Mobility of People with Lower Limb Amputations: Scales and Questionnaires: A Review

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Background: In the Netherlands and Northern Europe, over 90% of all lower limb amputations are performed for the treatment of vascular occlusive disease; about 45% of these lower limb amputations are related to diabetes mellitus. About 80% of the patients are over 60 years of age and have more or less co-morbidity in vascular, respiratory and neurological disease. The key to independence for this group is their walking ability and their ability to move in and around their homes. Limited indoor walking ability allows transfers from wheelchair to bed or toilet facilities to ensure independence and self-esteem. Limited outdoor walking ability gives the amputee the possibility of taking part in social activities in the local community. It includes transfers from wheelchair into transport facilities, taking ramps and uneven pavements. Analysis of the available mobility instruments in this field is essential to compare results of the rehabilitation treatment for this growing group of amputees. A multitude of measurement scales and questionnaires are available but they differ in methods and measuring range.

Objectives: A systematic literature review to compare mobility scales used for lower limb amputees.
Criteria for selecting studies for this review:

- **Types of studies:** Table 1
- **Types of participants:** Table 1
- **Types of interventions:** Table 1
- **Types of outcome measures:** Table 1 and 2

Search strategy for identification of studies: A literature search was carried out by computerized search of biomedical literature including Medline and Embase. The studies included were published between 1978 and 1998.
Conclusion: A multitude of measurement scales and questionnaires are available for differ in methods and measuring range. Measuring mobility by a scale has been shown to have limitations. Several authors did extensive research but they all measure only a number of aspects of mobility. Consensus about the measurement of mobility of lower limb amputees is not available in the recent literature.

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Table 1 Mobility scales compared in the study

Author	Population	Age	Amputation level	Reason for amputation	Mobility scale	Questionnaire	Use of aids	Stairs
(a) Studies using mobility scales with distinct qualitative levels of mobility								
Volpicelli[6] (1983)	103	29–94	Bilateral	Vascular, diabetes, trauma	Ordinal 6 levels	–	Crutch, crane, walker, wheelchair, bed	+
Narang[7] (1984)	500	2–90	TF, KD, TT	Trauma, illness	Ordindal 5 levels	+	Crutch, wheelchair, no prosthesis	–
Helm[8] (1986)	257	38–95	TF, TT bilateral	Vascular, diabetes others	Ordinal 4 levels		Crutch, frame, wheelchair, no prosthesis, cosmetic	–
Kullman[9] (1987)	452	8–90	Not given	Vascular diabetes, tumour, others	Ordinal 5 levels[b]	+	Not given	–
Stern[11] [a] (1988)	238	mean 66	TF, TT, bilateral	Vascular, diabetes	Ordinal 5 levels[b]	–	Crutch, walker, no prosthesis	–
Pinzur[12] (1988)	46	Not given	KD	Vascular, diabetes	Ordinal 6 levels	–	No	–
Wolf[13] (1989)	18	55–83	Bilateral TF/TT	Vascular	Ordinal 8 levels	–	Walking aids, wheelchair, assistance	–
Siriwardena[14] (1991)	598	50–70+	TF, KD, TT	Vascular	Ordinal 6 levels	–	Crutch, frame, wheelchair	–
Pohjolainen[15] (1991)	155	14–87	TF, TT	Vascular, tumour, trauma	Ordinal 7 levels	+	Crutch, frame, wheelchair, no prosthesis	–
Hanspal[16] (1991)	100	60–89	TF, TT	Not given	Ordinal 6 levels	+	Crutch, stick, frame wheelchair, cosmetic, assistance	–
Hepp[17] (1991)	198	Mean 63	85% unilateral 15% bilateral	Vascular	Ordinal 7 levels	–	Crutch, wheelchair, no prosthesis, bed	–
Houghton[18] [a] (1992)	440	39–90	TF, TT, GS, KD bilateral	Vascular	Ordinal 6 levels[c]	+	Crutch, stick, frame wheelchair, cosmetic assistance	–
Datta[19] [a]	41	31–84	Bilateral	Vascular, diabetes, trauma	Ordinal 6 levels[d]	–	Crane, crutch, walker, wheelchair	+
Zijp[20] (1992)	61	38–91	Not given	Not given	Ordinal 3 levels	–	Crutch, frame, wheelchair	–
Lachman[21] [a] (1993)	11	40–82	TF, TT	Vascular, infection, artroplasty	Ordinal 6 levels[c]	–	Crutch, stick, frame wheelchair, cosmetic, assistance	–
Campbell[22] [a] (1994)	210	43–96	TF, TT, GS	Vascular	Ordinal 6 levels[c]	–	Crutch, stick, frame, cosmetic	–
Johnson[23] [a] (1995)	120	25–89	TT	Vascular, trauma	Ordinal 6 levels[d]	+	Crutch, cane, walker, wheelchair, bed	–
Kanellopoulos[24] [a] (1996)	93	42–93	TF, TT bilateral	Vascular	Ordinal 6 levels[c]	+	Crutch, stick, frame wheelchair, cosmetic, assistance	–
Burger[25] (1997)	519	Mean 54,4	HD, TF, KD TT	Trauma	Ordinal 3 levels	+	Crutch, cane, wheelchair	+

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(b) Studies using mobility scales with ordinal scores

Kegel[26] (1978)	134	10–90	TF, TT bilateral	Vascular, trauma, tumour, congenital	Ordinal score	+	Crutch, frame, wheelchair	+
Day[27] (1981)	2400	Not given	Not given	Not given	Ordinal score	+	Walking aid, wheelchair	+
Steinberg[28] (1985)	114	65+	TF, TT bilateral	Not given	Ordinal score 3 levels	–	Crutch, cane, wheelchair, cosmetic	–
Beekman[29] (1988)	55	Mean 65,4	TF, TT	Diabetes, other causes	Ordinal score ratio scale: time walking speed interval score: distance	+	Crutch, cane, walker, wheelchair	+
Lavan[30] (1988)	146	65+	TF, TT bilateral	Vascular, other causes	Ordinal score	Clinical investigation	Not given	+
Chan[31] (1990)	47	65+	TF, TT, TM, bilateral	Vascular, tumour, trauma, diabetes	Ordinal score	+	Not given, cosmetic	–
Brodzka[32] (1990)	24	54–95	Bilateral TT–TT	Vascular	Ordinal score	Telephone interview	Crutch, frame, wheelchair	–
Collin[33] (1992)	40	50–81	TF, TT, bilateral	Vascular, diabetes	Ordinal score ratio scale: time	+ home visit	Not given except wheelchair use	+
Hagberg[34] (1992)	59	50+	TF, KD, TT	Vascular and other reasons	Ordinal score	+	Crutch	+
Nissen[35] (1992)	46	42–95	TF, TT bilateral	Diabetes and others	Ordinal score index measure	+	Wheelchair and other sources	–
Walker[36] (1994)	114	2–67	HD, TF, TT, TM, bilateral	Trauma	Ordinal score, interval score: distance	+	Not given	+
Gauthier-Gagnon[37] (1994)	89	24–87	TF, TT	Vascular, diabetes, tumour, trauma	Ordinal score, interval score: distance	+	Crutch, cane, frame	+
Sapp[38] (1995)	132	23–85	TF, TT	Not given	Not given	+	Cane, quad cane, crutches, walker	–
Datta[39] (1996)	53	60–80	TF, TT	Vascular, diabetes, trauma	Ratio scale: time	+	Walking aids	–
Legro[40] (1998)	114	20–87	TF, KD, TT, Syme	Vascular, tumour, trauma, congenital	Visual analogue scale prosthesis evaluation quest	+	Not given	–
Traballesi[41] (1998)	144	mean 68 ± 10	TF	Vascular, diabetes	Ordinal score Rivermead Mobility Index	+	Walking aids	+

Amputation level: HD, hip disarticulation; TF, transfemoral; KD, knee disarticulation; TT, transtibial; GS, Gritti Stokes; TM, transmalleolar.
[a]Refers to a scale previously used by another author as stated.
[b]Based on scale of Russek (1961).[10]
[c]Based on scale of Hanspal and Fisher (1991).[16]
[d]Based on scale of Volpicelli *et al.* (1983).[6]

Table 2 Comparison of scales working towards a continuous mobility scale from fully mobile with a prosthesis without walking aid towards totally bedridden

Fully mobile with prosthesis ---------- Bedridden	No aid normal walking	No aid abnormal walking	1 cane/crutch	2 canes/crutches	Walker frame	Wheelchair	Bed
Siriwardena[14]	I	II	III	IV	V	VI	
Volpicelli[6] Johnson[23]/Datta[19]	•		•	•	• •	•	
Narang[7]	•		• •	•		•	
Helm[8]		•	•	•	•		
Russek[10] Kullman[9]/Stern[11]	• •	•	•		•	•	
Pinzur[12]	•		• •	•	•	•	•
Wolf[13]	•	•	•		• •	• •	• •
Pohjolainen[15]	•	• •	•	•	• •	• •	
Hanspal[16]	•	•	•	•	•	•	
Lachmann[21] Campbell[20]/Houghton[18] Kanellopoulos[24]							
Hepp[17]	• •	•	•	• •		•	• •
Zijp[20]	•	•	•	•	•	•	
Burger[25]	•	•	•	•		•	