

VA/DoD CLINICAL PRACTICE GUIDELINE FOR REHABILITATION OF LOWER LIMB AMPUTATION



DEPARTMENT OF VETERANS AFFAIRS DEPARTMENT OF DEFENSE GUIDELINE SUMMARY



KEY ELEMENTS ADDRESSED BY THE GUIDELINE

1. Defines the phases of rehabilitation care and the steps included in each phase.
2. Recognizes the importance of comprehensive interdisciplinary assessment of the patient before and after surgery and understanding the physical and social support system.
3. Recognizes the importance of the decision about the appropriate level of amputation to maximize function.
4. Discusses surgical principles to optimize wound healing and shaping of the residual limb for prosthetic rehabilitation.
5. Discusses immediate postoperative dressing and management of the residual limb to maximize healing and functional outcome.
6. Identifies key elements of the rehabilitation treatment and prosthetic training across all phases of the rehabilitation process.
7. Emphasizes the importance of foot care to prevent future amputation and optimize the condition of the contralateral limb.
8. Describes the key components of medical management of medical comorbidities and prevention of complications.
9. Addresses strategies for pain management across all phases of the rehabilitation process.
10. Emphasizes the contribution of behavioral health assessment and intervention.
11. Recognizes the importance of patient education.
12. Emphasizes the need for life-long follow-up care.

AMPUTATION

VA access to full guideline: <http://www.oqp.med.va.gov/cpg/cpg.htm>
DoD access to full guideline: <http://www.qmo.amedd.army.mil/pguide.htm>

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Table 1. Amputation Rehabilitation Health-Related Outcomes

<p>Postoperative Pain</p>	<p>Reduce residual limb pain, improve effectiveness of coping, and reduce interference with daily function</p> <p>Reduce phantom limb pain</p> <p>Decrease consumption of narcotics (amount and type of pain medications throughout the acute surgical and early pre-prosthetic training phases)</p>
<p>Physical Health</p>	<p>Reduce the risk of adverse effects due to periods of prolonged immobilization:</p> <p>Decrease contractures</p> <p>Decrease incidence of pressure ulcers</p> <p>Decrease incidence of deep vein thrombosis</p> <p>Improve physical status (e.g., balance, normal range of motion especially at the hips and knees; increase strength and endurance to maximize efficient use of a prosthesis)</p>
<p>Function</p>	<p>Improve functional status (e.g., independent bed mobility, independent transfer, wheelchair mobility, gait, and safety)</p> <p>Improve ambulation (e.g., distance of ambulation, hours of prosthetic wearing, use of an assistive device, and ability to ascend/descend stairs)</p> <p>Improve quality of life/decrease activity limitation (e.g., activities of daily living [ADL], recreation, physical activity beyond ADL, community re-integration; and return to home environment)</p>
<p>Psychological Support and Well-Being</p>	<p>Reduce psychological comorbidities pre- and postoperative (e.g., depressive and anxiety disorders)</p> <p>Improve the quality of life</p> <p>Decrease the physical and mental/emotional disease burden</p>
<p>Patient Satisfaction</p>	<p>Improve satisfaction with the level of skills and levels of independence individual patients have been able to achieve</p> <p>For patients receiving prostheses, improve satisfaction with the prosthesis (comfort, functionality, and cosmesis)</p> <p>Improve satisfaction with the progress of care and status at discharge</p>
<p>Reintegration <i>(decrease participation restrictions)</i></p>	<p>Improve the discharge outcome (discharge to the least restrictive environment)</p> <p>Improve vocational outcomes</p> <p>Improve recreational participation</p> <p>Maximize community participation</p>
<p>Healthcare Utilization <i>(length of stay)</i></p>	<p>Optimize the length of rehabilitation stay</p> <p>Optimize the time from prosthetic fitting to reaching the mobility goals, regardless of the process of rehabilitation</p> <p>Increase life-long follow-up</p>



Table 2. Summary of Interventions in Rehabilitation Phases

	Preoperative	Acute Postoperative	Pre-prosthetic	Prosthetic Training	Long-Term Follow-up
1. Pain Management	<ul style="list-style-type: none"> Assess for existing pain prior to surgery and treat aggressively 	<ul style="list-style-type: none"> Assess and aggressively treat RLP and PLP (liberal narcotic use, regional anesthesia, and non-narcotic medications especially for neuropathic pain) 	<ul style="list-style-type: none"> Assess and treat RLP and PLP (transition to non-narcotic modalities including pharmacological, physical, psychological, and mechanical) 	<ul style="list-style-type: none"> Assess and treat RLP and PLP (transition to non-narcotic modalities including pharmacological, physical, psychological, and mechanical) Assess and treat associated musculoskeletal problems 	<ul style="list-style-type: none"> Reassess and adjust treatment for RLP and PLP (transition to non-narcotic modalities including pharmacological, physical, psychological, and mechanical) Assess and treat associated musculoskeletal problems
2. Medical Comorbidity Management [nutritional, cardiovascular, endocrine, neurologic, bowel & bladder, skin, musculoskeletal, infectious, & neuropsychiatric impairments]	<ul style="list-style-type: none"> Complete initial assessment of medical comorbidities and consultation as appropriate Initiate medical interventions and education as needed 	<ul style="list-style-type: none"> Complete initial assessment of medical comorbidities and consultation as appropriate, especially if not addressed preoperatively Initiate medical interventions and education as needed 	<ul style="list-style-type: none"> Continue medical interventions and education as needed 	<ul style="list-style-type: none"> Assess changes in medical comorbidities, and perform interventions and education as needed 	<ul style="list-style-type: none"> Assess changes in medical comorbidities and perform interventions and education as needed
3. Behavioral Health Psychological Cognitive Function	<ul style="list-style-type: none"> Complete psychological assessment except in urgent cases 	<ul style="list-style-type: none"> Complete psychological assessment if not done preoperatively Evaluate and address psycho-social symptoms/issues 	<ul style="list-style-type: none"> Evaluate and address psychosocial symptoms/issues 	<ul style="list-style-type: none"> Evaluate and address psychosocial symptoms/issues 	<ul style="list-style-type: none"> Evaluate and address psychosocial symptoms/issues
4. Residual Limb Management	<ul style="list-style-type: none"> Manage postoperative dressings Monitor the surgical wound for signs and symptoms of ischemia or infection Control edema and shape residual limb with the use of rigid dressings with or without an attached pylon, and/or residual limb-protector or ACE wrap Teach ACE wrap application or shrinker application Promote skin and tissue integrity with the use of a residual limb protector or rigid dressing Promote ROM and strengthening of proximal joints and muscles Consider vacuum assisted wound closure device for open wounds 	<ul style="list-style-type: none"> Continue to monitor wound healing Continue shaping and shrinkage of residual limb Teach ACE wrap application or shrinker application Teach patient care of residual limb Promote ROM and strengthening of proximal joints and muscles Instruct in desensitization exercises 	<ul style="list-style-type: none"> Optimize limb shaping & shrinkage prior to prosthetic fitting Teach donning/doffing of prosthetic system Instruct in use of shrinker or ACE wrap when out of prostheses Teach skin checks and skin hygiene Teach management of sock ply (if appropriate) Progress wear schedule Optimize pain management in order to promote mobility and restoration of function Instruct patient to observe pressure points and protect contralateral foot Monitor skin and tissue integrity with limits on wearing time and frequent skin checks in the newly fitted socket 	<ul style="list-style-type: none"> Provide contact numbers and instructions to the patient Educate regarding foot care and skin checks Educate regarding signs and symptoms of ill-fitting socket Monitor pain management programs and adjust with appropriate frequency Continue limb volume management 	

Table Key: ADL – activities of daily living;
 CV – cardiovascular;
 HEP – home exercise program;
 LE – lower extremity;
 PLP – phantom limb pain;
 RLP – residual limb pain;
 ROM – range of motion;
 UE – upper extremity

Table 2. Summary of Interventions in Rehabilitation Phases (continued)

	Preoperative	Acute Postoperative	Pre-prosthetic	Prosthetic Training	Long-Term Follow-up
5. Patient Education	<ul style="list-style-type: none"> • Pain control • Patient safety/fall precautions • Prevention of complications • Procedural/Recovery Issues <ul style="list-style-type: none"> – Level of amputation – Prosthetic options – Postoperative dressing – Sequence of amputation care – Equipment • Role of the interdisciplinary team and members • Psychosocial anticipatory guidance • Expected functional outcomes 	<ul style="list-style-type: none"> • Positioning • Rehabilitation process • Pain control • Residual limb care • Edema control • ACE wrapping • Wound care • Prosthetic timeline • Equipment needs • Coping methods • Prevention of complications • Contracture prevention • Safety 	<ul style="list-style-type: none"> • Positioning • Rehabilitation progress • Pain control • Residual limb care • Edema control • Positioning • Rehabilitation progress • Pain control • Residual limb care • Edema control • Application of shrinker • Prosthetic timeline • Equipment needs • Coping methods • Prevention of complications • Contracture prevention • Safety 	<ul style="list-style-type: none"> • Positioning • Rehabilitation process • Pain control • Residual limb care • Energy expenditure • Prosthetic education <ul style="list-style-type: none"> – Donning & doffing – Care of prosthesis – Skin integrity – Sock management • Equipment needs • Coping methods • Prevention of complications • Weight Management • Contracture prevention • Safety 	<ul style="list-style-type: none"> • Positioning • Rehabilitation process • Pain control • Residual limb care • Prosthetic timeline • Equipment needs • Coping methods • Prevention of complications • Weight management • Contracture prevention • Safety
6. Prosthetic	<ul style="list-style-type: none"> • Determine optimal residual limb length as requested by surgeon in accordance with patient goals • Patient visit / education 	<ul style="list-style-type: none"> • Limb care (see residual limb management) <ul style="list-style-type: none"> • Cast changes <ul style="list-style-type: none"> – Rigid removable dressing (RRD) – Immediate postoperative prosthesis (IPOP) – Nonweight bearing rigid dressing (NWB) • Postoperative dressing if appropriate 	<ul style="list-style-type: none"> • Initial prosthetic prescription generation if applicable 	<ul style="list-style-type: none"> • Prosthetic fabrication, fitting, alignment, and modification if applicable 	<ul style="list-style-type: none"> • Prosthetic fabrication, fitting, alignment, and modification if applicable • Schedule maintenance (components, upgrades, socket changes, specialty use devices) • Consider specialty leg such as running to meet newly established goals
7. Discharge Planning	<ul style="list-style-type: none"> • Complete initial assessment and initiate discharge planning 	<ul style="list-style-type: none"> • Complete initial assessment and initiate discharge planning (if not started preoperatively) • Contact family / support network • Develop discharge plan 	<ul style="list-style-type: none"> • Determine new needs and update discharge plan as appropriate • Arrange appropriate follow-up plans 	<ul style="list-style-type: none"> • Determine new needs and update discharge plan as appropriate • Arrange appropriate follow-up plans 	<ul style="list-style-type: none"> • Implement appropriate follow-up plans

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Table 2. Summary of Interventions in Rehabilitation Phases (continued)

	Preoperative	Acute Postoperative	Pre-prosthetic	Prosthetic Training	Long-Term Follow-up
8. Rehabilitation Interventions					
8.1 Range of Motion	<ul style="list-style-type: none"> • Treat identified contractures except in urgent cases • Assess current ROM in joints above and on contralateral side • Educate on importance of contracture prevention 	<ul style="list-style-type: none"> • Initiate passive ROM of residual and contralateral limb in flexion/extension and abduction/adduction • Position to prevent hip and knee flexion contractures when sitting or in bed • Progress to active-assistive ROM in all planes of motion for residual and contralateral limb 	<ul style="list-style-type: none"> • Maximize ROM to stretch hip and knee flexors • Advance to active ROM of residual and contralateral limbs 	<ul style="list-style-type: none"> • Continue contracture prevention with stretching program • Maximize ROM for prosthetic fit and training 	<ul style="list-style-type: none"> • Readdress ROM of LE and review home stretching program if needed
8.2 Strengthening	<ul style="list-style-type: none"> • Assess for preoperative strength deficits of UE and LE and treat (except in urgent cases) 	<ul style="list-style-type: none"> • Initiate strengthening program for major muscle groups of arms and legs 	<ul style="list-style-type: none"> • Continue therapeutic exercise program for strengthening UE and LE • Initiate trunk and core stabilization exercises 	<ul style="list-style-type: none"> • Progress therapeutic exercise program for all extremities 	<ul style="list-style-type: none"> • Educate on maintenance of strength for long-term activity
8.3 Cardiovascular	<ul style="list-style-type: none"> • Assess current CV fitness for increased energy requirement for prosthetic use • Educate regarding increased energy demand in walking with a prosthesis 	<ul style="list-style-type: none"> • Incorporate a CV component into the therapy program • Establish cardiac precautions to rehabilitation (heart rate, blood pressure, perceived exertion scales) 	<ul style="list-style-type: none"> • Advance CV aspect of program to meet needs of patient • Maintain cardiac precautions • Encourage reducing risk factors 	<ul style="list-style-type: none"> • Increase ambulation endurance to reach community distances • Maintain cardiac precautions • Encourage reducing risk factors 	<ul style="list-style-type: none"> • Establish maintenance program for endurance and fitness • Maintain cardiac precautions • Encourage reduction of cardio-vascular risk factors
8.4 Balance	<ul style="list-style-type: none"> • Assess preoperative balance, consider central and/or peripheral neurologic conditions 	<ul style="list-style-type: none"> • Initiate a balance progression: <ul style="list-style-type: none"> – Sitting balance – Sitting weight shifts – Sit to stand – Supported standing – Single limb standing balance 	<ul style="list-style-type: none"> • Progress sitting balance and single limb standing balance 	<ul style="list-style-type: none"> • Advance balance activities to equalize weight over bilateral lower extremities • Challenge balance with advanced activities 	<ul style="list-style-type: none"> • Reassess balance as it relates to gait
8.5 Mobility	<ul style="list-style-type: none"> • Assess current mobility 	<ul style="list-style-type: none"> • Establish upright tolerance • Initiate and progress to independent bed mobility, rolling, and transfers • Initiate wheelchair mobility • Progress to single limb gait in parallel bars 	<ul style="list-style-type: none"> • Progress single limb gait from parallel bars to use of assistive device • Progress to independent wheelchair mobility 	<ul style="list-style-type: none"> • Increase symmetry of weight bearing, maximize weight shift, equalize stride length, facilitate trunk rotation, teach reciprocal gait pattern • Progress out of parallel bars to use of appropriate assistive device 	<ul style="list-style-type: none"> • Address changes in medical status affecting prosthetic use (e.g., diabetes, heart disease, limb, and goals) • Reassess gait and retrain gait as necessary
8.6 Home Exercise Program	<ul style="list-style-type: none"> • Determine or obtain preoperative HEP addressing deficiencies and maximize above ROM strength, balance, etc. 		<ul style="list-style-type: none"> • Give patient supplies and instruction in exercise program for home 	<ul style="list-style-type: none"> • Advance HEP to focus on full ROM, strength and endurance 	<ul style="list-style-type: none"> • Address new physical requirements as patient goals change

Table 2. Summary of Interventions in Rehabilitation Phases (continued)

	Preoperative	Acute Postoperative	Pre-prosthetic	Prosthetic Training	Long-Term Follow-up
9. Functional Activities and ADLs	<ul style="list-style-type: none"> Assess preoperative activity level and independence to help establish goals and expectations 	<ul style="list-style-type: none"> Initiate basic ADLs such as eating, dressing, grooming, bathing, toileting Ensure patient safety 	<ul style="list-style-type: none"> Teach adaptive techniques for dressing, bathing, grooming, and toileting without a prosthesis 	<ul style="list-style-type: none"> Instruct in proper care of prosthesis and suspension system Practice transfers and ADLs in prosthesis each stand to floor/floor to stand transfers 	<ul style="list-style-type: none"> Obtain information on current ADLs Teach energy conservation principles Teach injury prevention techniques
10. Community Integration					
10.1 Vocation and Recreation	<ul style="list-style-type: none"> Obtain preoperative vocation, recreational interests, and mode of transportation 	<ul style="list-style-type: none"> Offer and promote trained peer visitation 	<ul style="list-style-type: none"> Initiate outings into the community without prosthesis Train in use of public transportation without prosthesis if appropriate Complete vocational rehabilitation evaluation Complete recreational training activities without prosthesis 	<ul style="list-style-type: none"> Initiate vocational and recreational training activities with prosthesis Progress to advanced skills such as climbing/ descending stairs, curbs, ramps and gait on uneven terrain Increase ambulation endurance to reach community distances Train in the use of public transportation with the prosthesis if appropriate 	<ul style="list-style-type: none"> Provide education on opportunities and precautions for long-term sport specific, recreation skills or resources, and prosthesis or assistive devices available. Provide counseling and contact information regarding opportunities in sports and recreation (paralympics, golfing, fishing, hunting, etc.)
10.2 Home Evaluation	<ul style="list-style-type: none"> Assess patient's home for accessibility and safety 	<ul style="list-style-type: none"> Assess patient's home for accessibility and safety if not already completed, and provide information on home modifications 	<ul style="list-style-type: none"> Assess patient's home for accessibility and safety if not already completed 	-	-
10.3 Driver's Training	-	-	<ul style="list-style-type: none"> Evaluate patient with right LE amputation for left foot accelerator if patient will drive Evaluate patient with bilateral LE amputations for hand controls if patient will drive 	<ul style="list-style-type: none"> Complete driver's training with adaptive equipment as needed Educate patient/family to comply with local state driving laws and individual insurance company policies 	-
11. Equipment	-	<ul style="list-style-type: none"> Assess living environment including stairs, wheelchair access, and bathroom accessibility Educate regarding home modifications, ramps, etc 	<ul style="list-style-type: none"> Measure and order appropriate wheelchair Provide appropriate assistive device for single limb ambulation Assess for personal equipment Assess for home adaptation and equipment 	<ul style="list-style-type: none"> Provide appropriate assistive device for ambulation with or without prosthesis 	<ul style="list-style-type: none"> Provide appropriate assistive device for ambulation with or without prosthesis Provide appropriate mobility device if ambulation is no longer an option

ACTION STATEMENTS AND RECOMMENDATIONS

CORE-1. Interdisciplinary Consultation/Assessment

Interdisciplinary team assessment and management should be employed in the care of all patients with amputations throughout all phases of care

1. Key disciplines to be consulted during the preoperative (when possible) and postoperative phases of rehabilitation care include: physiatry, surgery, physical therapy, occupational therapy, prosthetics, social work services, case management, mental health, nursing, nutrition, and recreation therapy. In addition, the following specialties should be available on a case-by-case basis: vascular surgery, plastic surgery, internal medicine, pain management, vocational therapy, and spiritual advisors.
2. The patient and family members (or other caregivers) should be an integral part of the interdisciplinary rehabilitation team.
3. Interdisciplinary rehabilitation team meetings should be conducted on a regular basis within the institution to facilitate communication and integration of a comprehensive treatment plan.
4. Outpatient amputation clinics should have interdisciplinary team participation for the periodic assessment of patients to ensure appropriate life-long care in order to preserve the quality of life, achievement of maximum function, and reduction of secondary complications.

CORE-2. Rehabilitation Treatment Plan

A comprehensive, interdisciplinary, patient-centered treatment plan should be developed early in the course of the rehabilitation process, and updated and modified throughout all phases of care.

5. Evaluations from all key team members should be included in the development of the treatment plan.
6. The treatment plan must address identified rehabilitation, medical, mental health, and surgical problems.
7. The treatment plan should identify realistic treatment goals.
8. The treatment plan should identify and address plans for discharge at the initiation of the rehabilitation process. The discharge treatment plan should include needs for specialized equipment, evaluation of and required modifications of the discharge environment, needs for home assistance, and an evaluation of the patient's ability to drive (see CORE-9: Social Environment).
9. The initial treatment plan should be established early in the rehabilitation process and updated frequently based on patient progress, emerging needs, or problems.
10. The treatment plan should indicate the anticipated next phase of rehabilitation care.

CORE-3. Pain Management

Pain assessment and treatment using pharmacological and non-pharmacological means for pain control should start in the preoperative phase and continue throughout the rehabilitation and prosthetic training.

11. Pain should be assessed at all phases of rehabilitation, preferably with a tool specific to pain assessment in patients with lower limb amputations. [Expert Opinion]
12. When assessing pain, standardized tools should be used. Examples include; Visual Analogue Scale (VAS), Short Form McGill Pain Questionnaire (SF-MPQ), and Pain Interference Scale (PIS). [B]
13. When possible, a postoperative treatment plan for pain control should be developed before surgery and be based on the preoperative pain assessment and treatment initiated. [I]
14. Measurement of the intensity of pain should be separately assessed at each site (i.e., phantom limb pain [PLP], residual limb pain [RLP], low back pain [LBP]) to achieve a thorough assessment of pain-related impairment. [B]
15. Prophylactic pain management should be considered prior to initiation of physical rehabilitation intervention. [I]
16. Narcotic analgesics should be considered in the immediate postoperative phase. [Expert Opinion]
17. Transition to a non-narcotic pharmacological regimen combined with physical, psychological, and mechanical modalities should be considered throughout the rehabilitation process. Treatment should target pain related to the residual/phantom limb and address pain in other body parts from a primary care approach. [C]
18. There is no consistent evidence to support or refute one specific type of pain control. Available modalities include: [I]
 - a. Pharmacological: anti-seizure medications (e.g., gabapentin), tricyclic antidepressants (TCA), selective serotonin re-uptake inhibitors (SSRI), non-steroidal anti-inflammatory drugs (NSAID), dextromethorathane, and long-acting narcotics
 - b. Epidural analgesia, use of patient controlled analgesia (PCA), or regional analgesia may be considered, although the benefit is unproven
 - c. Non-pharmacological: transcutaneous electrical nerve stimulation (TENS), desensitization, scar mobilization, relaxation, and biofeedback.

(See the VA/DoD Clinical Practice Guideline for the Management of Acute Postoperative Pain.)

Table 3. Pain Control in Phases of Rehabilitation

Phase	Pain Control
I. Preoperative	Assess for existing pain
II. Postoperative	Assess and aggressively treat residual and phantom limb pain
III. Pre-prosthetic	Assess for specific treatable causes of residual limb or phantom limb pain and apply specific treatments appropriate to the underlying etiology. If no specific cause can be determined treat with non-narcotic medications and other non-pharmacological, physical, psychological, and mechanical modalities
IV. Prosthetic training	Assess for specific treatable causes of residual limb or phantom limb pain and apply specific treatments appropriate to the underlying etiology. If no specific cause can be determined treat with non-narcotic medications and other non-pharmacological, physical, psychological, and mechanical modalities
V. Long-term follow-up	Assess and treat associated musculoskeletal pain that may develop with time

Table 4. Desensitization Techniques

Desensitization is believed to reduce pain in the residual limb and may help the patient with an amputation adjust to his or her new body image that now includes limb-loss:

- ★ Instruct the patient how to perform desensitization and distraction techniques to reduce the phantom pain
- ★ Tap the residual limb, to include tapping the rigid dressing
- ★ Gently massage the proximal residual limb, to include pressure points in the inguinal regions
- ★ If the phantom toes or foot feel like they are twisted or cramping, move the intact limb in a position of comfort that would mimic the improved position of the phantom side

CORE-4. Medical Care

Comprehensive medical assessment and the management of individuals undergoing amputation are imperative throughout the continuum of care. Optimizing medical, surgical, and rehabilitation outcomes requires a holistic approach to patient care.

19. Medical status including laboratory studies should be assessed and monitored as indicated to screen for infection, anemia, electrolyte imbalances, nutrition, and liver and kidney diseases.
20. The comprehensive medical care throughout the phases of rehabilitation of patient with amputation should address:
 - a. Cardiac and pulmonary function
 - b. Assessment and monitoring for infection using laboratory and radiographic studies
 - c. Assessment and management of diabetes and its complications to improve outcome and reduce the risk for complication and further amputation
 - d. Assessment and management of peripheral vascular diseases to improve outcome and prevent complications such as claudication and residual limb ischemia
 - e. Prevention of secondary complications such as venous thrombosis, embolism, heterotopic bone formation, contracture, and decubitus ulcers is necessary
 - f. Attention to bone health.
21. Modifiable health risk factors should be assessed and education and treatment strategies to reduce their impact on morbidity and mortality should be implemented (e.g., smoking cessation, body weight management, diabetes management, hypertension control, substance abuse).
22. In special populations, such as traumatic amputation, upper motor neuron lesions and burns, the risk of heterotopic ossification (HO) should be recognized. Appropriate intervention for prevention of HO includes radiation, nonsteroidal medications, and bisphosphonate medications.

CORE-5. Cognitive Assessment

A cognitive/neuropsychological assessment should be conducted prior to the operation, if possible, to assist in the process of determining the patient's ability to learn, adapt to, and utilize a prosthesis following surgery as well as the long-term abilities for autonomous and independent living. The assessment may be repeated after the surgery if indicated by the patient's function or the response to treatment.

23. A cognitive battery of testing should include:
 - a. Intellectual functioning and attention/concentration along with working memory and speed of processing
 - b. Executive functioning
 - c. Learning and memory: short- and long-term, auditory and visual, recall, and recognition
 - d. Self (and possibly family) reported cognition and emotional functioning.
24. Testing should be conducted by appropriately trained and certified individuals.
25. Evaluations should include standardized tests, self-reporting, behavioral descriptions and subjective estimations from family and others, careful history taking, recognition of other possible comorbid factors (e.g., depression, dementia), and acknowledgment of the limitations and sources of variability and error in measuring psychometric performance.
26. Neuropsychological referrals should be specific and guided by preliminary mental status assessment by the rehabilitation team. Neuropsychological assessments should focus on the referring question and not provide specific medical advice.

CORE-6. The Residual Limb

The residual limb should be appropriately managed to prepare for prosthetic training and to enhance functional outcomes.

27. Limb volume management is a critical issue throughout the lifespan of the individual.
 - a. Apply an external compressive device to optimize the limb volume (postoperative rigid dressing, ACE wrap, shrinker, liner).
 - b. Optimize overall fluid management by controlling congestive heart failure, renal failure, or dialysis treatments.
 - c. Encourage the patient to maintain a stable body weight.
 - d. Encourage the patient to wear an external compressive device when the prosthesis is not worn, especially during the early postoperative and prosthetic phases.
 - e. Discourage dependent positioning of the residual limb in a wheelchair.
28. The patient should be educated about care and management of the residual limb including:
 - a. Proper application of external compressive devices (ACE wrap, shrinker)
 - b. Proper donning and doffing technique for the prosthesis
 - c. Adjustment of prosthetic sock ply for limb volume change, if appropriate
 - d. Proper hygiene of the residual limb and prosthesis
 - e. Daily inspection of the residual limb for signs of abnormal pressure distribution
 - f. Training with a long handled mirror to assist in the inspection of the residual limb.

29. Interventions to prevent contracture at both the hip and the knee should be considered on an ongoing basis, especially in the early postoperative period and when the patient is an intermittent or marginal ambulator.
 - a. Rigid dressing and knee immobilizers may be considered for the patient with a transtibial amputation to prevent knee flexion contractures. A number of early postoperative dressing strategies help to maintain range of motion of the knee.
 - b. Initiate exercise programs to strengthen the quadriceps and gluteal muscles, along with active and passive range of motion exercises.
 - c. Initiate proper positioning and begin a prone lying program. Do not place pillows under the knee to increase comfort as it increases the chance of contractures forming.
 - d. Encourage ambulation and weight bearing through the prosthesis.
30. Bony overgrowth may become painful at any stage of its growth and cause significant pain and limitations in prosthetic fittings.
 - a. Use preventive measures where necessary in a high-risk population (radiation, bisphosphonates, NSAIDs).
 - b. Due to reductions in soft tissue volume, the relative prominence of bony overgrowth may increase, resulting in the need for prosthetic modifications or replacement.
 - c. Associated pain may be treated with prosthetic modifications and/or local injections.
 - d. Surgical excision and possible limb revision is a last resort.
31. Limb protection should be emphasized especially during the early phases when the risk of falls is greater.
 - a. The patient should be instructed to wear an external protective device on the residual limb.
 - b. An external protective device may include a postoperative rigid dressing or a prefabricated rigid dressing.
32. Skin and soft tissue should be monitored on a regular basis to detect any mechanical skin injury related to abnormal pressure distribution or signs and symptoms of infection.
 - a. Abnormal pressure distribution should be prevented by ensuring that the prosthesis is properly aligned and the prosthetic socket fit is adequate and it should be modified as needed.
 - b. Superficial infection (fungal, folliculitis, cellulites), or deep infection (osteomyelitis) should be treated early and aggressively to prevent deterioration of the residual limb condition that will have serious impact on the functional mobility of the patient.
33. Patients should be advised that a stable body weight is critical to long-term success.

Table 5. Residual Limb Management in Phases of Care

I. Preoperative	<ul style="list-style-type: none"> • Desensitization exercises, skin hygiene, and description of types of pain • Explain and differentiate between residual limb pain, phantom pain, and phantom sensation
II. Postoperative	<ul style="list-style-type: none"> • Donning/doffing of ACE wrap or shrinker if appropriate • Desensitization exercises, skin hygiene, and description of types of pain
III. Pre-prosthetic	<ul style="list-style-type: none"> • Care of residual limb
IV. Prosthetic training	<ul style="list-style-type: none"> • Donning/doffing of prosthetic system • Use of shrinker when out of the prosthesis • Skin checks and skin hygiene • Management of sock ply if appropriate • Observe pressure points and protect contralateral foot
V. Long-term follow-up	<ul style="list-style-type: none"> • Foot care and skin checks

CORE-7. The Contralateral Limb

Comprehensive evaluation of the neurological, musculoskeletal, soft tissue and vascular status of the contralateral limb is necessary to initiate educational programs and establish specialized footwear or orthotic needs.

34. Comprehensive assessment of the contralateral limb should include:
 - a. Evaluating for the presence and severity of a sensory deficit
 - b. Quantifying the presence and extent of a motor deficit
 - c. Determining the arterial perfusion status of the extremity
 - d. Evaluating the presence of deformity
 - e. Evaluating for signs of acute or chronic abnormal pressure loading, including tissue redness, ulceration or callosity
 - f. Inspecting the patient's footwear, including wear pattern.
35. The patient and/or caregiver should be educated about strategies to protect the skin integrity of the foot .
36. Appropriate foot care as indicated should provide:
 - a. Local foot care for callosities and nail care management by a health professional, especially in the context of sensory impairment or poor vision
 - b. Footwear that can be adapted to meet a patient's mobility needs, and that can accommodate a foot deformity and/or an orthotic device
 - c. Orthoses to optimize the pressure distribution on the foot or to substitute for muscle weakness or spasticity.
37. Regular follow-up to evaluate the adequacy of the footwear or orthosis should be established.
38. Specialized foot protection devices and/or mattresses should be considered for patients that are confined to bed or spend a considerable amount of time in the recumbent position.

CORE-8. Behavioral Health Assessment and Treatment

Complete a psychological assessment in the preoperative phase, if possible. Evaluate the psychosocial status and treat problems throughout all phases of rehabilitation.

39. Psychosocial functioning should be assessed at each phase of amputation management and rehabilitation. Assessment should focus on current and past symptoms of psychopathology, particularly depression, anxiety, and post-traumatic stress symptoms. [B]
40. Interventions need to focus particularly on depressive, anxiety and post-traumatic stress disorder (PTSD) symptoms, using empirically supported medical and psychotherapeutic treatments for depression and PTSD. [B] Refer to the VA/DoD Clinical Practice Guidelines on Major Depressive Disorder in Adults and Post-Traumatic Stress Disorder for management of these common problems.
41. Effective coping goals/strategies should be developed during psychotherapeutic or counseling interventions. [B]
42. During the assessment, examples of effective and ineffective coping strategies should be discussed with the patient, such as enlisting sufficient social support versus social withdrawal and disengagement and problem solving difficulties versus helplessness and passivity. [B]
43. Specific structured interventions for problems such as depression, anxiety, sexual difficulties, substance abuse or drug overuse, and pain should be considered. [B]

44. Interventions may operate through individual, couple, family, or group therapy modalities. [B]
45. Significant others should be included in psychotherapeutic and/or psychoeducational interventions as needed [B]
46. The use of validated tools for assessment should be considered; some examples may include:
 - a. Prosthesis Evaluation Questionnaire (PEQ) for psychometric assessment is a self-report questionnaire comprising 10 sub-scales: 4 prosthetic function scales, 2 mobility scales, 3 psychosocial scales, and 1 well-being scale.
 - b. Trinity Amputation and Prosthetic Experience Scales (TAPES) for psychosocial evaluation is also a self-report quality of life questionnaire with nine sub-scales; 3 psychosocial scales, 3 activity restriction scales, and 3 satisfaction subscales. TAPES has the advantage of being able to predict residual limb pain, phantom limb pain, and the extent of prosthetic use.
 - c. The Hospital Anxiety and Depression Scale (HAD) is a 14-item highly sensitive brief screening for anxiety and depression, commonly used in hospital settings.
 - d. The SF-36 Health Survey measures the degree of burden or dysfunction a medical condition has in a patient's life.
47. Psychological components to multidisciplinary approaches to chronic pain management should be included as needed. [B]

CORE-9. Social Environment (Support)

Identify the social and physical support system that will be available to the patient during the rehabilitation process and help cope with the challenges of limb loss.

48. A baseline assessment should be obtained and continuously updated throughout the rehabilitation phases. The assessment should include information about the existing social environment and support system:

Interpersonal Social Environment

- a. Family and extended family
- b. Community - including workplace, employers/employees and co-workers
- c. Spiritual, religious, and cultural support
- d. Peer support system (see Core-10: Peer Support Interventions)

Physical Environment

- e. Home environment – hazards and need for modification to address safety and accessibility
- f. Workplace
- g. Community – geographical location, distance from resources and services, and access to resources

Economic Environment

- h. Sources of income and/or financial support.

CORE-10. Peer Support Interventions

Peer support should be considered, if available, throughout the course of amputation and rehabilitation.

49. Peer visitation strategies may be considered throughout the rehabilitation cycle, particularly early when anxiety and adjustment problems may be most pronounced. [C]
50. Peer support interventions may be a particularly useful aspect of pre-procedural patient education interventions. [C]
51. Peer visitation volunteers should receive structured training prior to performing peer visitation services. The Amputee Coalition of America (ACA) provides a reputable training certification program. [C]
52. Patients should be referred to peer support groups or similar resources, if available. [I]

CORE-11. Patient Education

Patients scheduled for amputation should receive in-depth education regarding the procedure itself, and the various components of postoperative care and rehabilitation activities that will occur. A combination of information-giving and coping skills training should continue through all phases of the rehabilitation care.

53. Pre-procedural educational interventions should be provided to the patient before amputation, if possible, in order to decrease his/her fear, anxiety, and distress and to improve his/her post-procedural recovery. [B]
54. All members of the rehabilitation team should be involved in patient education as part of their interaction with the patient. [C]
55. Pre-procedural educational interventions should generally include information and a description of the specific procedures and events the patient will experience at the various phases of treatments, and continue throughout the continuum of care. [B]
56. Educational interventions should also include sensory information, that is a description of sensations and other feelings/symptoms the patient may experience at various stages during and following the procedure. [B]
57. Educational interventions may also include coping skills training; cognitive behavioral coping strategies are likely to be the most effective strategies. [B]
58. General supportive counseling (e.g., eliciting and validating the patient's anxieties, fears, and concerns) may also be helpful. Open-ended questioning, active listening techniques, eliciting anticipation of future stressors, and eliciting and encouraging utilization of the patient's social support resources are important strategies irrespective of whether information-giving or coping skills training interventions are being used. [C]

Table 6. Patient Education Minimum Standards

Patient Education Regarding Rehabilitation Techniques*

Healthcare organizations should:

- ★ Provide information and educate on skills that improve the patient’s health, toward both recovery and overall well-being
- ★ Assess a patient prior to teaching and construct a plan that’s based on the patient’s needs
- ★ Demonstrate the correct use of medical equipment to the patient
- ★ Provide information on potential food and drug interactions specific to the illness or condition
- ★ Counsel on nutrition intervention and modified diets
- ★ Inform the patient about further treatment and rehabilitation techniques
- ★ Provide the patient’s background to home healthcare specialists and other medical care providers the patient may see during follow-up

*The Joint Commission’s minimum standards

An educational timeline for patients undergoing a lower limb amputation should include the following content:

Table 7. Patient Education Summary Table

Education Content	Learning assessment	Pain control	Patient safety/falls	Complication prevention	Incentive spirometry	Tobacco cessation	Bowel/bladder management	Deep vein thrombosis prevention	Contracture prevention	Pressure ulcer reduction	Edema control	Sequence of amputation care	Prosthetic options	Wound care/scar management	Role of interdisciplinary team members	Peer support	Protection of contralateral limb	Signs/symptoms of infection	Care of prosthesis	Donning/doffing prosthesis	Skin hygiene
Preoperative	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Postoperative		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x
Pre-prosthetic rehabilitation		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
Prosthetic training		x	x	x		x					x		x	x	x	x	x	x	x	x	x

CORE-12. Learning Assessment

Obtain a learning assessment of the patient and family.

59. Prior to the learning assessment, the health professional should assess the patient with a lower limb amputation for core concerns, potential fears, support limitations, and cultural history.
60. The best time to begin a learning assessment is determined on a case-by-case basis but often begins with the initial contact with the patient who has had a lower limb amputation and their family.
61. The learning assessment should use open-ended questions to obtain the following and additional, information:
 - i. Patient/family's ability to cope with the health status, plan of care, prognosis, and outcome
 - j. Patient/family needs, concerns, roles, and responsibilities
 - k. Specific learning needs (knowledge, attitudes, skills) and educational level
 - l. Barriers to learning, including physical and/or cognitive limitations, language, emotional or psychological, and financial difficulties
 - m. Readiness to learn
 - n. Patient preferences regarding learning methods.

CORE-13. Physical Rehabilitation

The aim of rehabilitation is to achieve maximum independence and function. The individual's rehabilitation program takes into account their pre-amputation lifestyle, expectations, and medical limitations. The level of amputation, physical and psychological presentation, and social environment influence the expected level of functional independence. The rehabilitation team progresses the patient through a program based on continuous assessment and evaluation. Through regular assessment, the team should identify when the individual has achieved optimum function with or without the prosthesis, facilitating discharge to a maintenance program, and continue to follow-up as needed. The following areas of interventions include a suggested step approach, indicating the key elements in each area as they progress throughout the rehabilitation process.

Physical rehabilitation includes assessments and activities that improve the baseline status of the musculoskeletal system and include range of motion (ROM), strengthening, cardiovascular fitness, and balance.

CORE-13.1 Range of Motion

Continuously monitor and maximize the range of motion to enhance postoperative outcomes.

62. The residual limb should always be properly positioned to avoid contractures that could interfere with future prosthetic fit and ambulation. In a transtibial amputation, the residual limb should be placed in knee extension when in bed. For a transfemoral or transtibial amputation, the residual limb should be kept in neutral alignment for adduction/abduction and internal/external rotation. At no time should a pillow be placed under the residual limb.
63. A prone lying program should be initiated with all patients who have a lower extremity amputation to avoid hip flexion contractures. Progressively advance the length of time from the patient's tolerance to 30 minutes twice per day if possible.

CORE-13.2 Strengthening

Throughout the continuum of care, assess and improve the strength of all muscle groups that impact use of a prosthesis and overall functional capacity

64. A strengthening program should be initiated for the major muscle groups of the upper extremities, trunk, and the residual and contralateral limbs in order to maximize functional use of the prosthesis and prevent the development of comorbidities such as low back pain.
65. Both open and closed-chain exercises and isokinetic and progressive resistance exercises should be included in the strengthening program.
66. Specific muscle groups to strengthen include hip extensors, hip adductors, hip abductors, abdominal musculature, back musculature, knee extensors, rotator cuff, and elbow extension.
67. A home exercise program should be designed and tailored to a patient's individual needs for use on a long-term basis.

CORE-13.3 Cardiovascular Fitness and Endurance

Increase cardiovascular fitness and endurance to maximize the efficiency of gait, both with or without a prosthesis.

68. A tailored cardiovascular training program should be initiated as soon as possible in the postoperative phase and continue throughout the rehabilitation process.
69. The cardiovascular program should include upper body ergometry regardless of the ability to use a lower extremity prosthesis.
70. Gait training should progress from use of an appropriate assistive device and increase to community distances as cardiovascular fitness improves.
71. Consultation to a cardiac rehabilitation program should be considered, particularly in patients with known cardiopulmonary disease or dysvascular amputation.
72. Higher level sporting activities should be pursued to supplement routine cardiovascular fitness in younger individuals with traumatic amputation.

CORE-13.4 Balance

Initiate, measure, and adjust a balance re-training program to minimize a patient's risk of falling and increase the efficiency of gait, both with and without a prosthesis.

73. Sitting and standing balance should be assessed throughout the rehabilitation process using standardized assessment tools such as the Berg or Tinetti Balance Assessment.
74. Interventions should start with sitting balance and progress to sitting weight shifts, then sit to stand, supported standing, single-limb balance, and dynamic balance training.
75. Balance should be challenged with a variety of activities such as weight shifting on a soft surface, rocker board, ball rolling under the sound foot, and step-ups.

CORE-14. Functional Rehabilitation

Functional rehabilitation includes assessment and activities, such as activities of daily living (ADL), transfers, and mobility, which are performed to achieve a functional goal.

CORE-14.1 Functional Activities of Daily Living

Interventions to improve functional activities of daily living (ADL) should be initiated, measured and adjusted as needed during the postoperative phases.

76. The self-care component of functional activities of daily living (ADL) should include dressing, feeding, grooming, bathing, and toileting, with and without a prosthesis.
77. The transfers component of functional activities of daily living (ADL) should include the following, with and without a prosthesis:
 - a. sit to stand
 - b. bed to chair
 - c. chair to toilet
 - d. chair to tub
 - e. vehicle transfers
 - f. floor transfers.
78. Patients should be educated in strategies to prevent falls and improve safety.

CORE-14.2 Mobility and Equipment

Initiate mobility training to optimize the patient's ability to move from one location to another by means of adaptive equipment, assistive devices, and vehicle modifications.

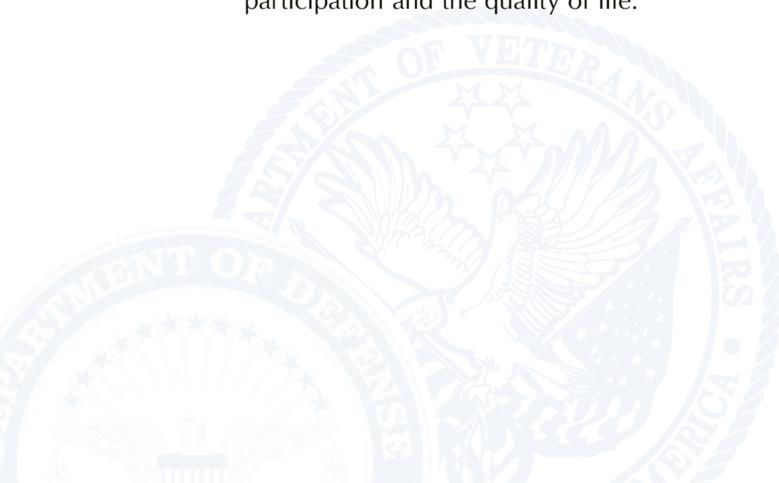
79. Standardized measures of mobility can assist with outcome measurement and determine additional social support and equipment needs. Consider utilizing one or more of the following measures, but note that they may not be helpful in the young active individual with traumatic amputation (see Table 8. *Advantages and Disadvantages of Recommended Assessment Tools*):
 - a. Amputee Mobility Predictor (AMP)
 - b. Functional Independence Measure (FIM)
 - c. Two-Minute Walk Test
 - d. Timed Up and Go Test (TUG)
 - e. Upper Extremity Ergometry.
80. The training program to improve mobility should include both the physical components of strengthening and cardiovascular fitness and practicing the actual activity.
81. Assistive devices (e.g., combination of canes, crutches, walkers, and manual and/or powered mobility) that the patient has demonstrated to be able to use safely and which improve the ability to navigate different environments should be prescribed.
82. A wheelchair should be prescribed for individuals with amputations who may experience times when they can not use their prosthesis(es) and/or assistive devices for mobility.
83. Advanced wheelchair mobility skills should be taught to navigate such environments such as stairs, escalators, curbs, uneven terrain, and soft surfaces (grass, sand, gravel).
84. Vehicle modifications should be prescribed for those who can not safely drive a vehicle due to right lower limb amputation, or left lower limb amputation with comorbidities to the right lower limb, or any individual with bilateral lower extremity amputations.

Table 8. Advantages and Disadvantages of Recommended Assessment Tools

Amputee Mobility Predictor (AMP)	<ul style="list-style-type: none"> Valid both with and without a prosthesis High inter- and intra-rater reliability Correlates with the 6-Minute Walk as a predictor of prosthetic success Negative correlation with age and comorbidity Can be performed in 15 minutes or less in the clinic Requires little equipment 	<ul style="list-style-type: none"> None found in the literature review
Functional Independence Measure (FIM)	<ul style="list-style-type: none"> Easily performed during evaluation and at intervals during rehabilitation Good intra- and inter-rater reliability Good predictor of continued prosthetic use after discharge 	<ul style="list-style-type: none"> Does not act as a predictor of prosthetic success Does not fully capture functional changes with progression of therapy Highest functional level that can be attained with a prosthesis is 6 out of 7 regardless of the patient's functional abilities (ceiling effect)
Two-Minute Walk	<ul style="list-style-type: none"> Easily performed in the clinic High intra- and inter-rater reliability Responsive to change with continued rehabilitation Correlates with other measures of physical function (6-Minute Walk, 12-Minute Walk) 	<ul style="list-style-type: none"> Increases in distance may simply be related to external cues rather than a response to therapy
Timed Up and Go (TUG)	<ul style="list-style-type: none"> Easily performed in the clinic High intra- and inter-rater reliability 	<ul style="list-style-type: none"> No studies found regarding predictive validity No studies found regard TUG in gait with a single limb and assistive device One study indicates that the TUG is dependent on the chair type (arms and height)
Upper Extremity Ergometry	<ul style="list-style-type: none"> Has been shown to be an effective way to determine safe maximal heart rates for exercise and prognostic information concerning the functional outcome after rehabilitation Patients that achieve a maximum work capacity of 45 watts per minute were able to ambulate with a prosthesis without an assistive device; those that achieve a maximum work capacity of 60 watts per minute were able to ambulate outdoors with their prosthesis Easy to administer and inexpensive 	<ul style="list-style-type: none"> Severe cardiac disease is prevalent in patients with dysvascular amputations Patients should be monitored for arrhythmias and ST-segment depression throughout testing or exercise programs

Whatever measure is used, some important principles emerge, including:

- ★ Patients should always be assessed on what they actually do, not what they can do.
- ★ Outcome measures should be selective to reflect rehabilitation goals.
- ★ Although measures of mobility and independence may be useful in evaluating immediate outcomes of prosthetic rehabilitation, longer term evaluation is required using measures that focus on restriction in participation and the quality of life.



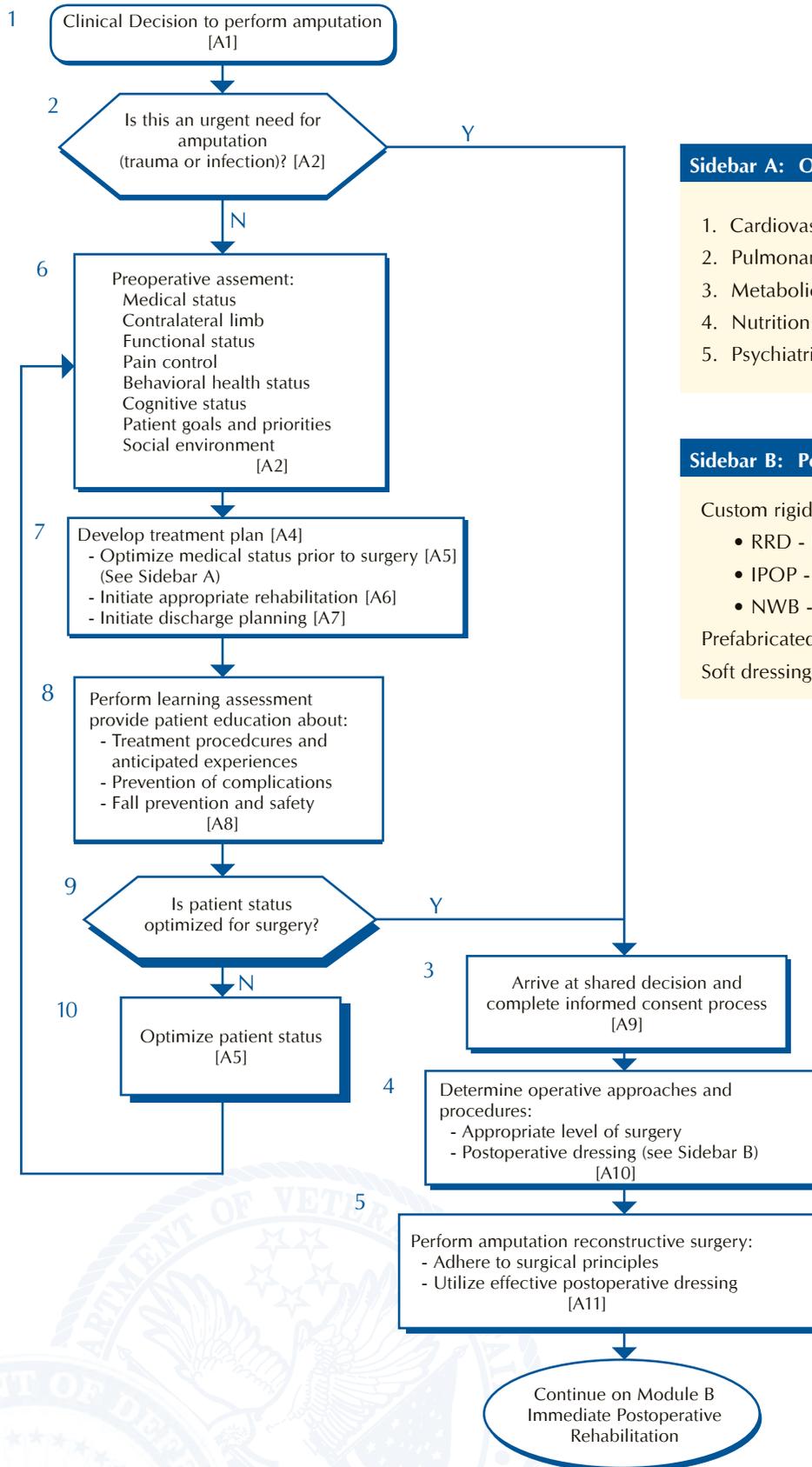
CORE-14.3 Community Reintegration

Establish goals for community reintegration and initiate, measure, and adjust interventions such as driver's training and vocational rehabilitation during the postoperative phases

85. Training in the use of public transportation, with and without a prosthesis, should be provided, if appropriate.
86. Endurance should be increased with ambulation to community distances if appropriate.
87. Information on organizations with opportunities for adaptive recreational activities should be provided.
88. Driver's training and vehicle modifications should be pursued, if not already done. Any patient with a right lower extremity amputation should be evaluated and trained on a left foot accelerator. A patient with bilateral lower extremities amputation should be evaluated and trained in hand controls.
89. The patient's home should be evaluated for accessibility and information on home modifications should be provided.
90. Patient's worksite should be evaluated for the potential need for accommodations to facilitate return to the work setting.
91. Patients should be provided with a list of resources for information regarding amputations, support groups, and accessibility for people with disabilities.



MODULE A PREOPERATIVE ASSESSMENT AND MANAGEMENT



Sidebar A: Optimizing Medical Comorbidity

1. Cardiovascular (including DVT prophylaxis)
2. Pulmonary
3. Metabolic
4. Nutrition
5. Psychiatric Illness

Sidebar B: Postoperative Dressing

- Custom rigid dressing
- RRD - Rigid removable dressing
 - IPOP - Immediate postoperative prosthesis
 - NWB - Non-weight bearing rigid dressing
- Prefabricated dressing
- Soft dressing

MODULE A

PREOPERATIVE ASSESSMENT AND MANAGEMENT

ACTION STATEMENTS AND RECOMMENDATIONS

A-1. Clinical Decision to Perform Amputation

Every care should be taken to assure that the amputation is done only when clinically indicated.

1. Amputation should only be considered if the limb is non-viable (gangrenous or grossly ischemic, dangerous malignancy or infection), or non-functional).

A-2. Is This an Urgent Need for Amputation (Trauma or Infection)?

Assess the degree of urgency in order to put the appropriate steps in motion to optimize the patient's outcome.

2. Consider urgent surgery in severe life-threatening situations including infection and trauma.

A-3. Preoperative Assessment

Obtain a comprehensive interdisciplinary baseline assessment of the patient's status.

3. A thorough medical assessment should be completed preoperatively to evaluate the patient's physical condition, nutrition, infection, neuropsychiatric impairment, and bowel and bladder function as well as a review of systems (cardiovascular, respiratory, endocrine, skin, neurological, and musculoskeletal).
4. Condition and function of the contralateral limb should be assessed including (see *CORE-7: Contralateral Limb*):
 - a. Quantify the severity of the sensory deficit
 - b. Observe for the presence of deformity
 - c. Observe for signs of abnormal soft tissue loading
 - d. Limb perfusion
 - d. Education, specialized heel protectors, or specialized mattresses should be used to assure that the patient does not develop ulceration on the remaining limb.
5. Baseline function should be evaluated prior to amputation surgery (see *CORE-13: Physical Rehabilitation and CORE-14: Functional Rehabilitation*):
 - a. Range of motion (ROM)
 - b. Strength
 - c. Exercise endurance
 - d. Balance
 - e. Mobility
 - f. Activities of daily living (ADL).
6. Pain control measures should be initiated in the preoperative period to optimize the postoperative rehabilitation (see *CORE-3: Pain Management*).
7. A psychological assessment and preparation strategies should be completed in the preoperative phase whenever possible (see *CORE-8: Behavioral Health Assessment and Treatment*).

8. A preoperative cognitive assessment should be conducted to assist in the process of determining the patient's ability to learn, adapt to, and utilize a prosthesis following surgery as well as the ability to participate in rehabilitation and to maximize functional independence and community reintegration (see *CORE-5: Cognitive Assessment*).
9. Patient's goals and priorities should be assessed prior to amputation surgery.
10. Assess patient's social environment, home and community environments, and support system (see *CORE-9: Social Environment*).

A-4. Develop the Treatment Plan

Initiate appropriate rehabilitation to maintain function and prevent secondary complications.

11. A unified, cohesive, and comprehensive treatment plan should be developed prior to surgery that includes specific interventions for treatment by the interdisciplinary rehabilitation team members and updated throughout the full continuum of care. (see *CORE 2: Rehabilitation Treatment Plan*).

A-5. Optimize Medical Status Prior to Surgery

Optimize the patient's medical status before surgery.

12. When possible, every effort should be made to correct controllable factors prior to undertaking surgical amputation, including: (see *CORE-4: Medical Care*)
 - a. Cardiovascular
 - b. Pulmonary
 - c. Metabolic
 - d. Nutrition
 - e. Psychiatric illness
 - f. Risk factor reduction (including cardiovascular risk and diabetes mellitus risk reduction)

A-6. Initiate Appropriate Rehabilitation Interventions

Maximize the patient's physical function before surgery.

13. Initiate appropriate rehabilitation interventions while the patient is awaiting amputation surgery, to maintain current function and prevent secondary complications (see *CORE-13: Physical Rehabilitation*; *CORE-14: Functional Rehabilitation*).



A-7. Initiate Discharge Planning

Establish a treatment plan for the rehabilitation process.

14. A discharge plan should be initiated early in the pre-operative period and updated throughout the rehabilitation process to address:
 - a. Location of rehabilitation
 - b. Social support/financial resources
 - c. Home environment assessment
 - d. Transportation
 - e. Vocational considerations
 - f. Durable medical equipment (DME).

A-8. Perform Learning Assessment and Provide Patient Education

Pre-procedural patient education should include learning assessment, and a combination of information presentation, and discussing of coping strategies.

15. A learning assessment and identification of barriers to learning or communication should be performed preoperatively.
16. Patients scheduled for amputation should receive education regarding the procedure and the various components of postoperative care and rehabilitation activities, including (see *CORE-11: Patient Education*):
 - a. Pain control
 - b. Patient safety/fall precautions
 - c. Prevention of complications
 - d. Procedural/recovery issues:
 - Level of amputation
 - Prosthetic options
 - Postoperative dressing
 - Sequence of amputation care
 - Equipment
 - e. Expectation for functional outcome
 - f. Potential psychosocial issues
 - g. Role of the rehabilitation team members.

A-9. Arrive at a Shared Decision and Complete the Informed Consent Process

Informed consent must be obtained whenever possible prior to amputation.

17. Based on a clinical evaluation by the treating surgeon with input from the interdisciplinary rehabilitation team, the patient (or person giving consent) should be presented with all viable treatment options and the risks and benefits for the following:
 - a. Level of amputation
 - b. Management of postoperative wound
 - c. Type of postoperative prosthesis.
18. The patient (or person giving consent) should be encouraged to ask questions. The surgeon should make every effort to answer those questions to the patient's satisfaction. The patient (or person giving consent) should be able to verbalize a good understanding of their treatment options at the end of the process.

19. Involvement of the patient's family and/or significant others should be encouraged.
20. The patient (or person giving consent) must agree to the surgical and immediate post-surgical treatment plan.
21. The informed consent process should be in compliance with institutional policy (satisfying The Joint Commission's requirements).

A-10. Determine Operative and Postoperative Approaches and Procedures

A-10.1 Appropriate Level of Surgery

Determine the appropriate level of amputation prior to surgery.

22. The choice of amputation level should take in consideration the risks and benefits. The factors in the risk-benefit assessment include the patient's goals and priorities, the patient's general condition and risk of additional surgeries, the potential for healing of the limb, and the predicted probable functional outcome.
23. Optimal residual limb length:
 - a. Transtibial
 - Optimum – length that allows space for the prosthetic foot and sufficient muscle padding over the residual limb – typically mid-tibia
 - Minimum – junction of middle third and proximal third of tibia just below the flair of the tibial plateau to allow sufficient tibia for weight-bearing.
 - b. Transfemoral
 - Optimum – length that allows space for an uncompromised knee system – typically just above the condylar flair
 - Minimum – junction of middle third and proximal third (below the level of the lesser trochanter) to allow sufficient femur length/lever arm to operate the prosthesis.
 - c. If there is uncertainty of the optimal length of the residual limb, preoperative consultation with an experienced physiatrist or prosthetist should be considered.
24. The potential for wound healing should be determined. The following may be considered: [I]
 - a. Laboratory studies:
 - C-reactive protein to check for infection
 - Hemoglobin to check for treatable anemia to ensure an appropriate oxygenation level necessary for wound healing
 - Absolute lymphocyte count to check for immune deficiency and/or infection
 - Serum albumin/prealbumin level to check for malnutrition and diminished ability to heal the wound.
 - b. Imaging studies:
 - Anteroposterior and lateral radiography of the involved extremity
 - CT scanning and MRI as necessary
 - Doppler ultrasonography to measure arterial pressure.
 - c. Additional tests:
 - Ischemic index (II) is the ratio of Doppler pressure at the level being tested to the brachial systolic pressure – a II of 0.5 or greater at the surgical level is necessary to support healing.
 - Assess preoperative amputation TcPO₂ levels – preoperative levels greater than 20mmHg are associated with successful healing after amputation. [A]

A-10.2 Determine Postoperative Dressing

Two major classifications of postoperative dressings that are commonly used:

Soft dressing	<ul style="list-style-type: none">• ACE wrap• Shrinker• Compression pump
Rigid dressing	<ul style="list-style-type: none">• Non-weight bearing rigid dressing (NWB)• Immediate postoperative prosthesis (IPOP)• Custom rigid removable dressing (RRD)• Prefabricated rigid removable dressing (RRD)• Prefabricated pneumatic immediate postoperative prosthesis (AirPOP)

An appropriate postoperative dressing should be selected by the surgeon in the preoperative phase to protect the residual limb, decrease edema, and facilitate wound healing; consider the use of a rigid postoperative dressing.

25. The appropriate postoperative dressing should be determined by the surgeon before surgery, recognizing that circumstances occurring during the surgery may necessitate changes. [I]
26. Consider the use of a rigid or semi rigid dressing to shorten the time to healing and readiness for prosthesis in dysvascular transtibial amputations. [B]
27. There is inconclusive evidence to recommend for or against a specific kind of rigid dressing. [I]
28. Properly fitted shrinkers should be used as soon as possible, after amputation. [I]
29. Patients with a bulbous transtibial limb are more likely to do better with a rigid dressing applied above the knee and changed every three to five days until they are able to tolerate a shrinker. [I]

A-11. Perform Amputation Reconstructive Surgery

A-11.1 Adhere to Surgical Principles

Consider the implications of the surgical reconstructive procedure on the patient's rehabilitation and the potential for prosthetic use.

30. Perform the appropriate amputation at the selected level, adhering to good surgical and amputation principles

A-11.2 Utilize Effective Postoperative Dressing

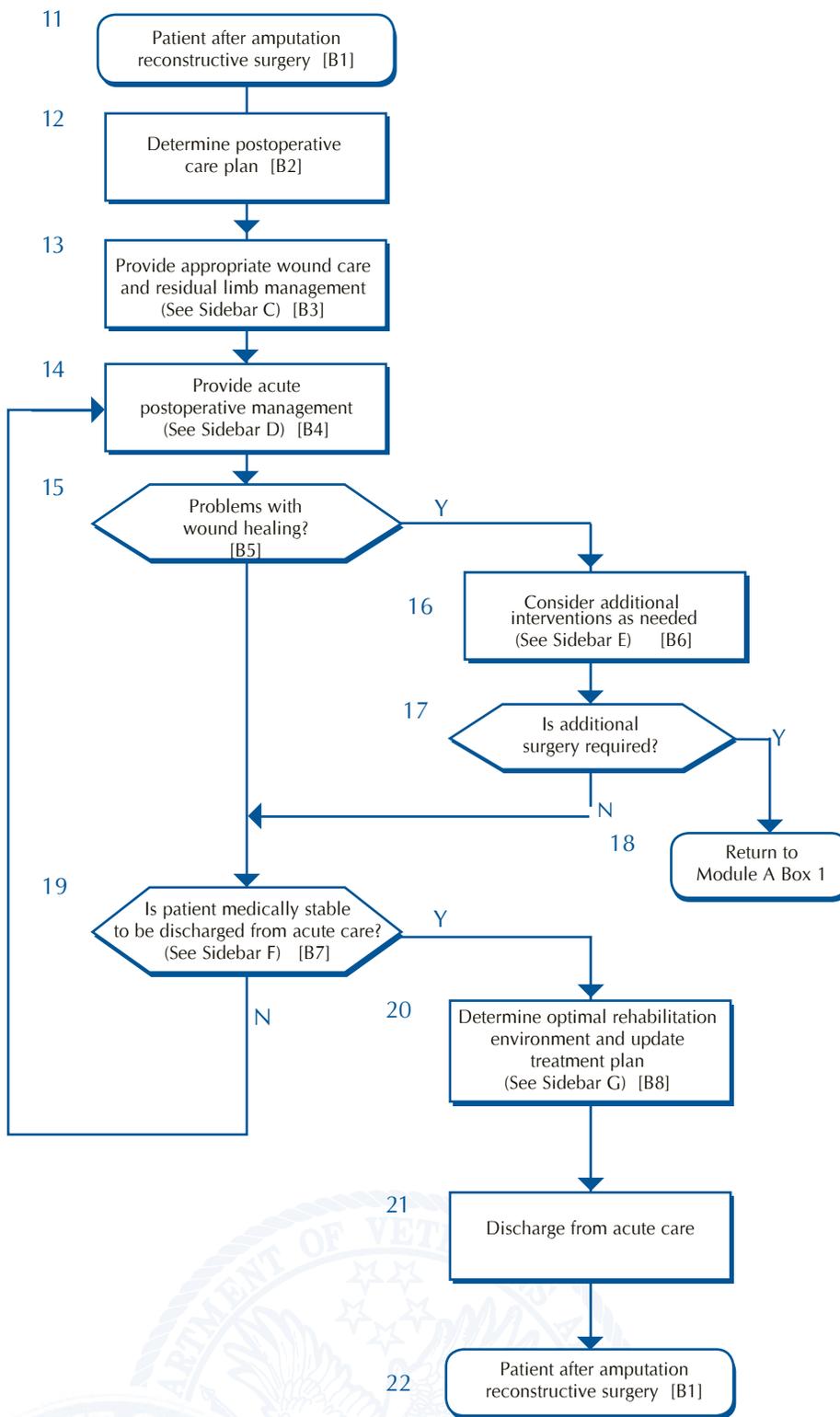
Apply the postoperative dressing of choice to protect the residual limb, decrease edema, and facilitate wound healing; especially consider the use of a rigid postoperative dressing.

31. Appropriate postoperative dressing should be applied after amputation.

MODULE B

IMMEDIATE POSTOPERATIVE REHABILITATION

B



Sidebar C: Residual Limb Management

- Edema control
- Prevention of contractures
- Protection from trauma
- Management of postoperative dressing

Sidebar D: Acute Postoperative Management

- Medical comorbidity
- Rehabilitation intervention
- Discharge planning
- Pain control
- Behavioral health

Sidebar E: Interventions to Resolve Wound Healing Problems

- Revision surgery
- Vascular evaluation/intervention
- Infection evaluation and treatment
- Aggressive local wound care
- Hyperbaric oxygen (HBO) [B6]

Sidebar F: Criteria for Discharge from Acute Care

- Wound healing appropriately
- Lack of infection
- Acceptable bowel and bladder function
- Medical comorbidity controlled
- Hemodynamically stable [B7]

Sidebar G: Possible Rehabilitation Environment

- Acute inpatient rehabilitation
- Outpatient rehabilitation
- Sub-acute rehabilitation
- Home therapy
- Self-directed therapy
- Skilled nursing facility
- Long-term care [B8]

MODULE B

IMMEDIATE POSTOPERATIVE REHABILITATION

ACTION STATEMENTS AND RECOMMENDATIONS

B-1. Patient after Amputation Reconstructive Surgery

Module B applies to patients in the immediate postoperative phase. During this critical phase of recovery, the focus of treatment is on the surgical and medical needs of the patient. As time progresses, and the patient becomes medically stable, the rehabilitation needs will outweigh the medical needs of the patient. The focus of the interdisciplinary team will then turn to rehabilitation intervention, targeting optimization of function, mobility, and quality of life.

B-2. Determine the Postoperative Care Plan

A plan of postoperative care should be determined before the operation by the surgeon and the rehabilitation team based on the interdisciplinary preoperative evaluation.

1. The postoperative plan should include a care plan to address:
 - a. Medical requirements
 - b. Wound or surgical requirements
 - c. Rehabilitation requirements including:
 - Prevent contractures
 - Reduce postoperative edema through the use of compression therapies
 - Protect the amputated limb from external trauma
 - Ensure patient safety

B-3. Provide Appropriate Wound Care and Residual Limb Management

The appropriate postoperative wound care and residual limb management should be prescribed by the surgeon performing the operation.

2. For a closed amputation and primary closure, the following procedures should be performed:
 - a. May apply sterile, non-adherent dressing secured with stockinet
 - b. Apply a compressive dressing to reduce edema and shape the residual limb
 - c. Monitor for infection
 - d. Remove the sutures or staples per the advice of the surgeon
3. For an open amputation, the following procedures should be considered:
 - a. Staged closure at a later date may be required for wounds heavily contaminated from infection or trauma
 - b. A vacuum-assisted-closure device may be helpful for open wounds
4. Residual limb management should continue with the focus on postoperative dressings, control of the edema and shaping of the residual limb, control of the pain, and protection of the residual limb from further injury. (See CORE-6 : Residual Limb)

B-4. Provide Acute Postoperative Management

Specific medical and surgical interventions need to be initiated immediately in the postoperative phase. Combat casualties with polytrauma may be best treated in a designated polytrauma center.

5. A thorough medical assessment should be completed postoperatively to assess physical condition, nutrition, lack of infection, and bowel and bladder function as well as a review of systems (cardiovascular, respiratory, endocrine, skin, neurological, and musculoskeletal).
6. Treatment of pain should be started immediately and address the specific source of pain:
 - a. Post surgical pain – appropriate edema control, liberal use of narcotics
 - b. Neuropathic/phantom pain –consider use of anticonvulsant (e.g., pregabalin, gabapentin, antidepressants (e.g., SSRIs, or TCAs)
 - c. Consider use of epidural or regional anesthesia.
7. Specific measures for deep vein thrombosis (DVT) and pulmonary embolism (PE) prophylaxis should be applied.
8. A nutrition assessment should be documented and specific recommendations should be applied; referral to a nutrition specialist should be considered.
9. A thorough sepsis workup for any signs/symptoms of systemic infection should be completed.
10. Medical and surgical comorbidities resulting from polytrauma, such as that seen in combat casualties, are best managed in rehabilitation centers that provide interdisciplinary management including multiple medical and surgical subspecialties with trauma experience.
11. Bowel and bladder functions should be monitored to maintain fluid balance as well as to avoid urinary retention and constipation, which may be brought on by medications (particularly opioids and anticholinergics) and/or decreased mobility.
12. Behavioral health support should be provided as necessary.
13. The following rehabilitation interventions should be initiated as tolerated:
 - a. Range of motion (ROM)
 - b. Strengthening
 - c. Cardiovascular fitness and endurance
 - d. Balance
 - e. Mobility
 - f. Functional activities and activities of daily living (ADL).
14. Patient and family education on positioning, skin care, and pain management; preservation of the intact limb; and approaches to modify risk factors should be re-enforced from preoperative training. (See CORE-13: Physical Rehabilitation and CORE-14: Functional Rehabilitation)

B-5. Problems with Wound Healing?

Assess the wound status using a standardized approach and provide intervention accordingly.

15. Patients undergoing lower limb amputations should be assessed using a standardized approach like the one described in Table 9. *Categories of Wound Healing (adapted from Smith, 2004)*. The depth and extent of involvement of the non-healing and nonviable skin, subcutaneous tissues, muscle, and/or bone will assist in the evaluation and treatment of problematic wounds.

Table 9. Categories of Wound Healing (adapted from Smith, 2004)

Category I:	<i>Primary</i> ; heal without open areas, infections or wound complications; no wound healing intervention required.
Category II:	<i>Secondary</i> ; small open areas that can be managed and ultimately healed with dressing strategies and wound care. Additional surgery is not required. May be possible to stay with the original plan with some portion of the wound intentionally left open.
Category III:	Skin and subcutaneous tissue involvement (no muscle or bone involvement); requires minor surgical revision.
Category IV:	Muscle or bone involvement; requires major surgical revision but heals at the initial amputation “level.”
Category V:	Requires revision to a higher amputation level; for example, a transtibial amputation that must be revised to either a knee disarticulation or a transfemoral amputation.

B-6. Consider Additional Interventions for Postoperative Wound Management as Needed

16. Early revision surgery may be considered for wounds that are slow to heal, particularly in Category III, IV, and V wounds.
17. Early vascular evaluation may be considered for patients with delayed healing and consultation for vascular intervention may be considered for patients with impaired peripheral arterial blood flow.
18. Early evaluation and treatment for potential superficial and deep infections may be considered for patients with delayed healing. The evaluation may include wound cultures, laboratory studies, and radiological studies. Debridement, intravenous antibiotics, and/or revision may be necessary to achieve infection control.
19. Early aggressive local wound care should always be initiated for any degree of wound breakdown. This may include the use of topical agents (regranex, aquacel silver, panafil)
20. Hyperbaric oxygen can be considered as an adjunct treatment for impaired wound healing.

B-7. Is the Patient Medically Stable to be Discharged from Acute Care?

21. Medical status should be assessed prior to proceeding to another level of care. The following criteria must be met prior to discharge to the next level of care:
 - a. Hemodynamically stable
 - b. Lack of systemic infection or an appropriate course of treatment in place
 - c. Stable surgical site
 - d. Acceptable bowel and bladder management
 - e. Comorbid conditions addressed.

B-8. Determine the Optimal Rehabilitation Environment and Update the Treatment Plan

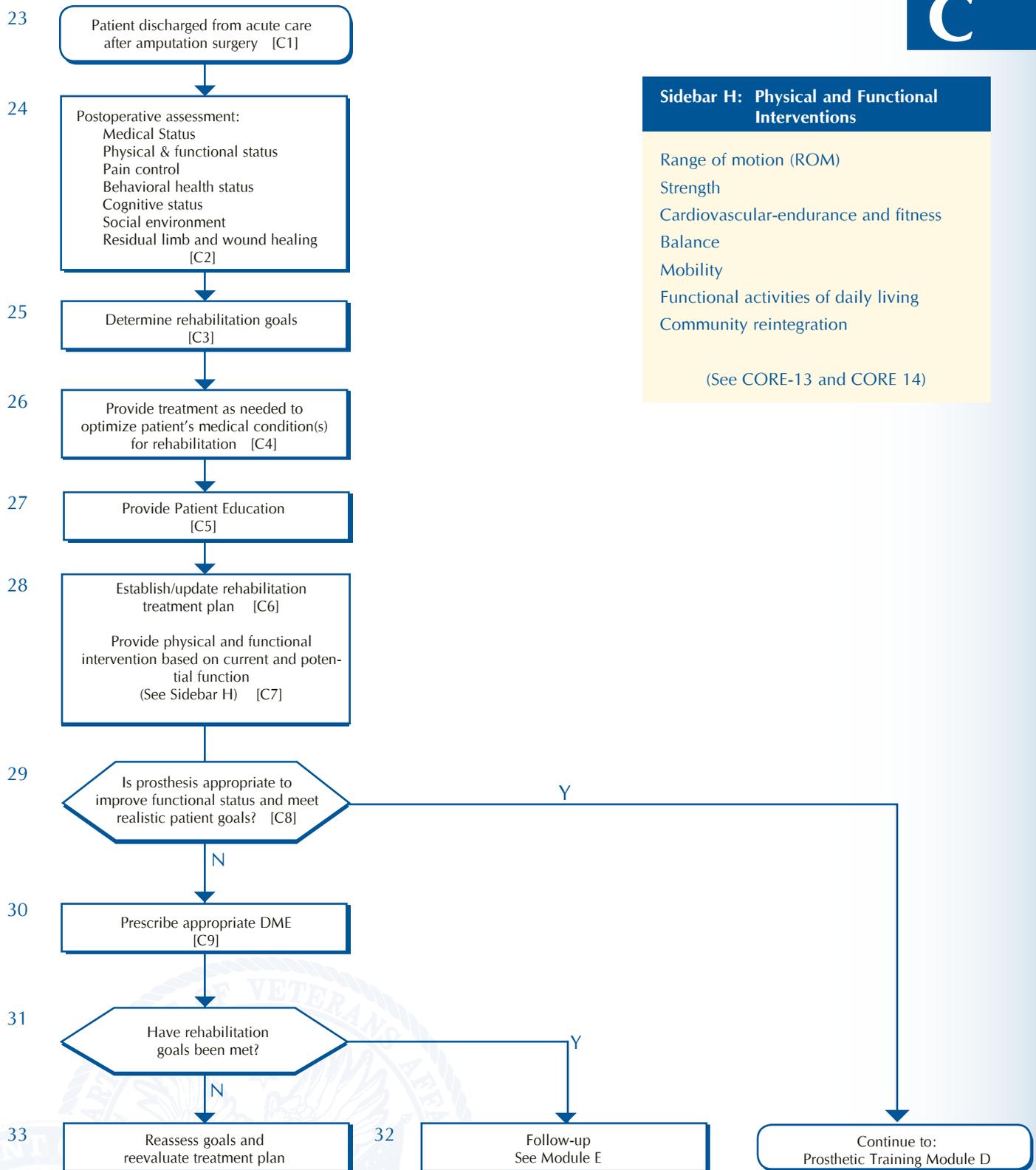
Determine the level of rehabilitation to be performed after discharge from the acute care setting. Update the treatment plan to reflect the level of rehabilitation and the patient's disposition.

22. Rehabilitative placement following a lower limb amputation should be based on the patient's medical status, current and anticipated function, ability to participate in rehabilitation interventions, social support system, and community resources.
23. To be discharged from acute care the patient's medical condition needs to be stable.
24. Patients are able to be discharged to home when:
 - Medically stable
 - Able to be mobile and transfer with available social support systems utilizing appropriate assistive devices (walker, cane, wheelchair)
 - Able to perform basic daily living skills independently or have a social support system to compensate for the deficiencies
 - There is an accessible home environment
 - There is access to continued rehabilitation interventions as needed.
25. Patient who do not meet criteria for discharge to home may be referred to:
 - a. Acute inpatient rehabilitation care when:
 - Able to follow a minimum of two-steps commands
 - Able to actively participate and benefit from at least two hours of therapy per day.
 - b. Sub-acute rehabilitation care or an extended nursing facility when:
 - Able to follow single step commands
 - Able to actively participate in less than two hours of therapy per day.
26. Patients not meeting the criteria for discharge to a rehabilitation program (e.g., they do not meet the above cited criteria and nursing care outweighs rehabilitation care) may be discharged to a program that is primarily focused on skilled nursing care when:
 - a. Medically stable
 - b. Able to tolerate only a few hours of therapy per week.

MODULE C

PRE-PROSTHETIC REHABILITATION

C



Sidebar H: Physical and Functional Interventions

- Range of motion (ROM)
 - Strength
 - Cardiovascular-endurance and fitness
 - Balance
 - Mobility
 - Functional activities of daily living
 - Community reintegration
- (See CORE-13 and CORE 14)

MODULE C

PRE-PROSTHETIC REHABILITATION

ACTION STATEMENTS AND RECOMMENDATIONS

C-1. Patient Discharged from Acute Care after Amputation Surgery

Patient is medically stable after an amputation surgery, discharged from acute care, and able to actively participate in rehabilitation. Module C applies to patients in a variety of settings. Some patients will be able to return home and be treated in an outpatient setting, while others might be admitted to a rehabilitation program.

C-2. Postoperative Assessment

Obtain a comprehensive multidisciplinary assessment of the patient's postoperative status.

1. A thorough medical assessment should be completed upon admission to rehabilitation to include: cardiovascular, pulmonary, endocrine, neurological, bowel and bladder, skin and musculoskeletal.
2. Special attention should be taken to assess the health of the contralateral leg and foot including vascular health, sensation, presence of deformity, abnormal skin or other tissue, and appropriate footwear.
3. Assess the healing of the wound by monitoring:
4. Involve the surgeon in problems with wound healing and wound management regardless of the patient's disposition.
5. Consult the specialized wound care team as needed.
6. Protect the residual limb from external trauma to reduce potential complications, delayed wound healing and encourage mobility.
7. Residual limb management should continue with the focus on control of edema, shaping the residual limb and control of the pain. (See CORE-6: *The Residual Limb*)
8. Postoperative physical and functional assessment should be performed after amputation surgery and prior to postoperative rehabilitation. Include the following:
 - a. Patient history, including
 - Past medical history
 - Home environment
 - Premorbid functional level – activities of daily living (ADL), mobility, and cognition
 - Social environment (see Core-9: *Social Environment [Support]*)
 - b. Physical assessment, including:
 - Range of motion (ROM) – bilateral hips, knees, and upper extremities
 - Strength – upper extremities and lower extremities
 - Sensation – involved limb and contralateral limb
 - Proprioception – involved limb and contralateral limb
 - Balance – sitting and standing
 - c. Functional assessment including:
 - Mobility – current level of function and use of assistive devices (bed, transfers, ambulation)
 - Basic ADLs – eating, grooming, toileting, bathing, and dressing
 - d. Screen for other impairments (e.g., vision and hearing, or other trauma)

9. Consider using standardized measures at admission and discharge to demonstrate progress and the efficacy of the rehabilitation process. The recommended tools for assessment include:
 - a. Amputee Mobility Predictor (AMP)
 - b. Functional Independence Measure (FIM)
 - c. Two-Minute Walk
 - d. Timed Up and Go Test (TUG)
 - e. Upper Extremity Ergometry

(See CORE-14.2: Mobility and Equipment)
10. Pain assessment should be performed by all members of the rehabilitation team.
11. Patients should be assessed for pain and treatment should be based on etiology and initiated/continued to optimize rehabilitation.
12. Consider prophylactic pain management prior to the rehabilitation session.

(See CORE-3: Pain Management)
13. A psychological assessment should be completed if not done preoperatively.
14. Continuous monitoring of behavioral health should be performed by all members of the rehabilitation team.

(See CORE-8: Behavioral Health Assessment and Treatment)
15. A postoperative cognitive/neuropsychological assessment should be conducted if not completed preoperatively.

(See CORE-5: Cognitive Assessment)

C-3. Determine Rehabilitation Goals

Establish rehabilitation goals at the beginning of the rehabilitation process involving members of the rehabilitation team and the patient, to guide the treatment.

16. Members of the rehabilitation team should work with the patient to establish goals specific to their area of expertise.
17. Goals should be written, be measurable, and be specific.

C-4. Provide Treatment as Needed to Optimize the Patient's Medical Condition(s) for Rehabilitation

Optimize medical status before, as well as during, pre-prosthetic rehabilitation.

18. The following conditions, if present, require aggressive management:
 - a. Hyperglycemia
 - b. Cardiac, respiratory, renal, and metabolic
 - c. Nutritional deficiency
 - d. Major psychiatric illness
 - e. Vascular lesions.

(See CORE-4: Medical Care)

C-5. Provide Patient Education

Provide in-depth patient education regarding the various components of postoperative care and anticipated rehabilitation activities.

19. During the pre-prosthetic rehabilitation phase the following should be covered with the patient:
 - a. Positioning
 - b. Rehabilitation process
 - c. Pain control
 - d. Residual limb care
 - e. Prosthetic timeline
 - f. Equipment needs
 - g. Coping methods
 - h. Prevention of complications
 - i. Safety and fall prevention (essential).

(See CORE-11: Patient Education)

C-6. Establish/Update the Rehabilitation Treatment Plan

Update the rehabilitation treatment plan to reflect the patient's progress, goals, and needs.

20. Rehabilitation goals should be documented in the treatment plan.
21. The treatment plan should be updated by the rehabilitation team to reflect changes in the patient's status.

(See CORE-2: Rehabilitation Treatment Plan)

C-7. Provide Physical and Functional Intervention Based on Current and Potential Function

Initiate, assess, and adjust the rehabilitation interventions to improve the patient's physical and functional status.

22. Provide physical and functional rehabilitation interventions in the following:
 - a. Residual limb management (teach care of the residual limb and the use of ACE wrap and shrinkers)
 - b. Range of motion (ROM) (residual and contralateral limbs at the hip and knee)
 - c. Strengthening (add trunk and core stabilization exercises; initiate a home exercise program)
 - d. Cardiovascular endurance (tailored to patient's fitness level and progressed as tolerated)
 - e. Balance (progress program to dynamic balance training).

(See CORE-13: Physical Rehabilitation and CORE-14: Functional Rehabilitation)

23. Provide interventions to evaluate and promote community reintegration:
 - a. Home evaluation and modification
 - b. Mobility (progress single limb gait from the parallel bars to the use of an appropriate assistive device)
 - c. Equipment (independent wheelchair mobility)
 - d. Functional activities and activities of daily living (ADL)
 - e. Driver's training and vehicle adaptation
 - f. Vocational rehabilitation or return to school
 - g. Recreation activities without a prosthesis.

(See CORE-14: Functional Rehabilitation)

C-8. Is a Prosthesis Appropriate to Improve Functional Status and Meet Realistic Patient Goals?

Determine if the patient is a candidate for a prosthesis.

24. Patient's candidacy for a prosthesis should be determined by the rehabilitation team based on the patient's characteristics, goals, and an objective evaluation of their functional status. Some areas to be considered:
 - a. Patient is willing and motivated to move forward for prosthetic rehabilitation
 - b. Patient has the ability to understand and apply knowledge to the fitting and use of a prosthesis
 - c. Contralateral limb will tolerate weight bearing
 - d. Patient is in adequate physical condition to tolerate walking with a prosthesis
 - e. Prosthesis contributes to quality of life or self image.

C-9. Prescribe Appropriate Durable Medical Equipment (DME)

Provide durable medical equipment (DME) prescription (e.g., wheelchair, walker, crutches, shower chairs).

25. Additional equipment to facilitate mobility and activities of daily living (ADL) is required for a patient with a lower extremity amputation.
26. The type of equipment should be based on the current and anticipated functional status.

Table C-1: Prosthesis Prescription Components Based on the Type of Ambulation Required

Functional Level	TRANSTIBIAL PRESCRIPTION	TRANSFEMORAL PRESCRIPTION
Unlimited household ambulatory (K 1)	<ul style="list-style-type: none"> Patella tendon bearing (PTB) or total surface bearing (TSB) Sleeve or pin/shuttle Soft foam or gel liner Flexible keel foot Endoskeletal or exoskeletal pylon 	<ul style="list-style-type: none"> Modified quadrilateral (quad) (improve sitting comfort) Silesian/pin/ shuttle/lanyard/total elastic suspension (TES) Gel liner or frame socket Knee systems * Flexible keel or single axis foot Endoskeletal pylon
Limited community ambulatory (K 2)	<ul style="list-style-type: none"> PTB or TSB Sleeve or pin/shuttle or suction Soft foam or gel liner or hard socket Flexible keel, multi-axial, or energy storage foot Endoskeletal or exoskeletal pylon 	<ul style="list-style-type: none"> Quad, modified quad or ischial containment Pin/shuttle/lanyard/silesian/suction/TES Gel liner or frame socket Knee systems * Flexible keel or single axis foot Endoskeletal pylon
Community ambulatory (K 3)	<ul style="list-style-type: none"> PTB or TSB Sleeve, pin/shuttle, suction, or vacuum Soft foam or gel liner or hard socket Flexible keel, multi-axial foot Torsion and/or vertical shock pylon Endoskeletal or exoskeletal pylon 	<ul style="list-style-type: none"> Quad, modified quad or ischial containment Pin/shuttle, suction, silesian/suction/TES Gel liner or frame socket Knee systems * Flexible keel, multi-axial or energy storage foot Torsion and/or vertical shock pylon Endoskeletal pylon
Exceeds basic ambulation (K 4)	<ul style="list-style-type: none"> PTB or TSB Pin/shuttle/sleeve/suction Soft foam or gel liner Flexible, multi-axial, or energy storage foot Specialty foot (running) Torsion and/or vertical shock pylon Endoskeletal or exoskeletal pylon 	<ul style="list-style-type: none"> Ischial containment Suction/pin/shuttle/silesian/suction/combo Gel liner or frame socket Knee systems * Quad, modified quad Flexible keel or specialty foot (running) Torsion and/or vertical shock pylon Endoskeletal pylon

*The specifications for knee systems are too varied to be presented in this table.



Table C-2: Specialty Prosthesis

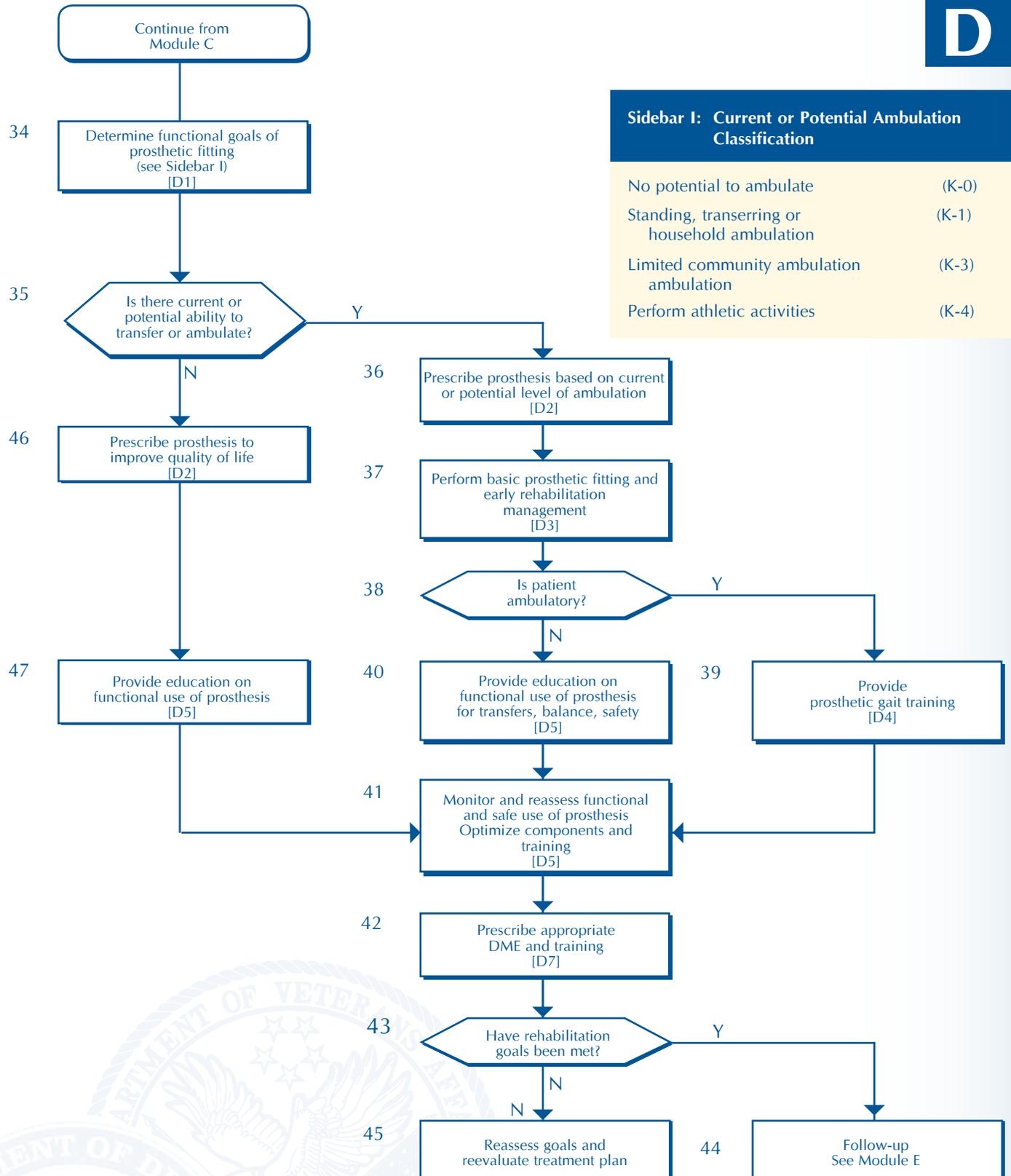
Function Level	TRANSTIBIAL PRESCRIPTION	TRANSFEMORAL PRESCRIPTION
Water limb	<ul style="list-style-type: none"> • Patella tendon bearing (PTB) or total surface bearing (TSB) • Sleeve and/or cuff and waist belt • Hard socket or gel liner • Water resistant foot • Endoskeletal or hollow core 	<ul style="list-style-type: none"> • Quad, modified quad or ischial containment • Pin/shuttle/lanyard/silesian/total elastic suspension (TES) • Water resistant foot • Waterproof single axis knee • Endoskeletal or hollow core
Cycling	<ul style="list-style-type: none"> • PTB or TSB with low posterior brim • Pin/shuttle/sleeve/cuff • Hard socket or soft foam or gel liner • Dynamic Response Foot (consider direct pedal attachment) • Endoskeletal or exoskeletal 	<ul style="list-style-type: none"> • Quad, modified quad or ischial containment • Pin/shuttle/lanyard/TES • Dynamic Response Foot (consider direct pedal attachment) • Endoskeletal
Snow skiing/boarding	<ul style="list-style-type: none"> • PTB or TSB • Pin/shuttle (add external brace for snow skiing) • Gel liner • Dynamic Response Specialty Foot for skiing (eliminate boot) foot for boarding • Endoskeletal 	<ul style="list-style-type: none"> • Prosthesis not recommend for snow skiing • Quad, modified quad or ischial containment • Pin/shuttle/lanyard/silesian/TES • Dynamic Response Foot for boarding • Endoskeletal
Water skiing/boarding	<ul style="list-style-type: none"> • PTB or TSB • Suction (add external brace for skiing) • Gel liner • Water resistant energy storage foot • Endoskeletal or exoskeletal 	<ul style="list-style-type: none"> • Prosthesis not recommend for water skiing



MODULE D

PROSTHETIC TRAINING

D



Sidebar I: Current or Potential Ambulation Classification	
No potential to ambulate	(K-0)
Standing, transferring or household ambulation	(K-1)
Limited community ambulation	(K-3)
Perform athletic activities	(K-4)

MODULE D**PROSTHETIC TRAINING*****ACTION STATEMENTS AND RECOMMENDATIONS*****D-1. Determine Functional Goals of Prosthetic Fitting****Table 10. Centers for Medicare and Medicaid Services Functional Levels**

Level of Function	Description of Ambulation Level
K 0:	The patient does not have the ability or potential to ambulate or transfer safely with or without assistance and the prosthesis does not enhance his/her quality of life or mobility.
K 1:	The patient has the ability or potential to use the prosthesis for transfers or ambulation on level surfaces at fixed cadence - typical of the limited and unlimited household ambulator.
K 2:	The patient has the ability or potential for ambulation with the ability to traverse low-level environmental barriers such as curbs, stairs, or uneven surfaces - typical of the limited community ambulator.
K 3:	The patient has the ability or potential for ambulation with variable cadence - typical of the community ambulator who has the ability to traverse most environmental barriers and may have vocational, therapeutic, or exercise activity that demands prosthetic utilization beyond simple locomotion.
K 4:	The patient has the ability or potential for prosthetic ambulation that exceeds basic ambulation skills, exhibiting high impact, stress, or energy levels - typical of the prosthetic demands of the child, active adult, or athlete.

Determine current and prospective functional needs of the patient.

1. Patients at K level "0" are not recommended for prostheses for ambulation or transfers.
2. Patients at K level "1" are recommended for prostheses that meet the functional goals of limited and unlimited household ambulation.
3. Patients at K level "2" are recommended for prostheses that meet the functional goals of limited community ambulation.
4. Patients at K level "3" are recommended for prostheses as community ambulators with the ability to traverse most environmental barriers and may have vocational, therapeutic, or exercise activity that demands prosthetic utilization beyond simple locomotion.
5. Patients at K level "4" are recommended for prostheses at the highest level of functioning typical of the child, active adult, or athlete.
6. Prosthetic fittings typically should not begin until the suture line has completely healed, although in unusual circumstances prosthetic fitting and limited ambulation may start with a clean non-infected wound with granulation tissue.

D-2. Prescribe the Prosthesis Based on the Current or Potential Level of Ambulation

7. The prescription for a patient with a transmetatarsal amputation should include:
 - a. Toe filler/arch support
 - b. Custom/prefabricated Ankle-foot orthosis (AFO) with toe filler:
 - c. Assessment adequate shoe fit
8. The prescription for a patient with a transtibial/transfemoral amputation should include:
 - a. Socket
 - b. Socket interface
 - c. Suspension mechanism
 - d. Pylon
 - e. Knee joint
 - f. Foot/ankle.

(See Module for a listing of specifications.)

D-3. Perform Basic Prosthetic Fitting and Early Rehabilitation Management

Fabricate, dynamically align, adjust, and modify the prosthesis, and instruct the patient on the use of a prosthesis when appropriate.

9. Initiate physical and functional interventions for prosthetic training as appropriate for the patient's functional goals:
 - a. Residual limb management (donning and doffing of prosthesis, gel liners or socks as appropriate)
 - b. Range of motion (ROM)
 - c. Strengthening
 - d. Cardiovascular fitness and endurance
 - e. Balance
 - f. Mobility
 - g. Functional activities and activities of daily living (ADL)
 - h. Equipment
 - i. Driver's training
 - j. Home evaluation
 - k. Home exercise program
 - l. Community integration.
10. A two-phase process may be considered for prosthetic fitting and training:
 - a. Phase One: Preparatory (preliminary) prosthesis
 - b. Phase Two: Definitive prosthesis.
11. If only a definitive prosthetic is to be fitted, the fitting for the socket should be delayed until the residual limb is fully mature (usually three to four months) or until general stabilization occurs in the patient's weight and residual limb volume.

D-4. Provide Prosthetic Gait Training

Prosthetic gait training must be performed for the patient to safely ambulate on all surfaces with or without adaptive equipment.

12. Once basic prosthetic management has been completed, the focus should move to weight bearing with the prosthesis, standing balance, weight shifts, and equalization of step length.
13. Once the patient has mastered prosthetic ambulation with a walker or other assistive device, training on stairs, uneven surfaces, and ramps/inclines are recommended.
14. Prosthetic gait training should incorporate aspects related to the patient's home, work, and/or recreational environments.

D-5. Provide Education on Functional Use of the Prosthesis for Transfers, Balance, and Safety

Provide training to help the non-ambulatory patient maximize their independence in transfers with the prosthesis.

15. Initial patient education in the use of a prosthetic lower limb should include:
 - a. Demonstration and training in donning and doffing the prosthesis (dependent upon the type of prosthesis provided)
 - b. Initial training in how to start ambulation (dependent upon the type of prosthesis provided)
 - c. Instruction in accomplishing safe transfers taking in consideration the home environment
 - d. Instruction in how to fall safely and get back up
 - e. Instruction in daily self inspections of the residual limb for excessive tissue loading; if erythema is present upon removing the prosthesis and does not completely resolve in 20 minutes, the patient should be instructed to report it immediately
 - f. Basic residual limb and prosthetic hygiene.
16. If appropriate, the patient's caregiver should also be instructed in management and care of the prosthesis, proper transfer technique and safety.

D-6. Monitor and Reassess Functional and Safe Use of the Prosthesis; Optimize Components and Training

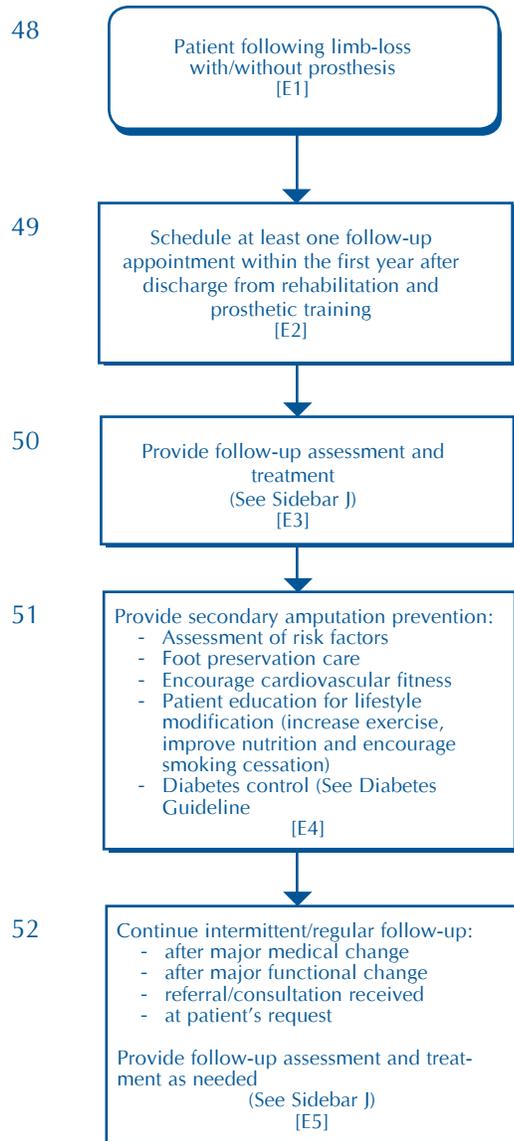
Continue to assess functional and safe use of the prosthesis and optimize the components and training at least throughout the first year post fitting.

17. Patients who were not prosthetic candidates or candidates for a transfer prosthesis should be evaluated periodically to determine if their functional goals may be expanded to include ambulation.
18. Patients with a prosthesis should be advised to report any of the following symptoms as they are signs that the prosthesis needs to be modified:
 - a. Ongoing pain
 - b. Skin breakdown
 - c. Change in the ability to don and doff the prosthesis
 - d. Change in the number of sock plies
 - e. Change in the pattern of usage
 - f. Change in functional needs or goals.
19. The prosthesis should be assessed at least once within the first year of prosthetic use to address:
 - a. Stability
 - b. Ease of movement
 - c. Energy efficiency
 - d. Appearance of the gait to determine the success of fitting and training.
20. Patients presenting with dermatologic problems require assessment and intervention:
 - a. Contact dermatitis: assess the hygiene of the liner, socks, and suspension mechanism
 - b. Cysts and sweating: assess for excessive shear forces and improperly fitted components
 - c. Scar management: requires massaging and lubricating the scar to obtain a well-healed result without dog ears or adhesions
 - d. Superficial fungal infections are common and will require topical anti-fungal agents for resolution.

D-7. Prescribe Appropriate Durable Medical Equipment (DME) and Training

Consider durable medical equipment (DME) prescription (e.g., wheelchair, walker, cane, crutches, shower chairs).

21. Additional equipment to facilitate mobility and activities of daily living (ADL) should be provided after lower extremity amputation with or without a prosthesis.
22. The type of equipment should be based on the current and anticipated functional status.



**Sidebar J:
Follow-Up Assessment**

1. Patient's goals
2. Functional Assessment
 - Gait and mobility
 - Residual limb
 - Contralateral limb
 - Socket fit or residual limb volume
 - Strength/ROM
 - Changing needs for DME
 - Activities of daily living
3. Secondary complications
 - Pain control
 - Skin integrity
 - Associated musculoskeletal conditions
4. Prosthetic assessment (repair, replacement, mechanical adjustment, new technology)
5. Vocational and recreational needs



MODULE E**IMMEDIATE POSTOPERATIVE REHABILITATION****ACTION STATEMENTS AND RECOMMENDATIONS****E-1. Patient Following Limb-Loss With or Without Prosthesis**

The follow-up algorithm applies to a patient with limb-loss who has achieved maximal functional potential with or without a prosthesis. The patient may begin long-term follow-up when the following goals are met:

- ★ Prosthetic fit is appropriate
- ★ Patient incorporated the prosthesis into his/her lifestyle and is satisfied with the outcome
- ★ Patient function is maximized per the goals set up at the initial rehabilitation process.

E-2. Schedule At Least One Follow-Up Appointment Within the First Year after Discharge From Rehabilitation and Prosthetic Training

All patients with amputations should have at least one scheduled follow-up appointment, within the first year after discharge, to evaluate the quality and comfort of the prosthetic fit and the patient's health status and function.

1. Patients with a prosthesis should visit the Amputation Clinic Team for an initial comprehensive visit to address any change in the condition of the residual limb.
2. Patients with minor repairs or adjustments to the prosthesis should visit a prosthetic laboratory.
3. Patients with a change in their medical condition should be seen by a primary care provider or physiatrist, in addition to their comprehensive follow-up with the Amputation Clinic Team.
4. A follow-up appointment should be made at the time of the comprehensive visit with the appropriate clinic or provided at the patient's request, after a major medical or functional change, or after a referral/consultation is received.
5. Patients with a lower limb amputation who are not prosthetic users should be seen by their primary care provider to manage comorbidities, evaluate medical risks, and maintain the health of the residual and contralateral extremity.
6. If the function of a non-prosthetic user changes and he/she becomes a prosthetic candidate, an appointment should be made with the Amputation Clinic Team for consideration of prosthetic restoration.

E-3. Provide Follow-Up Assessment and Treatment

The long-term follow-up should include assessment of the patient's goals, function, secondary complications, and the condition of the prosthesis. Treatment should also be provided as indicated.

7. The follow-up assessment for a prosthetic user should include:
 - a. Patient's goals (i.e., new recreation, vocation, or community requirements)
 - b. Functional assessment:
 - Gait and mobility
 - Residual limb health
 - Contralateral limb
 - Socket fit or residual limb volume
 - Strength and range of motion (ROM)
 - Changing needs for durable medical equipment (DME)
 - Activities of daily living (ADL)

- c. Secondary complications as a result of prosthetic use:
 - Pain control
 - Skin integrity
 - Associated musculoskeletal conditions (e.g., back pain and knee pain).
 - d. Prosthetic assessment (repair, replacement, mechanical adjustment, new technology)
 - e. Vocational and recreational needs.
8. The follow-up assessment for a non-prosthetic user should include:
- a. Patient's goals
 - b. Functional assessment
 - Residual limb health
 - Range of motion (ROM)
 - Strength
 - Gait and mobility
 - Changing needs for durable medical equipment (DME)
 - Activities of daily living (ADL)
 - c. Secondary complications in the residual and contralateral limb:
 - Pain control
 - Skin integrity
 - Associated musculoskeletal conditions (e.g., back and knee pain)
 - d. Vocational and recreational needs.

E-4. Provide Secondary Amputation Prevention

Identify high-risk patients and provide patient education to minimize the potential for secondary amputation.

9. Long-term follow-up should include an assessment and management of risk factors for secondary amputation including: peripheral vascular disease, diabetes, peripheral neuropathy or nerve injury, skin integrity, foreign bodies, bony deformities including heterotopic ossification, and a history of foot ulcers.
10. For the patient with vascular disease or diabetes, long-term follow-up should include appropriate foot care and patient education at every patient visit
(see the VA/DoD Clinical Practice Guideline for Diabetes Mellitus - Module F: Foot Care).
11. Patients identified to be at risk for limb-loss should be referred to an appropriate specialist.
12. Encourage cardiovascular fitness to compensate for the increased metabolic cost of ambulation post-amputation.
13. Provide patient and family education regarding risk-modification to encourage a healthy lifestyle through increased exercise, improved nutrition, and smoking cessation

E-5. Continue Follow-Up as Needed

A patient with a lower limb amputation should receive life-long care to maintain the quality and functionality of the prosthetic limb and the patient's abilities, goals, and quality of life.

14. Intermittent/regular follow-up should be provided to assess the patient's current needs, abilities, and goals.
15. Life-long care should include monitoring the patient for psychosocial adjustment, skin disorders of the residual limb, pain, musculoskeletal impairments, cardiovascular disease, other chronic diseases, and the health of the contralateral limb and provision of appropriate foot wear for the contralateral foot.
16. A follow-up appointment should also be provided at the patient's request, after a major medical or functional change, or after a referral/consultation is received.
17. For the prosthetic user, life-long care should also include surveillance for and management of secondary impairments associated with limb-loss; i.e., cardiovascular disease, accelerated degenerative joint disease of other joints, functional losses due to aging, and complications of prosthetic use.
18. For the prosthetic user, new technology should be considered but must be matched to the patient's function and goals, and followed with an additional period of gait training to help the patient learn to use new components. The latest technology is not always the best choice for the patient.



EVIDENCE RATING

Table A-4: Final Grade of Recommendation

Quality of Evidence	<i>The net benefit of the intervention</i>			
	Substantial	Moderate	Small	Zero or Negative
Good	A	B	C	D
Fair	B	B	C	D
Poor	I	I	I	I

Table A-5: Strength of Recommendation Rating System

A	A strong recommendation that the clinicians provide the intervention to eligible patients. Good evidence was found that the intervention improves important health outcomes and concludes that benefits substantially outweigh harm.
B	A recommendation that clinicians provide (the service) to eligible patients. At least fair evidence was found that the intervention improves health outcomes and concludes that benefits outweigh harm.
C	No recommendation for or against the routine provision of the intervention is made. At least fair evidence was found that the intervention can improve health outcomes, but concludes that the balance of benefits and harms is too close to justify a general recommendation.
D	Recommendation is made against routinely providing the intervention to asymptomatic patients. At least fair evidence was found that the intervention is ineffective or that harms outweigh benefits.
I	The conclusion is that the evidence is insufficient to recommend for or against routinely providing the intervention. Evidence that the intervention is effective is lacking, or poor quality, or conflicting, and the balance of benefits and harms cannot be determined.



ACRONYM LIST

ADL	Activities of Daily Living
AFO	Ankle-Foot Orthosis
AMP	Amputee Mobility Predictor
CBC	Complete Blood Count
CBT	Cognitive Behavioral Therapy
CV	Cardiovascular
DM	Diabetes Mellitus
DME	Durable Medical Equipment
DVT	Deep Vein Thrombosis
FIM	Functional Independence Measure
HAD	Hospital Anxiety and Depression Scale
HBO	Hyperbaric Oxygen Therapy
HCFA	Health Care Financing Administration
HEP	Home Exercise Program
HO	Heterotopic Ossification
HRQL	Health Related Quality of Life
IPOP	Immediate Postoperative Prosthesis
LBP	Low Back Pain
LE	Lower Extremity
NSAID	Non-Steroidal Anti-Inflammatory Drugs
NWB	Non-Weight Bearing
PACT	VA's 2001 CD-ROM - "Preservation-Amputation Care and Treatment"
PAOD	Peripheral Arterial Occlusive Disease
PCA	Patient Controlled Analgesia
PCL	Post-Traumatic Stress Checklist
PE	Pulmonary Embolism
PEQ	Prosthesis Evaluation Questionnaire
PIS	Pain Interference Scale
PLP	Phantom Limb Pain
PM&R	Physical Medicine & Rehabilitation
PTB	Patella Tendon Bearing
PTSD	Post-Traumatic Stress Disorder Symptoms
PVD	Peripheral Vascular Disease
RCT	Randomized Controlled Trial
RLP	Residual Limb Pain
ROM	Range of Motion
RRD	Rigid Removable Dressing
SF-MPQ	Short Form McGill Pain Questionnaire
SSRI	Selective Serotonin Re-uptake Inhibitors
TCA	Tricyclic Antidepressants
TENS	Transcutaneous Electrical Nerve Stimulation
TES	Total Elastic Suspension
TSB	Total Surface Bearing
TUG	Timed Up and Go Test
UE	Upper Extremity
VAC	Vacuum Assisted Closure Device
VAS	Visual Analog Scale