Occupational therapy with people who have had lower limb amputations

Evidence-based guidelines

College of Occupational Therapists

Brunel UNIVERSITY WEST LONDON

College of Occupational Therapists

Specialist Section Trauma and Orthopaedics

Front cover photograph ©Mike Prior
Dr Gill Hicks, MBE FRSA is the founder of not-for-profit organisation M.A.D for Peace (www.madforpeace.org), and a motivational speaker, author, curator, and trustee for several cultural organisations. She was the last living survivor to be rescued from the London 7/7 bombings in 2005. Both her legs were amputated below the knee, and her injuries were so severe that she was initially not expected to live. During her rehabilitation after the bombings she was assisted by an occupational therapist who helped to get her life back. She was honoured with an MBE for her services to charity in the Queen's New Year's Honours List 2008–09 and with an Honorary Doctorate from Metropolitan University, London for her work in both the worlds of Design and Charity. Her work as a peacemaker was also acknowledged when in March 2010 she became recipient of the Iman Wa Amal Special Judges Award at the 10th Annual Muslim News Awards for Excellence. The College would like to thank Gill for her support for this publication and for agreeing to appear on the cover.

The College would like to thank Mike Prior for the use of his images for the cover.

About the publisher

The College of Occupational Therapists is a wholly owned subsidiary of the British Association of Occupational Therapists (BAOT) and operates as a registered charity. It represents the profession nationally and internationally, and contributes widely to policy consultations throughout the UK. The College sets the professional and educational standards for occupational therapy, providing leadership, guidance and information relating to research and development, education, practice and lifelong learning. In addition, 11 accredited specialist sections support expert clinical practice.

College of Occupational Therapists

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First published in 2011
by the College of Occupational Therapists
106–114 Borough High Street
London SE1 1LB
www.COT.org.uk

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ISBN 978-1-905944-25-5

Typeset by Servis Filmsetting Ltd, Stockport, Cheshire
Digitally printed on demand in Great Britain by the Lavenham Press, Suffolk

Contents

Acknowledgments

With thanks to:

Brunel University, for funding this project under the Knowledge Transfer Scheme (www.brunel.ac.uk/research/rsdo/collaborative/ktp) and for the time and expert academic support provided by Dr Anita Atwal and Dr Georgia Spiliotopoulou. It is recognised that this expertise and financial support have been essential to the publication of these guidelines.

The College of Occupational Therapists, particularly Julia Roberts, Anna Pettican and Mandy Sainty for their support, guidance and enthusiasm.

The College of Occupational Therapists Practice Publications Group for reviewing the document and providing valuable feedback.

The peer reviewers Dr Shelley Crawford and Dr Avril Drummond and the stakeholders (see Appendix 6).

The preliminary readers for contributing to initially screening identified articles and to decide their relevance to the guidelines question.

Anne Ewing for her inspiration and motivation to begin the project.

Foreword

I am delighted to see the publication of these evidence-based guidelines for occupational therapists in the rehabilitation of people with lower limb loss. The role of occupational therapists in upper limb rehabilitation and prosthetics is well recognised, but I feel that their important role in rehabilitation for lower limb loss has often been underestimated. People too often perceive rehabilitation as simply the provision of a prosthesis and gait re-education. The patient or client who has lost a lower limb has his or her whole world changed, physically and emotionally, at home, work and leisure. Holistic rehabilitation must include addressing all of these aspects. Occupational therapists often find themselves addressing important needs that are essential to return the individual to as optimal a participant in the new environment as may be practical. This document should correct the misconceptions and, I hope, further improve the standards and support appropriate allocation of resources where necessary.

The fact that the recommendations are evidence-based should give greater validity to the document, especially to the scientifically oriented. However, in the field of rehabilitation, lack of evidence should not limit the practice when trying to provide the most appropriate service to the service user. For them, personal need to fulfil their goals remains paramount.

Standard methodology for development of guidelines has been used and the process followed has been described. The report completed a literature search and identified publications specifically relevant to occupational therapists. It presents its findings and analysis in a useful structure, including a critique of the articles reviewed, and is thus a useful summary for the professional. The evidence-based review and recommendations are presented in eight sections, analysed and supported by relevant references.

Scientific evidence helps guide the decision-making process between the different possible options in clinical management, but it does not replace common sense, which may override the decisions in provision of basic care and needs. Occupational therapists provide an essential component of rehabilitation for people with lower limb loss to complete a holistic package. This report will help and guide them to continue striving to provide the best for all their clients. I wish them all success.

Professor Rajiv S. Hanspal, FRCP, FRCS

Consultant in Rehabilitation Medicine, Royal National Orthopaedic Hospital

Past Chair, International Society of Prosthetics and Orthotics (ISPO), UK, and currently serving on the ISPO Protocol Committee

Past President, British Society of Rehabilitation Medicine and of the Amputee Medical Rehabilitation Society

Foreword

Why do I feel privileged to be invited to write this foreword? Because as a double amputee, with third-degree burns, crush spinal fracture and other injuries, I and my family have good reasons to be grateful over many years for the caring skills of occupational therapists in helping to keep me mobile and independent.

There are many adults in the UK with lower limb amputations. Implementation of these evidence-based guidelines will significantly help all of them, through the work of occupational therapists as members of multidisciplinary teams, concerned with the physical, psychological, social, spiritual and environmental needs of each individual.

There is rightly an emphasis on quality of life in which people with lower limb amputations, family members and carers are enabled to play key roles in identifying the most important activities of their lives in a spirit of real consultation. Concern with the prevention of falls will have a practical impact on health, and on keeping people safe in the community, in their homes and out of hospital. There is also a welcome understanding of the full importance of body image – to the mind and the soul. Occupational therapists work in many settings, and these are all embraced.

Warm congratulations are due to the team of occupational therapists with their colleagues in Brunel University for the rigorous and high academic quality of their research and the clarity of their presentation. They have filled a significant gap in the literature.

Occupational therapy has a real effect on the rehabilitation and quality of life for persons with lower limb amputations. These evidence-based guidelines are a further assurance of that pledge.

I conclude by wishing occupational therapists everywhere continued success and the resources they need.

Sam Gallop CBE

Advocate Associate, Parliamentary Limb Loss Group
Chair, McIndoe's RAF Medical Guinea Pig Club
Chair, emPOWER Charities Consortium

1 Rationale

1.1 The national population

The United Kingdom's (UK) National Amputee Statistical Database (NASDAB) indicates that 4957 people with lower limb amputations were referred to the UK's 43 National Health Service (NHS) prosthetic centres between April 2006 and March 2007. Seventy per cent of these amputations were due to dysvascular disease, with diabetes accounting for almost a third of all referrals. Over half of all people referred were aged over 65 years, with more than a quarter aged 75 years and over. Lower limb amputations accounted for 92 per cent of all referrals. The most common level of amputation at referral was the transtibial level (53 per cent) followed by the transfemoral level at 39 per cent (Information Services Division NHS Scotland 2009).

Although the best information available can be drawn from these figures, it does not show the whole picture. NASDAB represents only the population at NHS prosthetic centres and does not include data on a number of people with lower limb amputations who are referred to other settings, for example primary care trusts, intermediate care services, social services and private providers. Furthermore, these data have not been updated since April 2007, when NASDAB ceased to exist due to a lack of funding.

1.2 Background

Occupational therapists have a role to play at all stages of rehabilitation of people with lower limb amputations. They will be working as part of a multidisciplinary team and within various settings throughout the person's life – pre-amputation, post-amputation, pre-prosthetic and post-prosthetic phases. The therapist's aim is to maintain or restore the person's functional status with or without the use of a prosthesis or other equipment. Thus, there is a need to produce guidance to clearly indicate how, why and when occupational therapy can improve rehabilitation and quality of life for people with lower limb amputations. Likewise, there is a need to provide an up-to-date, evidence-based, profession-specific document that details stages of the occupational therapy rehabilitation process.

1.3 The development process

In December 2006 the College of Occupational Therapists Specialist Section – Trauma and Orthopaedics, Lower Limb Prosthetic Occupational Therapists initiated a project stemming from a need for occupational therapy guidelines to facilitate best practice. They were later given a remit by the College to produce evidence-based national guidelines for occupational therapists working with people with lower limb amputations. Volunteers from the Lower Limb Prosthetic Occupational Therapists formed a working group made up of experts in the field and specialists in lower limb rehabilitation following amputation (see Appendix 1). The group commenced the project with guidance from the College.

Since the task of producing evidence-based guidelines requires a high level of critical appraisal and research methods skills, the group sought academic assistance. From October 2008 the group accessed support from Brunel University, Centre for Professional

Practice Research. As part of this collaboration a 3-day critical appraisal skills workshop was provided by Dr Anita Atwal and Dr Georgia Spiliotopoulou of Brunel University. Dr Atwal and Dr Spiliotopoulou continued to provide academic support and guidance throughout the project under the Knowledge Transfer Scheme. Brunel University is an active supporter of knowledge transfer and £15,000 was secured to fund the group's work. Knowledge transfer is a process that facilitates collaboration and active working between academics and practitioners.

1.4 Aims of the evidence-based guidelines

The aims of the guidelines are as follows:

- To provide an evidence-based resource for occupational therapists working with adults (aged 18 years and over) with acquired unilateral or bilateral lower limb amputation. This excludes children and people with congenital limb deficiency, as the group's view was that the clinical intervention required for these groups would be significantly different and warrant separate guidelines.
- To facilitate best practice for occupational therapists working with people with lower limb amputation.
- To provide a written reference document for use by students and newly qualified occupational therapists.
- To support occupational therapists and service managers in service provision and planning.
- To inform service users and carers.
- To inform other professionals working with people with lower limb amputation about the role and responsibilities of the occupational therapist in this clinical area.

The evidence-based guidelines are applicable to any setting where occupational therapists are working with adults who have had lower limb amputation. These settings include:

- acute general hospitals (trauma and vascular services);
- specialist orthopaedic hospitals or plastic surgery units (reconstructive surgery/bone tumour);
- rehabilitation units (NHS and military);
- intermediate and community/social services;
- prosthetic and wheelchair services;
- vocational rehabilitation services and work environments; and
- private practice.

The categories covered were identified by the expert group as being the most pertinent areas of occupational therapy intervention where evidence existed and include:

- functional rehabilitation;
- environment;
- psychology;

- prosthetic use;
- assessment tools and outcome measures;
- cognition;
- work; and
- leisure and recreation.

1.5 Overview of the evidence-based guidelines document

This document comprises the initial stage of a project to produce practice guidelines for occupational therapists working with adults with lower limb amputations.

In this stage, the evidence-based guidelines are presented. Evidence-based markers were developed by identifying and critiquing the existing literature; recommendations for practice were made based on this evidence. Each recommendation was based on one or more research studies, which were critiqued and for which levels of evidence and quality scores were identified. Further work is now required to agree clinical guidelines based on a consensus of opinion among specialists in the field of rehabilitation with people following lower limb amputation. This expert opinion will not necessarily be based on research evidence but should address many of the gaps that exist in the evidence.

Please note that the clinician using this document is ultimately responsible for the interpretation of these evidence-based guidelines in the context of their specific circumstances and service users. The guidelines are intended to be used alongside the therapist's clinical expertise, with consideration of resources locally available. These evidence-based guidelines do not cover the requirements of the Health Professions Council's *Standards of conduct, performance and ethics* (HPC 2008) or the College of Occupational Therapists' *Code of ethics and professional conduct* (COT 2010) – knowledge and adherence to which is already assumed.

Note: Throughout this document people with lower limb amputation will be referred to as 'service users'.

2 Methodology

2.1 Evidence-based guidelines question

Is there evidence to support occupational therapy intervention for adults (aged 18 years and over) with lower limb amputation?

2.2 Literature search

These evidence-based guidelines are based on literature from MEDLINE, CINAHL, OT SEEKER, OTDBASE and the Cochrane Library from 1985 to January 2009. The database search was undertaken by the two academic advisors of the working group. Two literature searches were conducted. In literature search one, 'occupational therapy' was used as the first keyword combined with other keywords, such as 'lower limb amputation'. OTDBASE and OT SEEKER databases were searched only with the general keyword 'lower limb amputation', as this would be the only way to identify all related papers to occupational therapy and lower limb amputations. No research articles (qualitative or quantitative) were found that were related directly to occupational therapy or that answered the proposed question (see 2.1) from an occupational therapy perspective. Consequently, a second literature search was conducted, in which the keyword 'occupational therapy' was removed and a more general search was performed (see Appendix 2).

The second search always used 'lower limb amputation' as a keyword, either on its own or combined with one of the following keywords: 'multidisciplinary', 'activities of daily living', 'bathing', 'self care', 'domestic', 'quality of life', 'rehabilitation', 'driving', 'housing', 'leisure', 'transfers', 'prosthesis', 'outcome', 'cognition', 'falls', 'elderly/older people', 'home visits', 'work', 'phantom pain', 'wheelchair', 'occupation', 'social' and 'skin'. The second search had limitations, since articles without direct relevance to occupational therapy practice were also identified.

The inclusion criteria for the literature search were as follows:

- Quantitative, qualitative or mixed-type research.
- Research published in English.
- Participants had lower limb amputation.
- Participants were adults aged 18 years and over.

The exclusion criteria were as follows:

- Unpublished literature.
- Articles not published in English.
- Opinion articles.
- Expert opinion or consensus from an expert committee (as these do not arise directly from scientific investigation).

Once the literature search was completed, the evidence had to be linked directly or indirectly to occupational therapy practice within the UK. The group of experts in the field embarked on determining the relevance and importance of the research evidence to their own practice.

The expert group was asked to consider the following questions:

- Is there a direct reference to occupational therapy?
- Is there reference to interventions/outcomes or assessments that are of relevance to occupational therapy?
- Is this paper of relevance/importance to occupational therapy practice?

2.3 Literature search findings

A total of 58 papers were identified as being of possible relevance to occupational therapy. Of these, 29 papers were critically appraised by the group and used in the evidence-based recommendations. After reading all the other papers, the remaining 29 were finally excluded as they were not relevant to occupational therapy (see Appendix 3). Of the 29 excluded papers, 26 were research papers and 3 were systematic reviews; these papers have been used within the sections to set the context, but they have not been used for the evidence-based recommendations. Excluded papers were also used in the evidence sections to verify ideas and arguments linked to occupational therapy. Literature reviews were not included in the 58 papers and were excluded from the critique; however, some literature reviews were used in the background introduction of each section.

2.4 Critical appraisal of articles

Process

All members of the critical appraisal group received three days of training from the two academic advisors before appraising the evidence. The training was based on the McMaster's critical appraisal tools for both quantitative (Law et al 1998) and qualitative (Letts et al 2007) studies. Group members reviewed papers to appraise their quality and to identify their level of evidence. Each article was distributed according to its design to a member of the group who was most confident with the relevant research design. The appraisal of the first couple of papers for each reviewer was triangulated between the reviewer and the two academic advisors of the group, who were highly experienced in paper critiquing, until the whole team was confident with the outcome.

Methodology for appraising the evidence

A widely used aid to critical appraisal is the hierarchy of evidence, which involves ranking a range of studies in order of decreasing internal validity; however, Petticrew and Roberts (2003) suggested that the concept of a hierarchy of evidence is difficult to apply in social and public health research. The hierarchy of evidence relates to quantitative research and, as suggested in *The National Service Framework for Long-term Conditions* (DH 2005), randomised controlled trials and other quantitative approaches are not always best to address research questions involving populations with complex needs and assessment of impact on quality of life rather than cure.

Therefore, in order to produce evidence-based markers for occupational therapy with people with lower limb amputation, a typology was used. This was based on a mixed methodology involving:

- designation of levels of evidence (adapted from the National Health and Medical Research Council (NHMRC) of Australia 1999 (see Appendix 4, Table 1));
- markers related to the quality of the evidence (based on the typology used for the NSF for Long-term Conditions (DH 2005, p 88; see Appendix 4, Table 2)).

Furthermore, the research designs were categorised into primary and secondary research, and then split into quantitative, qualitative or mixed types of research (adapted from the NSF for Long-term Conditions (Department of Health 2005, p 88; see Appendix 4, Table 3)).

The designation of levels of evidence table was used as a guide to summarise study designs according to their generally perceived capacity for causing bias. This was adapted from *A guide to the development, implementation and evaluation of clinical practice guidelines* (NHMRC 1999). The initial designation of levels of evidence included levels I to IV. However, the group added a level V of evidence, since the original designation did not include a level for surveys, correlation studies, reliability and validity studies, outcome measures development, case studies and focus groups. Level V was used for these designs as many were identified during the literature search that were of relevance to occupational therapy. From the papers used for evidence-based recommendations, 26 papers were at level V, 1 at level IV, 1 at level III-3 and 1 at III-2.

The quality assessment resulted in the assignment of a score from 0 to 10 for each paper (0 being very poor, 10 being excellent). This score related to the paper's quality of research design, methodological strengths and weaknesses, integrity of conclusions, and the potential for generalisation of results. The papers used for the evidence-based recommendations scored as follows:

- High quality (7/10 or greater) = 5
- Medium quality (score 4–6/10) = 19
- Poor quality (score 3/10 or less) = 5

In order for the group to make an informed decision on the quality of the paper, further guidance was provided using the McMaster's guiding questions on quantitative and qualitative research.

After completion of the evidence appraisal, the findings were cross-checked with the two academic advisors and compiled in an evidence-based table. This included information on the study's authors, year and location, design, participants, interventions and outcome measures used, results, limitations, relevance to occupational therapy, level of evidence and quality score (see Appendix 5).

Evidence-based recommendations

At a further stage, the group and academic advisors met to look at the appraised research evidence. This stage involved the whole group discussing the evidence and reaching agreement in order to produce relevant evidence-based recommendations for occupational therapy practice. The group worked together to identify pertinent points from the literature and easily agreed on the statements generated. The evidence-based recommendations were categorised into the following sections: functional rehabilitation,

environment, psychology, prosthetic use, assessment tools and outcome measures, cognition, work, and leisure and recreation.

Due to a lack of further research evidence, a number of specific aspects of occupational therapy management of people with lower limb amputations have not been included in this document. However, further work based on a consensus of expert opinion among professionals would help to address these areas.

2.5 Research priorities

Large gaps exist in this document as the research found was often of a low evidence level, or did not directly discuss the application of occupational therapy. The research found did not always demonstrate areas of occupational therapy clinical practice deemed important by the group. Current practice amongst the group can be categorised under the broad headings of pre-amputation, post-amputation/non-prosthetic rehabilitation, pre-prosthetic preparation and prosthetic rehabilitation. However, much of the evidence found did not explore the occupational therapist's role in these areas. The guideline development group decided it was not appropriate to identify and underpin research priorities on the basis of the findings of the evidence review; however research priorities highlighted as important to the group include: the value of occupational therapy in environmental assessment and discharge planning; the provision of wheelchairs; and integration of the prosthesis into activities of daily living. This list is by no means exhaustive.

2.6 Peer reviewers and stakeholders

The evidence-based guidelines document was sent in draft format to peer reviewers and stakeholders (see Appendix 6). The peer reviewers were professionals working in related fields of occupational therapy and with experience of research and guidelines. The stakeholders were charities, user organisations or groups of other professional bodies involved with people with lower limb amputations. They were invited to comment on the quality and ease of use of the evidence-based guidelines. They gave their comments on a consultation questionnaire, which originated from the College of Occupational Therapists (see Appendix 7). The peer reviewers' and stakeholders' feedback and suggested amendments were integrated into the final document.

3 Summary of evidence-based recommendations

Section	Evidence level/quality score	Evidence-based recommendation for occupational therapy with people who have had lower limb amputation
Functional rehabilitation	V/3	1. Occupational therapists need to adhere to key milestones with respect to bed mobility and upper and lower body dressing (Ham et al 1994)
	V/4	2. It is recommended that stump boards are provided for people with transtibial amputations (White 1992)
	III-2/5	3. Indoor electric wheelchairs should be provided for personal independence for patients with rheumatoid arthritis (Lachman 1993)
	V/4, V/6, III-3/4, V/8, V/6, IV/3	4. Occupational therapists need to identify falls risk factors and provide appropriate individual interventions in collaboration with the multidisciplinary team (Kulkarni et al 1996, Miller et al 2001, Gooday and Hunter 2004, Miller and Deathe 2004, Pauley et al 2006, Dyer et al 2008)
	V/7	5. Frequency of occupational therapy sessions along with the service user's physical independence, better cognition, younger age and satisfaction with the prosthesis is significantly related to prosthetic use (Bilodeau et al 2000)
Environment	V/2	1. Occupational therapy with older adults who have had an amputation due to peripheral vascular disease or diabetes mellitus should enhance function through environmental modification appropriate for wheelchair use (Collin et al 1992)
Psychology	V/6, V/4	1. Occupational therapists need to monitor distress for longer than the initial postoperative phase (Atherton and Robertson 2006, Hawamdeh et al 2008)
	IV/4, V/4, V/6	2. Occupational therapists need to assess for anxiety throughout all episodes of care: preoperatively (Singh et al 2007, Hawamdeh et al 2008) and in the prosthetic phase (Atherton and Robertson 2006, Singh et al 2007)
	V/5	3. Where appropriate, referrals should be made for psychological support for adults with lower limb amputations (Price and Fisher 2002)

Section	Evidence level/quality score	Evidence-based recommendation for occupational therapy with people who have had lower limb amputation
	V/3, V/3, V/5	4. Occupational therapists should consider the importance of body image during the rehabilitation process (Beekman and Axtell 1987, Breakey 1997, Price and Fisher 2002)
Prosthetic use	V/5	1. Occupational therapists need to be aware of impaired hand function before prescription of liners used with lower limb prostheses (Baars et al 2008)
	V/3	2. Occupational therapists need to ascertain reasons for non-prosthetic use and refer to the multidisciplinary team as appropriate (Beekman and Axtell 1987)
	V/3	3. Older adults with above-knee or through-knee amputations should be provided with a wheelchair at the prosthetic and post-prosthetic stage of rehabilitation (Beekman and Axtell 1987)
Assessment tools and outcome measures	V/6	1. Occupational therapists should use the Amputee Activity Score (AAS) with lower limb prosthetic users to assess the level of activity a person achieves at discharge from prosthetic rehabilitation to review (Panesar et al 2001)
	V/6	2. Occupational therapists should use the Frenchay Activities Index (FAI) to determine the level of participation in extended activities of daily living following the rehabilitation and the prosthetic phase (Miller et al 2004)
	V/7	3. Occupational therapists should use the Patient Generated Index (PGI) measure to assess quality of life (QOL) outcomes in face-to-face assessment (Gallaghan and Condie 2003)
	V/7	4. Occupational therapists should use the Trinity Amputation and Prosthesis Experience Amputation Scales (TAPES) to assess adjustment to lower limb prostheses (Gallagher and MacLachlan 2000)
	V/6	5. Occupational therapists should use TAPES to evaluate changes in QOL during the rehabilitation process and provide a more holistic assessment (Gallagher and MacLachlan 2004)
	V/8	6. Occupational therapists should use the Amputee Body Image Scale (ABIS) to determine the level of body image disturbance and consider how this may affect rehabilitation (Gallagher et al 2007)

Section	Evidence level/quality score	Evidence-based recommendation for occupational therapy with people who have had lower limb amputation
	V/6	7. Occupational therapists should use the Office of Population Censuses and Surveys Scale (OPCS) with lower limb prosthetic users to assess functional capacity in the community at the inpatient stage (Panesar et al 2001)
	V/6, V/4	8. Occupational therapists should use the Clifton Assessment Procedures for the Elderly (CAPE) to predict mobility using a prosthesis (Hanspal and Fisher 1991, 1997)
	V/4	9. Occupational therapists should use the Kendrick Object Learning Test (KOLT) to facilitate decision-making in prosthetic use (Larner et al 2003)
Cognition (same as Assessment tools and outcome measures 8 and 9)	V/6, V/4	1. Occupational therapists should use CAPE to predict mobility using a prosthesis (Hanspal and Fisher 1991, 1997)
	V/4	2. Occupational therapists should use KOLT to facilitate decision-making in prosthetic use (Larner et al 2003)
Work	V/5	1. Support should be provided from the multidisciplinary team regarding successful work reintegration and maintenance of the work role (Bruins et al 2003)
Leisure and recreation	V/4	1. Occupational therapists need to assess and review participation in recreational activities (Legro et al 2001)

These evidence-based recommendations are not intended to be taken in isolation. They must be considered alongside the contextual information that follows in Sections 4.1–4.8.

It is also strongly advisable for readers to study Appendix 5 to understand fully the outcome of the search and the overall types of evidence found.

The reader must realise that these recommendations come from evidence of varying quality and strength. Some recommendations come from single research studies or come from poorer-quality work. See Appendix 4, Table 2, to understand fully the quality of research design, methodological strengths and weaknesses, integrity of conclusions, and the potential for generalisation of results.

4 Evidence-based review and evidence-based recommendations

4.1 Functional rehabilitation

Introduction

Rehabilitation is a key component of nursing and allied healthcare professionals' roles in most health and social care settings. Rehabilitation is a reiterative, active, educational, problem-solving process focused on a service user's behaviour or disability. It includes assessment, goal-setting, intervention and evaluation (Wade and DeJong 2000). Hence, the ultimate aim of the rehabilitation is to promote reintegration into the family, home, work, leisure, social and community occupations. Occupational therapy is an integral part of this process, focusing on functional abilities and purposeful activity as part of treatment. In the case of amputation, the goal of rehabilitation following surgery is to facilitate functional independence and to assist integration back into the service user's home and community.

A study by Pezzin et al (2000) suggests there is a substantial effect of inpatient rehabilitation in improving long-term physical, social and mental health outcomes of people with trauma-related amputations. Rehabilitation is of utmost importance for older adults, since functional decline may occur with older adult patients following lower limb amputation (Frykberg et al 1998). Evidence for the location of rehabilitation is mixed, and to date no UK studies have been conducted with regard to this. Klein et al (2001) compared the rehabilitation outcome of older adults with a transtibial amputation who had rehabilitation at home and as inpatients. This research found that mobility and independence outcomes were the same for both groups. However, patients who were at home had greater social support and greater satisfaction with the rehabilitation process, because they felt more involved in the planning and goal-setting.

It is important to consider mobility early on after amputation; this may be with a wheelchair. Stokes et al (2008) concluded that most therapists surveyed were following the British Association of Chartered Physiotherapists in Amputation Rehabilitation (BACPAR) guidelines (2003). BACPAR states that wheelchair mobility is the ideal, but specific reasons may lead therapists to teach people who have had an amputation to ambulate with aids; however, further research is needed to determine the risk that hopping poses to the contralateral foot. The lack of robust evidence means the risk of hopping cannot be quantified and therefore it should be recommended with caution. Although the prevalence of skin problems of the residual limb in people who have had a lower limb amputation is mainly unknown, caring for the skin on the residuum is important as skin problems can impact on the success of prosthetic rehabilitation (Meulembelt et al 2006). Skin integrity in relation to wheelchair seating and pressure-reducing cushions also needs to be considered (Gailey and Clark 1992).

Service users may find using a wheelchair preferable to using a prosthesis due to comfort, function or energy factors. When amputation is required, the appropriate level of amputation and future wheelchair use should be considered; ideally, an occupational therapist and physiotherapist should be members of the multidisciplinary team

(Houghton et al 1992). One study found that older adults with lower limb amputation used assistive devices with greater frequency than those with either a stroke or orthopaedic deficit (Gitlin et al 1996). Indeed, Jones et al (1993) suggest that home modifications and quality of rehabilitation may be an important factor in people maintaining their independence at home, although no data to support this were offered.

Evidence

There are currently no primary research studies that have supported the efficacy of occupational therapy rehabilitation with people with lower limb amputations. Although there is a lack of evidence, the occupational therapy role in this area is valued and well recognised. It is important that occupational therapists promote rehabilitation to ensure people with an amputation achieve their greatest level of independence. Greive and Lankhorst (1996) concluded that in most service users, functional abilities decrease after lower limb amputation, and age seems to be a significant factor related to functional outcome. One study examined the time taken to achieve specific functional milestones (Ham et al 1994). This study indicated that service users achieved bed mobility 1–2 weeks post-amputation; independence in upper body dressing within 4 weeks; and independence in lower body dressing within 5 weeks. It is important that occupational therapists enable people who have had a new amputation to achieve their greatest level of independence. The data from this study could be used to formulate an integrated care pathway that records rehabilitation milestones. The milestones could be useful for predicting the length of stay necessary in order to achieve functional independence.

A Serbian study of older people with vascular disease and unilateral amputations examined pain characteristics, functional status, social function and living conditions (Đurović et al 2007). Most participants in this study achieved significant functional improvement and reduction of pain, in spite of their social dysfunction, the absence of sociomedical support and inadequacy of the conditions of habitation. However, it is not clear whether even greater improvement could have resulted if occupational therapy had been included in rehabilitation.

Treatment approaches and outcomes will differ between prosthetic and non-prosthetic users, with age and functional ability before amputation being instrumental (Collin et al 1992). White (1992) found that service users reported positive benefits using stump boards; both therapists and users perceived stump boards as important for comfort and protecting the stump. Therapists prescribed stump boards to prevent contractures and control oedema. A study by Lachman (1993) found that people with rheumatoid arthritis and a lower limb amputation were more likely to use an electric wheelchair compared with those who had a lower limb amputation but did not have rheumatoid arthritis. Beekman and Axtell (1987) found that more than half of people who wore prostheses used their wheelchairs most of the time. These findings are discussed further in Section 4.4.

It is essential that the reasons for not wearing prostheses are determined and each individual's preference is taken into account during this process. Bilodeau et al (2000) studied factors such as physical and mental health, rehabilitation, physical independence and satisfaction with the prosthesis to understand why people who had an amputation used or did not use their prosthesis. The study found that prosthetic use was significantly related to the service user's physical independence, better cognition, younger age and satisfaction with the prosthesis. The frequency of occupational therapy sessions was also statistically significant in relation to prosthetic use.

A growing body of literature highlights the importance of falls management for people with lower limb amputations. One study found that 20 per cent of service users are likely to have a fall following amputation. Eighteen per cent of these resulted in injury, and most occurred between the times of 07:00 and 15:00 (Pauley et al 2006). Another study found that falls among service users with lower limb amputations are prevalent (58 per cent of service users with unilateral amputations and 27 per cent with bilateral amputations) (Kulkarni et al 1996). The largest proportion of falls (48 per cent) were reported as intrinsically related, 22 per cent were thought to be related to environmental reasons, 12 per cent to the prosthesis and 18 per cent to more than one factor. Gooday and Hunter (2004) found that 32 per cent had falls; these service users were significantly older than those who did not fall. Miller and Deathe (2004) considered the effect of fear of falling in the prosthetic user population; they found that asking service users about fear of falling would provide a clinician with a quick indicator of whether or not the service user is experiencing reduced balance confidence. Effective falls programmes are those that are multidisciplinary and are created to customise falls intervention for each service user deemed to be at risk of falling (Dyer et al 2008). Moreover, it is evident that people with lower limb amputation may value being taught how to get up from a fall. Kulkarni et al (1996) found that 25 per cent of those falling remembered being given instructions on how to get up from a fall.

Evidence-based recommendations

1. Occupational therapists need to adhere to key milestones with respect to bed mobility and upper and lower body dressing (Ham et al 1994).
2. It is recommended that stump boards are provided for people with transtibial amputations (White 1992).
3. Indoor electric wheelchairs should be provided for personal independence for patients with rheumatoid arthritis (Lachman 1993).
4. Occupational therapists need to identify falls risk factors and provide appropriate individual interventions in collaboration with the multidisciplinary team (Kulkarni et al 1996, Miller et al 2001, Gooday and Hunter 2004, Miller and Deathe 2004, Pauley et al 2006, Dyer et al 2008).
5. Frequency of occupational therapy sessions along with the service user's physical independence, better cognition, younger age and satisfaction with the prosthesis are significantly related to prosthetic use (Bilodeau et al 2000).

4.2 Environment

Introduction

The environmental needs of the individual following lower limb amputation can change throughout their rehabilitation. This can vary from initial wheelchair use to independent prosthetic use. Campbell and Ridler (1996) stated that occupational therapists provide valuable insight into a service user's home situation and circumstances and may predict potential problems after discharge. A study by Greive and Lankhorst (1996) found that with increasing age, functional outcomes decreased following lower limb amputation.

Diabetes neuropathy and peripheral vascular disease of the lower limbs can lead to amputation. Diabetes as a cause of amputation currently accounts for almost a third of

all referrals to prosthetics centres. Dysvascularity is the cause for 70 per cent of amputations. Over half of all people who have had an amputation referred to prosthetics centres are aged over 65 years, and more than a quarter are aged 75 years and over (Information Services Division NHS Scotland 2009). These older service users may have co-morbidities that indicate long-term use of a wheelchair.

For the individual with a lower limb amputation, providing an accessible environment is key to promoting independence at home and at work (Bruins et al 2003, Campbell and Ridler 1996, Schoppen 2001b, 2002, Van de Ven 1981). When rehabilitating people with lower limb amputations, occupational therapy may involve assessing, adapting and modifying the home or other external environments in order to facilitate participation in occupation. Pernot et al (1997) suggest that independence in activities of daily living was a key factor in predicting successful return home.

Evidence

No primary research has been conducted by occupational therapists in this area, although Jones et al (1993) suggest that home modifications and quality of rehabilitation may be an important factor in people maintaining their independence at home. However, this study did not offer data to support this suggestion. Collin et al (1992) found that partial walkers had lower kitchen and domestic activity scores, which were due to a lack of environmental modifications for wheelchair use.

The occupational therapist needs to consider a range of factors when assessing for any environmental adaptation. Collin et al (1992) advise that for older adults following lower limb amputation, the occupational therapist should consider wheelchair use, with environmental modification aimed at enhancing function.

Evidence-based recommendations

1. Occupational therapy with older adults who have had an amputation due to peripheral vascular disease or diabetes mellitus should enhance function through environmental modification appropriate for wheelchair use (Collin et al 1992).

4.3 Psychology

Introduction

Psychology is the study of the mind and soul and can involve self-concept. Self-concept can be subdivided into identity, body image, self-esteem and self-awareness. Lower limb amputation confronts the individual with numerous physical and psychosocial threats and challenges, including alterations in self-concept, physical dysfunction and pain, changes in employment/occupation status and lifestyle, and disruptions to valued activities (Rybarczyk et al 2000, Horgan and MacLachlan 2004).

Occupational therapists use psychological theories to underpin their interventions when promoting adaptation or integration for the individual. Interventions must address both the physical aspects of amputation and the psychosocial adjustment needed by the individual (Asano et al 2008). Key to understanding adjustment following lower limb amputation is the individual's experience and the inclusion of personal preference and perspectives, for example values, needs, emotional interests and motivations. Physical, environmental, social and cultural factors are also paramount (Gallagher et al 2008).

Depression and anxiety are prevalent following lower limb amputation. The need for occupational therapy management and use of occupation in addressing issues pertaining to depression and anxiety has been highlighted (Price and Fisher 2002, Hawamdeh et al 2008, Singh et al 2007).

When treating people with lower limb amputation, consideration must be given to pain, phantom pain and phantom sensation. A study by Bosmans et al (2007) demonstrates the relationship that phantom pain and sensation has upon subjective wellbeing, particularly when coupled with other factors such as medical history, social support and daily activities. However, no literature identifies the occupational therapist's role within the management of phantom pain. For this reason, the group was unable to explore the efficacy of occupational therapy with people who experience phantom pain.

Evidence

A psychological factor specific to the individual following lower limb amputation is body image. Studies demonstrate how satisfaction with body image relates to an individual's anxiety, self-esteem and satisfaction with life. The therapist needs to have an understanding of this relationship throughout the rehabilitation process (Breakley 1997, Beekman and Axtell 1987, Atherton and Robertson 2006). Interventions that target appearance-related beliefs and self-consciousness are of particular relevance (Atherton and Robertson 2006). Atherton and Robertson (2006) also suggest that distress and anxiety should be monitored over a longer period of time, and not only in the initial postoperative phase following amputation.

Depression was found to be prevalent following lower limb amputation in a study by Price and Fisher (2002). They identified the need for the occupational therapist to work collaboratively with the multidisciplinary team, particularly counsellors, to manage and address depression and issues surrounding body image. Along with studies by Hawamdeh et al (2008), Price and Fisher highlight the importance of occupation in decreasing anxiety and depression for the individual, both through activities of daily living and in return to work. Singh et al (2007) found that during the rehabilitation phase, where the individual was learning new skills and regaining independence, signs of anxiety and depression reduced significantly. Although there are tenuous links from these studies about the value of occupational therapy, no existing research has directly studied the occupational therapist's psychological management of a person following lower limb amputation; further research is needed in this area.

Evidence-based recommendations

1. Occupational therapists need to monitor distress for longer than the initial postoperative phase (Atherton and Robertson 2006, Hawamdeh et al 2008).
2. Occupational therapists need to assess for anxiety throughout all episodes of care: preoperatively (Singh et al 2007, Hawamdeh et al 2008) and in the prosthetic phase (Atherton and Robertson 2006, Singh et al 2007).
3. Where appropriate, referrals should be made for psychological support for adults with lower limb amputations (Price and Fisher 2002).
4. Occupational therapists should consider the importance of body image during the rehabilitation process (Beekman and Axtell 1987, Breakey 1997, Price and Fisher 2002).

4.4 Prosthetic use

Introduction

Prosthetic rehabilitation programmes are individual to each person after lower limb amputation, but the occupational therapist should take into account the following:

- level of amputation, condition of residual limb and prognosis (ability to weight-bear and balance);
- co-morbidities;
- cognition;
- pre-amputation lifestyle and roles.

Often the overall quality of life following a lower limb amputation has been found to be lower than that in the general population, but much of this is secondary to restricted mobility (Pell et al 1993, de Godoy et al 2002). New strategies and processes need to be learnt by the service user to become mobile on their prosthesis. Achieving an independent technique donning and doffing the prosthesis is a significant factor for the service user to succeed with prosthetic limb wearing (Baars et al 2008). Singh et al (2008) found that mobilising on a prosthesis requires considerable stamina.

A Cochrane review into prosthetic rehabilitation for older people with vascular disease following a unilateral transfemoral amputation highlighted the lack of evidence from randomised controlled studies to inform the choice of prosthetic rehabilitation (Cumming et al 2006). There is also limited research regarding the effectiveness of occupational therapy in this area. However, it is good practice that service users with a lower limb amputation should be advised on how to care for their residual limb as well as the remaining limb. Good stump care, including prevention of flexion deformities, is an important determinant of mobility outcome (Traballesi et al 2007, Baars et al 2008). Tsai et al (2003) compared the performance and safety of walking aids in people with lower limb amputations. This study suggests that two-wheeled walking aids allow prosthetic limb wearers (especially those with transtibial amputations) to walk more quickly and with less interruption, but no less safely, compared with four-footed walking aids.

It is important to support the service user to resume previous hobbies and leisure activities. However, within occupational therapy, few studies have explored this. Hanspal and Nieveen (2002) carried out a survey to obtain a national consensus for indications and recommendations of best practice for prescription of water activity prostheses. They suggest that every limb centre should have a written procedure and agreed guidelines for prescription of water activity limbs. Each service user's expectations, pre-amputation lifestyle and indication of use should be individually assessed.

Evidence

Baars et al (2008) found 70 per cent of service users with impaired hand function experienced liner-related skin problems, compared with 32 per cent of service users with normal hand function.

Beekman and Axtell (1987) found that 44 per cent of 23 service users with prostheses wore their prosthesis all day every day and used wheelchairs minimally or not at all. Over half of the service users evaluated used their wheelchairs most of the time, and 9 per cent had stopped wearing their prostheses. Over 60 per cent of the service users

reported cosmetic problems or discomfort at follow-up, and many cited this as a reason for not wearing their prosthesis.

Meulembelt et al (2006) completed a systematic review of literature of skin disorders of people who had a lower limb amputation. One article highlighted the prevalence of skin disorders in the residual limb in people with lower limb amputations. Of the 45 people in the study, 16 per cent reported skin problems. The authors suggest that skin problems can impact on prosthetic use and could impact on activities of daily living.

Evidence-based recommendations

1. Occupational therapists need to be aware of impaired hand function prior to prescription of liners used with lower limb prostheses (Baars et al 2008).
2. Occupational therapists need to ascertain reasons for non-prosthetic use and refer to the multidisciplinary team as appropriate (Beekman and Axtell 1987).
3. Older adults with above-knee or through-knee amputations should be provided with a wheelchair at the prosthetic and post-prosthetic stages of rehabilitation (Beekman and Axtell 1987).

4.5 Assessment tools and outcome measures

Introduction

Assessment tools and outcome measures are used widely within healthcare, allowing clinicians to determine achievements in rehabilitation or areas of performance (Ryall et al 2003, Skinner and Turner-Stokes 2006). They are a tool used by healthcare professionals to appraise and monitor their service to ensure effectiveness in the service they provide (Treweek and Condie 1998, Gallaghan and Condie 2003). A study by Stineman et al (1996) commented that a standardised outcome measurement is essential in rehabilitation for:

- assessing a service user's rehabilitation needs;
- setting client-centred goals;
- evaluating the outcomes;
- determining whether goals have been achieved.

Outcome measures will also assist the occupational therapist in assessing long-term needs, preparing service users for their future and managing expectations (Sansam et al 2009).

Rehabilitation of the person with lower limb amputation focuses on improving function in identified areas of occupational performance and therefore the use of functional outcome measures are essential (Treweek and Condie 1998). Pernot et al (1997) suggest that individuals who had undergone a functional assessment to determine whether they were suitable for prosthetic rehabilitation had a better outcome following gait training.

To ensure that occupational therapists are using outcome measures that effectively measure a service user's function, the outcome measure should have validity and reliability and be responsive to change (Panesar et al 2001). Ottenbacher et al (1996) reinforced the importance of inter-rater reliability by confirming that any functional

outcome measure should produce consistent results across raters, and over time for therapists to measure improvement or deterioration in activities of daily living. This ensures that change detected by the outcome measurement is not due to random error.

Evidence

The literature search highlighted the following studies assessing assessment tools and outcome measures appropriate for occupational therapists working in rehabilitation of the person who has had a lower limb amputation. Other commonly used assessment tools and outcome measures are available, such as the Canadian Occupational Performance Measure (COPM), but research evidence centred around the following tools:

Amputee Activity Score (AAS)

Some of the evidence focused on activity levels of prosthetic users. A study by Panesar et al (2001) compared three measures of progress in early rehabilitation of people with lower limb amputation. The Amputee Activity Score (AAS) was directly relevant to occupational therapy. This study used a modified version of the AAS; it assessed the service user's:

- ability to don or doff the prosthesis;
- hours per day wearing the prosthesis;
- use of walking aids;
- amount of walking;
- type of house;
- ability to climb stairs;
- social support at home;
- caring responsibilities for someone with a disability;
- participation in domestic activities of daily living; and
- access to their own wheelchair and frequency of wheelchair use.

The AAS does not include a section for assessing abilities with personal activities of daily living. The study used a modified AAS version as the authors deemed it necessary to include a score for service users who used their wheelchair indoors but preferred to walk outdoors. There is also a section for assessing the individual's employment status and work activities.

The AAS is a self-report tool by face-to-face interview, and the time taken to complete it is unclear. Validity and reliability of the AAS also need to be determined. A study describing the original AAS by Day (1981) stated that the validity and repeatability of the AAS were reviewed, but it is unclear from the article how these where measured.

The AAS was found to be a useful tool at discharge but more difficult to use at admission for rehabilitation (due to its layout) and in need of modification. This study was also completed with a small sample size, and bias may have been introduced, as scores of 23 service users were based on measurements from a previous research group.

Another measure described by Panesar et al (2001) was the Office of Population Censuses and Surveys Scale (OPCS). They suggested that occupational therapists could use this with lower limb prosthetic users to assess functional capacity in the community at inpatient stage.

Frenchay Activities Index (FAI)
One study reviewed outcome measures assessing an individual's level of participation in instrumental activities of daily living. Miller et al (2004) reported that the Frenchay Activities Index (FAI) had been tested as valid and reliable for use with individuals following a stroke, but it had yet to be assessed as a reliable or valid tool for use with individuals with a lower limb amputation. The FAI is a 15-item self-report questionnaire assessing how often in a period of 3 months an individual has:

- completed domestic activities, such as preparing meals, washing up, laundry and shopping;
- continued with hobbies and using public transport.

It also assesses in the past 6 months how often an individual has:

- travelled;
- gardened;
- participated in DIY;
- read books; and
- been involved in work.

For the purpose of the study, the authors decided to add three additional activities:

- sport/leisure;
- management of home finances; and
- socialising with family/friends.

This made it an 18-item questionnaire and expanded the assessment components for the population of people who had an amputation.

The study assessed the reliability and validity of the FAI-15 and the FAI-18. The sample size of the study was small, but the FAI-15 and FAI-18 were found to have 4-week test-retest reliability, satisfactory internal consistency and concurrent validity; however, further tests for reliability, construct and content validity are required. The authors highlight that bias may have been introduced through the study methodology and that there was no advantage found in using the FAI-18; therefore, the FAI-15 should be used.

This measure could be used to assess an individual's level of activity in domestic, work and leisure performance components. Further assessment would be required to identify reasons for difficulties in completion of these activities of daily living in an individual with lower limb amputation.

Patient Generated Index (PGI)
Gallaghan and Condie (2003) adapted the Patient Generated Index (PGI) quality-of-life measure for use with people who had a lower limb amputation. Gallagher and Desmond (2007) and Condie et al (2006) described the PGI as a client-centred outcome measure allowing service users to identify the five most important activities of their life that have been affected by amputation and its treatment. Service users rate how significantly they are affected on a chosen activity on a scale of 0–10. They grade the importance of each activity; the higher the score, the higher their quality of life.

The PGI was found to be moderately reliable in terms of repeatability during successive follow-up interviews. Its construct validity supported a stronger relationship between mental health and quality of life than between physical health and quality of life. Therefore, this measure could be used to assess quality-of-life outcomes in this client group. The measure demonstrated practical limitations related to its format, which makes it more appropriate to be used in a face-to-face interview. It should be noted that this study used a small sample group, and validity and reliability require further testing.

Trinity Amputation and Prosthesis Experience Amputation Scales (TAPES)
Gallagher and MacLachlan (2000) found that the Trinity Amputation and Prosthesis Experience Amputation Scales (TAPES) provide an initial assessment of adjustment problems. Gallagher and Desmond (2007) expanded on the TAPES, stating that it includes 9 subscales and contains 38 items. It assesses the following:

- Psychological adjustment: general and social adjustment, adjustment to limitation
- Activity restriction: functional, social and high activity levels
- Prosthesis satisfaction: weight, function and cosmesis
- Pain and other medical issues

The TAPES could identify service users who are experiencing adjustment difficulties and assist in the development and evaluation of treatment approaches. Gallagher and MacLachlan (2004) evaluated whether TAPES subscales are associated with quality of life. The authors suggested that there is potential for clinicians to use this tool in practice to evaluate changes in an individual's quality of life throughout the rehabilitation process.

Gallagher and MacLachlan (2000) suggested that face and content validity of the tool was established, but they do not clarify how it was assessed. From both studies, it is clear that future research is required to identify the stability of the TAPES over time (test-retest reliability), responsiveness to change, and floor to ceiling effects to look at predictive validity. It is also acknowledged that the self-report nature of the measure could introduce bias. At present, due to the small sample sizes of both studies, the results cannot be generalised.

Amputations Body Image Scale (ABIS)
Gallagher et al (2007) suggested that the Amputations Body Image Scale (ABIS) could be used in the rehabilitation of people who had an amputation to identify body image problems. The ABIS consists of a 20-item questionnaire and is scored using a 5-level ordinal scale. It assesses an individual's:

- anxiety about their physical appearance in social situations or when alone;
- physical appearance when wearing a prosthesis;
- phantom limb pain experience;
- concerns on how their limb loss affects them in daily living;
- avoidance of certain situations;
- viewing of their appearance, with and without the prosthesis.

Following Rasch analysis of the ABIS, the authors determined that a shortened version, the ABIS-R, would be a more valid and reliable tool. The ABIS-R was developed with 14 items and a 3-level ordinal scoring scale. This version was found to have satisfactory

internal consistency, good responsiveness to change, high separation reliability and construct validity.

The study found that the greater the levels of satisfaction with the prosthesis, the lower the levels of body image problems.

Kendrick Object Learning Test (KOLT)
The search also identified an outcome measure for use with individuals with cognitive impairment. Larner et al (2003) conducted a study to determine whether the Kendrick Object Learning Test (KOLT) could correctly predict whether an individual with a lower limb amputation will use a prosthesis during an inpatient rehabilitation programme. It was found to make the correct prediction in 70 per cent of cases. However, there are highlighted concerns over the reliability and validity of the assessment, and the sample size was small. The KOLT is now part of the Kendrick Scales of Cognitive Ageing (Kasca); therefore, further research would be required with the Kasca.

For further information on the KOLT, see Section 4.6.

Evidence-based recommendations

1. Occupational therapists should use the Amputee Activity Score (AAS) with lower limb prosthetic users to assess the level of activity a person achieves at discharge from prosthetic rehabilitation to review (Panesar et al 2001).
2. Occupational therapists should use the Frenchay Activities Index to determine the level of participation in extended activities of daily living following the rehabilitation and the prosthetic phase (Miller et al 2004).
3. Occupational therapists should use the Patient Generated Index (PGI) measure to assess quality-of-life outcomes in face-to-face assessment (Gallaghan and Condie 2003).
4. Occupational therapists should use the Trinity Amputation and Prosthesis Experience Amputation Scales (TAPES) to assess adjustment to lower limb prostheses (Gallagher and MacLachlan 2000).
5. Occupational therapists should use the TAPES to evaluate changes in quality of life during the rehabilitation process and to provide a more holistic assessment (Gallagher and MacLachlan 2004).
6. Occupational therapists should use the Amputee Body Image Scale (ABIS) to determine the level of body image disturbance and consider how this may affect rehabilitation (Gallagher et al 2007).
7. Occupational therapists should use the Office of Population Censuses and Surveys Scale (OPCS) with lower limb prosthetic users to assess functional capacity in the community at the inpatient stage (Panesar et al 2001).
8. Occupational therapists should use the Clifton Assessment Procedures for the Elderly (CAPE) to predict mobility using a prosthesis (Hanspal and Fisher 1991, 1997).
9. Occupational therapists should use the Kendrick Object Learning Test (KOLT) to facilitate decision-making in prosthetic use (Larner et al 2003).

The studies by Hanspal and Fisher (1991, 1997) and Larner et al (2003) (points 8 and 9) also form the evidence-based recommendations for Section 4.6.

4.6 Cognition

Introduction

For successful rehabilitation with or without a prosthesis, individuals with lower limb amputation require an ability to process information, learn and apply new knowledge as they progress through the rehabilitation stages. Cognitive problems should be identified at the beginning so that the team can set realistic goals and plans for discharge. Cognition has been identified as a factor associated with deterioration in physical ability, an inability to complete prosthetic rehabilitation, and the ability to remain living independently (Pernot 1997, Taylor 2005, Gallagher et al 2008). Likewise, Sansam et al (2009) found that cognitive impairment is a predictor of poor prosthetic use following lower limb amputation. If cognitive dysfunction exists, such as impaired reasoning, perception, comprehension, planning, attention and memory, there will be a significant impact on the person's ability to carry out functional tasks. It will also impact on all performance areas and affect successful prosthetic rehabilitation and long-term use. Gallagher et al (2008) provided an example of an activity: an individual with a transtibial amputation donning their prosthesis and then standing from a wheelchair. The individual would have to remember the following sequence: positioning the wheelchair, applying the brakes, removing wheelchair accessories, donning stump socks/liner, and applying the socket and suspension sleeve. Following this, the individual would have to check that the prosthesis was donned correctly and was comfortable before carrying out the correct transfer technique, which involves another complex sequence. There are many opportunities for an individual with cognitive impairment to experience difficulties with the task.

Evidence

Clinicians working in rehabilitation with people who have had an amputation acknowledge that a cognitive impairment can determine whether the individual will be able to use a prosthesis safely. A study by Chun-Chieh et al (2000) found that there was a statistically significant relationship between impaired cognitive status and the ability to mobilise with a prosthesis. None of the service users in this study with impaired cognition was successful in mobilising with a prosthesis; however, the sample size was small, and so the results should be applied to the general population with caution. Bilodeau et al (2000) found that successful prosthetic use was found to be significantly related to cognition in people with transtibial amputation. Transtibial amputation was almost significantly associated with increased prosthetic use. However, as this is a correlational study (a study that describes a relationship between variables but does not identify cause and effect), further prospective studies are required to determine which variables influence others in this study. The relationship in this study could be due to coincidence or there could be other factors or multiple factors influencing the variables; this requires clarification. Taylor (2005) commented that having a transfemoral amputation was a significant factor in the individual who is unsuccessful in prosthetic rehabilitation.

The evidence highlighted two cognitive assessments that could be used by occupational therapists to determine level and area of deficit. The assessments are the Kendrick Object Learning Test (KOLT) and the Clifton Assessment Procedure for the Elderly (CAPE). These assessments are also discussed in Section 4.5.

A study conducted by Larner et al (2003) found that the KOLT correctly predicted whether people with lower limb amputation will use a prosthesis during the inpatient rehabilitation programme in 70 per cent of the cases. The KOLT is a tool for assessing older people's cognitive abilities through immediate recall of visual and auditory information, assessing speed of processing and recording information. However, there

are concerns regarding the reliability and validity of the KOLT. The KOLT is also now part of the Kendrick Scales of Cognitive Ageing (Kasca). The Kasca was based on the Kendrick battery for the detection of dementia in older service users. The Kasca test measures object recall, digit copying, reasoning and visuospatial ability, and tests cognition in individuals with neuropsychological disorder; it can also be used to screen for onset for dementia.

The CAPE is designed for use with hospital inpatients. It measures the degree of cognitive and behavioural impairment through orientation, mental abilities, psychomotor performance tests and behaviour rating scale. A study by Hanspal and Fisher (1991) suggested that the CAPE could facilitate the decision on whether the prosthesis should be prescribed. In Hanspal and Fisher's 1997 study, there was a highly significant positive correlation between the cognitive state of older service users and mobility achieved with prosthesis. This allows professionals to carry out assessments to ensure they make more informed decisions around prosthetic intervention and future management needs. For both studies, it should be acknowledged that a small sample size was used and regression analysis should have been used to strengthen their claims.

Evidence-based recommendations

1. Occupational therapists should use the Clifton Assessment Procedures for the Elderly (CAPE) to predict mobility using a prosthesis (Hanspal and Fisher 1991, 1997).
2. Occupational therapists should use the Kendrick Object Learning Test (KOLT) to facilitate decision-making in prosthetic use (Larner et al 2003).

4.7 Work

Introduction

Current government initiatives in the UK are aimed at supporting people with and without disabilities to find paid or unpaid work (Black 2008). Some studies have highlighted the perceived benefits of work, which include financial reasons as well as social contacts with colleagues (Bruins et al 2003). Indeed, Schoppen et al (2001b) found that people who had to stop work as a result of their amputation showed a worse health experience than those people with an amputation who continued working.

There is evidence that people with lower limb amputations can have difficulties returning to work (Schoppen et al 2001a, Burger and Marincek 2007). The proportion returning to work varied from 43.5 per cent to 100 per cent, depending on age, country and cause of amputation. Moreover, the percentage of people who returned to the same work as pre-amputation differs in various studies and depends on the type of work and the level of amputation. Factors that can delay or prevent return to work include:

- problems related to the stump (Bruins et al 2003);
- wearing comfort of the prosthesis (Schoppen et al 2001a);
- educational level (Schoppen et al 2001a);
- age at the time of amputation (Schoppen et al 2001a);
- co-morbidity (Schoppen et al 2002);
- workplace modifications (Schoppen et al 2001b, Bruins et al 2003).

Characteristics needed for successful job reintegration were perceived as being motivation, good support from employers, and better co-ordination between the multidisciplinary team, employers and companies (Bruins et al 2003). Schoppen et al (2001a) suggested that individuals with a lower limb amputation may need to change to less physically demanding roles following the amputation in order to successfully return to work. The occupational therapist should routinely ask service users about their work as part of the assessment process. The occupational therapist is well placed to address return-to-work issues, because they help people maximise employment opportunities by carrying out workplace assessments, task analysis, capacity and motivation building, and management of absence. Fisher et al (2003) found that return to work increases over time, which could suggest the need for long-term vocational rehabilitation.

Evidence

There are no current studies to provide evidence that occupational therapy intervention assists people with lower limb amputations to return to work, although it is clear from the studies by Schoppen et al (2001a, b, 2002) and Bruins et al (2003) that occupational therapists could assist in modifying the work environment. A study by Pezzin et al (2000) suggests that following traumatic lower limb amputation, inpatient rehabilitation was positively associated with return to work and a lower likelihood of reduced hours of work.

Evidence-based recommendations

1. Support should be provided from the multidisciplinary team regarding successful work reintegration and maintenance of the work role (Bruins et al 2003).

4.8 Leisure and recreation

Introduction

The goal of rehabilitation for people with lower limb amputations should be to facilitate a return to independence and function in all areas of their life. Legro et al (2001) found that people with an amputation participated in a wide range of recreation activities. However, Collin et al (1992) found that leisure activity scores were lowest in people with lower limb amputations who used a wheelchair. The most important constraints on participation in leisure activities for people with lower limb amputations were lack of accessibility, material considerations, functional abilities, affective constraints and social constraints (Couture et al 2009).

Hanspal and Nieveen (2002) attempted to establish national consensus for indications and recommendations for best practice for the prescription of water activity limbs. Seventy-five per cent of respondents agreed to a water activity limb prescription for specific water activity that necessitated the use of water activity prostheses, and where risk analysis identified that participation in activity presented a health and safety risk due to associated medical or physical conditions. There is evidence that participation in leisure can provide natural opportunities for social interaction and friendship, and provide a sense of identity and social inclusion (Lloyd et al 2000, Pegg and Moxham 2000, Taylor 2003). In addition, leisure participation can:

- reduce psychological distress (Waters and Moore 2002);

- protect against and enable individuals to manage stress (Iwasaki 2001, Kleiber et al 2002);
- increase self-esteem and confidence (Baxter et al 1995, Passmore and French 2000); and
- enhance physical health (Cassidy 1996).

Evidence

No studies were found that were related directly to occupational therapy. Further research needs to be conducted to ascertain how leisure activities are incorporated into occupational therapy programmes. Occupational therapists need to ensure that they take into account the service user's individual needs and that people of a certain age may prefer more solitary leisure occupations and hence may not want to be referred for group activities. Legro et al (2001) found that people aged 60 years and over were more involved in moderate and sedentary activities than those aged 20–49 years. Similar findings are reported by Jones et al (1993), who found that watching television and listening to the radio are the most common activities for people with lower limb amputations (mean age 67 years, 1–2 years after amputation).

Evidence-based recommendations

1. Occupational therapists need to assess and review participation in recreational activities (Legro et al 2001).

Appendix 1: Guideline development group

Expert group – core members

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Appendix 2: Search strategies for literature search two

Articles included after reading full paper

Search terms	OTDBASE	OT Seeker	Medline	CINAHL
Lower limb amputation	x	x		
Lower limb amputation Multidisciplinary			x	x
Lower limb amputation Activities of daily living			Miller et al (2001), Gallaghan and Condie (2003), Miller and Deathe (2004), Miller et al (2004), Baars et al (2008)	Collin et al (1992), Ham et al (1994), Breakey (1997), Gallagher and MacLachlan (2000), Panesar et al (2001)
Lower limb amputation Bathing			x	x
Lower limb amputation Self care			x	x
Lower limb amputation Domestic			x	Atherton and Robertson (2006)
Lower limb amputation Quality of life			Gallagher and MacLachlan (2000)	Gallagher and MacLachlan (2004)
Lower limb amputation Rehabilitation			Lachman (1993), Price and Fisher (2002), Singh et al (2007)	Legro et al (2001), Panesar et al (2001), Larner et al (2003), Pauley et al (2006), Dyer et al (2008), Hawamdeh et al (2008)
Lower limb amputation Driving			x	x

Search terms	OTDBASE	OT Seeker	Medline	CINAHL
Lower limb amputation Housing			x	x
Lower limb amputation Leisure			x	x
Lower limb amputation Transfers			x	x
Lower limb amputation Prosthesis			Hanspal and Fisher (1991, 1997), Gallagher et al (2007)	Beekman and Axtell (1987), Kulkarni et al (1996), Bilodeau et al (2000), Gallagher et al (2007), Baars et al (2008)
Lower limb amputation Outcome			x	Panesar et al (2001), Atherton and Richards (2006)
Lower limb amputation Cognition			x	x
Lower limb amputation Falls			x	Kulkarni et al (1996), Gooday and Hunter (2004)
Lower limb amputation Elderly/older people			x	x
Lower limb amputation Home visits			x	x
Lower limb amputation Work			Bruins et al (2003)	x
Lower limb amputation Phantom pain			x	x
Lower limb amputation Wheelchair			x	White (1992)

Search terms	OTDBASE	OT Seeker	Medline	CINAHL
Lower limb amputation Occupation			x	x
Lower limb amputation Social			Gallagher et al (2007)	Gallagher et al (2007)
Lower limb amputation Skin			Baars et al (2008)	x

Appendix 3: Excluded papers

Twenty-nine papers were excluded as they were not relevant to occupational therapy. Of these 29 papers, the following 26 were research papers:

Muecke et al (1992)
Rybarczyk et al (1992)
Jones et al (1993)
Pell et al (1993)
Cutson et al (1994)
Greive and Lankhorst (1996)
Schaldach (1997)
Frykberg et al (1998)
Klein et al (2001)
Schoppen et al (2001a and 2001b)
Chin et al (2002)
Gardiner et al (2002)
Hanspal and Nieven (2002)
Mortimer et al (2002)
Schoppen et al (2002)
Evans et al (2003)
Ryall et al (2003)
Tsai et al (2003)
Devlin et al (2004)
McGuire (2004)
Kulkarni et al (2005)
Đurović et al (2007)
Franchignoni et al (2007)
Traballesi et al (2007)
Stokes et al (2008)

Of the 29 excluded papers, the following 3 were systematic reviews:

Cumming et al (2006)
Meulembelt et al (2006)
Van Velzen et al (2006)

Appendix 4: How to assess the evidence (typology)

Table 1: designation of levels of evidence

These levels of evidence ratings have been adapted from *A guide to the development, implementation and evaluation of clinical practice guidelines* (National Health and Medical Research Council, Australian Government 1999, p 56).

Level of evidence	Study design
I	Evidence obtained from a systematic review of all relevant randomised controlled trials
II	Evidence obtained from at least one properly designed randomised controlled trial
III-1	Evidence obtained from well-designed pseudo-randomised controlled trials (alternate allocation or some other method)
III-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case-control studies, or interrupted time series with a control group
III-3	Evidence obtained from comparative studies with historical control, two or more single-arm studies, or interrupted time series without a parallel control group
IV	Evidence obtained from case series, either post-test or pre-test/ post-test
V	Surveys, correlation studies, reliability and validity studies for outcome measure development, case studies and focus groups

Table 2: quality assessment for qualitative and quantitative studies

From the *National Service Framework for Long-term Conditions* (Department of Health 2005, p 88).

Each quality item is scored as follows: Yes=2, In part=1, No=0	**Score**
1. Are the research questions/aims and design clearly stated?	
2. Is the research design appropriate for the aims and objectives of the research?	
3. Are the methods clearly described?	
4. Is the data adequate to support the authors' interpretations/conclusions?	
5. Are the results generalisable?	
Total	

Note:
High-quality research studies score at least 7/10
Medium-quality studies score 4–6/10
Poor-quality studies score 3/10 or less.

Table 3: research design is classified according to the following categories

Extract of Table 3 from the National Service Framework for Long-term Conditions (Department of Health 2005, p 88).

Primary research-based evidence	
P1	Primary research using quantitative approaches
P2	Primary research using qualitative approaches
P3	Primary research using mixed methods (qualitative and quantitative)
Secondary research-based evidence	
S1	Meta-analysis of existing data analysis
S2	Secondary analysis of existing data

Appendix 5: Evidence-based review table

Abbreviations used in evidence-based review table

AK above knee
BK below knee
LL lower limb
LLA lower limb amputee
MDT multidisciplinary team
TK through knee
UK United Kingdom
USA United States of America

Author/year	Atherton and Robertson (2006)
Study location	UK
Study objectives	To determine prevalence of psychological morbidity in an amputee population and identify variables associated with increased distress
Design	P1 – cross-sectional survey
Participants	– *N*=67 – Inclusion criteria: LLAs aged ≥18 years, amputation within past 5 years, wearing prosthesis on a daily basis – Exclusion criteria: current diagnosis of life-threatening condition
Recruitment	Through 2 artificial limb and appliance centres in the Midlands, UK
Data collection	Verbal interviews – order of presentation counterbalanced using Latin squares
Outcome measures	1. Hospital Anxiety and Depression Scale (HADS): self-reporting, 14 items, 2 subscales on 4-point scale. Greater scores → greater level of morbidity 2. Psychological adjustment subscale of the Trinity Amputation and Prosthesis Experience Scales (TAPES): to understand the experience of and adjustment to both LL amputation and wearing of a prosthesis: self-reporting, 15 items, 3 subscales (general, social and limitation adjustment), scores for each subscale range from 5 to 25 (higher scores → better adjustment) 3. Self-Consciousness Scale (SCS): to address individual differences in self-consciousness, 23 items, 3 subscales (self-consciousness, public self-consciousness, social anxiety). Higher scores → greater levels of self-consciousness or anxiety 4. Appearance Schemas Inventory (ASI): to assess broad core appearance-related cognitive assumptions without reference to specific physical attributes: 3 subscales (body image vulnerability, self-investment, appearance stereotyping). Higher scores → greater body dissatisfaction

Author/year	Atherton and Robertson (2006)
Results	– Opt-in rate 42.4% – Using conservative cut-off scores, prevalence of anxiety and depression was 29.9% and 13.4%, respectively – Kendall's T-b analysis showed that total scores for appearance-related beliefs were associated with distress (anxiety T-b=0.241, $p<0.01$; depression T-b=0.296, $p<0.001$) and general and social adjustment (T-b=–0.222, $p<0.05$) – Kendall's T-b analysis showed that public but not private self-consciousness was associated with distress (anxiety T-b=0.224, $p<0.01$; depression T-b=0.199, $p<0.05$) and psychosocial adjustment difficulties (T-b=–0.195 to –0.242, $p<0.05$ to <0.01)
Study limitations	– Recruitment conducted in only 2 centres in the Midlands – Small sample size for a prevalence study – Psychometrics of the used outcome measures have not been reported for this specific study – A previous version of the ASI has been used – Regression analysis rather than correlation analysis would have been more effective to identify predictors of distress – Magnitude of T-b for public consciousness is not very high, although the correlations were significant. Magnitude of T-b for the ASI and distress is slightly higher – Cross-sectional design limits causality conclusions
Relevance for occupational therapy	This study suggests that clinicians need to monitor amputees for distress over a longer time period than the initial postoperative phase and that it is particularly important to assess for anxiety. It also suggests that interventions that target appearance-related beliefs and private self-consciousness may be of benefit to this population.
Level of evidence	V
Quality score	6
Reference	Atherton R, Robertson N (2006) Psychological adjustment to lower limb amputation amongst prosthesis users. *Disability and Rehabilitation, 28(19)*, 1201–1209

Author/year	Baars et al (2008)
Study location	The Netherlands
Study objectives	To investigate the relationship between liner-related skin problems of the stump in patients with LL amputation and impaired hand function
Design	P1 – retrospective survey
Participants	*N*=60 (50 transtibial and 10 knee disarticulation amputees, mean age 62.3 years)
Recruitment	1 rehabilitation setting

Author/year	Baars et al (2008)
Data collection	Case notes analysis on amputation, hand function, skin problems of the stump, co-morbidity, prosthesis, liner use and mobility score
Results	– 70% of patients with impaired hand function experienced liner-related skin problems compared with 32% of patients with normal hand function (p=0.035)
Study limitations	– Data from the medical notes were not always accurate or present to proceed with accurate statistical analysis
Relevance for occupational therapy	Occupational therapists need to be aware of hand function before prescription of liners used with prostheses.
Level of evidence	V
Quality score	5
Reference	Baars ECT, Dijkstra PU, Geertzen JHB (2008) Skin problems of the stump and hand function in lower limb amputees. *Prosthetics and Orthotics International, 32(2)*, 179–185

Author/year	Beekman and Axtell (1987)
Study location	USA
Study objectives	To determine factors related to prosthetic candidacy, to determine the level of function and extent of prosthetic use in patients with prostheses, and to establish predictors of prosthetic use
Design	P3 – retrospective survey
Participants	– *N*=55 patients (≥50 years, mean age 65.4 years) with vascular insufficiency resulting in unilateral AK or TK amputation only, or in amputation and prosthetic training (56%) – 23 of 31 patients with a prosthesis were evaluated 7–35 months after receiving the prosthesis – 20 patients had follow-up interview and functional follow-up assessment
Recruitment	1 centre between 1978 and 1980
Data collection	The charts of all participants were reviewed for sex, age, diagnosis, level of amputation and medical complications. For participants with a prosthesis, information around the prosthesis, range of motion, velocity, distance, equipment and transfers was also gathered through charts. Patients with a prosthesis were evaluated and interviewed at least 6 months after receipt of their prosthesis. The interview included questions regarding use of prosthesis and wheelchair, prosthetic comfort, need for prosthetic repair, status

Author/year	Beekman and Axtell (1987)
Data collection (cont.)	of health, new medical or residual problems, reasons for not wearing the prosthesis, and ambulatory equipment use. Follow-up evaluation was omitted for patients who were not fitted with a prosthesis.
Results	– Chart review showed that the only difference between patients who were fitted with a prosthesis and those who were not was their respective number of medical complications (χ^2=11.46, df=1, p<0.005) – 44% of 23 patients with a prosthesis wore their prosthesis all day every day and used a wheelchair minimally or not at all. Over half of the patients evaluated used their wheelchair most of the time. 9% had stopped wearing their prosthesis – *t*-test analysis showed that patients who demonstrated increased walking distances (*t*=3.18, df=17, *p*<0.01) and velocities (*t*=3.14, df=17, *p*<0.01) at follow-up used their prosthesis more and their wheelchair less than other patients – Neither gait factors nor hip range of motion at discharge was predictive of continued prosthetic use – Over 60% of patients reported cosmetic problems or discomfort at follow-up and many cited this as a reason for not wearing their prosthesis
Study limitations	– Patients were recruited from only 1 medical centre – Ethical approval issues are not discussed – The design is not clearly described – To identify factors related to prosthetic candidacy, χ^2 analysis was carried out to compare patients who had prostheses with those that did not. A regression analysis assessing all factors that might have led to prosthetic candidacy could have provided more sound results – To determine the level of function and extent of prosthetic use in patients with prostheses at discharge, descriptive analysis was done. There was no inferential statistical analysis – To establish predictors of prosthetic use, regression analysis would have provided more sound results. Instead, comparison analysis between 2 groups (prosthetic use/no prosthetic use) was carried out – The form for functional assessment was not given – Small sample, especially at follow-up evaluation
Relevance for occupational therapy	The results of this study may serve as a basis for clinical determination of prosthetic candidacy and functional goals for vascular amputees aged ≥50 years of TK and AK levels.
Level of evidence	V
Quality score	3

Author/year	Beekman and Axtell (1987)
Reference	Beekman CE, Axtell LA (1987) Prosthetic use in elderly patients with Dysvascular above-knee and through-knee amputations. *Physical Therapy, 67(10)*, 1510–1516

Author/year	Bilodeau et al (2000)
Study location	Canada
Study objectives	To study factors such as physical and mental health, rehabilitation, physical independence and satisfaction with the prosthesis to understand why amputees use or do not their prosthesis
Design	P1 – cross-sectional survey with correlational elements
Participants	*N*=65 unilateral vascular amputees aged ≥60 years, without severe cognitive problems, living at home and having received a prosthesis
Recruitment	4 hospitals in semi-urban area of Canada
Data collection	Through postal questionnaires, medical records, telephone interviews (20 minutes) to provide information on prosthesis use, physical independence, cognitive status and physical health status
Outcome measures	1. Questionnaire on amputee activities developed by Day (1981) to evaluate depressive mood and amputee's satisfaction. Total scores range from –70 (very inactive) to +50 (very active) 2. Barthel Index to measure physical independence: 10 items on a 2-point scale for personal care and mobility. Total scores range from 0 (complete dependence) to 100 (complete independence) 3. Satisfaction With Prosthesis (SATPRO) (Bilodeau et al 1999): 15 questions on a 4-point ordinal scale. Total scores range from 0 (satisfaction) to 45 (dissatisfaction) and are reported on a score out of 100 for easier interpretation 4. Short Portable Mental Status Questionnaire for the elderly (Pfeiffer 1975) to measure cognitive status: 10 items. Total scores range from 0 (no impairment) to 10 (severe impairment) 5. Geriatric Depression Scale (Brink et al 1982) to measure depression: self-rated, 30 items on a 2-point scale. Total scores range from 0 (not depressed) to 30 (depressed) 6. 4 self-perception questions from the Older American's Resources and Services (OARS) Multidimensional Functional Assessment Questionnaire (OMFAQ)
Results	– 81% of participants wore their prosthesis every day, and 89% of this group wore it for ≥6 hours a day – Bivariate analysis showed that less use of the prosthesis significantly decreased with age (r=–0.22, p=0.02) – Women used the prosthesis significantly less than men (p=0.02)

Author/year	Bilodeau et al (2000)
Results (cont.)	– Transtibial amputation was almost significantly associated with increased prosthesis use (p=0.07) – Possession of a wheelchair was significantly associated with less prosthesis use (p=0.0001) – Prosthesis use was significantly related to the amputee's physical independence (r=0.28, p=0.004), better cognition (r=–0.27, p=0.006), younger age (r=0.22, p=0.01) and the amputee's satisfaction (r=0.19, p=0.04). Frequency of occupational therapy sessions was statistically significant (r=0.59, p=0.05) – Multiple regression analysis showed that dissatisfaction with the prosthesis, not possessing a wheelchair and cognitive integrity explained 46% of the variance in prosthesis use
Study limitations	– Ethical issues are not discussed – Definition of prosthetic use differs among different studies; therefore, it is difficult to compare the results of this study with others – The reliability and validity of the Day (1981) questionnaire has not been checked for this study. Although the authors report good test–retest reliability and empirical and concurrent validity at its development, they do not provide exact information – For the rest of the outcome measures, psychometrics are reported but not checked for this study – A different p value is reported for the correlation with age in 2 different parts of the results – The magnitude of the coefficients is not always reported at the results, and so it is difficult to interpret significance at times – It is not always clarified which statistical test has been used for each reported result – Sample size is not justified – Further prospective studies are needed to determine which variables influence others, as this is a correlational study
Relevance for occupational therapy	This study could be useful for occupational therapists who work with LLAs on successful prosthetic use, as it indicates that the frequency of occupational therapy sessions is related to prosthesis use.
Level of evidence	V
Quality score	7
Reference	Bilodeau S, Herbert R, Desrosiers J (2000) Lower limb utilisation by elderly amputees. *Prosthetics and Orthotics International, 24(2)*, 126–132

Author/year	Breakey (1997)
Study location	USA

Author/year	Breakey (1997)
Study objectives	To determine whether a relationship exists between body image and psychosocial wellbeing (anxiety and depression, self-esteem and satisfaction with life) in LLAs
Design	P1 – survey with correlational elements
Participants	*N*=90 males (mean age 45 years, range 22–74 years), unilateral traumatic LL amputation at least 1 year post-amputation, 60 BK, 30 AK
Recruitment	Participants identified randomly through the files of 1 specialist
Data collection	Self-report postal questionnaire completed by participants, including 110 items consisting of 6 scales
Outcome measures	1. Self-developed Amputee Body Image Scale (ABIS) to assess how an amputee perceives and feels about his or her body (20 items, 5-point Likert scale, higher scores → body image problems) 2. Index of self-esteem (25 items, 0–100; higher scores → problems) 3. Generalised Contentment Scale (GSC) to measure non-psychotic depression (25 items, 0–100; higher scores → problems) 4. Clinical Anxiety Scale (CAS) (25 items, 0–100; higher scores → problems) 5. Satisfaction with Life Scale (SWLS) (5 items, 5–35; higher scores → satisfaction with life) 6. Demographic data (10 items)
Results	– 90/110 LLA respondents – Spearman analysis showed significant positive correlations between body image and self-esteem (*rs*=0.56, *p*<0.0001), anxiety (*rs*=0.57, *p*<0.0001) and depression (*rs*=0.64, *p*<0.0001) – Significant correlation between body image and life satisfaction (*rs*=–0.58, *p*<0.0001), indicating the more negative an amputee feels about his or her body image, the less satisfied he or she is with his or her life – No significant correlations between ABIS and time since amputation – When the sample was divided into 2 groups (less concerned, more concerned), the Mann–Whitney U test showed significant differences in all measures at the 0.0001 level
Study limitations	– Ethical approval issues and the procedure followed to request LLAs to participate in the study are not discussed – Recruitment from the files of only 1 specialist

Author/year	Breakey (1997)
Study limitations (cont.)	– Content validity of the ABIS has not been checked properly – The internal consistency of ABIS is satisfactory (Cronbach's alpha=0.88). However, the author does not discuss the properties of the data as to whether they meet the assumptions for use of Cronbach's alpha. Mean inter-item correlation (ρ) has not been calculated – The author did not discuss any type of reliability apart from internal consistency for the ABIS, which is the main tool used for the study. Moreover, no type of validity, apart from content validity, was discussed – The author did not discuss the validity or reliability of the used outcome measures with this group of patients or for this specific study – Regression analysis would be more appropriate to analyse relationships for this study
Relevance for occupational therapy	This study provides awareness on how body image relates to an individual's satisfaction with life, self-esteem and anxiety. Occupational therapists should be aware of this relationship and of the psychological consequences that amputation might have on an individual.
Level of evidence	V
Quality score	3
Reference	Breakey JW (1997) Body image: the lower limb amputee. *Journal of Prosthetics and Orthotics, 9(2)*, 58–66

Author/year	Bruins et al (2003)
Study location	The Netherlands
Study objectives	To study the process of job reintegration and to assess experiences of LLAs aged 18–60 years
Design	P3 – descriptive survey
Participants	*N*=24 men and 8 women (mean age 42.6 years), no more than 8 years after amputation
Recruitment	Through the large number of participants of a previous study (Schoppen et al 2001)
Data collection	32 two semi-structured interviews
Results	– Stump problems delayed the return to work (average 11.5 months) – Participants valued work as a form of spending the day and the social contacts with colleagues and others

Author/year	Bruins et al (2003)
Results (cont.)	– 11 participants reported having fewer promotion possibilities; reasons given were related to employers being concerned about absence due to ill health – 50% returned to the same employment, 31% to an altered role and 19% to new employment – Work-related adjustments were seldom initiated by members of the team; 7 participants were dissatisfied with adjustments in the workplace – Characteristics needed for successful job integration were perceived as being: motivation and good support from employers; and better co-ordination between professionals, implementing bodies, companies, employers and doctors
Study limitations	– Although this is a qualitative study the researchers have used content analysis to turn qualitative data into quantitative data. As a result, the paper does not address the experiences of LLAs in any great depth
Relevance for occupational therapy	Occupational therapists need to be actively involved in work reintegration and to work collaboratively with work agencies, employers, and social services regarding work adaptations. Occupational therapists need to actively promote good stump care for patients to enable them to participate in their chosen occupations.
Level of evidence	V
Quality score	5
Reference	Bruins M, Geertzen JHB, Groothoff JW, Schoppen T (2003) Vocational reintegration after lower limb amputation: a qualitative study. *Prosthetics and Orthotics International, 27(1)*, 4–10

Author/year	Collin et al (1992)
Study location	UK
Study objectives	To identify objective measures that correlate closely with the outcome of prosthetic rehabilitation (enhanced function and mobility, whether by the appropriate use of a wheelchair in an adapted environment, the use of a prosthetic limb, or a combination of methods) in order that the progress and results of rehabilitation programmes in amputees can be identified and monitored accurately
Design	P3 – survey with correlational and comparative elements
Participants	37 patients (27 males, mean age 66.9 years; 10 females, mean age 73 years) with an amputation due to peripheral vascular disease or diabetes mellitus and accepted for prosthetic training questioned, of which 34 were examined

Author/year	Collin et al (1992)
Recruitment	Through 1 disablement services centre (DSC)
Data collection	Questionnaire completed at home and an examination performed either at the hospital or at the centre
Outcome measures	1. Questionnaire to gather information on hospital admissions, medical history, use of DSC and community rehabilitation services, prosthetic use (hours/day) and wheelchair use in essential daily activities 2. Barthel Activities of Daily Living Index to measure independence in essential care activities 3. Nottingham extended ADL Index (NEADL) to assess independence in mobility, kitchen, domestic and social activities 4. Amount of formal care input, patient's status, and patient's satisfaction (2 items) with present level of function and with the medical, prosthetic, rehabilitation and community services was asked about 5. History of pain, and details of the other limb and infections was taken 6. Assessment of pre-amputation walking status graded in 3 categories 7. Mini-Mental Status Examination to measure cognitive function 8. 9-hole peg test to measure manual dexterity 9. Walking distance, cardiac fitness, respiratory peak flow, motricity index and grip strength
Results	– Based on mode of mobility, hours of use of prosthesis and observation, participants were grouped as 14 walkers, 10 partial walkers and 13 non-walkers – Kruskal–Wallis test showed that the Barthel Index was significantly different in each of the 3 groups (χ^2=26.02, p<0.001), wheelchair use requiring most help with personal care. Partial walkers had lower mean scores than the other 2 groups for extended activities of daily living in the kitchen and domestic sphere, but leisure activity scores were lowest in the wheelchair group (p=0.04) – Kruskal–Wallis test showed that partial walkers were slightly older than the other 2 groups (p<0.02), had a weaker hand grip (p<0.05) and had lower peak flows (p<0.004) – Barthel Index correlated closely with time taken to walk (ρ=–0.664, p<0.001) and there was a significant difference in speed between walkers and partial walkers (p<0.001) – 85% of the walkers completed a 10-metre walk in <30 seconds, whereas 90% of the partial walkers took >30 seconds – Grip strength and cardiovascular fitness correlated well with outcome

Author/year	Collin et al (1992)
Results (cont.)	– Age was not a predictor of outcome (whether prosthetic use training would be successful), but in those who were walking it correlated closely with speed. Age was strongly correlated with grip strength ($p<0.001$), Barthel Index ($p<0.001$) and social services input ($p<0.01$) – Gender was related to grip strength ($p<0.001$) – Pre-amputation walking status correlated with overall outcome ($p<0.01$) – Cognitive status and 9-hole peg test correlated with ADL scores – Partial walkers had lower kitchen and domestic activity scores, which were due to lack of environmental modifications for wheelchair users. These patients can easily be identified by measuring their walking speed and Barthel Index
Study limitations	– Ethical issues are not discussed – The aim could have been stated more clearly with respect to the outcome of rehabilitation – The recruitment was done through only 1 setting – Lack of consistency on the place where the examination was completed – It is not clarified who contacted the participants and their relationships to participants – It is unclear what scores were used to categorise participants into 3 groups (walkers/partial walkers/non-walkers) – The sample included both unilateral and bilateral amputees – The reliability and validity of the outcome measures used are not discussed – The authors assess predictors by using correlations, whereas a regression analysis would be more appropriate – The level of magnitude of the coefficients, and the significance of some correlations, is not always reported
Relevance for occupational therapy	This study suggests that older adults with an amputation due to peripheral vascular disease are unlikely to master walking again, and in this situation resources should be directed at enhancing function through environmental modification and appropriate wheelchair provision. It also suggests that it is important to review progress measuring walking speed, pulse recovery, Barthel Index and NEADL to ensure that these patients achieve the highest level of rehabilitation success by whatever means.
Level of evidence	V
Quality score	2
Reference	Collin C, Wade DT, Cochrane GM (1992) Functional outcome of lower limb amputees with peripheral vascular disease. *Clinical Rehabilitation, 6(1)*, 13–21

Author/year	Dyer et al (2008)
Study location	Canada
Study objectives	– To identify the associated and causative factors that led to falls in the adult amputee patient population – To develop 2 programmes from the resulting information: an effective falls prevention programme and a falls risk assessment specific for adult amputee patients – To report the preliminary data of the first three months of the study
Design	P3 – 2-stage study including a survey and a pre-/post-treatment design
Participants	*N*=24 patients. Inclusion criteria: all patients admitted to the ward during the first 3 months of the study were qualified as participants
Recruitment	Rehabilitation hospital in Edmonton with an 8-bed ward for patients with LL amputation
Data collection/ intervention	– Stage 1: causes of falls were explored through literature and comparison with existing NetSAFE programme, observational sessions with staff, and anonymised questionnaire from nursing staff – Stage 2: interventions were selected by the project team and assessed in terms of effectiveness in improving patients' safety. The anonymised questionnaire was recirculated to the nursing staff at the conclusion of the study. Data regarding amputee patient falls were retrieved from NetSAFE – Interventions: (1) Falls Assessment Tool revised to identify patients at risk of falling and delineate a process for intervention with these clients. (2) If a fall occurred, the MDT identified the root cause and developed a customised plan to prevent subsequent falls. (3) NetSAFE falls data reviewed monthly by the MDT to monitor the effectiveness of the interventions. (4) Nursing staff educated about the main causes and location of falls specific to the ward patients
Results	– Falls incidence in the ward was 31% in the first 9 months of data collected through NetSAFE – 14/18 patients fell while using a wheelchair. Among these falls, poor balance was associated with 9, patients' self-transfer involving a wheelchair was associated with 10, and sitting and reaching in the wheelchair was associated with 4 – The chances of a patient who had fallen once of falling again were 1 in 3 – Within the first 3 months of the study there was a 5% decrease in falls with only 2 patients falling once. Neither of these falls resulted in physical injury. – The response rate of the pre-/post-intervention questionnaire from the nursing staff was 60% (18/30)

Author/year	Dyer et al (2008)
Results (cont.)	– Initially only 25% of the nursing staff had agreed that the Falls Assessment Tool was being used effectively; this increased to 65% after implementation of the intervention – Initially 50% had agreed that the Nursing Assessment Tool was useful for differentiating patients at risk of falling; this increased to 60% – The efficacy of identifying patients at risk of falling was 40%; this increased to 65% – Post-intervention, the nursing staff indicated a 43% increase in investigation into falls and information dissemination regarding falls – The majority of staff reported a substantial improvement regarding the effective reporting and discussion of NetSAFE data (pre-intervention 8%, post-intervention 90%)
Study limitations	– Small sample size – The design of the study needs further clarification – The methods of assessment need further clarification – The characteristics of the sample are not clarified; since there were no specific inclusion criteria, the sample might be heterogeneous – There is only descriptive analysis of the results without the use of inferential statistics; therefore, the results cannot be generalised – The study does not explore other factors that may be relevant to the reduction of falls during this period, and there is no control group – The study was based in only 1 ward of 1 hospital – Ethical clearance is not discussed – The recruitment process is not discussed
Relevance for occupational therapy	This study suggests that the coordinated efforts of the MDT to create customised falls intervention for each patient deemed to be at risk of falling were considered effective and worthwhile. This study is relevant to occupational therapy as part of the MDT.
Level of evidence	IV
Quality score	3
Reference	Dyer D, Bouman B, Davey M, Ismond KP (2008) An intervention program to reduce falls for adult in-patients following major lower limb amputation. *Healthcare Quarterly*, *11(3)*, 117–121

Author/year	Gallaghan and Condie (2003)
Study location	Glasgow, UK
Study objectives	To adapt the Patient Generated Index (PGI) Quality Of Life (QOL) measure for use with LLAs and to conduct a test-retest reliability and construct validity study on the adapted measure
Design	P1 – outcome measure development

Author/year	Gallaghan and Condie (2003)
Participants	*N*=42 unilateral LL transfemoral amputees, aged ≥16 years, fitted with a prosthesis and discharged into the community for at least 1 year following postoperative rehabilitation therapy; 39 of these completed the second stage of the study
Recruitment	7 participating hospitals
Data collection	– Repeated questionnaire interviews with a 4-week interval administered by trained peers in the participants' homes – As a first step, participants completed the PGI and SF-12; as a second step, they completed the PGI only
Outcome measures	1. Adapted PGI to measure QOL: completed in 3 stages. Total scores: 0–10 2. Short Form 12 Health Survey (SF-12): health-related QOL measure reported as a physical and a mental component summary on a scale between 0 and 100 (average normal=50)
Results	– Consent rate 51% – PGI test–retest reliability analysis achieved an intraclass correlation coefficient (ICC) of 0.48 (p<0.001) – ICC values for the 7 most commonly mentioned areas of life affected by the amputation and its treatment ranged from 0.40 to 0.92, and all were statistically significant (p=0.05 to 0.001) – Construct validity was supported as the PGI and the SF-12 Health Survey physical and mental component summaries gave Pearson correlation coefficients (r=0.12, p<0.05) and (r=0.56, p<0.001) respectively – Multiple regression analysis showed that SF-12 physical and mental component scores explained 31.5% of the variability in PGI scores; the mental component scores alone explained 31.2%
Study limitations	– The authors reported comparing the PGI with SF-12 to assess construct validity, whereas they correlated the 2 measures by using Pearson correlation analysis – Although the correlations between PGI and SF-12 were significant, the levels of magnitude of the coefficient for the physical component is quite low (r=0.12) – Further types of reliability and validity should be tested before the tool can be used safely – Small sample size for this type of study
Relevance for occupational therapy	The PGI was adapted and this study suggests that it was found to be moderately reliable in terms of repeatability during successive follow-up interviews. Its construct validity supported a stronger relationship between mental health and QOL than between physical health and QOL.

Author/year	Gallaghan and Condie (2003)
Relevance for occupational therapy (cont.)	This measure could be used with caution to assess QOL outcomes in groups of LLAs. It can also be used to base treatment strategies on the goals identified by patients in step 1 of the measure, and then focusing care activity on those goals given low scores in step 2 with high weights in step 3. However, the measure has practical limitations related to its format, which makes it more appropriate to be used in a face-to-face interview.
Level of evidence	V
Quality score	7
Reference	Gallaghan BG, Condie ME (2003) A post-discharge quality of life outcome measure for lower limb amputees: test-retest reliability and construct validity. *Clinical Rehabilitation, 17(8)*, 858–864

Author/year	Gallagher and MacLachlan (2000)
Study location	Ireland
Study objectives	To develop a multidimensional self-report instrument to better understand the experience of amputation and adjustment to LL prosthesis that could supplement clinical assessment and contribute to research in this area
Design	P3 – outcome measure development
Participants	*N*=104 participants aged >18 years with LL amputation
Recruitment	1 clinic at Cappagh Orthopedic Hospital
Data collection	3-stage process: (1) review of the literature and existing measures; (2) expert opinion (clinical and research psychologists, prosthetists, rehabilitation and orthopaedic consultants); (3) focus groups with LLAs (thematic analysis of data)
Outcome measures	Postal questionnaire (closed-ended questions) consisting of 3 sections: (1) psychosocial issues: 89 items rated on a 5-point Likert scale; (2) activity restriction: 19 items rated on a 3-point scale; (3) satisfaction with prosthesis: 10 items rated on a 5-point scale
Results	– 61% response rate from LLAs – Factor analysis revealed: (a) 3 psychosocial subscales (general, social and adjustment to limitation); internal consistency (Cronbach's alpha=0.886, 0.862, 0.833, respectively); (b) 3 activity restriction subscales (functional, social and athletic activity restriction) (Cronbach's alpha=0.865, 0.838, 0.763, respectively); (c) 3 satisfaction subscales (functional, aesthetic and weight satisfaction). (Cronbach's alpha=0.854, 0.777 for functional aesthetic scales respectively. Weight satisfaction comprised by a single item)

Author/year	Gallagher and MacLachlan (2000)
Results (cont.)	– Subscales displayed preliminary evidence indicating predictive validity: (1) multiple regression analysis suggested that adjustment to limitation and general adjustment predicted a significant proportion in prosthetic use; (2) logistic regression analysis (LRA) revealed that the adjustment to limitation significantly discriminates respondents who experience stump pain; (3) LRA indicated that the adjustment to limitation and aesthetic satisfaction subscales significantly discriminated those who experienced phantom limb pain from those who did not – Construct validity was established with 60 people (36% response rate) completing the revised TAPES and: (1) World Health Organization Quality of Life Questionnaire (WHOQOL: BREF, 1998 – 28 items rated on a 5-point scale); significant correlations between TAPES subscales and WHOQOL: BREF domain scores (r=0.392 to –0.634, p<0.001 to 0.003); (2) Impact of Event Scale: intrusion scale – 7 items, avoidance scale – 8 items; significant correlations (r= –0.265 to –0.623, p<0.05 to 0.001); no significant correlations with activity restriction or satisfaction with the prosthesis; (3) Trait Meta Mood Scale; Significant correlations with the repair and clarity subscales of TMMS (r=0.337 to 0.578, p<0.01 to 0.0001) – Final version of TAPES consists of 54 items and the administration time is approximately 5–10 minutes
Study limitations	– Participants recruited from only 1 hospital – For ordinal data, RASCH analysis is more appropriate than factor analysis – The authors suggest established face and content validity but do not clarify how this was assessed – The finding that the general adjustment and adjustment to limitation subscales explained 19% of the variance in prosthetic use should be treated with caution because the variance explained is low – Future research should identify the stability of the instrument over time (test–retest reliability) and should look at predictive validity using prospective studies – Small sample for generalisation of results
Relevance for occupational therapy	Occupational therapists might use this tool for clinical and research purposes with some caution. The TAPES may provide an initial evaluation of adjustment problems and consequently identify patients experiencing maladjustment and the development and evaluation of treatment approaches.
Level of evidence	V
Quality score	7
Reference	Gallagher P, MacLachlan M (2000) Development and psychometric evaluation of the Trinity Amputation and Prosthesis Experience Scales (TAPES). *Rehabilitation Psychology, 45(2)*, 130–154

Author/year	Gallagher and MacLachlan (2004)
Study location	Ireland
Study objectives	To investigate whether multivariate combinations of TAPES subscales are important in predicting different domains in quality of life
Design	P1 – survey study
Participants	*N*=63 people (37% response rate) returned completed questionnaires, 69.8% male, 42.9% trauma, 57.1% BKA. Inclusion criteria: age ≥18 years, unilateral LLA
Recruitment	Through hospital charts from patients attending limb-fitting centre
Data collection	Through postal questionnaires
Outcome measures	1. World Health Organization Quality of Life Questionnaire brief version (WHOQOL-BREF): 4 scales related to QOL: physical, psychological, social relationships and environment. 28 items on 5-point Likert scales 2. TAPES: 9 subscales in total: (a) 3 psychosocial subscales – general, social adjustment and limitation adjustment; each contains 5 items measured with a 5-point rating scale; higher scores indicate higher level of adjustment; (b) 3 activity restriction subscales: function, social, athletic activity restriction; each contains 4 items measured on a 3-point scale; higher scores indicate higher activity restriction; (c) 3 subscales assessing satisfaction with prosthesis measured with a 5-point scale, with 5 items in functional and aesthetic satisfaction and only 1 item in weight satisfaction; higher scores in scales indicate higher satisfaction with prosthesis. TAPES also considers phantom limb pain and residual limb pain and other medical factors not related to amputation
Results	– Pearson analysis showed significant relationship between length of time living with the prosthesis and each of physical health (r=0.26, p>0.05), social relationships (r=0.29, p>0.05) and the environment (r=0.33, p<0.01) scales on the WHOQOL – Significant relationship between the degree of prosthetic use and both the psychological domain (r=0.29, p<0.05) and the social relationships domain (r=0.50, p<0.001) – No significant relationship between age and QOL domains – ANOVA analysis did not reveal any significant differences in any of the QOL domain scores (physical health, psychological, social relationships, environmental) arising from age, gender, level or cause of amputation

Author/year	Gallagher and MacLachlan (2004)
Results (cont.)	– Stepwise multiple regression analysis showed that the general adjustment scale, functional restriction subscale, physical capabilities rating, experience of residual limb pain, health rating and adjustment to limitation subscale predicted 84% of the variance in the physical health domain of QOL – The general and social adjustment subscales, level of amputation, aesthetic satisfaction with prosthesis and physical capabilities rating TAPES predicted 72% of the variance in the psychological domain of QOL – TAPES ratings of social adjustment, degree of prosthetic use and length of time with prosthesis predicted 63% of variance in the social domain of QOL – The general adjustment subscale of TAPES predicted a significant proportion of the 44% of variance in the environmental domain of QOL
Study limitations	– Further longitudinal research is required to explore possible cause and effect relationships and to determine the TAPES responsiveness to change – All participants came from a single facility – Sample size is very small for assessing this number of predictors – Further validity and reliability studies is required – Authors need to be more specific by providing more information on reliability and validity of measures being used – Self-report could introduce bias as there is no control over the response – There is no information on how much of the variance is explained by each predictor – Outcome measures responsiveness to change not mentioned
Relevance for occupational therapy	TAPES could be used by occupational therapists to evaluate changes in an individual's QOL during the rehabilitation process and provide a more holistic assessment.
Level of evidence	V
Quality score	6
Reference	Gallagher P, MacLachlan M (2004) The Trinity Amputation and Prosthesis Experience Scales and quality of life in people with lower limb amputation. *Archives Physical Medicine Rehabilitation, 85(5)*, 730–736

Author/Year	Gallagher et al (2007)
Study location	Ireland
Study objectives	To examine the validity and reliability and the quality of the rating categories of the Amputee Body Image Scale (ABIS) using Rasch Analysis
Design	P1 – outcome measure development
Participants	*N*=145 people with LL amputation, currently wearing a prosthesis, male 68.3%, BKA 50.3%, AKA 35.9%. Inclusion criteria: age >18 years with LL amputation
Recruitment	Through hospital charts of 2 limb-fitting centres in Ireland
Data collection	Through postal questionnaires
Outcome measures	1. ABIS: 20 items (ratings 1–5) assessing how an amputee perceives/feels about body image. Total scores range from 20 to 100 (high scores indicate high body image disturbance) 2. Trinity Amputation Prosthesis Experience Scales (TAPES): (a) 3 psychosocial subscales (general adjustment, social adjustment and limitation adjustment), each containing 5 items (ratings of 1–5, with higher scores indicating higher level of adjustment); (b) 3 activity subscales (functional activity restriction, social activity restriction and athletic activity restriction), each containing 4 items measured on a 3-point scale, with higher scores indicating higher activity restriction; (c) 3 more subscales: prosthetic satisfaction (5-point rating scale), functional satisfaction (5 items), aesthetic satisfaction (4 items), weight satisfaction (1 item), with higher scores indicating higher satisfaction with prosthesis. TAPES also assesses phantom pain and residual limb pain and other medical problems not related to amputation, and rates general health
Results	– According to Rasch analysis and expert review, some response categories were collapsed and 6 items were deleted. The remaining 14 items were used to create the revised ABIS (ABIS-R) rated with a 3-level rating scale – ABIS-R fitted the unidimensional construct that the scale was intended to measure – ABIS-R demonstrated good reliability (Cronbach's alpha and person separation reliability=0.87), targeting and internal construct validity – Correlations with the 9 TAPES subscales (in particular, *r*=–0.54 with general adjustment, *r*=–0.43 with social activity restriction, and *r*=–0.40 with social adjustment) supported the convergent validity of ABIS-R

Author/Year	Gallagher et al (2007)
Study limitations	– Participants came from only 2 facilities – Self-report could introduce bias as there is no control over the response – Further aspects of validity and reliability should be explored – Although this is a satisfactory sample for this type of study, a larger sample would be required
Relevance for occupational therapy	This tool could be used by occupational therapists to determine the level of body image disturbance in patients with LL amputation and consider how this may affect rehabilitation.
Level of evidence	V
Quality score	8
Reference	Gallagher P, Horgan O, Franchignoni F, Giordano A, MacLachlan M (2007) Body image in people with lower limb amputation: a Rasch Analysis of the Amputee Body Image Scale. *American Journal of Physical Medicine Rehabilitation, 86(3)*, 205–215

Author/year	Gooday and Hunter (2004)
Study location	Edinburgh, UK
Study objectives	To study the factors contributing to falls among recent LLAs, and to check whether there will be a reduction to the number of falls during inpatient rehabilitation and to resulting injuries by intervention
Design	P1 – 3-stage study. Retrospective, followed by prospective, historical cohort study. Then a follow-up study conducted after interventions
Participants	– Stage 1: *N*=200 LLAs who had an accident during their inpatient rehabilitation within 2 years – Stage 2: *N*=113 patients (mean age 69 years, range 34–94 years) admitted to the unit over a 15-month period – Stage 3: *N*=62 consecutive patients
Recruitment	20-bedded inpatient rehabilitation unit for amputees
Data collection/ Intervention	– Stage 1: retrospective audit of incident forms carried out – Stage 2: prospective study undertaken. Comparison between patients who had a fall or other accidents and patients who did not was also undertaken to identify patients who were at higher risk of falling. At this stage intervention was carried out, aiming to reduce falls – Stage 3: patients studied using simple risk assessment sheet so that interventions in stage 3 could be targeted at patients who were at particularly high risk of falling and sustaining injury. All measures apart from Hospital Anxiety and Depression (HAD) were applied as per stage 2

Author/year	Gooday and Hunter (2004)
Outcome measures	Outcome measures used at stage 2: 1. Mini-Mental State Examination 2. HAD score 3. Office of Population Censuses and Surveys (OPCS) measure of disability 4. Specialist registrar in rehabilitation medicine working at the ward collected additional information related to the circumstances of the accident 5. Number of falls and other accidents and resulting injuries
Results	– Audit at stage 1 showed that approximately a third of admissions (32%) were complicated by an accident. Most accidents were falls – Stage 2 showed that patients who fell were significantly older than those who did not (p<0.0001). Patients who were employed before admission were shown to be statistically significantly less likely to have an accident (p=0.004) – Stage 3 showed there were 37 accidents in total, of which 35 were falls. Compared with the stage 2 study (using χ^2 analysis), there was no reduction in the proportion of patients who had a fall or other accident in stage 3, but significantly fewer falls resulted in any injury (p=0.05)
Study limitations	– Ethical issues are not discussed – Unclear research question; methods are not described very clearly – The recruitment was done through only 1 unit – It is not always specified what statistical test has been used to determine significant or non-significant outcomes – The authors talk about relationship, but they have used only comparative tests – A regression analysis in each stage might have been more suitable to identify predictors, rather than a comparison and descriptive analysis – The sample size on stage 3 is small and so the absence of stump injuries could have occurred by chance
Relevance for occupational therapy	This study suggests that although the interventions employed did not reduce the proportion of patients who had falls or other accidents, significantly fewer falls resulted in injuries. This study could be relevant to occupational therapists who work with patients at a high risk for falls in the rehabilitation phase, particularly while transferring.
Level of evidence	III-3
Quality score	4
Reference	Gooday HML, Hunter J (2004) Preventing falls and stump injuries in lower limb amputees during inpatient rehabilitation: completion of the audit cycle. *Clinical Rehabilitation, 18(4)*, 379–390

Author/year	Ham et al (1994)
Study location	UK
Study objectives	To ascertain functional recovery patterns of lower limb amputees
Design	P1 – survey study
Participants	*N*=459
Data collection	Case note analysis using non-standardised structured questionnaire over 12 weeks treated for a 12-month period between October 1987 and September 1988
Results	– Postoperatively (1–2 weeks) LLAs were able to move about the bed, move from lying to sitting position and sit up unaided. This was achieved by over 80% of the participants – Upper body dressing independently took 3–4 weeks, and lower body dressing independently took 3–5 weeks
Study limitations	– The design is not discussed in any specific detail – The validity and reliability of the nine functional activities used on the form are not reported sufficiently – Other variables could have impacted upon the milestones. Availability of rehabilitation professionals the type and amount of therapy received are not discussed; therefore, the milestones may not be accurate – The research is dependent upon physiotherapists completing the forms accurately. There is no evidence that data were verified for accuracy – Data for the whole of the study are not available – Research ethics are not discussed
Relevance for occupational therapy	The data from this study could be used to formulate an integrated care pathway that records rehabilitation milestones. The milestones could be useful for predicting length of stay to achieve functional independence.
Level of evidence	V
Quality score	3
Reference	Ham R, de Trafford J, Van de Ven C (1994) Patterns of recovery for lower limb amputation. *Clinical Rehabilitation, 8(4)*, 320–328

Author/year	Hanspal and Fisher (1991)
Study location	UK
Study objectives	To study the relation between the success of rehabilitation and the intellectual state of elderly patients after amputation
Design	P1 – correlation study

Author/year	Hanspal and Fisher (1991)
Participants	*N*=100 unilateral amputees (49 BK, 51 AK) aged ≥60 years who had achieved maximum mobility and were attending the clinic only for maintenance of the prosthesis
Recruitment	1 clinic
Data collection	Mobility achieved was identified through a complete clinical examination
Outcome measures	Clifton assessment procedures for the elderly to assess cognitive and psychomotor functions: 1 score for orientation, 1 score for mental ability, 1 score for time taken, 1 score for errors, 1 score for psychomotor task and 1 total score – can be used by therapists and nurses without special training
Results	– Pearson correlation analysis showed that there was a highly significant positive correlation between scores obtained on the intellectual assessment and the mobility of elderly patients with a prosthesis (r=0.82, p<0.01) – A total score on the cognitive assessment scale of at least 30 was associated with the ability to walk indoors and outdoors in patients without medical factors limiting mobility. Only 4% of all participants achieved this score and were unable to walk outdoors. Only 2% of the participants could walk outdoors and scored less than 30 – A *t*-test showed that the level of amputation had no significant effect on the variables under consideration – The time taken to complete the psychomotor task was related to age (p<0.01)
Study limitations	– No information on how recruitment was achieved or on ethics – The recruitment was done through only 1 clinic – The psychometrics of the Clifton assessment are not reported for this study – No information on who completed the study and their relationships with the patients that might affect data collection – At the conclusion, the authors talk about prediction of mobility. In this case, a regression analysis should have been performed instead of correlation analysis. If this had been done, the contribution of each of the 5 factors to predict mobility could have been evaluated
Relevance for occupational therapy	This study suggests that a patient's score on the cognitive assessment scale could facilitate the decision on whether a prosthesis should be prescribed. It also suggests that predicting the mobility allows a rehabilitation package to be planned (including home adaptations, wheelchair provision and training).

Author/year	Hanspal and Fisher (1991)
Level of evidence	V
Quality score	6
Reference	Hanspal RS, Fisher K (1991) Assessment of cognitive and psychomotor function and rehabilitation of elderly people with prostheses. *British Medical Journal, 302(6782)*, 940

Author/Year	Hanspal and Fisher (1997)
Study location	UK
Study objectives	– To test the hypothesis that cognitive state would reliably predict achieved mobility following standard limb fitting and rehabilitation practices – To compare the results of this study with those of a previous study with the same cohort
Design	P1 – correlation study
Participants	*N*=32 patients of an original cohort of 50, mean age 66.4 years (range 54–72 years); 20 of these had co-existing medical complications affecting mobility, in contrast to those of the previous study
Recruitment	Through the original cohort of a previous study
Data collection	All patients were tested by one of the authors at 2–4 weeks and again at 8–14 months post-amputation when final mobility was achieved. A complete clinical examination was carried out to help grade the mobility achieved
Outcome measures	Clifton Assessment Procedures for the Elderly (CAPE) to assess cognitive and psychomotor functions: 1 score for orientation, 1 score for mental ability, 1 score for time taken, 1 score for errors, 1 score for psychomotor task and 1 total score – possible score 0–35 – can be used by therapists and nurses without special training
Results	– Pearson correlation showed that the scores of the CAPE at first assessment with those of the second assessment were highly correlated (r=0.93, p<0.001) – The correlation between mobility grade achieved and the final CAS scores was r=0.45 (p<0.01), whereas in the previous study it was r=0.81 – In the 12 patients who had no medical complications the correlation was r=0.92 (p<0.001) – The results were compared with the previous study on established patients

Author/Year	Hanspal and Fisher (1997)
Study limitations	– The authors suggest that the CAS scores achieved on the first and second assessments were compared by Pearson correlation, whereas these were correlated – The authors suggest that since the correlation between mobility and CAS (total scores) was r=0.45, then the intellectual status accounts for about 20% of the explained variance in mobility even when co-existing medical conditions affected it. Such claims cannot be supported by correlation analysis, but regression analysis would be needed – The same applies to the claims about the 12 patients who had no medical conditions, for whom the authors suggest that intellectual ability accounts for the 85% of mobility – Regression analysis would be more appropriate in identifying predictors rather than doing simple correlation analysis – The authors do not explain why they conducted Pearson correlations instead of Spearman's, since the mobility grades are of an ordinal level – No ethical issues or consent are discussed – The authors do not explain the recruitment process – The assessments were done by the authors. If these were the specialists in the clinic who were regularly treating the patients, then the data collected might be biased – The psychometrics of the CAS, which is the main outcome measure, are not presented – Small sample size
Relevance for occupational therapy	This study suggests that there is a highly significant positive correlation between the cognitive state of elderly patients and the mobility achieved with the prosthesis. Therefore, it could be possible to use intellectual assessment in order to be aware of possible expectations about a patient's future mobility and therefore make more informed intervention decisions.
Level of evidence	V
Quality score	4
Reference	Hanspal RS, Fisher K (1997) Prediction of achieved mobility in prosthetic rehabilitation of the elderly using cognitive and psychomotor assessment. *International Journal of Rehabilitation Research, 20(3)*, 315–318

Author/Year	Hawamdeh et al (2008)
Study location	Jordan
Study objectives	To assess the prevalence of anxiety and depression among Jordanian LLAs with different clinical characteristics and sociodemographic data
Design	P1 – survey

Author/Year	Hawamdeh et al (2008)
Participants	*N*=56 patients with unilateral LL amputation (22 AK, 34 BK) with mean duration 8.4±5.75 years
Recruitment	3 settings in Jordan
Data collection	Face-to-face interviews using questionnaires to assess sociodemographic information and clinical data
Outcome measures	Level of depression and anxiety: Hospital Anxiety and Depression Scale (HADS) – possible total score 0–21 (0–7 is considered normal)
Results	– Prevalence of depressive and anxiety symptoms was 20% and 37%, respectively – More females than males had reactive depression and anxiety symptoms – More traumatic amputees had depression and anxiety compared with those who had their amputation because of disease – More single patients and patients with no social support had psychological symptoms – More BK amputees had depression compared with AK amputees – More unemployed or patients with low income had psychological symptoms
Study limitations	– Recruitment process is not fully clarified – Reliance on self-reports – The authors suggest a negative relationship between length of time since amputation and prevalence of psychological abnormalities (anxiety or depression). However, this could not be supported as there was no correlational analysis between these variables. Instead, a comparison of percentages is implied between patients with psychological abnormalities or not as categorised by length of time since amputation – Small sample – Wide variety in age – Patients were not followed longitudinally – Subjects with surgical amputations may have associated illnesses, which may contribute to their symptoms – Comparison between only 2 variables was carried out separately, whereas other types of inferential statistics controlling for the assessed factors could provide more conclusive results
Relevance for occupational therapy	Occupational therapists as part of the multidisciplinary team may work toward psychologically preparing patients before amputation and contribute to their vocational rehabilitation and sense of wellbeing to decrease anxiety and depression levels.
Level of evidence	V

Author/Year	Hawamdeh et al (2008)
Quality score	4
Reference	Hawamdeh ZM, Othman YS, Ibrahim AI (2008) Assessment of anxiety and depression after lower limb amputation in Jordanian patients. *Neuropsychiatric Disease and Treatment, 4(3)*, 627–633

Author/year	Kulkarni et al (1996)
Study location	UK
Study objectives	To establish the prevalence of falls in patients with LL amputations in a given 12-months period and to identify any factors which contributed to those falls, as well as the effect of falls on their quality of life
Design	P1 – prospective survey
Participants	*N*=164 LLAs of all ages seen by the consultant (all of them agreed to participate)
Recruitment	Through a subregional DSC providing prosthetic rehabilitation by a clinical team consisting of a consultant, a prosthetist and a physiotherapist
Data collection	Through structured questionnaires with LLAs completed by a member of the team based on self-reports
Results	– Data was analysed mostly by using descriptive statistics. Comparisons between groups were carried out using χ^2 test, Mann–Whitney U-test and 2-sample *t*-test – Falls among patients with amputations are prevalent (58% of patients with unilateral amputations and 27% with bilateral amputations) – There was no difference in the proportion reporting a fall between AK and BK amputations in unilateral patients (χ^2=3.7, *p*=0.054) – 48% of falls were reported as intrinsically related, 22% related to environmental reasons, 12% related to the prosthesis and 18% related to more than 1 factor – 88% of patients with AK amputations had their first fall while wearing a prosthesis compared with 48% with BK amputation – 25% of patients falling remembered being given instructions on how to get up from a fall
Study limitations	– Study carried out in only 1 setting – No information on how ethical approval was achieved or how patients were invited to participate in the study – The reasons for falls were reported by patients (and not investigated by the team) – Since the patients were interviewed by a member of their intervention team, one might question the authenticity of their reports

Author/year	Kulkarni et al (1996)
Study limitations (cont.)	– There is no clarification on whether the data characteristics were appropriate for the use of these statistical tests – Generalisations are difficult since mostly descriptive statistics were used – The results are indicative but not conclusive, because when comparisons between groups were made there was no control of other factors, such as group activity
Relevance for occupational therapy	This study suggests that therapists working in a multidisciplinary team and LLAs need to be aware of factors leading to falls. In this way, they would be able to achieve the reduction in incidence by identifying preventative strategies. Therapists might be able to intervene in environmental factors to prevent falls and provide clear and documented instructions on how to get up from a fall.
Level of evidence	V
Quality score	4
Reference	Kulkarni J, Toole C, Hirons R, Wright S, Morris J (1996) Falls in patients with lower limb amputations: prevalence and contributing factors. *Physiotherapy, 82(2)*, 130–136

Author/Year	Lachmann (1993)
Study location	UK
Study objectives	To investigate reasons for amputation of LL in patients with rheumatoid arthritis (RA)
Design	P3 – comparative retrospective case studies
Participants	*N*=11 LLAs with RA and a control group
Data collection	– Through medical records to ascertain the onset, course and drug treatment of the disease – Cause of amputation, postoperative progress, limb fitting and rehabilitation was recorded – Mobility scores were recorded using the mobility guide framework devised by Hanspal et al (1991) for people with amputations
Results	– High incidence of complicated knee arthroplasty in RA amputees – Walking training exacerbated symptoms of RA – Delayed stump healing occurred in 6 of the patients with RA compared with 2 patients in the control group – Patients with RA had poor mobility compared with the control group – Patients with RA valued being fitted with prostheses as it also assisted with transfers and they attached importance to the cosmetic effect of the prosthesis – 8 patients with RA used an electric wheelchair compared with none of the control group

Author/Year	Lachmann (1993)
Study limitations	– It is difficult to make comparisons with the control group regarding issues about quality of life and prosthesis use as the data are not available for the control group – The sample size is small
Relevance for occupational therapy	Therapists and patients need to ensure that rehabilitation and training programmes are modified to take into account the symptoms of RA. Provision of an indoor electric wheelchair is important for personal independence for patients with RA. Patients with RA valued a prosthesis to assist with transfers and for their cosmetic effect.
Level of evidence	III-2
Quality score	5
Reference	Lachman SM (1993) The mobility outcome for amputees with rheumatoid arthritis is poor. *Journal of Rheumatology, 32(12)*, 1083–1088

Author/Year	Larner et al (2003)
Study location	UK
Study objectives	To determine whether psychological tests during admission to rehabilitation ward predicts use of prostheses during the inpatient rehabilitation programme
Design	P1 – correlation study
Participants	*N*=43 LLAs (mean age 66.35 years)
Recruitment	Inpatient rehabilitation unit in the UK offering prosthetic provision
Data collection	Participants were assessed using psychological measures
Outcome measures	1. Hospital and Depression Scale (HADs) 2. Recovery Locus Scale (RLOC) 3. Kendrick Object Learning Test (KOLT)
Results	– 31 patients did not learn how to use the prosthesis. Of these, 12 were either medically unsuitable or had tried and failed to learn how to use a prosthesis – Logistic regression analysis showed that the KOLT correctly predicted outcome in 70% of cases – Anxiety, depression and recovery locus of control were not significant predictors of functional prosthetic use
Study limitations	– It is unclear from the paper how professionals' decisions were recorded regarding a patient's ability to use the prosthesis. Moreover, it is unknown which professionals were asked to record their decisions

Author/Year	Larner et al (2003)
Study limitations (cont.)	– The sample size is small and it is unclear why the KOLT was considered to be appropriate, especially in view of concerns about the reliability and validity of this test
Relevance for occupational therapy	Occupational therapists may wish to consider whether psychological tests such as the KOLT may support clinical decision-making regarding patients who may need additional support to use prosthesis.
Level of evidence	V
Quality score	4
Reference	Larner S, van Ross E, Hale C (2003) Do psychological measures predict the ability of lower limb amputees to learn how to use a prosthesis? *Clinical Rehabilitation, 17(5*), 493–498

Author/year	Legro et al (2001)
Study location	USA
Study objectives	To ascertain preferred recreational activities of people with LL amputation
Design	P3 – survey
Participants	*N*=92 people with LL amputation in the community (mean age 55 years).
Recruitment	Sample identified through 2 hospitals in Seattle, WA
Data collection	Questionnaire that included participants naming 2 favourite recreational activities important to them, and stating how well they perform the activity with or without prostheses
Results	– Ability to perform an activity was judged much higher using a prosthesis than not using a prosthesis – Activities that required high energy were more problematic to perform – Participants aged 60–83 years chose more moderate and sedentary activities than those aged 20–49 years – Amputees participated in a wide range of activities
Study limitations	– The activities named by the participants could only be generalised to the USA and to males (86% of respondents were male) – The questionnaire was lengthy, and data were missing
Relevance for occupational therapy	When considering participation in social occupations, occupational therapists need to take into account that people aged 60–83 years may participate in more sedentary activities than those aged 18–59 years.

Author/year	Legro et al (2001)
Relevance for occupational therapy (cont.)	LLAs participate in a variety of activities, and each person requires an individual assessment of their needs. Occupational therapists need to consider the impact level of the activity and prosthesis use.
Level of evidence	V
Quality score	4
Reference	Legro MW, Reiber GE, Czerniecki JM, Sangeorzan J (2001) Recreational activities of lower limb amputees with prostheses. *Journal of Rehabilitation Research and Development, 38(3)*, 319–325

Author/year	Miller and Deathe (2004)
Study location	Canada
Study objectives	– To determine whether balance confidence scores change significantly over a 2-year period of time in a cohort of people with LL amputation – To determine the longitudinal predictors of balance confidence and to examine predictors of change in balance confidence between baseline and follow-up
Design	P1 – prospective longitudinal correlational study
Participants	*N*=A convenience sample of 245 community-living unilateral LLAs, either BK or AK. Participants wore their prosthesis for at least 6 months on a daily basis before first data collection
Recruitment	Through 1 university clinic
Data collection	– Through postal questionnaires to collect data at 2 time points 3 years apart – Demographic and amputation specific variables were collected from the subjects' charts and linked with survey data
Outcome measures	1. Balance confidence: 16-item Activities-specific Balance Confidence (ABC) scale (0–100) 2. Social support: 6-item version of the Interpersonal Support Evaluation List (ISEL) (4-point scale) 3. Disability status: Postal Barthel Index 4. Level of depressive symptomatology: Centre for Epidemiologic Studies Depression Scale (CESD) (4-point Likert Scale) 5. Adaptations: Prosthetic Profile of Amputees (binary) 6. Fear of falling (yes/no) 7. Perceived health status (4 categories), medication, pain, falls: patient reports

Author/year	Miller and Deathe (2004)
Results	– 80% response rate – Difference between ABC summary scores at baseline and follow-up was not statistically significant (t(244)=–0.418, *p*=0.68) – Being younger, being male, having good perceived health, being able to ambulate without thinking (automatic walking) and without the use of a mobility device, having fewer symptoms of depression and not being afraid of falling were all independently related to having higher balance confidence (accounted for 55% of the variance in balance confidence). The strongest predictors were mobility device use, followed by age and fear of falling – Change in balance confidence between baseline and follow-up was predicted by gender (improvement in scores for women) and perceived health was very close to being significant (*p*=0.05) (accounted for 15% of the variance)
Study limitations	– Recruitment from only 1 university clinic – The reliability and validity of the used tools were not reported for this specific study – Causality cannot be suggested as this was a correlational study – Reliance on self-reports for many variables
Relevance for occupational therapy	This study suggests that asking patients about fear of falling would provide a clinician with a quick indicator of whether or not the patient is experiencing reduced balance confidence. The predictors identified are those to be considered by clinicians of patients who are more likely to have either high or low levels of balance confidence and therefore require additional treatment. Balance confidence can be associated with further reduction in function, which might be preventable or modifiable by using appropriate strategies and interventions.
Level of evidence	V
Quality score	8
Reference	Miller WC, Deathe AB (2004) A prospective study examining balance confidence among individuals with lower limb amputation. *Disability and Rehabilitation*, *26(14–15)*, 875–881

Author/year	Miller et al (2004)
Study location	Canada
Study objectives	To examine the test-retest reliability and validity of the original and modified version of the Frenchay Activities Index (FAI) in individuals with LL amputation
Design	P1 – outcome measure development – 2 weeks test-retest design

Author/year	Miller et al (2004)
Participants	*N*=84 individuals, primarily men (78.6%), mean age 56.5 years, with a unilateral transtibial (71.4%) or transfemoral amputation related to traumatic (59.5%) or vascular causes. Inclusion criteria: age ≥19 years, unilateral transtibial/transfemoral due to trauma or vascular insufficiency, having a prosthesis for at least 6 months, medically and prosthetically stable
Recruitment	Through a rehabilitation amputee programme between June and December 2001
Data collection	– All participants completed a questionnaire containing the FAI and other scales, the 2-minute walk, and timed up and go tests during a regularly scheduled clinic visit – 55 participants completed a second FAI posted to them 2 weeks later – 29 participants completed the second FAI upon return for testing related to another project
Outcome measures	1. FAI: 15-item self-report measure to assess the frequency of participation in extended ADLs. 3 further items added by the authors to represent the LLA population (18 items in total) 2. Activity-specific Balance Confidence Scale: rates balance confidence between 0% and 100% on 16 mobility activities 3. Prosthetic Evaluation Questionnaire-Mobility Scale – 13-item self-report scale to assess perceived potential for mobility over past 4 weeks (0 – cannot do activity; 10 – no problem) 4. 2-minute walk: measures distance an individual can walk at usual pace in 2 minutes 5. Timed up and go test: the time taken for an individual to stand from sitting, walk 3 metres, turn, walk back to the chair and sit down is recorded 6. Walking device aid use
Results	– Relative reliability for the FAI (intraclass correlation coefficient (ICC)=0.79) and FAI-18 (ICC=0.78) was satisfactory – Hypothesised relationships (p=0.001) between both FAI versions and the Activity-specific Balance Confidence Scale, Prosthetic Evaluation Questionnaire-Mobility Scale, 2-minute walk and timed up and go test were observed – Negative correlation between FAI and timed up and go test (r=–0.49), whereas all other tests had a positive correlation with FAI – Significant mean differences evident for amputation cause, use of mobility device, median age and median number of years as an amputee – Neither version distinguished between amputee level or gender groups
Study limitations	– Validity and reliability of outcome measures used could have been provided in more detail

Author/year	Miller et al (2004)
Study limitations (cont.)	– More information is needed to justify the need for adding 3 items to the FAI – Half of the sample completed reports at the clinic; the others were sent the reports by post – this could introduce bias – Construct/content validity not clarified – It is not clarified whether the data meet the assumptions for the use of parametric tests – Recruitment through only 1 setting
Relevance for occupational therapy	This is an outcome measure that in its original format could be used to determine the level of participation in extended ADL following rehabilitation and the prosthetic phase.
Level of evidence	V
Quality score	6
Reference	Miller WC, Deathe AB, Harris J (2004) Measurement properties of the Frenchay Activities Index among individuals with a lower limb amputation. *Clinical Rehabilitation, 18(4)*, 414–422

Author/Year	Miller et al (2001)
Study location	Canada
Study objectives	To determine in amputee patients whether having fallen in the past 12 months, fear of falling and balance confidence are important factors with respect to 3 indicators of quality of life: mobility capability, mobility performance, and participation in social activities
Design	P1 – population-based survey and chart review with correlation elements
Participants	*N*=435 community living unilateral LLAs who had their prosthesis for at least 6 months and wore it on a daily basis, and who attended 1 of 2 outpatient amputee programmes in 1998
Recruitment	2 university affiliated outpatient amputee programmes in south-western Ontario
Data collection	Through postal questionnaires and chart reviews
Outcome measures	1. Postal survey questionnaire to collect data related to mobility device use, automatism, problems with the unimpaired leg, and problems with the residual limb and prosthesis, perceived health status, co-morbidity, medication, pain and alcoholic intake 2. Modified 6-item version of Interpersonal Support Evaluation list (ISEL) to determine social support: 4-point scale, total scores range from 0 to 18 (stronger instrumental and emotional support)

Author/Year	Miller et al (2001)
Outcome measures (cont.)	3. Modified version of Barthel Index to measure activity of daily living, including 2 items on independence with donning and doffing the prosthesis 4. Center for Epidemiologic Studies-Depression Scale (CES-D) to assess depression: 4-point scale, total scores range from 0 to 60 (greater level of distress) 5. Single-question items tapping adaptation to amputation and to the prosthesis taken from the Prosthetic Profile of Amputees: 5-point scale 6. Falling in the past 12 months and fear of falling recorded as nominal data 7. 16-item Activities-Specific Balance Confidence (ABC) Scale to determine balance confidence: scale from 0% to 100% 8. 13-item self-report Prosthetic Evaluation Questionnaire mobility subscale (PEQ-MS) to evaluate the perceived mobility capability in the past 4 weeks: 11-point scale, total scores range from 0 to 10 (no problem) 9. 6-item self-report Houghton Scale to assess prosthetic use 10. Frenchay Activities Index (FAI) to measure frequency of participation in activities, 18 items (Cronbach's alpha=0.87)
Results	– 77% response rate – Post hoc analysis revealed no difference between responders and non-responders based on age, gender, years since amputation, cause or level of amputation – Falling experiences in the past 12 months were not significantly related with any outcome – Fear of falling was important in univariate relationships in all 3 outcomes, but not when balance confidence was included in multivariable modelling – Balance confidence was statistically significant with each of the outcomes and remained significant with inclusion of the covariates – Statistical interaction (balance confidence × automatism; balance confidence × medication count) in modelling mobility capability and in modelling mobility performance (balance confidence × pain + balance confidence × amputation level) – Final models accounted for 70%, 60% and 55% of the variation in mobility capability, mobility performance and social activity, respectively
Study limitations	– Recruitment done through the records of only 2 hospitals – Participants had to complete lots of assessments, which might have affected the quality of the responses – The data are determined from self-reports, which might be limited by recall bias, which might affect the accuracy of the results

Author/Year	Miller et al (2001)
Study limitations (cont.)	– By sampling only individuals who wore their prosthesis daily, generalisability is affected. By eliminating those who did not wear the prostheses daily, there is a danger of underrepresenting individuals who had more falls, a greater fear of falling, a lower balance confidence score, and perhaps lower mobility capability and performance and social activity scores – One might argue that by measuring mobility performance using the Houghton Scale, one would measure performance related to use and not to capability or skills – Causality cannot be established with this cross-sectional study, and further prospective studies would be needed
Relevance for occupational therapy	This study suggests that balance confidence was the only factor associated with mobility capability and performance and social activity in the final adjusted models. Clinicians and researchers could consider this variable in the rehabilitation of amputee patients.
Level of evidence	V
Quality score	6
Reference	Miller WC, Deathe AB, Speechley M, Koval J (2001) The influence of falling, fear of falling, and balance confidence on prosthetic mobility and social activity among individuals with a lower extremity amputation. *Archives of Physical Medicine and Rehabilitation, 82(9)*, 1238–1244

Author/year	Panesar et al (2001)
Study location	UK
Study objectives	To assess the responsiveness to change in overall function and specific areas of function between admission and discharge and between discharge and follow-up, and concurrent and predictive validity of 3 established outcome measures in relation to early LL vascular amputee rehabilitation: Functional Independence Measure (FIM), Office of Population Censuses and Surveys Scale (OPCS) and Amputee Activity Score (AAS)
Design	P1 – prospective observational study with comparative and correlational elements
Participants	*N*=34 consecutive patients (median age 67 years, range 44–85 years) admitted for rehabilitation following LL amputation for vascular disease
Recruitment	1 inpatient rehabilitation unit

Author/year	Panesar et al (2001)
Data collection	– An occupational therapist and doctor in training completed the assessments – FIM: for the inpatient stage the scores were based on specialists' observation; at follow-up, the scores were based on patients' or their carers' testimonies – Locomotor Index (LI): for 23 patients, scores were retrieved from the Scottish Physiotherapy Amputee Research Group – Differences between total scores and between subsection scores at different times were analysed using the Wilcoxon sign rank test to study the responsiveness to change – Comparisons of the total scores were made with each other, and the total scores for each measure were compared with other outcomes to assess validity
Outcome measures	1. FIM: to assess burden of care (amount of support a person requires) in inpatient rehabilitation 2. OPCS: to assess disability (functional capacity) in the community 3. AAS: to assess disability (actual level of activity a person achieves) for outpatient amputees with a prosthetic limb 4. Locomotor Index: recommended for amputee rehabilitation 5. Duration of stay 6. Discharge placement
Results	– 34 of 51 patients completed all measures – All measures showed significant change between admission and discharge ($p<0.00001$) – Only the AAS showed significant change between discharge and follow-up ($p<0.0001$) – Subsection analysis revealed expected improvements in mobility between discharge and follow-up (AAS) – During the inpatient stage, progress was detected in certain activities of daily living (bathing, dressing lower, toileting) in the FIM and OPCS (personal care, intellectual functioning) – The measures correlated with each other at the 3 assessment periods ($p<0.001$) using the Kendal coefficient of concordance. There was significant correlation of the 3 measures with the LI ($p<0.01$) – All of the measures admission scores correlated with duration of stay (OPCS $p<0.005$, AAS $p<0.006$, FIM $p<0.009$), and admission OPCS also correlated with discharge placement ($p<0.036$)
Study limitations	– Recruitment achieved through only 1 inpatient rehabilitation unit – It is not clarified how the participants were approached to participate in the study, or the relationship of the assessors with the patients – For the LI, scores for 23 patients were based on previous measurements from a different research group, which may have caused bias in measurements

Author/year	Panesar et al (2001)
Study limitations (cont.)	– Small sample size – Reliability measures were not assessed for any measure for this specific study
Relevance for occupational therapy	This study suggests that the FIM and the OPCS are suitable for the inpatient stage and are fairly straightforward to use. The AAS would appear to be the best measure at time of discharge and thereafter, but its layout makes it more awkward to use at time of admission.
Level of evidence	V
Quality score	6
Reference	Panesar BS, Morrison P, Hunter J (2001) A comparison of three measures of progress in early lower limb amputee rehabilitation. *Clinical Rehabilitation, 15(2)*, 157–171

Author/year	Pauley et al (2006)
Study location	Canada
Study objectives	To identify risk factors for falling and fall-related injury among a group of inpatients undergoing rehabilitation after major lower limb amputation
Design	P1 – retrospective cohort study without control group
Participants	*N*=1267 participants, all inpatient rehabilitation patients with an admitting diagnosis of amputation
Recruitment	Through 1 centre
Data collection	– Patients were categorised into 3 groups: (1) those who did not sustain a fall during their rehabilitation stay (non-fallers), (2) those who fell once (single fallers) and (3) those who fell ≥2 times (multiple fallers) – Review of patient clinical records and electronic databases to gather data on demographics, length of stay, nature of amputation, daily and as-needed medication use, time/location of falls, types of injuries sustained, co-morbidities, scores on the Houghton scale of prosthetic use, scores on FIM
Outcome measures	1. Houghton scale of prosthetic use 2. FIM
Results	– 260 (20.5%) of 1267 patients fell at least once – There were a total of 374 falls, 67 (17.9%) of which resulted in ≥1 injuries – Of the 374 falls, 29% occurred during transfers without assistance typically between the wheelchair and bed or toilet, 20.3% from the sitting position, 9.9% from standing, 8.3% from leaning/reaching, 3.7% during transfers with assistance, 3.7% during transfers walking, and 1.6% other

Author/year	Pauley et al (2006)
Results (cont.)	– Falls most commonly occurred in the patient's room (63%), followed by the washroom (24.1%), hallway (3.4%) and rehabilitation area (2.9%) – Adjusted odds ratio (OR) and 95% confidence intervals (CI) were calculated for factors significantly associated with falling. These factors included age ≥71 years (OR=1.40, 95% CI=1.02–1.89), length of stay 22–35 days (OR=2.97, 95% CI=1.14–7.72) or >5 weeks (OR=6.07, 95% CI=2.34–15.71), ≥4 co-morbidities (OR=1.93, 95% CI=1.09–3.41), cognitive impairment (OR=1.68, 95% CI=1.02–3.21), use of benzodiazepines (OR=2.22, 95% CI=1.24–3.96) and use of opiates (OR=5.76, 95% CI=3.29–10.09) – Factors significantly associated with fall-related injuries included bilateral amputation (OR=3.68, 95% CI=1.49–9.05) and falls during the day shift (OR=2.63, 95% CI=1.24–5.57)
Study limitations	– Only 1 setting used for data collection – Retrospective collection of data has a potential bias over missing data and accuracy on data collection – The study suggests a link between factors and falls, but does not prove causality – The study lacks information on ambulatory frequency and capacity of patients throughout their rehabilitation stay. Looking at falls without considering functional ability may be misleading – The author does not present psychometrics of the assessment tools used – No use of control group – No information on how the measurement/data collection was initially done
Relevance for occupational therapy	This study suggests that 1 in 5 patients with lower limb amputation is likely to experience at least 1 fall during inpatient rehabilitation, with 18% sustaining an injury. This study is of relevance to occupational therapy, as it indicates that further research should be conducted to develop appropriate intervention strategies or environmental adaptations to minimise risk of falling during inpatient rehabilitation.
Level of evidence	V
Quality score	6
Reference	Pauley T, Devlin M, Heslin K (2006) Falls sustained during inpatient rehabilitation after lower limb amputation: prevalence and predictors. *American Journal of Physical Medicine and Rehabilitation, 85(6)*, 521–532

Author/year	Price and Fisher (2002)
Study location	UK
Study objectives	– To explore the nature of problems presented spontaneously to the counsellor. – To evaluate the effect counselling offered in the first few weeks after amputation
Design	P3 – survey (2 studies reported)
Participants	– *N*=133 patients overall who had at least 1 counselling session – Study 1: *N*=100 patients who raised emotional problems during the counselling session within 2 years post-amputation; 58 men, 42 women, mean age 56.5 years (range 17–93 years) – Study 2: *N*=122 of 133 valid responses from participants for postal questionnaire 1, of whom 58 participants also responded in postal questionnaire 2 (44 males, 14 females, mean age 64 years, range 23–91 years, 6 had lost 1 arm, 49 had lost 1 leg, and 3 had lost 2 legs)
Recruitment	Through 1 centre
Data collection	– Study 1: analysis of the counselling records to assess which problems were most frequently reported, categorised according to main subject headings – Study 2: first round of postal questionnaires to all patients. Second round of postal questionnaires to those who had responded effectively in round 1 – Between rounds 1 and 2, a counselling session was offered to participants – 18 (31%) of these patients elected to have counselling; their follow-up responses were compared with those who declined counselling
Results	– Descriptive statistics used to analyse data – Issues raised spontaneously by 100 patients showed that the main emotional problems were depression – Patients who had been counselled were less worried about performing household tasks and housing matters than they had been at first – Patients who were not counselled expressed greater concern about these issues at a later stage – All patients at the follow-up stage expressed greater concern about employment and their prosthesis – Depression, body image and anger showed an increase in both groups: the increase for the counselled patients was larger for depression and body image and smaller for anger than those who were not counselled

Author/year	Price and Fisher (2002)
Study limitations	– The authors do not explain in detail how the data were extracted from the counselling notes or, more importantly, how the data from the surveys were analysed and formulated – Comparisons are difficult as little information is given about the patients' demographics, the length of the counselling sessions and whether the patients who refused counselling had input from other professionals
Relevance for occupational therapy	The study highlights the need to manage depression and issues around body image with amputees. It shows that occupational therapists need to collaborate with counsellors and to ensure that patients receive ongoing rehabilitation to reach their own goals within activities of daily living and work.
Level of evidence	V
Quality score	5
Reference	Price EM, Fisher K (2002) How does counselling help people with amputation? *Journal of Prosthetics and Orthotics, 14(3)*, 102–106

Author/year	Singh et al (2007)
Study location	UK
Study objectives	To ascertain the course of depressive and anxiety symptoms shortly after LL amputation after a period of inpatient rehabilitation
Design	P1 – case series pre-test/post-test study
Participants	*N*=105 successive admissions over a 1-year period with unilateral or bilateral amputation secondary to peripheral vascular disease and/or diabetes mellitus, trauma or malignancy; mean age 62.9 years
Recruitment	Inpatients admitted to a rehabilitation ward after LL amputation
Intervention	A period of rehabilitation teaching new skills and improving patient independence
Outcome measures	1. Hospital Anxiety and Depression Scale (HADS) on admission and discharge. Self-report measure; score >8 identifies significant symptoms 2. Data were also collected on time from operation to admission, time to limb-fitting, length of stay, gender, age, co-morbidities and social details

Author/year	Singh et al (2007)
Results	– At admission, 28 (26.7%) and 26 (24.8%) patients had symptoms of depression and anxiety, respectively. This dropped to 4 (3.8%) and 5 (4.8%), respectively, by time of discharge, a mean of 54.3 days later. *t*-test analysis showed that these reductions were statistically significant (depression, p<0.001; anxiety, p<0.03) – There was statistically significant correlation between patients with symptoms of both depression and anxiety ($p<0.001$) – *t*-test analysis showed that patient stay was longer in those with symptoms (depression $p<0.03$, anxiety $p<0.001$) – Pearson's correlation showed that there was no association with level of amputation, success of limb-fitting, age or gender – Pearson's correlation analysis showed that depressive symptoms were associated with presence of other medical conditions ($p<0.01$) and anxiety scores with living in isolation ($p<0.05$)
Study limitations	– HADS is a self-reporting measure, which might result in biased results – There is no clear information on how data were collected, who and how recruitment was achieved, or the rehabilitation programme – Ethical issues are not discussed – The authors did not clarify why they used Pearson's correlation instead of Spearman's test for checking associations among variables – Recruitment was done through 1 inpatient unit in the UK, whereas most amputee rehabilitation units in the UK are outpatient-based – Levels of anxiety and depression were checked again at discharge, which is a period that may be falsely reassuring to patients who gain confidence and expectations that will be drastically altered on discharge home; therefore, follow-up measurements should be checked
Relevance for occupational therapy	This study suggests that levels of both depression and anxiety resolve rapidly. It is possible that a period of rehabilitation teaching new skills and improving patient independence and mobility may modify the previous bleak outlook of amputees. This finding may be useful in the rehabilitation of the most distressed amputees.
Level of evidence	IV
Quality score	4
Reference	Singh R, Hunter J, Philip A (2007) The rapid resolution of depression and anxiety symptoms after lower limb amputation. *Clinical Rehabilitation, 21(8)*, 754–759

Author/year	White (1992)
Study location	UK
Study objectives	To investigate the supply of wheelchair stump boards by the Disablement Services Authority (DSA) and their use by therapists and patients with amputation
Design	P3 – 3-part survey
Participants	– Part 1: *N*=14 regional managers (return rate 86%) of DSA – Part 2: *N*=30 (return rate 86%) head occupational therapists – Part 3: *N*=12 older adult (return rate 100%) amputees
Data collection	– Part 1: letters to regional managers of DSA to supply information on policies and supply of stump boards – Part 2: postal questionnaires to head occupational therapists about stump board use – Part 3: postal questionnaires to older adult amputees regarding stump board use
Results	– Highlights the importance of early supply of King's stump board – All therapists used stump boards with patients having BK amputations, and 50% of therapists used them with TK amputations – Stump boards were prescribed for the prevention of contractures and the control of oedema. Comfort and protection of stump were also considered to be important factors – King's mark II most commonly used. However, there are many disadvantages: the board was too short to support below-knee stumps; when swung to the side for transfers, the board may obscure the brake lever; the board cannot be tilted to accommodate flexion contractures – No reported problems from older adults regarding problems with transfers using King's board. Older adults perceived that using a stump board had increased their comfort in a wheelchair, offered protection to the stump and encouraged them to accept their amputation – Organisational issues were identified
Study limitations	– Sample size, particularly of older adults and therapists, is small, which impacts upon the trustworthiness of the research findings – Descriptive statistics only used. Percentages are not always given from findings – The methods are not clearly described and not enough detail is given about the patient group or the postal surveys

Author/year	White (1992)
Relevance for occupational therapy	Patients reported positive benefits about using a stump board. Therapists and patients perceived that stump boards are useful for protecting the stump and for comfort. Therapists prescribed stump boards for BK amputations. Therapists prescribed stump boards to prevent contractures and the control of oedema King's mark II stump board was perceived to have many advantages, but also some negative perceptions were reported regarding its design.
Level of evidence	V
Quality score	4
Reference	White E (1992) Wheelchair stump boards and their use with lower limb amputees. *British Journal of Occupational Therapy, 55(5)*, 174–178

Appendix 6: Stakeholders

Associate Parliamentary Limb Loss Group
British Association of Chartered Physiotherapists in Amputee Rehabilitation
British Association of Prosthetists and Orthotists
British Association of Rehabilitation Medicine
College of Occupational Therapists
Diabetes Association
Douglas Bader Foundation
emPower – The Charities Consortium of Users of Prostheses, Orthoses, Wheelchairs, Electronic Assistive Technology and Rehabilitation Services
International Society of Orthotics and Prosthetics, UK
Limbless Association
Meningitis Trust
National Amputee Nurses
National Association for Amputee Rehabilitation Counsellors
Peggy & Friends

Peer reviewers

Dr Shelley Crawford, Lead Occupational Therapist, Belfast Health and Social Services Trust

Dr Avril Drummond, Associate Professor and Reader in Rehabilitation Research; and Research Occupational Therapist, University of Nottingham

Appendix 7: Consultation questionnaire

Stakeholder and peer reviewer consultation feedback form

Document title: Evidence-based guidelines for occupational therapy with people who have had lower limb amputation.

Consultation date:

Name	
Work location, e.g. Somewhere General Hospital, UK	
Role	
Email	
Preferred telephone number	
Preferred time of day to be contacted if needed	

1. Is the purpose and use of the evidence-based document adequately explained?
2. Would a new practitioner be able to pick up the document and know what it was for?
3. Is the language used accessible and user-friendly?
4. Are there any sections that are unclear or difficult to understand?
5. Is the text inclusive of all people who may use it, e.g. students, practitioners, educators, researchers?

6. Is the text generally applicable to your field of practice/your location?
7. Is the text/terminology sensitive in terms of gender, race and culture etc?
8. Do you agree with the definitions given under the glossary?
9. Are there any other words that you think should be defined in the glossary?
10. Where possible we have cross-referenced other potentially useful documents. Is this helpful?
11. If you have any other comments or suggestions, please take the opportunity to make them here (continue on a separate sheet if necessary).

Appendix 8: Glossary of terms

Assistive device	Device that assists a person to perform a particular task, for example aids, adaptations and equipment such as crutches, wheelchairs and chair-raisers
Bilateral	Two-sided, for example both legs involved
Body image	A person's perception of their physical appearance, or the interpretation of the body by the brain
Doffing/doff	Removing the prosthesis
Donning/don	Putting on the prosthesis
Inter-rater reliability	Extent to which a measure produces consistent results across different raters and over time
Liner	Covers the residual limb; used as a method of suspension
Literature search	Detailed, organised, step-by-step search for all literature available on a topic
Literature review	Summary of previous research on a topic (found from the literature search)
Methodology	Procedures carried out in the collection and analysis of the data
Outcome measure	Determination and evaluation of the results of a process, and their comparison with the intended results; for example, the measure of change from before intervention to after intervention
Prosthesis	Artificial replacement of a body part, in this case the leg
Qualitative research	Cover term for research originating from psychology, sociology and philosophy; concerned with how people come to know the world in which they live
Quantitative research	Research technique that collects numerical information; concerned with precise measurement, replicability, prediction and control
Reliability	Extent to which an instrument consistently measures what it is designed to measure
Research	Systematic process of investigation with the purpose of contributing to the body of knowledge that shapes and guides practice
Residual limb/residuum/stump	Remaining part of the amputated limb

Socket	Component of the prosthesis containing the residual limb
Suspension	Component of the prosthesis attaching it to the body
Through-knee amputation	Amputation through the knee joint
Transfemoral/above-knee amputation	Amputation through the femur bone
Transtibial/below-knee amputation	Amputation through the tibia bone
Unilateral	One-sided, for example one leg involved
Validity	Extent to which an instrument accurately measures what it is designed to measure

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Occupational therapy with people who have had lower limb amputations

Evidence-based guidelines

This publication is an evidence-based resource to support occupational therapists working with adults with acquired unilateral or bilateral lower limb amputation. It provides best practice guidance for those occupational therapists currently working in this specialism, as well as offering a useful reference document for students and newly qualified occupational therapists. It can also be used to inform service users, carers and other professionals working with people with lower limb amputation about the roles and responsibilities of the occupational therapist in this clinical area.

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