:142-148.

Resnik, L. and Borgia, M., (2011). Reliability of outcome measures for people with lower-limb amputations: distinguishing true change from statistical error. Physical Therapy, 91(4), pp. 555-565.

Schoppen T, Boonstra A, Groothoff JW, de Vries J, Goeken LNH, Eisma WH (1999). The timed "up and go" test: reliability and validity in persons with unilateral lower limb amputation. Archives of Physical Medicine and Rehabilitation 80:7:825-8.

Siggeirsdottir K, Jonsson B, Jonsson HJ, Iwarsson S (2002). The timed 'Up & Go' is dependent on chair type. Clinical Rehabilitation 16:6:609-616.

Wall J, Bell C, Campbell S, Davis J (2000). The timed get-up-and-go test revisited: measurement of the component tasks. Journal of Rehabilitation Research and Development 37:1:109-114

Whitney JC, Lord SR, Close JCT. (2005). Streamlining Assessment and Intervention in a Falls Clinic Using the Timed Up and Go Test and Physiological Profile Assessments. Age and Ageing, 34:567 – 571.

Timed Up and Go test – example instructions

To maximise usefulness it is important to be as consistent as possible, over time and between assessors, and so it is advised to create centre specific instructions that all assessors use on all occasions. Aspects to control include: the height of the chair; arm rests or not; whether the subject walks 3m then turns on the spot or is asked to walk around a target. The example below is a protocol used by one amputee rehabilitation centre and is a combination from various descriptions in the literature, trying to be as specific and concise as possible.

Test protocol

1. *Test setup.* Figure 1 shows the test area. Always use the same upright arm chair (seat height 47cm) placed with its back against the central pillar in the Rehab Gym. Place a cone on the black cross, 3m from the front of the chair. Have a stopwatch ready.

2. *Prepare subject.* Ask the subject to transfer to the test chair and position their usual walking aids (as applicable) near at hand. SAKL knee joints should be locked in extension ready for standing.

3. *Explain the test.* "Sit with your back against the chair and your arms on the armrest. When I say 'go' please get up and, using your walking aid, walk around the cone, then

Figure 1: TUG setup

return to the chair and sit back down. I am going to be timing but it's not a race, please go at a pace that's comfortable and safe for you."

4. *Timing.* Start timing on the word 'go', stop timing when the subject's buttocks first touch the seat.

5. *Repetitions.* If the patient is able, repeat the test three times. Use the first attempt for the subject to become familiar and to check they have understood the instructions. Time the second and third attempts and record the faster of these two. Give the subject time to recover between each attempt. Note if only one repetition is possible.

6. *Recording.* Enter the time (in seconds) in the prosthetic notes and the Gym database.

7. *Frequency.* Conduct the test just before the patient is discharged then at 1st follow-up (approx. 6 weeks) and at 6 months. At discharge check that relevant appointments are booked in the Gym diary. At the follow-up make sure the patient is asked to come to the Rehab Gym for the TUG test before going to see the Consultant, so that test results can be entered in the prosthetic notes for the Consultant's reference.
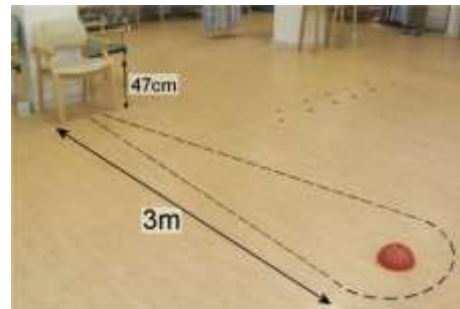
Name of outcome measure

L-test of Functional Mobility (L-Test)

What is it?

This is a modification of a basic TUG test and is also considered a quantitative and standardised measure.

Justification for inclusion in the BACPAR recommended toolbox of outcome measures

No cost.

Easy to use and interpret.

It has been shown to have reduced ceiling effects when compared to the TUG. It has good inter-rater reliability and high concurrent validity was shown between the L-test and other walk tests with moderate concurrent validity seen when compared to self-reported mobility measures.

Where can I find it?

Example instructions attached.

When to use it

In the same way that the TUG is used the L-test can be used at any time during prosthetic rehabilitation. It can be used to inform treatment planning or to monitor change in basic mobility after intervention or after discharge but it has been shown to be a better test for the higher level activity amputees.

How to use it

The subject is timed as they stand up from a chair, walk 5m, turn left for 5m, turn around walk 5m, turn right and walk 5m to return to the chair. The score is simply the time taken to complete the circuit.

How to interpret it

Reduction in score (time to complete) indicates improvement in 'basic mobility'. Any increase in score during or following rehabilitation should prompt further investigation of factors such as confidence, socket comfort, fitness, co-ordination or balance, and may indicate need for additional intervention.

Findings can contribute to evaluation of clinical effectiveness if comparisons are made during rehabilitation.

How to apply it

Used at specific time points during the rehabilitation process it can assist goal setting around achieving improvements in L-test times and can provide feedback to patients and increase motivation to continue to improve mobility. It can also contribute to the decision making process around discharge, indication for top-up of rehabilitation or adjustment of prosthetic components.

Scores/ trends may be compared within and across levels of amputation, age or pathologies to set realistic expectations or give a picture of an individual's progress.

References

Deathe, A.B. and Miller, W.C., (2005). The L test of functional mobility: measurement properties of a modified version of the timed "up & go" test designed for people with lower-limb amputations. *Physical Therapy,* **85**(7), pp. 626-63

L-test – example instructions

The L Test is a modified version of the TUG which incorporates 4 turns, of which at least 1 would be to the opposite side. The total distance covered is a 20-m walk. Standardized instructions should be given to the subjects to ensure successful completion of the test.

The time (in seconds, to the nearest 10th of a second) that it took for the subject to stand from a chair, walk 10 m (in the shape of an L) at the subject's usual walking speed, turn 180 degrees, and return 10 m (in the shape of an L) to a seated position is recorded.

ExampleTest protocol

1. *Test setup.* Use an upright arm chair (seat height 47cm). Place a cone on a black cross, 5m from the front of the chair. Place a second cone 5m away at 90° to the left of the first cone.
2. *Prepare subject.* Ask the subject to transfer to the test chair and position their usual walking aids (as applicable) near at hand. SAKL knee joints should be locked in extension ready for standing.
3. *Explain the test.* "Sit with your back against the chair and your arms on the armrest. When I say 'go' please get up and, using your walking aid (if applicable), walk around both cones, then return to the chair and sit back down. I am going to be timing but it's not a race, please go at a pace that's comfortable and safe for you."
4. *Timing.* Start timing on the word 'go', stop timing when the subject's buttocks first touch the seat.
5. *Repetitions.* If the patient is able, repeat the test three times. Use the first attempt for the subject to become familiar and to check they have understood the instructions. Time the second and third attempts and record the faster of these two. Give the subject time to recover between each attempt. Note if only one repetition is possible.
6. *Recording.* Enter the time (in seconds) in the prosthetic notes and the Gym database.
7. *Frequency.* Conduct the test just before the patient is discharged then at 1st follow-up (approx. 6 weeks) and at 6 months.

Name of outcome measure

Timed walk tests (2-min walk test & 6-min walk test)

What is it?

These are time-based tests. While a 12-minute performance (run) test was developed and validated as a guide to physical fitness in healthy young men this was later modified to an indoor 12-minute-walk test for the assessment of exercise tolerance in individuals with chronic bronchitis. Shorter versions of this walk test (i.e. 6 and 2 minute walk tests) were also developed in similar populations.

The 2-minute-walk test has been shown to be comparable to the 6 and 12-minute walk tests in patients with chronic respiratory disease and to be correlated to measures of oxygen consumption. Adequate validity and reliability has been reported for the 2-minute walk test in various populations, including lower limb amputees (Pin et al 2014).

Justification for inclusion in the BACPAR recommended toolbox of outcome measures

No cost.

Easy to use and interpret.

The 2-minute walk test showed correlation with measures of physical functioning and prosthetic use in persons with major lower limb amputations (Brooks et al 2002).

High intra and inter-reliability correlations were also reported for the 6min walk with no reported systemic variations between trials and a small learning effect in persons with transtibial amputation (Lin et al 2008).

Where can I find it?

Example instructions attached.

When to use it

Walk tests can be administered as part of the assessment to monitor overall treatment effectiveness in this population.

How to use it

Time-based tests are typically conducted in an enclosed quiet corridor. Patients are instructed to walk from end to end, covering as much ground as possible in the allotted time period. The primary outcome of interest is distance walked.

How to interpret it

An increase in the distance walked indicates improvement in basic mobility. Any decrease in the distance during or following rehabilitation should prompt further investigation of factors such as confidence, socket comfort, fitness, co-ordination or balance, and may indicate need for additional intervention.

The 2-minute walk test has been shown to be responsive to change with rehabilitation in lower limb amputees (Brooks et al 2001) however it should be noted that clinicians should look for a change of

greater than 34.3m to be sure that a "real" change in the patient's condition has occurred (Resnik et al. 2011). A difference of at least 45m should be observed for the 6min walk test (Resnik et al 2011).

How to apply it

Used at specific time points during the rehabilitation process it can assist goal setting around achieving improvements in distance times and can provide feedback to patients and increase motivation to continue to improve mobility. It can also contribute to the decision making process around discharge, indication for top-up of rehabilitation or adjustment of prosthetic components.

Scores/ trends may be compared within and across levels of amputation, age or pathologies to set realistic expectations or give a picture of an individual's progress.

References

Brooks, D., Hunter, J.P., Parsons, J., Livsey, E., Quirt, J. and Devlin, M., (2002). Reliability of the two-minute walk test in individuals with transtibial amputation. *Archives of Physical Medicine & Rehabilitation,* **83**(11), pp. 1562-1565.

Brooks, D., Parsons, J., Hunter, J.P., Devlin, M. and Walker, J., (2001). The 2-minute walk test as a measure of functional improvement in persons with lower limb amputation. *Archives of Physical Medicine & Rehabilitation,* **82**(10), pp. 1478-1483.

Gremeaux, V., Damak, S., Troisgros, O., Feki, A., Laroche, D., Peennou, D., Benaim, C. and Casillas, J., (2012). Selecting a test for the clinical assessment of balance and walking capacity at the definitive fitting state after unilateral amputation: a comparative study. *Prosthetics and orthotics international,* **36**(4), pp. 415-422.

Lin, S. and Bose, N.H., (2008). Six-minute walk test in persons with transtibial amputation. *Archives of Physical Medicine & Rehabilitation,* **89**(12), pp. 2354-2359.

Pin, T.W., (2014). Psychometric Properties of 2-Minute Walk Test: A Systematic Review. *Archives of Physical Medicine and Rehabilitation,* .

Resnik, L. and Borgia, M., (2011). Reliability of outcome measures for people with lower-limb amputations: distinguishing true change from statistical error. *Physical Therapy,* **91**(4), pp. 555-565.

Timed walk tests

Time-based tests are typically conducted in an enclosed quiet corridor. Patients are instructed to walk from end to end, covering as much ground as possible in the allotted time period. The primary outcome of interest is distance walked.

Example protocols

2-min timed walk test

1. **Test setup**
   A hallway free of obstacles with pre-measured distances marked for easy calculation of the total distance covered.

2. **Subject preparation**
   The position and type of any prosthetic knee joints will be noted at every test. The type of walking aid used will also be noted as applicable.

3. **Explanation of the test**
   The following instructions will be given to the participant: "*Cover as much ground as possible over 2 minutes. Walk continuously if possible, but do not be concerned if you need to slow down or stop to rest. The goal is to feel at the end of the test that more ground could not have been covered in the 2 minutes.*"

4. **Timing**
   Timing will start when the participant starts walking and the distance covered will be measured at the end of 2 minutes.

6-min timed walk test

1. **Test setup**
   A hallway free of obstacles with pre-measured distances marked for easy calculation of the total distance covered.

2. **Subject preparation**
   The position and type of any prosthetic knee joints will be noted at every test. The type of walking aid used will also be noted as applicable.

3. **Explanation of the test**
   The following instructions will be given to the participant: "*Cover as much ground as possible over 6 minutes. Walk continuously if possible, but do not be concerned if you need to slow down or stop to rest. The goal is to feel at the end of the test that more ground could not have been covered in the 6 minutes.*"

4. **Timing**
   Timing will start when the participant starts walking and the distance covered will be measured at the end of 6 minutes.

Name of outcome measure

Berg Balance Scale

What is it?

The Berg Balance Scale (BBS) is a well-established clinical outcome measure originally designed to assess the balance of elderly individuals. The BBS is confirmed with good validity and reliability for use with older adults and individuals with conditions prone to balance disturbance such as stroke, spinal cord injury, multiple sclerosis, brain injury, Huntington's disease, and Parkinson's disease. It has now been confirmed the BBS has strong internal validity for the construct of balance when used with lower limb amputees (Wong et al 2013).

Justification for inclusion in the BACPAR recommended toolbox of outcome measures

Minimal equipment required.

15 to 20 minutes to administer.

Easy to use and interpret.

The BBS appears to be a valid and reliable clinical instrument for assessing balance in individuals with lower-limb amputation (Major et al 2103).

Where can I find it?

Copy and instructions attached.

When to use it

The BBS can be administered as part of the assessment and to monitor overall treatment effectiveness in this population.

How to use it

The BBS is usually conducted in gym area.

Equipment needed: Ruler, two standard chairs (one with arm rests, one without), footstool or step, stopwatch or wristwatch.

Completion Time: 15-20 minutes.

Scoring: A five-point scale, ranging from 0-4. "0" indicates the lowest level of function and "4" the highest level of function. Total score available= 56.

A total score is calculated on each occasion from the observed performance across 14 activities.

How to interpret it

Cut-off scores for the elderly were reported by Berg et al 1992 as follows :

A score of 56 indicates functional balance.

A score of < 45 indicates individuals may be at greater risk of falling.

It has been reported more recently that in the elderly population a change of 4 points is needed to be 95% confident that true change has occurred if a patient scores within 45–56 initially, 5 points if they score within 35–44, 7 points if they score within 25–34 and, finally, 5 points if their initial score is within 0–24 on the Berg Balance Scale (Donoghue et al 2009).

How to apply it

Used at specific time points during the rehabilitation process it can assist goal setting around achieving improvements in distance times and can provide feedback to patients and increase motivation to continue to improve mobility. It can also contribute to the decision making process around discharge, indication for top-up of rehabilitation or adjustment of prosthetic components.

Scores/ trends may be compared within and across levels of amputation, age or pathologies to set realistic expectations or give a picture of an individual's progress.

References

Berg K, Wood-Dauphinee S, Williams JI, Maki, B: (1992) Measuring balance in the elderly: Validation of an instrument. Can. J. Pub. Health, July/August supplement 2:S7-11,.

Berg K, Wood-Dauphinee S, Williams JI, Gayton D⊗1989) Measuring balance in the elderly: Preliminary development of an instrument. Physiotherapy Canada, 41:304-311,.

Donoghue, D. and Stokes, E.K., (2009). How much change is true change? The minimum detectable change of the Berg Balance Scale in elderly people. *Journal of Rehabilitation Medicine,* 41(5), pp. 343-346.

Major, M.J., Fatone, S. and Roth, E.J.,(2013). Validity and reliability of the berg balance scale for community-dwelling persons with lower-limb amputation. *Archives of Physical Medicine and Rehabilitation,* 94(11), pp. 2194-2202.

Wong, C.K., Chen, C., C. and Welsh, J.,(2013). Preliminary Assessment of Balance With the Berg Balance Scale in Adults Who Have a Leg Amputation and Dwell in the Community: Rasch Rating Scale Analysis. *Physical Therapy,* 93(11), pp. 1520-1529.

Wong, C.K., (2013). Interrater Reliability of the Berg Balance Scale for People With Lower Limb Amputations. *Physical Therapy,* 94(3), pp. 371-378.

Berg Balance Scale

GENERAL INSTRUCTIONS

Document each task and/or give instructions as written. When scoring, record the lowest response category that applies for each item.   In most items, the subject is asked to maintain a given position for a specific time. Progressively more points are deducted if:

• the time or distance requirements are not met

• the subject's performance warrants supervision

• the subject touches an external support or receives assistance from the examiner

Subject should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing is a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5, and 10 inches. Chairs used during testing should be a reasonable height. Either a step or a stool of average step height may be used for item 12.

Berg Balance Scale

   1. SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hand for support.

(   ) 4 able to stand without using hands and stabilize independently

(   ) 3 able to stand independently using hands

(   ) 2 able to stand using hands after several tries

(   ) 1 needs minimal aid to stand or stabilize

(   ) 0 needs moderate or maximal assist to stand

   2. STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding on.

(   ) 4 able to stand safely for 2 minutes

(   ) 3 able to stand 2 minutes with supervision

(   ) 2 able to stand 30 seconds unsupported

(   ) 1 needs several tries to stand 30 seconds unsupported

(   ) 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item 4.

3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL

INSTRUCTIONS: Please sit with arms folded for 2 minutes.

( ) 4 able to sit safely and securely for 2 minutes

( ) 3 able to sit 2 minutes under supervision

( ) 2 able to able to sit 30 seconds

( ) 1 able to sit 10 seconds

( ) 0 unable to sit without support 10 seconds

4. STANDING TO SITTING

INSTRUCTIONS: Please sit down.

( ) 4 sits safely with minimal use of hands

( ) 3 controls descent by using hands

( ) 2 uses back of legs against chair to control descent

( ) 1 sits independently but has uncontrolled descent

( ) 0 needs assist to sit

5. TRANSFERS

INSTRUCTIONS: Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way

toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

( ) 4 able to transfer safely with minor use of hands

( ) 3 able to transfer safely definite need of hands

( ) 2 able to transfer with verbal cuing and/or supervision

( ) 1 needs one person to assist

( ) 0 needs two people to assist or supervise to be safe

6. STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

( ) 4 able to stand 10 seconds safely

(   ) 3 able to stand 10 seconds with supervision

(   ) 2 able to stand 3 seconds

(   ) 1 unable to keep eyes closed 3 seconds but stays safely

(   ) 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding on.

(   ) 4 able to place feet together independently and stand 1 minute safely

(   ) 3 able to place feet together independently and stand 1 minute with supervision

(   ) 2 able to place feet together independently but unable to hold for 30 seconds

(   ) 1 needs help to attain position but able to stand 15 seconds feet together

(   ) 0 needs help to attain position and unable to hold for 15 seconds Berg Balance Scale continued…

8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

(   ) 4 can reach forward confidently 25 cm (10 inches)

(   ) 3 can reach forward 12 cm (5 inches)

(   ) 2 can reach forward 5 cm (2 inches)

(   ) 1 reaches forward but needs supervision

(   ) 0 loses balance while trying/requires external support

9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: Pick up the shoe/slipper, which is in front of your feet.

(   ) 4 able to pick up slipper safely and easily

(   ) 3 able to pick up slipper but needs supervision

(   ) 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently

(   ) 1 unable to pick up and needs supervision while trying

(   ) 0 unable to try/needs assist to keep from losing balance or falling

10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING

INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder. Repeat to the right. (Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.)

(   ) 4 looks behind from both sides and weight shifts well

(   ) 3 looks behind one side only other side shows less weight shift

(   ) 2 turns sideways only but maintains balance

(   ) 1 needs supervision when turning

(   ) 0 needs assist to keep from losing balance or falling

11. TURN 360 DEGREES

INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

(   ) 4 able to turn 360 degrees safely in 4 seconds or less

(   ) 3 able to turn 360 degrees safely one side only 4 seconds or less

(   ) 2 able to turn 360 degrees safely but slowly

(   ) 1 needs close supervision or verbal cuing

(   ) 0 needs assistance while turning

12. PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED

INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.

(   ) 4 able to stand independently and safely and complete 8 steps in 20 seconds

(   ) 3 able to stand independently and complete 8 steps in > 20 seconds

(   ) 2 able to complete 4 steps without aid with supervision

(   ) 1 able to complete > 2 steps needs minimal assist

(   ) 0 needs assistance to keep from falling/unable to try

13. STANDING UNSUPPORTED ONE FOOT IN FRONT

INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)

(   ) 4 able to place foot tandem independently and hold 30 seconds

(   ) 3 able to place foot ahead independently and hold 30 seconds

(   ) 2 able to take small step independently and hold 30 seconds

(   ) 1 needs help to step but can hold 15 seconds

(   ) 0 loses balance while stepping or standing

   14. STANDING ON ONE LEG

INSTRUCTIONS: Stand on one leg as long as you can without holding on.

(   ) 4 able to lift leg independently and hold > 10 seconds

(   ) 3 able to lift leg independently and hold 5-10 seconds

(   ) 2 able to lift leg independently and hold ≥ 3 seconds

(   ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently.

(   ) 0 unable to try of needs assist to prevent fall

(   )   TOTAL SCORE (Maximum = 56)

 Patient Name: _____

Rater Name: _____

Date: _____

Appendix

Brief definitions of some of the terms used in scientific papers and how they may be presented are given below. The clinical examples have all been taken from references used in the Toolbox to help put them in context.

Outcome Measures can be used for many different purposes. A predictive measure should be able to classify individuals into a set of pre-defined categories either concurrently or prospectively . A descriptive or discriminative measure should be able to detect differences between people or groups. And an evaluative measure should be able to detect changes over a period of time in an individual or group. Some outcome measures may be designed to do only one of the above, while others may be able to do a combination of these, though some of the requirements of these different types are competing. Whichever purpose it is designed for the psychometric properties of the outcome measure need to be reported to satisfy the user that it is fit for purpose in the population they wish to use it (Kirshner, Guyatt 1985).

Psychometric properties of an outcome measure are the characteristics that express it's adequacy in terms of reliability, validity, measurement error and responsiveness. Clinimetrics is the practice of assessing or describing symptoms, signs and laboratory findings by means of scales, indices and other quantitative instruments, all of which should have adequate psychometric properties (Streiner 2003, Galea 2005).

Parameters	Definition	How is it measured/presented	Clinical Example
Reliability	**Reliability determines the extent to which scores (for patients who have not changed) are the same for repeated measurement under several conditions: using different sets of items from the same outcome measure (internal consistency); over time (test-retest); by different persons on the same occasion (inter-rater); or by the same persons (i.e. raters or responders) on different occasions (intra-rater).**		
Intra-rater Reliability	This parameter indicates how consistently a rater administers and scores an outcome measure	**Intra-class correlation coefficients (ICC)** Presented as a number between 0 (no consistency) to 1 (complete consistency)	(Brooks, Hunter et al. 2002) examined the reliability of the 2MWT. Participants completed 2 successive timed walks measured by 2 different raters on 2 consecutive days. All ICCs were > .98 showing good intra- and inter-rater reliability. NB the distance walked was not consistent as it increased over the 2 days in those patients undergoing rehabilitation, but the

			improvement was observed by both raters.
Inter-rater Reliability	This Indicates how well two raters agree in the way they administer and score an outcome measure.	**ICC** as above	(Brooks, Hunter et al. 2002) – see above
Test-retest reliability	This reliability parameter Indicates the consistency in test results, especially self-reported tests, when administered on more than one occasion.	**ICC** as above	If an individual completes a self-report survey and then repeats the survey the on a second occasion when no change is expected, the results should be similar.
Agreement parameter / Measurement error	This is the degree to which scores or ratings are identical irrespective of who performs or scores the test.	**Standard error of measurement** (**SEM**)or **smallest detectable change** (**SDC**) or minimal detectable change (**MDC**)	(Deathe, Miller 2005) reported SEM in absolute values - 3sec for the L-Test (Resnik, Borgia 2011) also reported MDC in absolute values for all measures: 2MWT (34.3m), 6MWT (45m), TUG (3.6s), AMP (3.4pts)
Internal Consistency	This reliability parameter is reserved for outcome measures that are designed to test only one concept. Internal consistency assesses the extent to which all items or question in an outcome measure address the same underlying concept, e.g. in a mobility scale, all items should deal with mobility.	There are two main methods used to measure internal consistency: Classical Test theory uses **Cronbachs alpha (α)** to indicate the reliability of an outcome measure as a whole. Item Response Theory uses **Rasch Analysis** to assess internal consistency by looking at each item within the outcome measure	The internal consistency of the ABC scale was excellent as measured by Cronbachs alpha (0.93). (Miller, Deathe et al. 2003) Rasch analysis was used to examine all the items in the BBS. This onfirmed that the BBS was able to test a range of difficulty and identify four levels of ability, respectively. (Wong, Chen et al. 2013)

Parameters	Definition	How is it measured/presented	Clinical Example
Validity	**The degree to which the instrument (the outcome measure) measures the construct(s) or concept it aims to measure. Validity can be expressed in several different ways each representing a different characteristic.**		
Content /Face validity	The degree to which the content of an outcome measure is an adequate reflection of the construct or concept to be measured.	Usually by **consensus** of an expert group	An instrument measuring activity limitation in young athletic individuals should include not only walking but also running, jumping, and climbing.
Structural validity	The degree to which the scores of an outcome measure are an adequate reflection of the dimension or factor of the construct being measured.	**Factor Analysis** – if >50 % of data refer to one factor this confirms that the outcome measure is measuring one factor / dimension. Anything less indicates more than one factor is being assessed. **Rasch Analysis** may also be used.	(Wong, Chen et al. 2013) 70% of the data were explained in the model pertaining to one dimension, i.e. balance capability (Franchignoni, Giordano et al. 2007) used Rasch modelling on a modified LCI-5 to confirm good structural validity when level 1 and 2 category responses were combined and 4 items were deleted due to either over or under-fitting.
Construct validity	The degree to which the scores of an outcome measure are consistent with pre-defined (a priori) hypotheses that outline relationships to the scores of other instruments, or differences between groups. Can be referred to as: i) Concurrent validity – shows the ability to distinguish between groups (e.g. older and younger LLAs)	No consensus on the number that should be tested or proved, but rule of thumb is that 75% of hypotheses should be proved. i) **Proven hypotheses** – as above	(Major, Fatone et al. 2013) hypothesised positive relationships between the BBS scores and the ABC scale, the mobility scale of the PEQ, the Frenchay Activities Index

		and the 2MWT and a negative relationship with the L-test score.
	ii) Convergent validity – shows that measures that should be related are related	ii) Measured by **ICC** and should be high	(Deathe, Miller 2005) used 2MWT and TUG when testing for convergent validity of the L-Test.
Criterion validity	The degree to which the scores of an outcome measure are an adequate reflection of a 'gold standard'. If no gold standard is available then it may be appropriate to test hypothetical relationships – see construct validity	The estimation of criterion validity depends on the type of data. i) **ICC** if both instruments (outcome instrument and gold standard) have continuous scores (e.g. time, distance etc) should preferably be above 0.70. ii) If the outcome instrument has a continuous score but the gold standard has a dichotomous score (e.g. Yes / No) then area under the **receiver operated characteristic** (**ROC**) is the preferred method. Again, a criterion of 0.70 is suggested.	Criterion validity requires the presence of an established gold standard test but there are very few situations in rehabilitation where such a gold standard test exists. Therefore most studies present findings of proposed hypotheses. However, (Gremeaux, Damak et al. 2012) presented ROC curves for the 2MWT. The modified Houghton Scale was used to stratify the patients into two groups; those with no mobility problems (scored 20/20) and those who scored less than 20 indicating a functional limitation. According to the ROC analysis cut off values of 130m or 150m were highly associated with the existence of functional limitations.

Parameters	Definition	How is it measured/presented	Clinical Example
Responsiveness	**The ability of an outcome measure to detect change over time in the construct to be measured.**		
Internal responsiveness	Ability of a measure to change over a specified time frame. Will depend on the particular population being studied, the treatment or intervention which occurs during the time frame and the outcome measure used to determine any changes. If there is a high variability in baseline scores in relation to the mean change scores the effect size will be small and the ability of the OM to detect meaningful changes is also small. NB Does NOT relate to any changes in the OM corresponding to changes in clinical or health status at an individual patient level.	**Paired-t-test** is a statistical test used to detect the change in the average scores at two time points, but is dependent on the sample size and variability of the OM used. **Standard effect size** is the difference between the mean baseline scores and the follow-up scores, divided by the baseline standard deviation (SD). Rule of thumb 0.2 = a change of approx. 1/5 of the baseline SD, considered small 0.5 = moderate 0.8 = a change of at least 4/5 the baseline SD and considered large.	In the study by (Devlin, Pauley et al. 2004) the effect size calculated for the change in mean scores for the Houghton Scale from discharge to follow-up was 0.60, indicating a moderate difference. (Brooks, Parsons et al. 2001) stated that their findings indicated that the 2MWT was "responsive to change during rehabilitation". Significant improvements were seen in means and SDs of the distances walked between baseline and discharge and follow-up. However, effect sizes were not calculated.
External responsiveness	This reflects the extent to which changes in the OM, again over a specified time, relate to corresponding changes in a reference measure of health status.	**Correlations** based on change scores from two measures provides scores between -1 and 1 indicating negative and positive associations. **ROCs** are only used when the external clinical scores is dichotomous, i.e. improved and not-improved.	Few studies involving prosthetic patients have reported the external responsiveness of the OMs being used.

These terms and definitions were taken from the following articles: (Terwee, Bot et al. 2007, Scholtes, Terwee et al. 2011, de Vet, Terwee et al. 2006, Mokkink, Terwee et al. 2010, Kottner, Audige et al. 2011, Husted, Cook et al. 2000)

References included in appendix:

Brooks, D., Hunter, J.P., Parsons, J., Livsey, E., Quirt, J. and Devlin, M., (2002). Reliability of the two-minute walk test in individuals with transtibial amputation. *Archives of Physical Medicine & Rehabilitation,* 83(11), pp. 1562-1565.

Brooks, D., Parsons, J., Hunter, J.P., Devlin, M. and Walker, J., (2001). The 2-minute walk test as a measure of functional improvement in persons with lower limb amputation. *Archives of Physical Medicine & Rehabilitation,* 82(10), pp. 1478-1483.

DeE vet, H.,C.W., Terwee, C.B., Knol, D.L. and Bouter, L.M., (2006). When to use agreement versus reliability measures. *Journal of clinical epidemiology,* 59(10), pp. 1033-1039.

Deathe, A.B. and Miller, W.C., (2005). The L test of functional mobility: measurement properties of a modified version of the timed "up & go" test designed for people with lower-limb amputations. *Physical Therapy,* 85(7), pp. 626-635.

Devlin, M., Pauley, T., Head, K. and Garfinkel, S., (2004). Houghton Scale of prosthetic use in people with lower-extremity amputations: reliability, validity, and responsiveness to change. *Archives of Physical Medicine & Rehabilitation,* 85(8), pp. 1339-1344.

Franchignoni, F., Giordano A., Ferriero, G., Munoz S., Orlandini, D. and Amoresano, A., (2007). Rasch analysis of the Locomotor Capabilities Index-5 in people with lower limb amputation. *Prosthetics and orthotics international,* 31(4), pp. 394-404.

Galea, M., (2005). Introducing Clinimetrics. *Australian Journal of Physiotherapy,* 51(3), pp. 139-140.

Gremeaux, V., Damak, S., Troisgros, O., Feki, A., Laroche, D., Perennou, D., Benaim, C. and Casillas, J., (2012). Selecting a test for the clinical assessment of balance and walking capacity at the definitive fitting state after unilateral amputation: a comparative study. *Prosthetics and orthotics international,* 36(4), pp. 415-422.

Husted, J., Cook, R., Farewell, V. and Gladman, D., (2000). Methods for assessing responsiveness:a critical review and recommendations. *Journal of Clinical Epidemiology,* 53, pp. 459-468.

Kirshner, B. and Guyatt, G., (1985). A methodological framework for assessing health indices. *Journal of chronic diseases,* 38(1), pp. 27-36.

Kottner, J., Audige, L., Brorson, S., Donner, A., Gajewski, B., J., Hro'bjartsson, A., Roberts, C., Shoukri, M. and Streiner, D., L., (2011). Guidelines for Reporting Reliability and Agreement Studies (GRRAS) were proposed. *International journal of nursing studies,* 48(6), pp. 661-671.

Major, M.J., Fatone, S. and Roth, E.J., (2013). Validity and reliability of the berg balance scale for community-dwelling persons with lower-limb amputation. *Archives of Physical Medicine and Rehabilitation,* 94(11), pp. 2194-2202.

Miller, W.C., Deathe, A.B. and Speechley, M., (2003). Psychometric properties of the Activities-Specific Balance Confidence Scale among individuals with a lower-limb amputation. *Archives of Physical Medicine & Rehabilitation,* 84(5), pp. 656-661.

Mokkink, L.B., Terwee, C.B., Patrick, D.L., Alonso, J., Stratford, P.W., Knol D.L., Bouter, L.M. and De Vet, H., (2010). *The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes.*

Resnik, L. and Borgia, M., (2011). Reliability of outcome measures for people with lower-limb amputations: distinguishing true change from statistical error. *Physical Therapy,* 91(4), pp. 555-565.

Scholtes, V.A., Terwee, C.B. and Poolman, R.W., (2011). What makes a measurement instrument valid and reliable? *Injury,* 42(3), pp. 236-240.

Streiner, D.L., (2003). Clinimetrics vs. psychometrics: an unnecessary distinction. *Journal of clinical epidemiology,* 56(12), pp. 1142-1145.

Terwee, C.B., Bot, S.D.M., De Boer, M.,R., Van der Windt, D.,A.W.M., Knol, D.L., Dekker, J., Bouter, L.M. and De Vet, H.,C.W., (2007). Quality criteria were proposed for measurement properties of health status questionnaires. *Journal of clinical epidemiology,* 60(1), pp. 34-42.

Wong, C., K, Chen, C., C. and Welsh, J., (2013). Preliminary Assessment of Balance With the Berg Balance Scale in Adults Who Have a Leg Amputation and Dwell in the Community: Rasch Rating Scale Analysis. *Physical Therapy,* 93(11), pp. 1520-1529.